CAAPII REDD+ Project

By Carbonext

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Project Title	CAAPII REDD+ Project
Version	01
Date of Issue	22nd of July of 2022
Project Location	State of Pará, Brazil
Project Proponent(s)	Carbonext Tecnologia em Soluções Ambientais Ltda Matogrosso Participações Ltda Dunorte Agroflorestal Ltda
Prepared By	Carbonext Tecnologia em Soluções Ambientais Ltda
Validation Body	RINA Services S.p.A. Società coordinata dal Socio unico RINA S.p.A.
Project Lifetime	25th of July 2019 – 24th of July 2049; 30-year lifetime
GHG Accounting Period	25th of July 2019 – 24th of July 2049; 30-year lifetime
History of CCB Status	Not applicable
Gold Level Criteria	• Community: The CAAPII REDD+ Project intents to be validated at the Gold Level for exceptional community benefits since in the Project Description it was identified that the project zone is in an

	administrative area of a medium human development country in which at least 50% of the households within the communities are below the national poverty line. All the social activities designed intent to improve the well-being and life quality of the community members involved in the project, such as deforestation avoidance, trainings and courses of sustainable practices, fire brigade, security and safety, events on health, environmental education activities, events on motivation (study, sports, jobs, and others), improvements in schools' infrastructure and others, further described on this PD. • Biodiversity: The CAAPII REDD+ Project intent to preserve 11 species of fauna and flora, according to the list of identified endangered (EN) and critically endangered (CR) species (presented in sector 5.5.1.), increasing monitoring of the area, preventing illegal activities, building environmental awareness with the population through courses and environmental education activities, biodiversity inventory, monitoring, avoiding deforestation and protecting 33,766.64 ha of forest areas.
Expected Verification Schedule	September of 2022

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1. SUMMARY OF PROJECT BENEFITS

1.1 Unique Project Benefits

Outcome or Impact Estimated by the End of Project Lifetime	Section Reference
1) Protection and conservation easement of 33,766.64 hectare in the Amazon Forest.	2.1.1
2) Provide environmental awareness with knowledge on environmental education and sustainable practices, in order to minimize deforestation.	4.4.1
3) Improve the quality of life for the local community, providing new perspectives of income, activities of education, health and gender equality.	4.1.1
4) Remote satellite monitoring of 33,766.64 hectare for the identification of illegal trespassing and deforestation.	3.3.2
5) Protection of habitat for fauna and flora species within the project area, including endangered species and local important species.	5.1.2

1.2 Standardized Benefit Metrics

The table below (table 1) presents the estimation of net benefits the CAAPII REDD+ Project aims to achieve during the project lifetime. There are some metrics with no means of quantification since the project intents to impact effectively as many people as possible in the communities involved in the project. The number of people impacted with the project will be presented on the Monitoring Report, as detailed in the Monitoring Plans in sectors 3.3; 4.4 and 5.4.

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
GHG emission reductions or removals	Net estimated emission removals in the project area, measured against the without-project scenario	Not applicable	N/A
	Net estimated emission reductions in the project area, measured against the without-project scenario (in the 30-year project lifetime)	14,128,193.11 tCO_2	3.2.4
Forest[1] cover	For REDD[2] projects: Estimated number of hectares of reduced forest loss in the project area measured against the without-project scenario (in the 30-year project lifetime)	28,677.00 hectare	3.2.1
	For ARR[3] projects: Estimated number of hectares of forest cover increased in the project area measured against the without-project scenario	Not applicable	N/A
Improved land management	Number of hectares of existing production forest land in which IFM[4] practices are	Not applicable	N/A

[1] Land with woody vegetation that meets an internationally accepted definition (e.g., UNFCCC, FAO or IPCC) of what constitutes a forest, which includes threshold parameters, such as minimum forest area, tree height and level of crown cover, and may include mature, secondary, degraded and wetland forests (*VCS Program Definitions*)
[2] Reduced emissions from deforestation and forest degradation (REDD) - Activities that reduce GHG emissions by slowing or stopping conversion of forests to non-forest land and/or reduce the degradation of forest land where forest biomass is lost (*VCS Program Definitions*)
[3] Afforestation, reforestation and revegetation (ARR) - Activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and/or restoring vegetative cover through the planting, sowing and/or human-assisted natural regeneration of woody vegetation (*VCS Program Definitions*)
[4] Improved forest management (IFM) - Activities that change forest management practices and increase carbon stock on forest lands managed for wood products such as saw timber, pulpwood and fuelwood (*VCS Program Definitions*)

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
	expected to occur as a result of project activities, measured against the without-project scenario		
	Number of hectares of non-forest land in which improved land management practices are expected to occur as a result of project activities, measured against the without-project scenario	Not applicable	N/A
Training	Total number of community members who are expected to have improved skills and/or knowledge resulting from training provided as part of project activities	Data not available	4.4.1
	Number of female community members who are expected to have improved skills and/or knowledge resulting from training as part of project activities	Data not available	4.4.1
Employment	Total number of people expected to be employed in project activities,[5] expressed as number of full-time employees[6]	Data not available	4.4.1
	Number of women expected to be employed as a result of project activities, expressed as number of full-time employees	Data not available	4.4.1

[5] Employed in project activities means people directly working on project activities in return for compensation (financial or otherwise), including employees, contracted workers, sub-contracted workers and community members that are paid to carry out project-related work.
[6] Full time equivalency is calculated as the total number of hours worked (by full-time, part-time, temporary and/or seasonal staff) divided by the average number of hours worked in full-time jobs within the country, region or economic territory (adapted from the UN System of National Accounts (1993) paragraphs 17.14[15.102];[17.28])

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
Livelihoods	Total number of people expected to have improved livelihoods[7] or income generated as a result of project activities	Data not available	4.4.1
	Number of women expected to have improved livelihoods or income generated as a result of project activities	Data not available	4.4.1
Health	Total number of people for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	Data not available	4.4.1
	Number of women for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	Data not available	4.4.1
Education and Environmental Awareness	Total number of people for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	Data not available	4.4.1
	Number of women and girls for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	Data not available	4.4.1
Water	Total number of people who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	Not applicable	N/A

[7] Livelihoods are the capabilities, assets (including material and social resources) and activities required for a means of living (Krantz, Lasse, 2001. *The Sustainable Livelihood Approach to Poverty Reduction*. SIDA). Livelihood benefits may include benefits reported in the Employment metrics of this table.

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
	Number of women who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	Not applicable	N/A
Well-being	Total number of community members whose well-being[8] is expected to improve as a result of project activities	Data not available	4.4.1
	Number of women whose well-being is expected to improve as a result of project activities	Data not available	4.4.1
Biodiversity conservation	Expected change in the number of hectares managed significantly better by the project for biodiversity conservation,[9] measured against the without-project scenario	33,766.64 ha	5.2.1
	Expected number of globally Critically Endangered or Endangered species[10] benefiting from reduced threats as a result of project activities,[11] measured against the without-project scenario	11	5.5.1

As requested on this sector, the estimation of the net benefit the project aims to achieve during its lifetime for each metric was provided. The phrase "*data not available*" was inserted where the metric does apply but there are no means of quantification, since the exact numbers will be collected during the course of the project, as well as the project aims to achieve as many community members as possible.

[8] Well-being is people's experience of the quality of their lives. Well-being benefits may include benefits reported in other metrics of this table (e.g. Training, Employment, Livelihoods, Health, Education and Water), and may also include other benefits such as strengthened legal rights to resources, increased food security, conservation of access to areas of cultural significance, etc.
[9] Managed for biodiversity conservation in this context means areas where specific management measures are being implemented as a part of project activities with an objective of enhancing biodiversity conservation, e.g. enhancing the status of endangered species
[10] Per IUCN's Red List of Threatened Species
[11] In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

2. GENERAL

2.1 Project Goals, Design and Long-Term Viability

Figure *1* - Photo taken by Carbonext of the Capim River in the Project Area of the CAAPII REDD+ Project.

2.1.1 Summary Description of the Project (G1.2)

The CAAPII REDD+ Project aims to protect Amazon rainforest of 33,766.64 ha in Paragominas, Ipixuna do Pará and Tomé-Açu, in Pará State - Brazil. The project promotes forest conservation and estimates to reduce GHG emissions of 14,128,193.11 tCO_2 in 30 years by avoiding deforestation, in 5 farms (PA): Maringá e Catarinense, Lagoa Grande, do Lago, Santa Helena 1 and Catarinense.

Historically, Pará explores unsustainably the Forest. Since 2016[12], the state deforests the most in Brazil, for 16 consecutive years. In 2019, it was responsible for 40% of all Amazonian deforested area, destroying 3,862 km^2 [13]. The region named "Deforestation Arc" extends from 7 states including Pará, concentrating 75% of Amazon deforestation[14]. In 2021, the list with 52 cities, implemented by Decree nº6.321/2007 (2007) and Ordinance n°428 (2018) by the Ministry of Environment, considered these cities priority for prevention, monitoring and control actions against deforestation[15], limiting credits for agriculture and cattle productors.[16] Paragominas was included in the list in 2008 but after actions to combat illegal deforestation left it in 2011[17].

[12] Terra Brasilis. 2022. Available on: http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/amazon/increments. Accessed in 11/04/2022.
[13] https://g1.globo.com/natureza/noticia/2019/11/18/quatro-estados-respondem-por-mais-de-80percent-do-desmatamento-na-amazonia.ghtml
[14] https://acervo.socioambiental.org/sites/default/files/documents/prov0115.pdf
[15] Priority Municipalities. Source:http://combateaodesmatamento.mma.gov.br/municipios-prioritarios. Access:05/05/2022
[16] https://www.gov.br/mma/pt-br/assuntos/servicosambientais/controle-de-desmatamento-e-incendios-florestais/pdf/Listagemmunicpiosprioritriosparaaesdepreveno2021.pdf
[17] https://oeco.org.br/reportagens/28764-a-historia-do-municipio-que-saiu-da-lista-negra-dos-maiores-desmatadores/#:~:text=Paragominas%20foi%20rapidamente%20inclu%C3%ADdo%20pelo,e%20IBAMA%20contra%20o%20desmatamento.

Other municipalities around the project area have been on the list as well, such as Tailândia, Dom Eliseu and Ulianópolis[18].

Currently, the deforestation of the Amazon Forest in the region of the project in Pará is due to three main anthropic activities: cattle raising, soybean cultivation and timber exploration (legal and illegal). Invasions of non-productive lands are common practice, followed by the implementation of these activities. The livestock in the state achieved 20,881,204 heads (2019[19]). From 2018 to 2020[20], Paragominas reached 357,189 heads of cattle (2020) (29.4% growth in two years). Ipixuna do Pará presented an increase of 41.8% in 2 years, while in Tomé-Açu the growth was of 17.2%. In 2020, the three cities produced 37.1% of all charcoal produced from timber[21]. The production of roundwood and firewood (2020) corresponded to 449,161.00 m³ of timber removed[22]. The production of soybean in Pará has grown exponentially: from 2009 to 2020 it increased 964%[23]. The value of soybean increased almost 350% from May 2015-March 2022[24]. The area of its cultivation increased[25] from 71,410.00 ha (2009) to 643,267 ha (2020), a 900% increase.

Seven communities were identified around the project area in which action would be focused. The estimated population of the 5 visited communities is 14.000 inhabitants[26]. Most of them work with familiar agriculture. The local characteristics and vulnerabilities are being analyzed in the meetings, visits and socioeconomic diagnosis. Using this diagnosis, the design of activities aims to achieve the established goals for sustainable development, biodiversity conservation and climate regulation. Periodically, activities will be implemented along the project lifetime, and will be reassessed, adjusted and adapted as needed. The project's climate, community and biodiversity objectives are: 1) conserve 33,766.64 hectare of the Amazon Forest in the project area, avoiding unplanned deforestation and avoiding emission of 14,128,193.11 tCO2e in the 30 years of the Project's crediting period; 2) improve communities' well-being; 3) preserve the biodiversity; and 4) bring benefits to climate regulation as consequence.

[18] https://www.gov.br/mma/pt-br/assuntos/servicosambientais/controle-de-desmatamento-e-incendios-florestais/pdf/Listagemmunicpiosprioritriosparaaesdepreveno2021.pdf
[19] SEDAP, 2019– Secretaria de Estado de Desenvolvimento Agropecuário e da Pesca do Estado do Pará. Available on: http://www.sedap.pa.gov.br/content/bovinos. Accesed in 11/04/2022.
[20] IBGE https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/18/16459?localidade1=150345&localidade2=150800&tipo=grafico&indicador=16533https://cidades.ibge.gov.br/brasil/ac/bujari/pesquisa/18/16459?tipo=grafico&indicador=16533
[21] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/16/12705. Accessed in 11/04/2022.
[22] IBGE Cidades, 2020. Available on:https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/16/12705. Accessed in 11/04/2022.
[22] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/tome-acu/pesquisa/16/1270. Accessed in 11/04/2022.
[22] IBGE Cidades, 2020. Available on:https://cidades.ibge.gov.br/brasil/pa/ipixuna-do-para/pesquisa/16/12705. Accessed in 11/04/2022.
[23] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?tipo=grafico&indicador=10370. Accessed in 11/04/2022.
[24] https://sisdep.conab.gov.br/precosiagroweb/
[25] https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?ano=2009
[26]Estimated with populational density of the Vila Nova and the area calculated by the SIG team. Available on: https://carbonextbr.sharepoint.com/sites/DocsCarbonext/Documentos%20Compartilhados/REDE%20CARBONEXT/Técnico/Projetos%20REDD+/Caapii/PD/Memorial%20de%20Cálculo/Obsoleto/Memorial%20de%20Cálculo%20-%20Social%20amostragem.xlsx https://painel.incra.gov.br/sistemas/Painel/ImprimirPainelAssentamentos.php?cod_sr=14&Parameters%5BPlanilha%5D=Nao&Parameters%5BBox%5D=GERAL&Parameters%5BLinha%5D=1

2.1.2 Project Scale

Project Scale	
Project	
Large project	x

2.1.3 Project Proponent (G1.1)

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2.1.4 Other Entities Involved in the Project

The other entities that participated in the project identified until the first monitoring period are presented in this sector.

Organization name	Instituto Manguezal (NGO)
Role in the project	Partner with the environmental education activities in the School Conto de Fadas and Nova Esperança
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2.1.5 Physical Parameters (G1.3)

The CAAPII REDD+ Project is composed by 5 properties, named: Maringá e Catarinense Farm, Catarinense Farm, do Lago Farm, Lagoa Grande Farm and Santa Helena 1 Farm. The area of this properties is distributed in three municipalities: Ipixuna do Pará, Tomé-Açu and Paragominas.

According IBGE (2017), the Pará State is subdivided in six mesoregions[27], and the project is inserted in two mesoregions: Northeast and Southeast of Pará. The Reference Region (RR) is the largest geographic boundary and includes the Project Area (PA). It consists of the geographic boundary of the territory where the analysis of rates, agents, drivers of deforestation and patterns of land use change are based to project the baseline and future deforestation. The RR of the CAAPII REDD+ Project has an area of 741,288.95 ha (seven hundred and forty one thousand, two hundred and eighty eight, and ninety five hectare), located in the municipalities of Paragominas, Ipixuna do Pará, Tomé-Açú and Tailândia, in the state of Pará.

The map below (1) shows the location of the 5 properties involved in the CAAPII REDD+ Project in the 3 municipalities, in the Pará state.

Map 1 - Location of the Project Area of the CAAPII REDD+ Project.

The table 1 presents the geographic coordinates of the centroids of each property involved in the project.

[27] IBGE – INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Malha Municipal, 2015;** Base Cartográfica Contínua do Brasil, ao Milionésimo – BCIM 2010; STRM – Relevo simbreado, 2000**.** Source**:**https://geoftp.ibge.gov.br/organizacao_do_territorio/divisao_regional/divisao_regional_do_brasil/divisao_regional_do_brasil_em_regioes_geograficas_2017/mapas/15_regioes_geograficas_para.pdf. Access:18/03/2022.

Table 1 - Geographic coordinates of the centroids of each property. Datum: SIRGAS2000.

Property	Latitude	Longitude
Fazenda Maringá e Catarinense	03° 02' 46.3194" S	48° 11' 46.3670" W
Fazenda Catarinense	03° 11' 03.5028" S	48° 06' 24.1216" W
Fazenda Lagoa Grande	03° 02' 15.5790" S	47° 53' 55.1156" W
Fazenda do Lago	03° 04' 48.0490" S	47° 53' 01.3097" W
Fazenda Santa Helena I	03° 04' 14.8609" S	47° 41' 44.9169" W

Topography

The topography present in the RR ranges from a maximum elevation of 131,4150 meters to a minimum 0,9605 meters, shown in map 2 below.

Map 2 - -Elevation variation in the reference region (RR) and project area (PA).

Slope

According Embrapa classification, most of RR area concentrates the slope varying up to 20%. In RR area there are 5 slope classes presented in table 2 below, and the spatial distribution of these classes is shown in map 3.

Table 2 - Slope Classification and areas.

Class	Area (ha)	RR %
Flat	119,068.3385	16.062
Slightly undulating	488,532.2331	65.903
Undulating	129,264.8970	17.438
Hilly	4,407.1303	0.595
Mountainous	16.3557	0.002
Total	741,288.9546	**100%**

Map 3 - Slope classes in reference region (RR) and project area (PA), according to Embrapa classification (1999).

Geological

The project area is inserted in the structural province Parnaíba - Marajó-Grajaú Basin, which includes the State of Maranhão and the Northeast of Pará. In terms of lithostratigraphic units, presented in the map 4, it presents superficial cover of the Phanerozoic eon, of the Cenozoic era, formed in the Neogene period, in the Holocene epoch. These are Holocene alluvium (N4a) that are coarse to conglomeratic deposits of channel residuals; sandy bar deposits and overflow pelitic and includes fluviolacustrine and eolian deposits, and Baixo Tocantins Sedimentar Cover (N4bt) compose basically of sand. In the Pleistocene epoch it presents Pleistocene Detrital-Lateritic Cover (N3dl) composed of yellowish sandy-clayey sediments, kaolinitic, allochthonous, partially and totally pedogenized, generated by alluvial-colluvial processes, from the Paleogene period and in the Holocene epoch it presents the Paleocene Detrital-Lateritic Cover (E3dl) in the base kaolinitic clayey zone; bauxitic zone with concretions and on top gibbsite lenses; ferruginous concretionary zone; pisolitic nodular zone; clay capping.

Map 4 - Geological features of the project region.

It also presents components of the coastal structural province, which is the Barrier Group (Nb), a transition between the Miocene, Pliocene and Pleistocene epochs, composed of sandstones, siltstones, argillites and conglomerates of varied colours, with concretionary ("sandstone of Pará") and kaolinitic levels, deposited in a predominantly continental environment by fluvial, fluviolacustrine and alluvial fans.

Finally, the Ipixuna Formation (K2ix) of the Phanerozoic Eon, Mesozoic Era, Upper Cretaceous period of the Parnaíba Structural Province belongs to the Cretaceous Basin of Grajaú, where the base is formed by white, fine, kaolinitic sandstones, with tangential cross stratification and, strictly of red siltstones and argillites[28]. Table 3 below shows all the classes present in RR.

[28] Geological Map. Source: https://geoftp.ibge.gov.br/informacoes_ambientais/geologia/levantamento_geologico/mapas/unidades_da_federacao/pa_geologia.pdf. Access:18/03/2022

Table 3 - Geological classes present in RR area.

Class	Area (ha)	RR %
Barrier Group	56,126.1478	7.57
Ipixuna Formation	188,676.2557	25.45
Itaperucu Formation	1,482.4128	0.20
Pleistocene Alluvium-Coluvium Cover	1,961.8881	0.26
Neo-Pleistocene Detrial-lateritic Cover	432,471.0661	58.34
Paleogene Detrial-lateritic Cover	40,968.1762	5.53
Baixo Tocantins Sedimentar Cover	467.5876	0.06
Holocene Alluvial Deposits	14,192.2328	1.91
Holocene Colluvial Deposits	2,252.7946	0.30
Continental waterbody	2,690.3929	0.36
Total	741,288.9546	**100%**

Geomorphological

The project area is inserted in the morphostructural domain Phanerozoic sedimentary covering and basin, detailed in map 5, presents the geomorphological units according IBGE: Planalto dissecado do Gurupí-Grajaú, Tabuleiros Paraenses and Planícies Fluviais due to the presence of the Capim River in this area.

Map 5 - Geomorphological units in reference region (RR) and project area (PA) of the CAAPII REDD+ Project.

The relief unit Tabuleiros Paraenses is characterized by a vast extension of low relief low range tablelands, occurring in the northeaster region of the state of Pará. This flat landform was originated during successive phases of resumption of erosive processes, which generated inclined and, in some cases, slightly concave plane systems. They are formed by a set of relief forms with tabular tops, conforming features of gently inclined ramps and humps carved in unconsolidated sedimentary coverings, denoting eventual structural control. They result from the establishment of dissection processes. The tops of plateaus and plateaus, dominated by residuals or dominating dissected reliefs; it also occurs in interplanal and peripheral pediplanic depressions in the form of "tabuleiros" (low uplands) and at the foot of escarpments that dominate the lower erosion levels[29].

The relief unit Planalto Dissecado do Gurupí-Grajaú is in the southeast portion of Pará State and some of Maranhão State. It is a surface of flat top to strongly dissected in tabular forms, marked by indentations and recesses of valleys in its borders, which enter the central core, giving a sinuous or arborescent aspect to the set of indentations. The contact of this unit with the neighbouring ones is generally made through breaks in the slopes and in some cases by escarpments of medium amplitude. The plateau is a water divider and it's sculpted in lithologies of the Grajaú Sedimentary Basin, referring to the Itapecuru Formation, of cretaceous age and locally constituted by dark brown clays[30].

The unit relief Planícies Fluviais are characterized by the presence of embedded valleys, with a narrow band of sandy strands developed by river sedimentation. They are formed by processes of dragging and bouncing of coarse material; suspension of colloids and deposition of sediments along stretches of the banks. Sometimes the material is found pedogenized. Contact, with other units and generally abrupt, by marginal ravines; eventually by ramped surface. This unit is made up of material from the alteration of crystalline rocks and/or reworked sedimentary rocks, which generated soil Podzólicos Vermelho-Amarelos, sometimes Plínticos, associated with Plintossolos álicos, on the terraces; and Latosols, sometimes plinthic, associated with Gleissolos, on the terraces with plains, forming unconsolidated sedimentary deposits. The area of occurrence is flat, resulting from different fluvial accumulations, periodically or permanently flooded, comprising abandoned meanders and fluvial dikes with different orientations, linked with or without slope rupture to a higher plateau. They occur in valleys with alluvial fill containing fine to coarse Pleistocene and Holocene material.[31] The Table 4 below presents the geomorphologic classes present in the RR.

[29] Geomorphological Map. Source: https://geoftp.ibge.gov.br/informacoes_ambientais/geomorfologia/mapas/unidades_da_federacao/pa_geomorfologia.pdf. Access:18/03/2022
[30] Geomorphological Map. Source: https://geoftp.ibge.gov.br/informacoes_ambientais/geomorfologia/mapas/unidades_da_federacao/pa_geomorfologia.pdf. Access:18/03/2022
[31] Technical manual of geomorphology 2ªed. Source:https://biblioteca.ibge.gov.br/visualizacao/livros/liv66620.pdf. Access: 18/03/2022.

Table 4 - Geomorphological classes present in RR of the CAAPII REDD+ Project.

Class	Area (ha)	RR %
Chapada de Paragominas	4,463.3582	0.60
Planalto Dissecado do Gurupi-Grajaú	34,701.1040	4.68
Planícies e Terraços Fluviais	16,548.6161	2.23
Tabuleiros Paraenses	682,884.9421	92.12
Continental waterbody	2,690.9341	0.36
Total	741,288.9546	**100%**

Pedological

According to the IBGE soil classification, it was identified four different types of soils: Concretionary Petric Plintosol (FFc), Yellow Dystrophic Latosol (Lad), Hydromorphic Ferrihumiluvic Spodosol (ESKg) and Haplic Gleysol Tb Dystrophic (GXbd)[32] (map 6).

Map 6 - Pedological features of the RR.

[32] Pedological Map.
Source:https://geoftp.ibge.gov.br/informacoes_ambientais/pedologia/mapas/unidades_da_federacao/pa_pedologia.pdf.
Access:18/03/2022.

The Concretionary Petric Plintosol presents a concretionary horizon or layer (iron oxide - hardened and consolidated plintite), with serious restrictions to agricultural use due to the presence of deconcretions that hinder the rooting of plants, and cause obstacles to the use of agricultural equipment and little volume of soil available for plants, pastures are the most common uses in these areas[33]. There is an accumulation of clay below the surface or textural B horizon within 200 cm of the surface and they do not present any restrictive characteristics in the fourth level of classification. The Yellow Dystrophic Latosol presents a superficial horizon modified by the continuous use of the soil by man, with the addition of organic matter. It has a superficial layer rich in organic matter. Soils with clay accumulation below the surface or textural B horizon within 200cm of the surface, soils with petroplinite and/or concretions within 200cm of the surface (when present) indicate imperfect drainage and restriction in the effective soil depth. Sandy soils with difficulty in retaining moisture. It is a soil of low fertility[34]. The Hydromorphic Ferrihumiluvic Spodosol presents strongly restricted to drainage and has a sandy texture to depths greater than 100 cm, susceptible to erosion[35]. The Gleissolo Háplico Tb Distrófico is a soil with low activity and low fertility[36]. The table 5 below presents the pedological classes present in the RR.

Table 5 - Pedological classes present in RR.

Class	Area (ha)	RR %
ESKg - Espodossolo Ferrihumilúvico Hidromórfico	721.4081	0.0973
FFc - Plintossolo Pétrico Concrecionário	155,401.8960	20.9637
GXbd - Gleissolo Háplico Tb Distrófico	17,655.1420	2.3817
LAd - Latossolo Amarelo Distrófico	564,817.3144	76.1939
PVAd - Argissolo Vermelho-Amarelo Distrófico	2.7477	0.0004
Continental Waterbody	2,690.4464	0.3629
Total	741,288.9546	**100%**

Hydrology

The state of Pará has seven hydrographic macro-regions[37] which are Baixo Amazonas, Tapajós, Portel-Marajó, Xingu, Atlantic Coast-Northeast, Calha Norte and Tocantins-Araguaia.

[33] Plintossolo Pétrico Concrecionário Description. Source:https://www.agencia.cnptia.embrapa.br/gestor/solos_tropicais/arvore/CONT000gn362ja202wx5ok0liq1mqrdmmd4k.html. Access: 18/03/2022.
[34] Latossolo Amarelo Distrópico Description. Source:https://www.agencia.cnptia.embrapa.br/gestor/solos_tropicais/arvore/CONT000fzyjaywi02wx5ok0q43a0r58asu5l.html. Access:18/03/2022.

[35] Espedossolo Ferrihúmilúvico Hidromórfico Description.Source:https://www.agencia.cnptia.embrapa.br/gestor/solos_tropicais/arvore/CONT000gn2222vs02wx5ok0liq1mq5moe5rv.html.Access:18/03/2022.

[36]Gleissolo Háplico Tb Distrófico Description. Source: https://www.agencia.cnptia.embrapa.br/gestor/solos_tropicais/arvore/CONT000gn230xhn02wx5ok0liq1mqmwvavn5.html. Access:08/03/2022.
[37] Hydrographic Region. Source: https://www.ibge.gov.br/geociencias/cartas-e-mapas/informacoes-ambientais/31653-bacias-e-divisoes-hidrograficas-do-brasil.html?=&t=downloads. Access:21/03/2022.

The project is inserted in the Tocantins-Araguaia hydrographic region, in the Baixo Tocantins mesoregion and Acará/Guamá microregion.

The water courses present in the RR are many as shown in the map 7, the Capim river is the main river that crosses the RR with 169.84 kilometers of extension within the area, being the most important river of the region of the project and forming the Capim River Basin, subdivided in 25 sub-basins.

Map 7 - Rivers and Igarapés in Reference Region (RR) and Project Area (PA) area.

In second place we have the Acará river with 143.64 kilometers and in third the Acará-Mirim river with 108.74 kilometers, the table 6 below presents all identified watercourses and their respective dimensions.

Table 6 - Water courses present in the RR area.

Name	Lenght (km)	Name	Lenght (km)
Capixaba Stream	14.1021	Igarapé Jacamim	8.9779
Igarapé Açaiteua	10.6078	Igarapé Joroca	10.7978
Igarapé Água Azul	14.5362	Igarapé Papurá	18.0838
Igarapé Aventureiro	7.3498	Igarapé Puraquequara	10.7673
Igarapé Binteua	26.1681	Igarapé Puritirá	21.9878
Igarapé Borba Gato	9.0820	Igarapé Saravá	6.7663
Igarapé Braço	3.0846	Igarapé Tiandeua	9.9954

Igarapé Cachoeirinha	12.7814	Igarapé Timboteua	27.1848
Igarapé Caratauá-açu	27.8571	Igarapé Tracajá	25.0119
Igarapé Carrapatinho	1.6638	Igarapé Tucanandeua	17.1496
Igarapé Cipoteua	2.0702	Igarapé Tucumandeua	11.4675
Igarapé Cupijó ou Canaã	1.3393	Acará River	143.6409
Igarapé da Ananaí ou Goiabal	30.4807	Acará-mirim River	108.7472
Igarapé da Joroca ou Cima	25.5739	Água Boa River	6.3140
Igarapé da Onça	13.1781	Aiú-açu River	2.7713
Igarapé da Pimenta	1.4618	**Capim River**	**169.8443**
Igarapé do Inferno	7.1007	Cuxiú River	17.7308
Igarapé Fortaleza	37.9820	Paraquequara River	10.4354
Igarapé Ipiranga II	9.6981	Timbó-açu River	1.4866
Igarapé Ipiranguinha	15.7814	Tomé-açu River	56.6107
		Total	**957.6706**

Climate

The project is located in Am weather type (humid or sub-humid tropical climate), according to the Köppen classification (1948) [38], equatorial zone with a dry period of one to two months of the year, the average temperature is above 18ºC in all months of the year (map 8). It is a transition area between Af (Tropical humid or super humid climate) and Aw (Tropical) climates.

[38] Koppen Climate Classification. Source: https://www.cnpf.embrapa.br/pesquisa/efb/clima.htm#:~:text=Am%20%2D%20Clima%20tropical%20%C3%BAmido%20ou,pelos%20totais%20elevados%20de%20precipita%C3%A7%C3%A3o. Access:21/03/2022.

Map 8 - Climate features of the RR, according to Köppen classification.

Temperature

The temperature behavior in RR during the year according to data of a historical series 1991-2021 from dataclimate.org shows that the warmest month is October, with an average temperature of 28.4ºC, and the month with the lowest temperature is April, with an average temperature of 24.9ºC, showing a variation of 3.4ºC throughout the year (Figure 2)[39].

[39] Temperature -Precipitation – Rainy – Humidity - Data Source: https://pt.climate-data.org/america-do-sul/brasil/para/paragominas-714961/. This weather data was collected between 1991 and 2021 for the variables temperature, precipitation, water temperature, humidity, rainy Days. Sunhours use the timeframe 1999-2019

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max. Temp. (°C)	30.30	29.30	28.90	28.80	29.30	29.80	31.20	33.20	34.00	34.20	33.80	32.10
Med. Temp. (°C)	25.80	25.10	24.90	24.90	25.30	25.60	26.30	27.50	28.20	28.40	28.40	27.20
Min. Temp. (°C)	22.90	22.60	22.50	22.50	22.60	22.30	22.30	22.70	23.30	23.70	24.00	23.60

Figure 2 - The temperature variation of the RR (historical series 1991-2021).

Map 9 shows the spatial distribution over the RR area of the annual mean temperature variation, from WorldClim historical climate database[40], the maximum temperature is 26.57 ºC and the minimum temperature is 25.93 ºC.

Map 9 - Spatial distribution of Annual Mean Temperature in Reference Region and Project Area.

[40] https://www.worldclim.org/data/worldclim21.html

Precipitation

In RR the month with the highest precipitation according to the historical series between 1991-2021 from dataclimate.org is March with about 380 mm of rainfall, and September is the month with the least precipitation with 16mm[40] (figure 3).

Figure 3 - Precipitation in the RR (Historical Series 1991-2021)[40].

The map 10 below shows the precipitation, from WorldClim historical climate database[41], in the RR.

Map 10 - Spatial Distribution of Average Annual Precipitation in Reference Region(RR) and Project Area (PA).

[41] https://www.worldclim.org/data/worldclim21.html

Vegetation

In the region of project, the forest type predominant is Dense Ombrophilous Forest, and its variations Alluvial, Lowlands and Submontane. The predominant characteristic of this forest type is the abundant and frequent rainfall, the temperatures oscillate between 22ºC and 25ºC. The variations in this forest type were defined by topographic (altitudinal) and latitudinal variation[42].

Map 11 - Vegetation of the Reference Region and Project Area of the CAAPII REDD+ Project.

The map 11 above presents the distribution of forest types in the RR, and the table 7 presents the area of each forest type within the RR, and their respective percentages.

Table 7 - Area (hectares) and percentage (%) of vegetation classes and others uses identified in Reference Region areas, from IBGE classification.

Vegetation classes and other land uses	Class code	Area (ha)	RR %
Submontane Dense Ombrophilous Forest	Ds	35,928.3976	4.85
Lowland Dense Ombrophilous Forest	Db	689,215.5957	92.97

[42] https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=263011

Alluvial Dense Ombrophilous Forest	Da	13,438.8672	1.81
Bodies of water	Magua	2,705.5943	0.36
Total		741,288.4549	100%

2.1.6 Social Parameters (G1.3)

The population of the state of Pará is miscegenated, formed by descendants of African people, native indigenous people, Europeans, and Japanese. There is a great influence from the northeastern culture due to the migratory flow resulting from the construction of the integration highways. The state of Pará went through two distinct colonization cycles, the first one being related to the advance of the Europeans, the Portuguese, the Dutch, and the Spanish, who went into the forest to discover the new world; however, colonization was consolidated with the presence of the Portuguese in this territory, extracting resources from the area, using mainly the Acará, Guamá, and Capim rivers for these activities[32].

The second occupation cycle occurred due to the opening of the great highways BR-100, BR-316 and BR-222 - from the 50s to the 80s. The construction of this highway and the governmental incentives caused a migratory flow from the surrounding regions (coming also from other states). Small settlements originated small villages, which were consolidated as municipalities later on. The migration process was intensified after the railroad Belém-Bragança construction, causing a reconfiguration of the State[43].

It is important to consider the history of occupation in the State of Pará since the CAAPII REDD+ Project is developed in the municipalities of Paragominas, Ipixuna do Pará, and Tomé-Açu, in the state of Pará, Northern Brazil.

The Paragominas was founded in 1961 by Célio Resende Miranda, with the approval of the president Juscelino Kubitschek. The foundation of the city of Paragominas was built using the plan drawn up by urban planner Lucio Costa[44]. The occupation of the Paragominas region was different from the others, because its initial colonization was carried out by families coming from the South of Brazil, specifically Minas and Goiás, and not from the Northeast as in other regions of the Pará. The city of Paragominas has an airport with a satisfying infrastructure and the airstrip can handle small to large aircraft.

The Ipixuna do Pará city was founded in 1958, the pioneer Manoel do Carmo arrived in the region, along with his family of thirteen people. Next came Irineu Farias, Antonio Cipriano and Manoel Henrique. The place was known firstly as “Km 108” and was later named after the river Ipixuna, that in Tupi-Guarani means “river of dark waters”. Only in 1993 it was established as a municipality[45].

[43]Embrapa Available on: https://ainfo.cnptia.embrapa.br/digital/bitstream/item/162428/1/Livro-Nordeste-1.pdf. Accessed:04/04/2022.

[44] Available on: https://paragominas.pa.gov.br/o-municipio/historia/. Acessed:05/04/2022.
[45] History of Ipixuna do Pará. Source: https://ipixunadopara.pa.gov.br/o-municipio/historia/. Access: 06/04/2022.

Tomé-Açú was occupied by the first inhabitants of the region near the Acará-Mirim River were the Tembé indigenous people, who lived off subsistence agriculture. The first white colonizers that occupied the territory of Tomé-Açu was the Portuguese José Maria de Carvalho, who was also the first wood trader at the Tomé-Açu Igarapé. Before the emancipation of Tomé-Açú in 1959, the region belonged to Acará municipality[46].

The table 8 presents some of the main characteristics of the municipalities of Paragominas, Tomé- Açu and Ipixuna do Pará, according to the last census data, of 2010.

Table 8 - List of some characteristics of each municipality according to the IBGE.

Parameter	Paragominas	Ipixuna do Pará	Tomé-Açú
Population in 2010 (inhabitants)	97,819	51,309	56,518
Population estimated in 2020 (inhabitants)	115,838	67,170	64,604
Area (km²)	19,342,565	5,215,555	5,145,361
Population density (hab/km²)	5,06	9,84	10,98
Distance from capital – Belém (km)	307,1	255,7	203,0
Elementary school (unit)	75	65	95
High School (unit)	9	2	3
Schooling rate – 06 to 14 years	95,9%	74,8%	95,6%
Treated water distributed per day (m³)	25,342	-	-
Untreated distributed water per day (m³)	-	15,000	5,340
Volume of water consumed per day (m³)	25,342	11,643	5,340
Volume of sewage treated per day (m³)	542	-	-
Hospital Public (stablishment)	15	11	8
Hospital Private (stablishment)	13	2	3
Religion – Catolic	55,911	36,006	31,105
Religion – Evangelic	29,828	11,148	18,335
Religion – Non-Religious	11,081	4,099	6,305
Relingion – Others	932	56	765

The sanitation theme includes solid waste management, water treatment and distribution, sewage collection and treatment, and other parameters essential to socio-economic development.

About sanitation 22.91% of the total population of Paragominas has access to sewage services, the Pará state average is 11.6% and the country is 65.87%. Its important emphasize only the urban population has

[46] Tomé Açú Town Hall official website. 2022. Available on: https://www.prefeituratomeacu.pa.gov.br/hist%C3%B3ria. Accessed: 06/04/2022.

access to the sewage treatment, the rural population is not served, 87,224 of the population has no collected sewage[37]. The solid waste is collected 85% of the population (residential waste), 100% of the urban population has this service, but only 33.68% of the rural population has this service, of the total waste collected only 0.54% is recovered by selective collection[37]. The distribution and treatment water system, 19,997 inhabitants don't have access to potable water[47].

The municipality of Ipixuna do Pará did not declare sanitation information in Sistema Nacional de Informações sobre Saneamento – SINIS, and no information was found in the database www.aguaesaneamento.org.br[48].

The municipality of Tomé-Açú serves 68.39% with potable water, the average of the state is 43.58%, and the country is 83.71%, 20,057 inhabitants don't have access to potable water[39]. About de solid waste collect, 75% the population has the waste collected, in this scenario 99.2% of the urban inhabitants has this serve and only 44.4% of the rural inhabitants has the waste collected, 15,861 inhabitants do not have waste collection service[39]. Tomé-Açú did not declare sewage data[49].

The municipalities of Paragominas, Tomé-Açu and Ipixuna do Pará belong to Rio Capim Integration Region. The Integration Regions were created with the intention of representing areas with similar occupation, economic dynamism, and social level, where the municipalities maintain integration among themselves, both physically and economically, and participate together to reduce regional inequality. Those integration regions were created by the Article 1º of Decree 1.066 of 2008 who created the integration regions of the State of Pará, the 12 integration regions are Araguaia, Amazonas, Carajás, Guarajá, Guamá, Lago de Tucuruí, Marajó, Rio Caeté, Rio Capim, Tapajós, Tocantins, Xingu. Each integration region now has its own government planning, actions and works, according to its regional identities and specificities[50]. According to the Amazon Foundation for the Support of Studies and Research of Pará[51] the Rio Capim integration region has a GDP around R$4.3 billion, about 5% of Pará GDP, accounts for 11% of the state's agricultural and livestock GDP. It is the largest producer of grains with 40% of the produced in the state, being the largest producer of soybeans (50%) and corn (30%). It is also the leader in fruit production, with 83% of orange production and 33% of passion fruit. In mining, it stands out for having kaolin mines in Ipixuna do Pará and bauxite mines in Paragominas. The Rio Capim Integration is important in pasture, with the 5th largest cattle herd of the state, at about 8%[52].

[47] Source: https://www.aguaesaneamento.org.br/municipios-e-saneamento/pa/paragominas. Access: 02/05/2022.
[48] Source:https://www.aguaesaneamento.org.br/municipios-e-saneamento/pa/ipixuna-do-para. Access: 02/05/2022.
[49] Source: https://www.aguaesaneamento.org.br/municipios-e-saneamento/pa/tome-acu. Access: 02/05/2022.
[50] Abreu, G.; **Divisão do Estado em 'Regiões de integração' auxilia no planejamento de ações governamentais.** SECOM - 01/02/2022. Available on: https://agenciapara.com.br/noticia/34603/. Accessed:11/04/2022.
[51] FAPESPA - Amazon Foundation for the Support of Studies and Research of Pará Source:https://www.fapespa.pa.gov.br/sobre-nos.Acess:02/05/2022.
[52] Diagnóstico Socioeconômico e Ambiental da Região de Integração Rio Capim. Costa, E.; Paes, G. Presentation by Fapespa – Fundação Amazônia de Amparo a estudos e Pesquisas do Pará. Availabre on: https://docplayer.com.br/86524037-Diagnostico-socioeconomico-e-ambiental-da-regiao-de-integracao-rio-capim.html. Accessed: 11/04/2022.

Historically, the state of Pará explores and deforests unsustainably the Amazon Forest. According to data from Terra Brasilis[53] , based on Prodes/IBGE, since 2006, the state of Pará has been the state that most deforests in Brazil, for 16 consecutive years). The municipality of Paragominas was included in the list of municipalities that most deforested in 2008. This list was created by the ministry of environment implemented by de Decree nº6.321/2007, and the objective is to list the municipalities that need more attention and inspection for deforestation[54]. After actions to combat illegal deforestation and other measures made by the city involving reduction of deforestation, Paragominas left the list of priority municipalities in 2010. It is important to emphasize that other municipalities around the project area have been on the list as well.

Currently, the deforestation of the Amazon Forest in the region of the project in Pará is mostly influenced by anthropic activities: cattle raising and soybean agriculture (Map 12).

Map 12 - Land use map in the region of the project, referring to 2020. Source: Mapbiomas.

[53] Terra Brasilis. 2022. Available on: http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/amazon/increments. Accessed in 11/04/2022.

[54] Priority Municipalities. Source:http://combateaodesmatamento.mma.gov.br/municipios-prioritarios. Access:05/05/2022

As seen in the figure above, the most present anthropic deforestation is caused cattle raising. The cattle raising activities in the state achieved the total of 20,881,204 heads in 2019 (SEDAP,2020[55]) that represents essentially 10% of Brazilian herd. From 2018 to 2020[56], the cities of Paragominas, Ipixuna do Pará and Tomé-Açu had a boost on livestock. The municipality of Paragominas reached 357,189 head of cattle in 2020, which represents a 29.4% growth in two years. Ipixuna do Pará presented an increase of 41.8% from 2018 to 2020, while in Tomé-Açu the growth was of 17.2% for the same period.

The production of soybean in the state of Pará has grown exponentially, as the figure 4 shows. From 2009 to 2020 the production increased more than 964% in the state[57], and it is still growing since the value of soybean in the market also increased. Still according to data from IBGE, the area of its cultivation also increased between the years: from 71,410.00 ha in 2009 to 643,267.00 he in 2020. It means a 900% increase in area (ha).

Figure 4 - Soybean production from 2009 to 2020 in the Pará state. Source: IBGE, 2020. Available on https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?tipo=grafico&indicador=10368. Accessed in 06/04/2022.

Forestry and timber exploration (both legal and illegal) is also a common practice in the region. In 2020, the cities of Paragominas, Tomé-Açu and Ipixuna do Pará produced around 37.1% of all charcoal from timber in the state of Pará[58]. The production of roundwood and firewood in 2020 in the municipalities corresponded to 449,161.00 m³ of timber removed[59]. Historically, the logging is also very present in the project region.

[55] SEDAP, 2019– Secretaria de Estado de Desenvolvimento Agropecuário e da Pesca do Estado do Pará. Available on: http://www.sedap.pa.gov.br/content/bovinos. Accesed in 11/04/2022.
[56] IBGE https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/18/16459?localidade1=150345&localidade2=150800&tipo=grafico&indicador=16533https://cidades.ibge.gov.br/brasil/ac/bujari/pesquisa/18/16459?tipo=grafico&indicador=16533
[57] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?tipo=grafico&indicador=10370. Accessed in 11/04/2022.
[58] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/16/12705. Accessed in 11/04/2022.
[59] IBGE Cidades, 2020. Available on:https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/16/12705. Accessed in 11/04/2022.
[59] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/tome-acu/pesquisa/16/1270. Accessed in 11/04/2022.
[59] IBGE Cidades, 2020. Available on:https://cidades.ibge.gov.br/brasil/pa/ipixuna-do-para/pesquisa/16/12705. Accessed in 11/04/2022.

Each city of the CAAPII REDD+ Project is composed by the urban and rural inhabitants, composed by different communities with their own particularities and demands. The stakeholders' and communities' descriptions are detailed at section 2.1.9.- Stakeholder Descriptions.

Fourteen communities were identified by literature and research in official public geodatabases with support from GIS team within a buffer of 20 km of the project area (Table 9, Map 13). The onsite visits, meetings and interviews with the local people was used to locate the communities and make diagnosis of the social and economic conditions that are being used to design the project activities. In the onsite visits and public consultation, however, 7 communities were identified as suitable for project activities' development, around the project area in which action would be focused. The communities in red are excluded from the CAAPII REDD+ Project due to several reasons, that will be further explained. If in the next years, a better relation is established, the possibility of activities with them will be considered.

Table 9 - List of communities identified within a buffer of 20km of the Project Area. The communities painted in red will be excluded from project activities in this moment. *Projection and Datum: UTM zone 22S, SIRGAS2000 (EPSG: 31982)

Community	Municipality	Latitude (E)* 23 M	Longitude (S)*
Vila Roça Queimada	Ipixuna do Pará	823814	9661911
Vila Balalaica (riverside of the Capim River)	Ipixuna do Pará	827163	9656421
Vila Balalaica (sede)	Ipixuna do Pará	827256	9670205
Vila Nova Esperança	Ipixuna do Pará	829879	9674508
Vila Diamantina	Ipixuna do Pará	843003	9674911
Distrito de Canaã	Ipixuna do Pará	853584	9674191
Vila Bom Jesus	Ipixuna do Pará	855136	9683073
Colônia Oriente	Paragominas	857027	9663824
Colônia do Uraim	Paragominas	857027	9661364
Cachoeiro do Potiritá	Paragominas	858994	9662642
Vila Itapura	Paragominas	811309	9643209
Vila Nova	Tomé-Açu	807717	9684435
Vila Rainha da Selva	Tomé-Açu	793495	9675510
TI Amanayé	Tomé Açu	829406	9660380

Map 13 - Location of the communities identified in a 20km buffer of the CAAPII REDD+ project area.

The indigenous land named Amanayé/Sarauá was excluded from project activities in this moment. This area Amanayé borders with the property Fazenda Maringá e Catarinense from the project area. This land has conflicts since indigenous people were expelled in 2002 from their area by illegal land grabbers to explore timber[60]. These land grabbers formed the community Balalaica Sede and Balalaica (riverside of the Capim River), also excluded from project activities. It was reported by the landowner of the property Fazenda Maringá e Catarinense that in 2015 there was a big fire in an attempt to scare the owner and invade his property (figure 5a). The purchase of 2 water trucks (figure 5b) by the land owner happened in the same year. The fence was placed right after and the firebreak dividing the areas was also made. In 2018, the Federal Prosecution Service of Brazil began the order of dispatch of the invaders. In 2019, an investigation showed that at least 150 non-indigenous families were in the area. Data from the Instituto Nacional de Pesquisas Espaciais (INPE), showed that from 2008 to 2019 more than 2.6 thousand hectare were deforested in the territory. From 2016 to 2020, a total of 1.6 thousand hectare were burnt[61]. A new

[60] http://www.mpf.mp.br/pa/sala-de-imprensa/noticias-pa/justica-federal-determina-que-nao-indigenas-desocupem-terra-indigena-saraua-pa-dentro-de-90-dias

[61] https://g1.globo.com/pa/para/noticia/2021/10/04/mpf-alerta-para-o-risco-de-conflito-que-pode-gerar-uma-tragedia-sem-precedentes-em-ipixuna-do-para.ghtml

order to leave in 90 days the area by the invaders was dispatched in 25/02/2022. The Federal Prosecution Service of Brazil points that can be conflicts soon[62].

Figure 5 - a) Photo taken in 2015 by the owner of the farm Maringa e Catarinense after the fire and attempt of invasion coming from the Indigenous land Amanayé. 4b) One of the water trucks of the properties of the CAAPII REDD+ Project, purchased in the same year.

The community Roça Queimada is also excluded from project activities because it is between the conflict in the indigenous land Sarauá and the Balalaica (Sede and riverside) Community. It was also reported by the proponent (property owner) that the community is not receptive and can be dangerous to visit. Thus, the social team did not feel comfortable to visit the area in this first period of the project.

The Vila Rainha da Selva was not located by the Carbonexts' social team, as well as the Colônia do Uraim. Instead of the community Colônia do Uraim, the community Cachoeiro do Potiritá was found, consulted and included in the project.

The community Colônia Oriente was identified and visited by the social team, but the exclusion of the project was defined after it was identified conflicts regarding land tenure. Several processes can be consulted in the JusBrasil website[63] .

The Vila do Bom Jesus and Vila Itapura were identified in official public geodatabases by GIS in the buffer of 20km from the project area, but during the onsite visits and community consultation, there was a logistic problem, that did not allowed the visitation of the social Team. The bridge was broken and the path was interrupted. Both communities will be visited as soon as possible to verify the possibility of project activities with them.

The identification of the vulnerabilities that can be worked with the communities is essential to direct the project activities in the most effective way possible. The identification of vulnerabilities for each community is presented in sector 4.4.1.. Thus, for the CAAPII REDD+ Project, the main approach will be the contact with the community and their needs through the school of the smaller communities (at this first moment):

[62] https://g1.globo.com/pa/para/noticia/2022/02/25/justica-da-90-dias-para-nao-indigenas-deixarem-terra-saraua-pa-no-para.ghtml
[63] https://www.jusbrasil.com.br/processos/nome/40224281/fazenda-oriente

Vila Nova Esperança, Cachoeiro do Potiritá and Vila Diamantina. This decision was based on some important factors, such as the education and environmental awareness identified as fragile, the power of the school to work with diverse and transversal topics, and other that are further detailed in the sector 2.1.11. – Project activities and Theory of Change. The Communities Distrito de Canaã and Vila Nova will also be worked on, but different approaches are being developed since these are much bigger in population number.

2.1.7 Project Zone Map (G1.4-7, G1.13, CM1.2, B1.2)

The CAAPII REDD+ Project is composed by 5 properties distributed in the municipalities of Paragominas, Ipixuna do Pará and Tomé-Açu: Maringá e Catarinense Farm, Lagoa Grande, do Lago, Santa Helena 1 and Catarinense. In the table below (10) it is presented the total area of the properties and the areas that compound the Project Area. The indigenous land Sarauá/Amanayé was identified in the Region of Reference and borders the farm Maringá e Catarinense.

Table 10 - Properties involved in the CAAPII REDD+ Project, with total area and project area.

PA	Property	City	Total Area (ha)	Project Area (ha)
PA1	Fazenda Maringá e Catarinense	Ipixuna do Pará/ Tomé-Açu	39,190.58	30,322.2304
PA1	Fazenda Catarinense	Ipixuna do Pará	1,463.26	668.0742
PA2	Fazenda do Lago	Paragominas	1,549.45	1,153.2229
PA2	Fazenda Lagoa Grande	Paragominas	1,499.55	1,006.1778
PA3	Fazenda Santa Helena I	Paragominas	1,173.7	616.9306
Total			44,876.54	33,766.6359

The Project Zone map will be divided in 3 maps, in order to show more clearly the details: one map with details of the properties and the project area of each one of them (14); one map presenting the communities within the 20km buffer (15); and one map showing the region of reference of the project (16). The boundaries of the CAAPII REDD+ Project are provided, however, there is no prediction until this moment of offsite climate, community and biodiversity impacts. The possible offsite impacts on climate, community and biodiversity will be further discussed, identified and diagnosed, so they can be known and possibly monitored, avoided and mitigated especially in the case they are negative. The impact on other stakeholders can occur inside the region of reference.

The first map (14) presents the project area in green compound by the 5 properties of the CAAPII REDD+ Project: The Maringá e Catarinense farm, Catarinense farm, Lagoa Grande farm, do Lago farm and Santa Helena 1 farm.

The High Conservation Values (HCVs) areas for biodiversity (identified in sector 5.1.2.) are the project area, since the bibliographic research identified the possibility of distribution of the priority species in the project area. The Capim River was identified as the community HCVs area, indicated in blue on the map 14. The CAAPII REDD+ Project will only evaluate the Permanent Preservation Areas (APPs) that are in the project area.

Map 14 - The properties of the CAAPII REDD+ Project, the biodiversity HCVs are also in the project area and the community HCV in blue, the Capim River.

The communities, Conservation Units and indigenous lands described in sector 2.1.9, located within the 20 km buffer from the project areas, as well as the ones located in the Reference Region are presented in the map 15. The Reference Region has 741,288.95 ha.

Map 15- Communities, indigenous lands and other settlements identified within a 20km buffer of the project area of the CAAPII REDD+ Project.

The populational density of the 5 communities visited by the social team for the project was estimated based on the only number of inhabitants obtained in the public consultation with the leadership of the Vila Nova Community, which is an approximation since no official numbers were obtained. According to this leadership interviewed, Vila Nova Community has around 4,500 inhabitants in an area of 0.65 km^2. This gives the populational density of: 6,923.08 inhabitants per km^2. The areas of the 5 communities were measured with the help of the GIS tool, so the populational density of the 5 communities could be calculated and presented in the table (11) below. In total, the estimation is of approximately 14,000 inhabitants in the 5 communities: Vila Nova Esperança. Distrito de Canaã, Vila Diamantina, Cacoeira do Potiritá and Vila Nova.

Table 11 - Communities visited involved in the CAAPII REDD+ Project and the estimative of number of inhabitants.

Municipality	Community	Area measured by the GIS team (km^2)	Inhabitants
Ipixuna do Pará	Vila Nova esperança	0.13	900

Municipality	Community	Area measured by the GIS team (km^2)	Inhabitants
Ipixuna do Pará	Distrito de Canaã	0.80	3500
Paragominas	Cachoeira do Potiritá	0.27	1,869.231
Ipixuna do Pará	Diamantina	0.46	3,184.615
Tomé- Açu	Vila Nova	0.65	4,500
TOTAL		**2.31**	**13,953.8**

The CAAPII REDD+ Project intents to be a grouped project, however, at this moment, there are no predicted instances to be added to the project area. In the case of new additions during the next monitoring periods, the areas will be located within the Reference Region (Map 16).

Map 16 - Project map showing the reference region and project area boundaries of the CAAPII REDD+ Project.

2.1.8 Stakeholder Identification (G1.5)

The project proponents assessed the local stakeholders identifying those that are potentially impacted, negatively or positively, by the project. The identification process started with the identification of community leaders and community associations, government agencies and regional environmental entities, non-

government organizations, research institutes, national parks, conservation areas, settlements, and organizations or groups with similar interests in the outcome of the project activities.

The identification analysis considered the following criteria:

- Geographic Location: communities located inside the project area and in the surroundings up to 20 kilometers from de project area buffer.
- Dependency on the Project Area: Communities that use the project area and develop some type of activity in it.
- Identification with forest conservancy: Institutions, NGOs, federal/state/municipal bodies that works towards the forest conservancy and sustainable development.
- Social Movements: Institutions, NGOs, federal/state/municipal bodies that works towards the development of local communities.

Stakeholders were primarily analyzed based on their influence, along with their rights, interests, and relevance to the Project, to ensure the CAAPII REDD+ Project was properly aligned with the stakeholders. The first step in this identification process was carried out by the Carbonext technical team based on information provided by official government bodies to determine the actors present in the area. Subsequently, it was verified that the Project Area does not overlap with the surrounding communities, using georeferenced information system (GIS) data.

Followed after the identification, the stakeholders were divided into two groups: stakeholders relevant for the Public Community Consultation, and relevant for the Public Institutional Consultation. Subsequently, onsite visits were conducted by a social professional, to inform about the project idea, its activities, the potential benefits to the communities and their participation in the project. When a community is not identified by satellite images or official databases by the GIS team and is identified only in the field, or it is a remote community, or there is no contact point, a first visit is made to identify a leader or a reference point within the community, and in a second visit if verified that the community is receptive, the project and possible positive impacts are presented.

To complement field information, a series of onsite interviews were conducted by the team, validating the secondary information previously collected and ensuring that all relevant stakeholders were considered (figure 6). The socioeconomic diagnosis was carried out with these information. The social interviews and meetings have also the objective to get closer to the communities, to understand their living, their needs, their general characteristics, thus the project activities can be designed to be more effective and align with the communities' perspectives.

Figure 6 - Meeting in the School Conto de Fadas, in the Cachoeira do Potiritá community.

Consultations with all stakeholders shall continue throughout the Project Lifetime to assess the activities, make adaptations if needed, design new actions, mitigate impacts and so on.

2.1.9 Stakeholder Descriptions (G1.6, G1.13)

The communities of the project were identified, at first, by the GIS Team of Carbonext, that were able to locate the communities within 20 km of the Project Area by satellite images or official geodatabases. Then, the proponents and landowners were consulted and gave information about the communities they knew in the region. The next step was the confirmation of their locations by the Carbonext Social Team, through the onsite visits and meetings in the communities (Figure 7).

Table 12 - Communities identified by Carbonext social team that are suitable for project activities.

Stakeholder	City	Description and Relevance
Vila Bom Jesus	Ipixuna do Pará	First identified by Carbonext, this community is relevant to the project because of its proximity, influence and the possibility to develop social activities with this community, benefiting them directly. Due to logistic problems to access the local, this community has not been visited yet, but will be as soon as possible to accomplish the public

Stakeholder	City	Description and Relevance
		consultation and community diagnosis to the development of the activities.
Vila Itapura	Paragominas	First identified by Carbonext; This community is relevant to the project because of its proximity, influence and the possibility to develop social activities with this community, benefiting them directly. Due to access problems, this community has not been visited yet, but will be as soon as possible to accomplish the public consultation and community diagnosis to the development of the activities.
Comunidade Cachoeira Potiritá	Paragominas	First identified by Carbonext; This community is relevant to the project because of its proximity, influence and the possibility to develop social activities with this community, benefiting them directly.
Vila Nova Esperança	Ipixuna do Pará	First identified by Carbonext; This community is relevant to the project because of its proximity, influence and the possibility to develop social activities with this community, benefiting them directly.
Vila Canaã	Ipixuna do Pará	First identified by Carbonext; This community is relevant to the project because of its proximity, influence and the possibility to develop social activities with this community, benefiting them directly.

Stakeholder	City	Description and Relevance
Vila Nova	Tomé-Açú	First identified by Carbonext; This community is relevant to the project because of its proximity, influence and the possibility to develop social activities with this community, benefiting them directly.
Comunidade Diamantina	Ipixuna do Pará	First identified by Carbonext; This community is relevant to the project because of its proximity, influence and the possibility to develop social activities with this community, benefiting them directly.

Figure 7- Meeting with the Vila Diamantina Community held by Carbonexts´social team to explain the CAAPII REDD+ Project. (Source: Photo taken by Carbonext).

The community identification process identified fourteen communities and villages near the project area, but as explained in the sector 2.1.6., some of them were excluded from the CAAPII REDD+ Project, remaining 7 communities suitable for project activities (table 12). It is important to mention that, if in the next years the land tenure matter became legally solved and the conflicts end, the possibility of activities with them will be considered and assessed.

Institutional

The institutional stakeholders were identified through research made by the Carbonext Technical team, considering the location of the project, the types of activities that are being developed, to whom it may be related and relevant, and the possibility of beneficial partnerships to the communities (table 13).

Table 13 - Institutional Stakeholders identified for the CAAPII REDD+ Project.

Stakeholder	City	Function of the institution	Description and relevance
Paragominas City Hall	Paragominas	Public management, promotes sustainability including environment, social and economic development programs. Ensures law enforcement.	This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to health, socioeconomic matters, gender equality, education, infrastructure, sustainable practices, technical support, motivation and engagement of the communities, forest and biodiversity conservation.
EMATER-PA	Paragominas	Rural extension and technical assistance institute. This organization promote the familiar agriculture,	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of

Stakeholder	City	Function of the institution	Description and relevance
		supporting with technical supporting and agricultural training - capacitation.	beneficial partnerships to the communities in activities related to infrastructure and technical support, sustainable practices and development, improve in production, courses and workshops on sustainable agriculture, and other activities. .
Secretaria do Verde e Meio Ambiente	Paragominas	Plans, coordinates, executes, supervises and controls the plans related to the municipal environmental policy. Also promotes measures and establishes guidelines for the preservation, control, and recovery of the environment, considering it a public asset for the collective use and improvement of the quality of life. Specially Paragominas has	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to environmental education activities and biodiversity preservation.

Stakeholder	City	Function of the institution	Description and relevance
		implemented the program "município verde" to reduce and combat deforestation, violence, and child labor.	
Secretaria de Educação	Paragominas	Guarantees the qualification of teachers and students from the public school. It's responsible to educational policy, development projects, including urban and rural zones.	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related on education and infrastructure of the schools.
Secretaria Municipal de Assistência Social - SEMAS	Paragominas	Promotes and defends the rights of children, adolescents, women, and the elderly people, to make sure that social rights.	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to socioeconomic matters, gender equality, motivation in the rural life and others.

Stakeholder	City	Function of the institution	Description and relevance
Biodiversity Research Consortium Brazil-Norway (BRC)	Paragominas	It develops research and monitoring activities on biodiversity, carbon flux and ecological footprint, tropical forest restoration with inclusion of biodiversity and soil.	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to biodiversity and forest conservation and environmental education.
Sindicato dos Produtores Rurais de Paragominas	Paragominas	Seek to guarantee the rights of benefits, severance pay, declarations for rural retirements, better working conditions, and the rights granted by the Rural Social Security	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to sustainable practices, technical support and increase on the production through sustainable development.
Cooperativa dos Pequenos Produtores Rurais do Uraim	Paragominas	An autonomous association, composed by voluntary small rural producers, aiming at	Identified by Carbonext. This Institution is relevant to the project according to the location, function

Stakeholder	City	Function of the institution	Description and relevance
		the mutual benefit of its members through the union of efforts for the sale of their products, purchase of inputs, and training.	and possibility of beneficial partnerships to the communities in activities related to sustainable practices, technical support, engagement with the rural workers of the communities and increase on the production through sustainable development..
Ipixuna do Pará City Hall	Ipixuna do Pará	Public management promotes sustainability including environment, social and economic development programs. Ensures law enforcement.	This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to health, socioeconomic matters, gender equality, education, infrastructure, sustainable practices, technical support, motivation and engagement of the communities, sustainable development, forest and biodiversity conservation.

Stakeholder	City	Function of the institution	Description and relevance
EMATER-PA	Ipixuna do Pará	Rural extension and technical assistance institute. This organization promote the familiar agriculture, supporting with technical supporting and agricultural training - capacitation.	Identified by Carbonext; This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to sustainable practices, increase of production through sustainable development, technical support.
Secretaria do Meio Ambiente, Ciência e Tecnologia	Ipixuna do Pará	This secretariat, plans, coordinates, executes, supervises and controls the plans related to the municipal environmental policy. The Secretariat also promotes measures and establishes guidelines for the preservation, control, and recovery of the environment, considering it a public asset for the collective use and improvement of the quality of life.	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to biodiversity and forest conservation, sustainable development and environmental education.

Stakeholder	City	Function of the institution	Description and relevance
Secretaria Municipal de Educação	Ipixuna do Pará	Promote education for children, young people, and adults. To set goals for the development of education at all levels, incentive programs for education and the reduction of illiteracy. Supervises, plans and controls school meals, student transportation and pedagogical support services.	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to education and infrastructure of the schools.
Secretaria Municipal de Assistência Social - SEMAS	Ipixuna do Pará	Attention to the family, childhood, adolescence, the elderly, and the disabled; defining the municipality's basic social projects, such as the right to education, health, work, culture, housing, leisure, and all the social rights that guarantee citizenship; Confronting poverty, providing assistance services. Improving	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to gender equality, socioeconomic matters, technical support, motivation, capacitation and engagement of the communities.

Stakeholder	City	Function of the institution	Description and relevance
		the lives of socially unassisted and marginalized minorities, as well as the family, motherhood, childhood, the elderly, the disabled, ex-prisoners, beggars, the mentally ill, immigrants, and others who find themselves in situations of vulnerability; programs that reduce social inequalities;	
Tomé Açú City Hall	Tomé-Açú	Public management, promotes sustainability including environment, social and economic development programs. Ensures law enforcement.	This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to health, socioeconomic matters, gender equality, education, infrastructure, sustainable practices, technical support, motivation and engagement of the communities, forest

Stakeholder	City	Function of the institution	Description and relevance
			and biodiversity conservation..
EMATER-PA	Tomé-Açú	Rural extension and technical assistance institute. This organization promote the familiar agriculture, supporting with technical supporting and agricultural training - capacitation.	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to sustainable practices, capacitation, technical support, sustainable development and increase of production.
Secretaria Municipal de Meio Ambiente SEMMA	Tomé-Açú	This secretariat, plans, coordinates, executes, supervises and controls the plans related to the municipal environmental policy. The Secretariat also promotes measures and establishes guidelines for the preservation, control, and recovery of the environment, considering it a public asset for the collective use and	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to forest and biodiversity conservation, and environmental education.

Stakeholder	City	Function of the institution	Description and relevance
		improvement of the quality of life.	
Secretaria Municipal de Educação SEMED	Tomé-Açú	To guarantee a quality public education that is inclusive, sustainable, democratic, and participative, aiming at the integral development of the individual in order to exercise his or her citizenship.	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to education and infrastructure of schools.
Secretaria Municipal de Trabalho e Assistência Social - SETAS	Tomé-Açú	Integral assistance to families, children and adolescents, women, the elderly, homeless people and people with disabilities that for some reason are in a situation of greater social vulnerability	Identified by Carbonext. This Institution is relevant to the project according to the location, function and possibility of beneficial partnerships to the communities in activities related to gender equality, socioeconomic matters, technical support, capacitation, motivation and engagement of the communities.
Serviço Nacional de Aprendizagem Rural - SENAR	Paragominas	This institution provides courses and workshops in	Identified by Carbonext. This Institution is relevant to

Stakeholder	City	Function of the institution	Description and relevance
		different areas to rural families	the project according to the possibility of beneficial partnerships to the communities in activities related to sustainable practices, increase in production through sustainable development, technical support and capacitation.

The CAAPII REDD+ Project is a grouped Project and in case of inclusion of new properties for forest conservation, the same institutional stakeholders identified above (table 13) will be considered. In the case of the identification of new institutional stakeholders during the Project lifetime, these will be included in the respective MR.

2.1.10 Sectoral Scope and Project Type

- Project Scope 14: Agriculture, Forestry and Other Land Use (AFOLU).
- Project Category: Reducing Emissions from Deforestation and Degradation (REDD).
- Type of Activity: Avoided Unplanned Deforestation & Degradation (AUDD).
- Climate, Community and Biodiversity (CCB - Version 3).
- Reference of Methodology: Approved VCS Methodology for Avoided Unplanned Deforestation (VM0015) V.1.1.
- This is a grouped project (more details in sector 2.1.21.).

2.1.11 Project Activities and Theory of Change (G1.8)

The theory of change is a methodology that aims to present the steps of how the goals and/or objectives of a project or program can be achieved in the short, medium to long term to produce local, genuine and

beneficial changes regarding community, climate and biodiversity. The proposed schedule is flexible allowing corrections and adaptations of activities throughout the development of the project, when the actions are proved to be ineffective or need adaptation.

The CAAPII REDD+ project aims to contribute to the improvement of the quality life of the populations living around the project's forest plots. The CAAPII REDD+ project has 4 goals for the project region: 1) conserve and protect 33,766.64 hectare of the Amazon Forest; 2) bring better quality of life and well-being for the communities; 3) preserve the biodiversity; and 4) bring benefits to climate regulation as consequence. These goals will be achieved over the 30 years of the project, gradually, as the social, climate and biodiversity actions advance. The project is not located within a jurisdiction covered by a jurisdictional REDD+ program, since there is no jurisdictional REDD+ Project in the State of Pará yet.

The strategic lines of the CAAPII REDD+ Project aim to build a good communication and relationship between the proponents and the communities, establishing an adherence to the project and to the programs that will be implemented together with the local communities. Only with good engagement, the conservation of the Amazon Forest and the other goals can be achieved. Considering this, the strategy for this project is to act together with the local schools and teachers, in order to reach the members of the communities of the project through students and their families, relatives and friends. It is important to mention that deforestation only happens because of people, thus taking care of the employees of the farms and especially the communities, training and acting together with them means the conservation of the forest areas, biodiversity and maintenance of the climate, holding and tying these 4 goals together.

It is important to emphasize that the base of the Theory of Change of the CAAPII REDD+ Project is the protection of the Amazon Forest areas in the properties of project area. The protection and conservation of the forest, has been possible, due the sustainable forest management activity developed in the project area. This activity enables the land occupation and use, since historically is known that unoccupied areas are invaded for illegal practices[64]. The area is productive and thus the invasions are inhibited because the land is occupied, the forestry sustainable management brings the movement of people in the area, income for the monitoring actions ensuring the area is protected such as terrestrial patrol, purchase and maintenance of transport vehicles and equipment, courses and trainings to security, safety and fire combat, and many others that are developed by the landowner for many years. The practice of sustainable management helps in the terrestrial monitoring, ensuring the permanence of the limits of the farm and consequently protecting the forested area that lies within these limits.

On the other hand, the monitoring and protection actions cannot depend only on the management forestry activity to guarantee the safety of the area, because this activity is unstable and not regular every year. Some factors, such as the slowness of the public system in issuing a license to explore the area, may delay

[64] https://www.scielo.br/j/ea/a/pstJcmXTJKSNGRYZNLPWhsN/?lang=pt

the exploration period or even stop the whole activity of the year as scheduled by the farm owner. Other factors, such as climate changes related to heavy rains, may also impede the practice of sustainable forest management, since during the rainy season it is not possible to carry out management in these areas, making this practice unfeasible. When events of this nature occur, there will only be expenses with monitoring, protection and maintenance of the area, since there is no gain in resources from the management in that year. This can directly affect the protection of forest areas against invasion and fire, if there are no additional resources for monitoring.

The timber harvest activities also called in this document sustainable forest management depend on authorization from the responsible regulatory agency which are IBAMA (Brazilian Institute of Environment and Renewable Resources) and SEMA (Para State Secretary of Environment). To receive the operation authorization (AUTEF), which covers both the extraction of timber and wood residues, for each Annual Production Unit (APU), an annual process generally involves significant delays that are beyond the company's control and there is no action I can take to speed up this process.

The decision to first approach the local schools was taken because it is a favourable place to stablish a good communication and it is where we noticed receptivity of the project activities; the educational environment propitious and prosperous to cultural and environmental learning; capacity of gaining confidence and reach effectively the students and young, teachers, families, relatives, friends and all the people of the local community; capacity to cover multiple topics on biodiversity, ethics, sustainability, gender, health and many others since the schools are transversal to all the matters of the society.

The strategy is to start with the smaller communities identified in the public consultations: Vila Nova Esperança, Cachoeiro do Potiritá and Vila Diamantina. If the Vila Itapura and Vila Bom Jesus have resemblance with these communities, the approach will be applied to them as well. As mentioned in the sector 2.1.6. of this PD, these four communities have similar points of vulnerability that can be worked in a similar tactic, with adaptations if some points are stronger in a community than in the other.

For the bigger communities, Distrito de Canaã and Vila Nova, the approach will be through the schools as well. The difference is that there are many schools to be consulted and the dimension of the logistic must be well evaluated and designed, so the impact can be beneficial and continuous, not only punctual.

In the first years, the first outputs will be made after the public consultation, meetings with the communities, onsite visits and secondary research that are indispensable for the activities designs based on the needs and diagnosis of the communities and improvement of the biodiversity and climate. A beneficial relationship with the local population will be built with activities directed for schoolchildren from the 1st to 6th year. Gradually, the activities will be expanded to the older students, the parents, families, relatives and friends, aiming to reach the community. In the following steps, according to the previous experience established, the actions developed will be replicated to the other communities in the RR, with adjustments and

adaptations according to the local reality of each community, always aiming for continuous improvement within the CAAPII REDD+ project regarding climate, community and biodiversity.

It is important to mention that all the activities proposed and outputs have also influence on the other activities, even if not directed to the same goal. When together, they complement each other and are more effective on building beneficial impacts. For example, the conservation of endangered species can only be effective together with environmental education activities, decrease of hunting after trainings and workshops on animal husbandry and sustainable practices and so on. The preservation of these species influences also in the ecosystem services, that can bring benefits to climate regulation as well. Thus, the 4 goals of the CAAPII REDD+ Project are interconnected.

In order to describe each project activity, their outputs, outcomes and goals, the table 14 is presented below. All the activities are aligned with the Sustainable Development Goals by the United Nations (UN), that are further shown in sector 2.1.12.

Table 14 - Activities proposed for the CAAPII REDD+ Project to achieve the 4 goals proposed, and SDGs related.

Activity proposed/ outputs	Description	Expected climate, community, and/or biodiversity:		Related SDG (more details on sector 2.1.11)
		Outcomes	Impacts/goals	
Capacity trainings and professionalization	A series of courses and workshops directed population on different topics: familiar agriculture, educational monitors, specialization on professional areas, sustainable practices, surveillance and security, and so on. In partnership with SENAR and other institutions.	• Opportunities on new/better jobs. • Income diversification, • Sustainable development. • Increase on income. • Improvement on health and nutrition. • Reduction and prevention of hunger and diseases. • Reduce illegal logging and forest exploration.	Improvement on the quality of life and well-being of the communities; Conservation of 33,766.64 ha of Amazon Forest.	

Activity proposed/ outputs	Description	Expected climate, community, and/or biodiversity:		Related SDG (more details on sector 2.1.11)
		Outcomes	Impacts/goals	
		• Reduction of GHG emission.		
Events on health, safety and nutrition	Periodical events on the communities directed to health problems (obesity, blood pressure, eye health, and others), common diseases, nutrition, safety at work.	• Improvement on health and nutrition. • Improvement on safety. • Prevention of accidents. • Reduction and prevention of hunger and diseases.	Improvement on the quality of life and well-being of the communities	
Activities on Environmental Education	Activities and actions about several topics: waste, recycling, ecosystem services, species and their function, vegetable garden, pollution, sustainability, and others.	• Improvement on health. • Protection of endangered species. • Decrease on hunting. • Environmental awareness. • Maintenance of ecosystem services. • Sustainable development. • Reduction of GHG emission.	Improvement on the quality of life and well-being of the communities; Biodiversity conservation; Climate regulation benefits; and Conservation of 33,766.64 ha of Amazon Forest.	

Activity proposed/ outputs	Description	Expected climate, community, and/or biodiversity:		Related SDG (more details on sector 2.1.11)
		Outcomes	Impacts/goals	
Motivational workshops and events	Workshops and talks in order to motivate the local people on carriers, sports, rural life, studies, and others.	• Improvement on health and nutrition. • Opportunities on new/better jobs. • Better education. • Leisure. • Prevention on mental diseases.	Improvement on the quality of life and well-being of the communities	
Empowerment and training capacity for women	Talks and courses directed to women about several topics: professional carrier, empowerment, gender, sexuality, sports and health, studies, maternity, and others.	• Improvement on health and nutrition of women. • Opportunities on new/better jobs for women. • Better education for women. • Leisure for women. • Increase on gender equality. • Income diversification. • Sustainable development. • Increase on income. • Reduction of sexual diseases.	Improvement on the quality of life and well-being of the communities	

Activity proposed/ outputs	Description	Expected climate, community, and/or biodiversity:		Related SDG (more details on sector 2.1.11)
		Outcomes	Impacts/goals	
		• Decrease on violence against women.		
Protection of the Capim River	Diagnosis of the Permanent Preservation Area (APP) in part of the Capim River involved in the CAAPII REDD+ Project Area	• Improvement on health. • Reduction and prevention of diseases. • Prevention of accidents. • Water quality. • Improvement on the well-being of the communities.	Improvement on the quality of life and well-being of the communities; and Climate regulation benefits	
Fire Brigade training	Training to combat fires in the forest areas	• Prevention of accidents. • Environmental awareness. • Maintenance of ecosystem services. • Sustainable development. • Reduction of GHG emission. • Protection of endangered species.	Improvement on the quality of life and well-being of the communities; and Climate regulation benefits; Biodiversity conservation; and Conservation of 33,766.64 ha of Amazon Forest	
Fauna and Flora Monitoring	To monitor the species present in the project area, with specialized hired company	• Protection of endangered species. • Decrease on hunting. • Maintenance of ecosystem services.	Biodiversity conservation; Climate regulation benefits; and Conservation of 33,766.64 ha of Amazon Forest	

Activity proposed/ outputs	Description	Expected climate, community, and/or biodiversity:		Related SDG (more details on sector 2.1.11)
		Outcomes	Impacts/goals	
Campaigns on specific species and environmental education projects	Actions with the community specifically about priority species, so the people can know the animals and their characteristics.	• Protection of endangered species. • Decrease on hunting. • Maintenance of ecosystem services. • Environmental awareness.	Biodiversity conservation; and Conservation of 33,766.64 ha of Amazon Forest	
Protection of 33,766.64 ha of the Amazon Forest of the project area and avoidance of GHG emission from deforestation	Protection of the project area through actions against deforestation, invasions for illegal activities, fires, hunting, such as sustainable management of forestry activity, monitoring of the area, reinforcement of the security, purchase and maintenance of equipment and vehicles. Satellite monitoring from the start date to the 2nd of July of 2022.	• Prevention of deforestation of the Amazon Forest. • Avoidance of GHG emissions. • Prevention of illegal logging and invasions. • Prevention of hunting. • Prevention of fire. • Maintenance of ecosystem services. • Habitat and biodiversity loss prevention. • Benefits for the communities. • Protection of endangered species.	Improvement on the quality of life and well-being of the communities; Biodiversity conservation; Climate regulation benefits; and Conservation of 33,766.64 ha of Amazon Forest.	

These are the first outputs proposed as project activities, that will be adapted and improved according to the response on the communities. New activities will be developed and design, together with the communities, so the 4 goals of the CAAPII REDD+ Project are sustained by beneficial, effective, and consistent activities based on the local reality of each community. As the project progresses along its

lifetime, the relationship with the communities gets closer and the monitoring of the impacts can be assessed.

The contact between the Carbonext team and all the schools is being stablished, together with teachers, school directors and Municipal Secretaries of Education. The Conto de Fadas school (in the community of Cachoeiro do Potiritá) and the Nova Esperança School (in Vila Nova Esperança) have already participated in the 14th and 15th June of 2022 of an environmental education activity regarding waste, construction of vegetable garden and the creation of an organic waste composter for the schools (figure 8). Our partner in these activities was the specialized NGO Instituto Manguezal, from Belém city. The activities with the other schools will be scheduled before the next monitoring period.

Figure 8 - Environmental education activity in the Cachoeiro do Potiritá community. Photo by Carbonext.

On the 13th June of 2022, the fire brigade training started at the Fazenda Maringá e Catarinense, first with the workers of the property, so they can act quickly in case of any fire (figure 9). The 16 men trained by a specialized company named Swat International have received a certificate. The next fire brigade trainings will be conducted with more workers and also with some members of the communities, to be scheduled with the property owner and the availability of the communities, in this year or the next.

Figure 9 - a and b - Fire brigade training with the workers of the Maringá e Catarinense Farm.

As mentioned before, the project activities related to the protection of the project area are being considered from the start date of the 25th of July of 2019, with the hiring of the specialist to manage the sustainable forestry management activity and guarantee the occupation and monitoring of the 5 properties. More information is presented further in sector 2.1.14. Since then, the area is being protected with continue terrestrial monitoring patrols with vehicles (figure 10), satellite monitoring, reinforcement of surveillance and many other actions that are further presented also in sector 2.1.14.

Figure 10 - Truck car patrol of the Maringá e Catarinense Farm for monitoring of the area.

With the project outputs, outcomes and impacts in mind, the following simplified result chain of Theory of Change was based on a tree (figure 11), representing the growth of the project and the interconnection of its “branches” to reach the goals: conservation of 33,766.64 ha of Amazon Forest; improvement of life

quality and well-being of the communities around the project area; climate regulation benefits and the conservation of the Amazonian Biodiversity.

The tree of the result chain of the CAAPII REDD+ Project Theory of Change represents the activities that are going to be implemented with the project, bringing changes to the community, biodiversity and climate. The actions to protect the project area that are already caried out by the landowner are not represented, however these are the base of the project to sustain the conservation of the Amazon Forest within the 33,766.64 ha in the farms. With that being said, the actions on the monitoring and protection of the area are still ongoing and will continue to be improved, reinforced and new ones will be proposed as project activities.

Figure 11 - CAAPII REDD+ Project Tree (Result Chain) of the Theory of Change.

2.1.12 Sustainable Development

The concept of sustainable development was defined in the 1980s, when environmental issues (air pollution, diseases from different types of pollution, water pollution, consumption of natural resources, and others) were coming to the fore being considered important by many countries, sectors of industry and the economy. In attempting to align economic development with environmental conservation, the World Commission on Environment and Development, created by the United Nations (UN), defined in its report "Our Common Future" sustainable development as "the way in which present generations meet their needs without compromising the ability of future generations to meet their own needs"[65].

All actions that will be developed with the communities as well as the development and implementation of the CAAPII REDD+ project are aligned with the Sustainable Development Goals (SDGs), at the same time aligned with Brazil's actions and national policy towards sustainable development.

The Sustainable Development Goals were set up in 2015 by the United Nations General Assembly (UN-GA) and are intended to be achieved by 2030[66]. The SDGs are the blueprint to achieve a better and more sustainable future, addressing the global challenges including poverty, inequality, climate change, environmental degradation, peace and justice[67]. In total, there are 17 SDGs integrated and directed to balance the development between social, economic and environmental sustainability.

The actions of the project CAAPII REDD+, as seen in the sector 2.1.10, aim to achieve 13 SDGs, listed below. As the activities are presented in the Project Description, their respective SDG will be presented with their respective symbols.

The thirteen Sustainable Development Goals pursued by the CAAPII REDD+ Project are listed below. The table 14 on the sector above 2.1.11 shows the activities of the project and their respective SDG associated.

[65] BRUNDTLAND, Gro Harlem. **Nosso futuro comum: Comissão Mundial Sobre Meio Ambiente e Desenvolvimento.** 2ª.ed. Rio de Janeiro: FGV,1991. Source: https://edisciplinas.usp.br/pluginfile.php/4245128/mod_resource/content/3/Nosso%20Futuro%20Comum.pdf. Acess:13/04/2022.
[66]UNDP - United Nations Development Program, 2022. Available on: https://www.undp.org/sustainable-development-goals. Accessed in: 14/04/2022.
[67] UN - United Nations, 2022. Available on https://www.un.org/sustainabledevelopment/sustainable-development-goals/. Accessed in: 14/04/2022.

SDG 1 - End poverty in all its forms, everywhere

1.5 by 2030, build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

- **Activities of the CAAPII REDD+ Project related to the SDG 1: Trainings and workshops with community members in order to provide new job opportunities, sustainable development, income diversification and increase in the productivity of the cultures, so the poverty can be reduced.**

SDG 2 - End hunger, achieve food security and improved nutrition, and promote sustainable agriculture

2.1 by 2030, end hunger and ensure access for all people, in particular the poor and people in vulnerable situations, including children, to safe, nutritious and sufficient food throughout the year.

2.2 by 2030, end all forms of malnutrition, including achieving by 2025 internationally agreed targets on chronic malnutrition and under-five malnutrition, and meet the nutritional needs of adolescents, pregnant and lactating women and older people.

2.3 by 2030, double the agricultural productivity and incomes of small-scale food producers, particularly women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-agricultural employment.

2.4 by 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen adaptive capacity to climate change, extreme weather, droughts, floods and other disasters, and that progressively improve land and soil quality.

- **Activities of the CAAPII REDD+ Project related to the SDG 2: Trainings and workshops with community members and employees on sustainable practices so the familiar/small agriculture can develop sustainably, the productivity can increase and create income diversification. The increase in the livelihood brings more stable food availability. Events on health and nutrition will benefit the communities.**

SDG 3 - Ensure healthy lives and promote well-being for all at all ages

3.3 by 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases, and combat hepatitis, waterborne and other communicable diseases.

3.4 by 2030, reduce by one-third premature mortality from noncommunicable diseases (NCDs) through prevention and treatment, and promote mental health and well-being.

3.5 strengthen prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol 3.6 by 2020, halve global deaths and injuries from road traffic crashes.

3.9 by 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals,

air and water soil contamination and pollution.

- **Activities of the CAAPII REDD+ Project related to the SDG 3: Events on health and nutrition will benefit the communities and prevent illness. Trainings and workshops with community members and employees on safety and security, motivation on sports and studies will bring improve for well-being and more safety. The environmental education activities aim to reduce the pollution including the water pollution.**

SDG 4 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

4.1 by 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.

4.3 by 2030, ensure equal access for all men and women to quality, affordable technical, vocational and higher education, including university.

4.4 by 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent work and entrepreneurship.

4.5 by 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the most vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.

- **Activities of the CAAPII REDD+ Project related to the SDG 4: Trainings and workshops with community members and employees on multiple topics, motivation on sports and studies will bring improve for well-being and education. The environmental education activities aim to motivate the study and scientific data. The activities for the empowerment of girls and women will bring more equality and more opportunities to women to study.**

SDG 5 - Achieve gender equality and empower all women and girls

5.1 end all forms of discrimination against all women and girls everywhere.

5.2 eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation.

5.5 ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life.

- **Activities of the CAAPII REDD+ Project related to the SDG 5: The activities for the empowerment of girls and women will bring more gender equality, more opportunities to women to study and working positions, independence and voice on decision making.**

SDG 6 - Ensure availability and sustainable management of water and sanitation for all

6.1 by 2030, achieve universal and equitable access to safe and affordable drinking water for all.

6.2 by 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, with special attention to the needs of women and girls and those in vulnerable situations.

6.3 by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and substantially increasing recycling and safe reuse globally.

6.4 by 2030, substantially increase water use efficiency in all sectors and secure sustainable withdrawals and freshwater supplies to address water scarcity, and substantially reduce the number of people suffering from water scarcity.

6.6 by 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes.

6.a by 2030, scale up international cooperation and capacity-building support for developing countries in water and sanitation-related activities and programs, including water harvesting, desalination, water use efficiency, wastewater treatment, recycling, and reuse technologies.

6.b support and strengthen the participation of local communities to improve water and sanitation management.

- **Activities of the CAAPII REDD+ Project related to the SDG 6: Activities to make a diagnosis of part of the Capim River in the Project Area and environmental education activities to reduce pollution and waste disposal on the river.**

SDG 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

8.6 substantially reduce the proportion of young people not in employment, education or training.

8.7 take immediate and effective measures to eradicate forced labor, end modern slavery and human trafficking, and ensure the prohibition and elimination of the worst forms of child labor, including recruitment and use of child soldiers, and by 2025 end child labor in all its forms.

8.8 protect labor rights and promote safe and secure work environments for all workers, including migrant workers, in particular migrant women, and people in precarious employment.

- **Activities of the CAAPII REDD+ Project related to the SDG 8: Trainings and workshops with community members and employees on safety and security, capacitation on sustainable practices to new job opportunities.**

SDG 10 - Reduce inequality between and within countries

10.2 by 2030, empower and promote the social, economic and political inclusion of all, regardless of age, gender, disability, race, ethnicity, origin, religion, economic or other status.

- **Activities of the CAAPII REDD+ Project related to the SDG 10: All the trainings and courses and the actions to protect forest areas aim to promote social, economic and political inclusion of all.**

SDG 11 - Make cities and human settlements inclusive, safe, secure, resilient and sustainable

11.1 by 2030, ensure access for all to safe, adequate and affordable housing and basic services and urbanize slums.

11.5 by 2030, significantly reduce the number of deaths and the number of people affected by disasters and substantially reduce the direct economic losses caused by disasters relative to global GDP, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

- **Activities of the CAAPII REDD+ Project related to the SDG 11: Trainings and workshops with community members and employees on safety and security, capacitation on sustainable practices to sustainable development.**

SDG 12 - Ensure sustainable consumption and production patterns

12.2 by 2030, achieve sustainable management and efficient use of natural resources.

12.5 by 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

- **Activities of the CAAPII REDD+ Project related to the SDG 12: Trainings and workshops with community members and employees on sustainable practices to sustainable development. Environmental education activities aim also to the sustainable development with topics such as waste reduction and recycling.**

SDG 13 - Take urgent action to combat climate change and its impacts

13.1 strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

13.3 improve education, raise awareness and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning.

- **Activities of the CAAPII REDD+ Project related to the SDG 13: Environmental education activities aim also to the sustainable development and understanding the human impacts, conservancy, ecosystem services, and other topics. Mitigation on climate events and diagnosis of part of the Capim River in the PA to protect the water . Fire Brigade training against fire events. Fauna and Flora Monitoring, campaigns**

on specific species, environmental education projects, protection of 33,766.64 he of the Amazon Forest of the project area and avoidance of GHG emission from deforestation to protect the ecosystem services and climate regulation. Satellite monitoring of the PA.

SDG 15 - Protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt the loss of biodiversity

15.1 by 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in accordance with obligations under international agreements.

15.2 by 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests, and substantially increase afforestation and reforestation.

15.3 by 2030, combat desertification, and restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation neutral world.

15.5 take urgent and significant steps to reduce the degradation of natural habitats, halt the loss of biodiversity, and protect and prevent the extinction of endangered species.

15.7 take urgent action to end poaching and trafficking of protected flora and fauna species, and address both the demand and supply of illegal wildlife products.

15.9 by 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies, and accounting systems.

- **Activities of the CAAPII REDD+ Project related to the SDG 13: Environmental education activities aim also to the sustainable development and understanding the human impacts, conservancy of species and ecosystem services, and other topics. Mitigation on climate events and diagnosis of part of the Capim River in the PA to protect the water. Fire Brigade training against fire events. Fauna and Flora Monitoring, campaigns on specific species, environmental education projects, protection of 33,766.64 ha of the Amazon Forest of the project area and avoidance of GHG emission from deforestation to protect the ecosystem services and habitat and biodiversity loss. Satellite monitoring of the PA.**

SDG 16 - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels

16.1 significantly reduce all forms of violence and related mortality rates everywhere.

16.2 end abuse, exploitation, trafficking, and all forms of violence against and torture of children.

16.5 substantially reduce corruption and bribery in all its forms.

16.6 develop effective, accountable, and transparent institutions at all levels.

16.7 ensure responsive, inclusive, participatory and representative decision-making at all levels.

16.10 ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements.

16.a strengthen relevant national institutions, including through international cooperation, to build capacity at all levels, particularly in developing countries, to prevent violence and combat terrorism and crime .

16.b promote and enforce non-discriminatory laws and policies for sustainable development.

- **Activities of the CAAPII REDD+ Project related to the SDG 16: Trainings and workshops with community members in order to provide new job opportunities, sustainable development, income diversification and increase in the productivity of the cultures, so the disparities and injustice can be reduced.**

The Monitoring will be carried out for each activity developed, and the impact of the activity will be measured, through indicators such as numbers of people impacted, women served, type of SDG attached, and others that will be described in each monitoring plan and, after, on the report.

2.1.13 Implementation Schedule (G1.9)

During the project lifetime, from the development to implementation, some important dates and milestones will take place, such as introductory meeting dates, visits, start and end dates of each project activity, start and end dates of the GHG accounting period, monitoring program, verification etc. The table below presents

the milestones, that can suffer alteration along the project development (table 15). Precise dates will be established and disclosed to the stakeholders.

Table 15 - Implementation Schedule of the CAAPII REDD+ Project.

Date	**Milestone(s) in the project's development and implementation**
25th of July of 2019	Project Start Date – Hiring of the specialist on monitoring and forest management to increase productivity in the properties and manage the forestry activity, to support monitoring and vigilance for the conservation of the Amazon Forest in the Project Area.
25th of July of 2019	Start of the GHG accounting period.
25th of July of 2019 – 2nd of July of 2022	Satellite monitoring; First monitoring period.
25th of July of 2019 – 21st of July of 2022	Ground monitoring of the project area; Increase of productivity to afford monitoring and vigilance of forest areas; Reinforcement of surveillance with 2 motorcycles, 2 trucks and 1 airplane; Maintenance of tractors and equipment against fire.
9th December 2021	Signature of the Contract for the development of REDD+ Project.
Jan – April 2022	Development of the CAAPII REDD+ Project, meetings to define strategies and project activities for community and biodiversity.
4th – 8th April 2022	Identification and first introductory meetings with the communities.
4th – 8th April 2022	Institutional and Public Consultation.
25th April – 6th May 2022	Second onsite visit and meetings with the communities.
17th May 2022	Purchase of Airplane for air monitoring.
13th – 16th June 2022	Third onsite visit and meetings with the communities.
13th June 2022	Fire brigade training with the employees of the properties.
14th June 2022	Environmental education activity with the Nova Esperança School, in the Vila Nova Esperança Community in Ipixuna do Pará.
15th June 2022	Environmental education activity with the Conto de Fadas School in Cachoeira do Potiritá Community in Paragominas.
2022 - 2049	Activities to protect the Project area: monitoring (terrestrial and air), reinforcement of the surveillance, maintenance and acquisition of new vehicles to the patrols and equipment.
2022 - 2049	Fire alerts and deforestation monitoring via satellite.
2022 - 2049	Fire Brigade Training - once a year.
2023 - 2049	Events, trainings and workshops in Sustainable development and practices - once a year (minimum).

2023 - 2049	Events for motivation on study, sports, jobs, and others – once every two years.
2023 - 2049	Environmental education activities with schools and adults- once a year (minimum).
2023 - 2049	Health, nutrition and safety workshops and events - once a year (minimum).
2023 - 2049	Activities and courses directed to women empowerment and professionalization.
2023	Fauna and Flora Inventory of the Project Area.
2024 - 2049	Fauna and Flora Monitoring – at least once every three years.
2022 - 2049	Mapping and monitoring of community development and project impacts (periodically).
24th of July of 2049	End of crediting period.

2.1.14 Project Start Date

As stated, especially in the sector 2.1.6, historically, the state of Pará explores and deforests unsustainably the Amazon Forest, ranked as the state in Brazil that deforest the most[68] , the project region is inserted, for example, in the municipality of Paragominas, that has been included in the "Deforestation Arc" in 2008, created by the ministry of environment implemented by de Decree nº6.321/2007, with the objective of listing the municipalities that need more attention and inspection against deforestation[69].

The activities associated with the deforestation in the region are the cattle raising in pasture areas, followed by the expansion of the soybean production. Both activities first cut clear the trees of the Amazon Forest, selling the timber to the market. The practices of livestock and agriculture activities also bring the fire, that is used to "clean" the areas and often take great proportions, burning areas and areas of forest. This is a common practice in the region. Thus, these activities impact directly in the habitat loss, fragmentation, climate regulation and biodiversity loss. Other anthropogenic actions that negatively impact the conservation of the forest are the practices of illegal activities such as illegal logging and hunting.

Another fact that must be considered is the tenure matter in the region, that is also common in the Amazon. There are many invasions of properties by land grabbers and illegal exploration of timber especially in so-called unproductive areas. This practice causes great conflicts and tension. As already mentioned in sector 2.1.6, in 2015 there was an attempt of invasion after a fire in the surroundings of the Maringá and

[68] Terra Brasilis. 2022. Available on: http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/amazon/increments. Accessed in 11/04/2022.
[69] Priority Municipalities. Source:http://combateaodesmatamento.mma.gov.br/municipios-prioritarios. Access:05/05/2022

Catarinense Farm. Another example is the land reintegration process in 2022 to the indigenous people Amanayé from the Sarauá indigenous land, which have been expelled by land grabbers in 2002.

Considering the deforestation historic, as well as the fire events, invasions and practices of illegal activities in the region, the landowner of the properties involved in the CAAPII REDD+ Project took a series of actions since 2015 to protect his properties and the Amazon Forest inside them. The actions were directed to increase the productivity of the land with a sustainable forestry management and the protection of the area by monitoring and reinforcement of surveillance.

The project Start Date was defined as the 25th of July 2019. The start date is evidenced by actions towards the conservation and monitoring of the five properties included in the project area, with the hiring of a specialist to monitor and manage the forestry of the properties, thus increase the productivity and management of the activity, and protect the properties. Only with the income, the properties could be protected, managed and monitored. In addition, historically, unproductive areas in the Amazon are often invaded[70], so the sustainable use of the area maintain the property productive.

The timeline of the firsts protections activities that complement the hiring of the specialist in monitoring and management of the properties is presented below (table 16). Events of fire and illegal invasions of properties is common in the region. The evidence for the actions to monitor and protect the forest areas in the properties of the proponent will be made available to the audit team.

Table 16 - Timeline of the first protection activities of the properties of the CAAPII project.

Date	Topic	Description
2015	Fire	Fire event of great proportion in the limits of the Maringá e Catarinense farm
03/2015	Legal process of land repossession	Land dispute and conflict in the Beira-Rio Farm in Paragominas, invaders with no legal rights of the possession of the tenure
09/04/2015	Protection against fires	Acquisition of water truck
14/08/2015	Protection against fires	Acquisition of water truck
06/10/2017	Invasion of the property	Police Report (“BO”) - Hunting
2017	Fire	Fires in the surroundings of the PA
2018	Fire	Fires in the surroundings of the PA

[70] https://www.scielo.br/j/ea/a/pstJcmXTJKSNGRYZNLPWhsN/?lang=pt

11/01/2018	Protection against fires	Equipment maintenance
2019	Fire	Fires in the surroundings of the PA
25/05/2019	Protection against fires	Equipment maintenance
25/07/2019	**Increase of the monitoring of the properties and management of the forestry income to reinforce the security and surveillance of forest areas**	**Hiring of a specialist to improve productivity and management of the properties, reinforce of monitoring, management and forest protection.**
25/07/2019 to 02/07/2022	Deforestation monitoring	Satellite monitoring of the Project Area; First Monitoring Period
March, May, July and December/2020	Protection against fires	Equipment maintenance
22-24/07/2020	Training of workers	Sustainable forestry training for the workers
28/08/2020	Reinforcement of security and surveillance	Acquisition of pickup truck
11/01/2021	Reinforcement of security and surveillance	Acquisition of pickup truck
30/03/2021	Protection against fires	Equipment maintenance
02/2022	Legal process of land repossession	Land dispute and conflict with the communities that invaded illegaly the indigenous Land Sarauá, with no legal rights of the possession of the tenure (Roça Queimada, Balalaica sede and Balalaica (riverside).
18/03/2022	Reinforcement of security and surveillance	2 motorcycles
18/03/2022	Protection against fires	Equipment maintenance

04/2022	Legal process of land repossession	Land dispute and conflict with the Colônia Oriente Community, with no legal rights of the possession of the tenure
17/05/2022	Reinforcement of security and surveillance	Acquisition of Airplane for air monitoring
13/06/2022	Training of workers and protection against fires	Fire brigade training for the workers of the Mariná e Catarinense farm

*The dates are organized by dd/mm/yy in the table 16.

2.1.15 Benefits Assessment and Crediting Period (G1.9)

Project crediting period from (dd/mm/yy):

- Start date: 25/07/2019.
- End date: 24/07/2049.

Project crediting duration: 30 years.

2.1.16 Differences in Assessment/Project Crediting Periods (G1.9)

There is no difference between GHG emission accounting period and the community/biodiversity benefits assessment periods of the CAAPII REDD+ Project.

2.1.17 Estimated GHG Emission Reductions or Removals

In the 30 years of the CAAPII REDD+ Project it is estimated that the net GHG emission reductions protecting the project area against deforestation is of 14,128,193.11 tCO_2e (table 17).

Table 17 - Estimated GHG emission reductions year by year by the CAAPII REDD+ Project.

Year	Estimated net GHG emission reductions (tCO2e)
2019	42,015
2020	269,045
2021	347,598
2022	396,322
2023	475,212

2024	438,149
2025	506,228
2026	469,132
2027	443,425
2028	491,726
2029	521,373
2030	499,183
2031	521,402
2032	504,800
2033	535,035
2034	543,388
2035	521,301
2036	647,095
2037	572,473
2038	562,943
2039	587,061
2040	481,019
2041	469,440
2042	456,879
2043	494,020
2044	448,671
2045	481,174
2046	409,195
2047	314,490
2048	350,392
2049	328,006
Total estimated ERs	14,128,193.11
Total number of crediting years	30
Average annual ERs	470,940

2.1.18 Risks to the Project (G1.10)

There are likely natural and human-induced risks that can affect the expected benefits on climate, community and biodiversity. In the table below (table 18) is presented the first identified risks of the project. Further risks may arise during the 30 years of project, but Carbonext is prepared to rapidly identify, design and implement mitigation measures, so the project can be successful and benefit the region in as many aspects as possible.

Table 18 - Risks of the CAAPII REDD+ Project, identified until this moment.

Identify Risk	Potential impact of risk on climate, community and/or biodiversity benefits	Actions needed and designed to mitigate the risk

Project Non-Permanence Risk*	Discontinuity of the project activities on climate, community and biodiversity, bringing negative impacts.	To ensure the continuity of the project some actions are taken: **1)** contract between the project proponents, signing the commitment with the project activities during its entire lifetime. **2)** engagement and direct contact with the community to maintain their participation and project management and adherence to the proposed projects. **3)** project proponents have the necessary funds to maintain the project activities until the start of the GHG revenue. **4)** team of specialists working on field, in the project PD and verifications continuously and periodically.
Illegal deforestation, hunt, invasions and other illegal activities inside the project area	Deforestation of Amazonian Forest, decrease of ecosystems services, habitat and biodiversity loss.	To avoid illegal activities: **1)** Reinforcement of surveillance and security of the project area. **2)** ground patrols continuously. **3)** remote sensing monitoring of the project area with a maximum frequency of 7 days (identify illegal deforestation as soon as possible and take rapid mitigation measure). **4)** Environmental education and sustainable practices activities to create “Environmental awareness” within the population; **5)** Satellite monitoring of the project area since the start date.

Fire	Fire events, leading to habitat and biodiversity loss, as well as emission of GHG and destruction of forest areas of the project	To avoid and act quickly on fire events: **1)** Reinforcement of surveillance and security of the project area. **2)** Ground patrols continuously. **3)** Remote sensing monitoring of the project area with a maximum frequency of 7 days (identify illegal deforestation as soon as possible and take rapid mitigation measure). **4)** Environmental education and sustainable practices activities to create "Environmental awareness" within the population. **5)** Periodic and continue fire brigade trainings. **6)** Maintenance and purchase of equipment against fire.
Inefficiency or generation of negative impact by project activities	Poor results on climate, community, or biodiversity aspects, differing from what was expected previously as a result from project activities	To ensure the efficiency of the CAAPII REDD+ Project: **1)** Consider local specific needs in the design and implementation of the activities. **2)** monitoring of indicators to quantify and qualify obtained results. **3)** Direct contact with stakeholders and proponents to collect feedback from those who are involved in the project, create and adapt activities whenever necessary accordingly.

*more details on the project risk analysis will be available on the Non-Permanence Risk Report.

2.1.19 Benefit Permanence (G1.11)

To maintain and enhance climate, community and biodiversity benefits beyond the project lifetime, a set of actions and activities will be taken related to environmental education, health and nutrition, sanitation, trainings and workshops about sustainability practices, vegetable garden and other professionalizing courses, mitigation actions regarding local climate events, infrastructure of schools, monitoring and studies about the local fauna and flora, and many other that are still being defined according to the information gathered in the social diagnosis to understand the local vulnerabilities and how can the Project bring benefits. All of these measures aim to build environmental awareness, sustainable practices and change of habit, propose other perspectives on education and sources of income, that will be carried out in long-term during the project lifetime and passed along generations also after the project ends. The proponents believe that investing in culture, health, education and in the environment now will make a difference in the region from the project onwards.

Regarding the financial support, the proponents have the funds needed to maintain the project activities until the first verification. After that, the project fund will come from the revenues obtained from the sales of carbon credit to continue the activities in the region.

- Climate

The project CAAPII REDD+ aims to decrease and avoid deforestation and, as consequence, GHG emissions. The reduction of GHG emission will benefit the climate. To generate more climate benefits, a constant and effective monitoring of the project area will be maintained during the project lifetime. The evaluation of the Permanent Preservation Areas (APPs) of the Capim River in the Project Area will also benefit the climate regulation and protection of fresh waters that are important in the region not only for the environment, but also to the fauna and to the communities. Also, other activities are being developed taking into account the rainy season and floodable areas, training on sustainable agriculture, waste and pollution, sustainable development and others, that will be evaluated according to the local vulnerabilities and characteristics, and improvement opportunities identified.

- Community

The community activities are designed to enhance the life quality and well-being in different aspects. Trainings and workshops in topics that will bring knowledge to improve the subsistence activities carried out, such as sustainable cattle ranching and sustainable forest management, bioproducts and non-timber products, and other subjects. Workshops and events on health, nutrition, safety, education, environment and ecosystem services will also be carried out. Continuous communication and consultation will be maintained though the project lifetime to ensure that the activities are reaching the goals, always considering recommendations, feedbacks, complaints. If necessary, implement changes, adapt activities, create new ones and attend new demands. The activities also aim to create an environmental awareness

that will benefit biodiversity, climate regulation and their own community's well-being indirectly along generations.

- Biodiversity

For the biodiversity activities and benefits, a third-party company will be hired to develop an inventory of fauna and flora, producing a more exact diagnostic of the area, and, as consequence, enhancing the project assertiveness and effectiveness. During the project period, the constant monitoring of biodiversity will observe impacts, changes in the population, behavior and use of area. The data generated can be used in scientific studies in partnership with universities and researchers. This is important to understand the local fauna and flora and thus, enhance the conservation on priority species (endangered, threatened, endemic, and so on) and design effective activities to protect them. The activities on environmental education with the communities are also relevant to create environmental awareness and conservation sense. Besides the regular monitoring, conservation activities and environmental education, further actions will be proposed taking into account the local biodiversity and the engagement of the local population during the project lifetime.

More information regarding the actions taken to mitigate the projects risks are described in the section above, 2.1.18..

2.1.20 Financial Sustainability (G1.12)

Funding for project activities is secure by funds from the project proponents from the start date until the first verification (see Non-Permanence Risk Report). After that, the revenues from GHG emissions reductions will provide an additional flow of funds for the implementation and achievement of the project's climate, community and biodiversity benefits, as well as will enable the protection of the Project Area. The financial forecast of the project revenue from GHG emissions reduction is presented in the financial additionality. Evidence of the proponents' funds will be made available to the audit team.

2.1.21 Grouped Projects

1) Eligibility Criteria for Grouped Projects (G1.14)

The CAAPII REDD+ is a grouped project developed under sectoral scope 14 Agriculture, Forestry and Land Use – AFOLU, design to include the Reduction Emissions from Deforestation and Degradation - REDD by Avoided Unplanned Deforestation – AUD, according to VCS methodology requirements v4.1[71].

[71] VCS-Methodology-Requirements_v4.1.pdf (verra.org)

This grouped project was developed with the purpose to reduce net GHG emissions by reducing deforestation and forest degradation, occasioned by conversion of forest land to non-forest land, during the period of 30 years. The project is designed to include more than one "project activity instance" after the project validation process and possibly expand to other communities not identified/accessed up to now inside the established 20 kilometers buffer of the Project area. New landowners across the project lifetime can also be interested on taking part of the Project (if all the proponents agree).

The project considers the internationally definition accepted of forest, which include mature forests, secondary forests, and degraded forests, and qualified as forest for a minimum of 10 years before the project start date, respecting the eligibility criteria established by methodology VM0015 V.1.1.

According to the Decision 11/CP.7 of Marrakesh Accord, the following definition of forests is adopted (UNFCCC, 2002) [72]: (a) "Forest" is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 meters at maturity in situ. A forest may consist either of closed forest formations where trees of various stores and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily un-stocked as a result of human intervention such as harvesting or natural causes, but which are expected to revert to forest.

The project has a geographic area defined and clearly within which project activity instances may be developed, which is defined using geodesic polygons, corresponding to the current Reference Region.

The determination of baseline scenario and demonstration of additionality were based upon the initial project activity instances (carried in the 5 properties), as presented in this PD for validation. For inclusion of new geographic areas, it will be demonstrated that such areas are subject to the same baseline scenario and rationale for the demonstration of additionality as the geographic area.

A single baseline scenario is determined for the entire designated geographic area (Reference Region), aligned with VM0015 methodology. The additionality of the initial project activity instances was demonstrated for each designated geographic area, in accordance with the methodology applied to the project. All factors relevant to the determination of the baseline scenario or demonstration of additionality (i.e., common practice; laws, statutes, regulatory frameworks or policies relevant to demonstration of regulatory surplus; historical deforestation rates) were assessed across the grouped project geographic area and respective Reference Region.

[72] https://unfccc.int/files/meetings/workshops/other_meetings/application/pdf/11cp7.pdf (page 5 of PDF)

The project proponent has defined the capacity limit for this project activity in terms of the Reference Region. If exceptionally a new instance is located outside the Reference Region, it will be guaranteed that all limit premises will respect the same conditions of similarity of historical deforestation rates as applied in the Reference Region to the initial project instances.

For this grouped project, the following set of eligibility criteria for the inclusion of new project activity instances has been defined, which is applicable for VM0015 REDD AUD activities, and the geographic area demarcated by the Reference Region:

1) Meet the applicability conditions set out in the methodology applied to the project: all the applicability criteria mentioned in VM0015 shall be met for any new instance: a) baseline activities shall include unplanned deforestation; b) project activities shall include one or a combination of the eligible categories defined in the description of the scope of the methodology (table 1 and figure 2 of VM0015); c) new instances may include different types of forest systems meeting the definition of “forest”; d) at the date of inclusion in this project, the new instance shall include only land qualifying as “forest” for a minimum of 10 years prior to the project start date; e) The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) as long as they do not grow on peat.
2) Adopt and apply the project activities, technologies or measures specified in the project description: all new instances to be included in this project activity will necessarily be assessed using the same satellite imagery and field techniques as applied for the first 5 instances, as described in the PD.
3) All new instances shall be subject to the baseline scenario determined in the project description for the specified project activity and geographic area.
4) All new instances shall have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area. For example, the new project activity instances must have financial, technical and/or other parameters (such as the size/scale of the instances) consistent with the initial instances, or face the same investment, technological and/or other barriers as the initial instances.
5) All new instances shall be subject to the same community and biodiversity without-project scenarios as determined for the project.
6) All new instances shall be subject to the same processes for stakeholder engagement described in G3 and respect for rights to lands, territories and resources including free, prior and informed consent described in G5.
7) All new instances shall have similar monitoring elements.

In addition, new project activity instances shall:

1) Preferentially occur within the Reference Region (as mentioned above any instance to be included outside the Reference Region will undergo all the required similarity assessments).

2) Comply with all the set of eligibility criteria for the inclusion of new project activity instances (cited above).

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

4) Be validated at the time of verification against the applicable set of eligibility criteria mentioned above.

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

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

7) Be eligible for crediting from the start date of the instance through to the end of the project crediting period (only).

Where a new project activity instance starts in a previous verification period, no credit may be claimed for GHG emission reductions or removals generated during a previous verification period and new instances are eligible for crediting from the start of the next verification period. Where inclusion of a new project activity instance necessitates the addition of a new project proponent to the project, such instances shall be included in the grouped project within five years of the project activity instance start date. The procedure for adding new project proponents will respect the rules of the VCS Program document Registration and Issuance Process.

AFOLU non-permanence risk analyses will be assessed for each new geographic area. Activity-shifting, market leakage and ecological leakage assessments will be reassessed where new instances of the project activity are included in the project.

1) The geographic area within which all project activity instances shall occur is delineated with the Reference Region set in this PD.

2) The determination of the baseline for the project activity is in accordance with the requirements of the methodology applied to the project.

3) The demonstrations of additionality for the project activity are in accordance with the requirements of the methodology applied to the project.

4) A set of eligibility criteria for the inclusion of new project activity instances at subsequent verification events is defined in this PD (above in this topic).

5) A description of the central GHG information system and controls associated with the project and its monitoring is provided in the Monitoring Plan.

It is important to notice that the Leakage Management areas originally inserted in the project design will be priority to recruit new project instances. If the new instances involve the original Leakage Management areas, new areas shall be identified and adopted to manage leakage.

2) Scalability Limits for the Grouped Projects (G1.15)

The project scalability is delimited by the geographic area, in this project defined as the reference region. If exceptionally a new instance is located outside the Reference Region, it will be guaranteed that all limit premises will respect the same conditions of similarity of historical deforestation rates as applied in the Reference Region to the initial project instances. Also, the eligibility criteria described in the section above shall be met. The landowner of the new instance shall have enough financial funds to maintain the instance activities until the beginning of revenue from GHG emissions reductions.

3) Risk Mitigation Approach for Grouped Projects (G1.15)

The risks associated with the non-continuity of benefits is reduced given that the project activities proposed for the new instances will be developed by Carbonext's technical team, which has the technical capacity to determine the strategies and activities of the project, in addition to offering technical support to the landowners for the proper execution of the activities and monitoring. Thus, the continuous technical and scientific accompaniment performed by Carbonext during the project duration generates a support framework for monitoring, reporting and verification issues, which ensures the quality of the work and a continuous process of adjustment and improvement.

2.2 Without-project Land Use Scenario and Additionality

2.2.1 Land Use Scenarios without the Project (G2.1)

To identify the land use scenarios without the project, the VCS approved tool VT0001 - Tool for the Demonstration and Assessment of Additionality in VCS, was applied. Forest is expected to be converted to non-forest land in the baseline scenario. In Section 3.1.4., it is presented the analysis of deforestation, the vector agents and main causes.

In summary, the existing conditions and land use scenario in the municipalities of Paragominas, Ipixuna do Pará and Tomé-Açu are similar, concentrated in deforestation through anthropogenic agents in the project region, after violent land invasions because of the land tenure matter, being the three main activities implemented: cattle raising and pasture, soybean and other grain agriculture, and timber exploration (as detailed in item 2.1.6. and further demonstrated in 2.2.2. and other sectors of this PD). Timber exploration can be sustainable and is still a financially interesting activity, but it is also related to illegal logging and exploration when unauthorized, leading to an uncontrolled deforestation. Mining and other activities such as charcoal production, urbanization and familiar agriculture have also impacts on the forest areas and, even in smaller quantities compared to the other, are consider agents of deforestation as well. The activity of forest management is not the common practice in the region, since most timber extractions are not sustainable, and after all the timber has been removed, crop or cattle raising is installed on the exploited area.

In the map 17 and table 19 below, it can be seen the distribution and percentage of the different classes of land use in the RR in 2020 and the deforestation pressure in PA, according to the classification of the Mapbiomas[73] project.

[73] https://mapbiomas.org/

Map 17 - Land use of 2020 in the RR, with the classes of Mapbiomas project (mapbiomas.org)

Table 19 - Detail of land use of 2020 in RR. Source: Mapbiomas.

Land Use Classes	Area (ha)	% of RR area
Forest	481,216.1451	64.916
Non Forest Natural Formation	4,227.5742	0.570
Pasture	235,345.7427	31.748
Agriculture	12,185.8146	1.644
Soybean	2,940.1829	0.397
Forest Plantation	39.06	0.005
Urban Area	104.31	0.014
Mining	429.30	0.058
Water	4,800.8251	0.648
Total	741,288.9546	100

Without the project, the invasions and conflicts over land tenure, encouraged by the expansion of activities such as pasture, soybean production and timber exploration would continue increasing in the region, deforesting great areas of Amazon Forest. This would negatively impact the climate regulation, the biodiversity of fauna and flora, loss of habitat, decrease in habitats quality, fragmentation, pollution and changes in the hydrology, and many other negative things.

The project has not been implemented to generate GHG emissions of any kind. The CAAPII REDD+ project aim to conserve areas with Amazon Forest, avoiding deforestation and consequently GHG emissions. In addition, the project aims also to improve life quality and biodiversity conservation. The number of years in which the properties in this project belong to the land owner is described in table 20 below, and actions against deforestation and property security have been developed and implemented in the areas of these farms since the acquisition, because invasions of unproductive areas are common in the region, so the owner could guarantee the permanence of his possessions of the properties and the forested areas inside could be protected.

Table 20 - Years of purchase of the farms.

PA	Property	City	Tenure Years
PA1	Fazenda Maringá e Catarinense	Ipixuna do Pará/ Tomé-Açu	26
PA1	Fazenda Catarinense	Ipixuna do Pará	26
PA2	Fazenda do Lago	Paragominas	37
PA2	Fazenda Lagoa Grande	Paragominas	37
PA3	Fazenda Santa Helena I	Paragominas	14

As already mentioned in sector 2.1.14., the land tenure matter in the region brings many conflicts and is common in the Amazon. There are many invasions of properties by land grabbers and illegal exploration of timber especially in so-called unproductive areas. As an example, in 2015 there was an attempt of invasion after a fire in the surroundings of the Maringá and Catarinense Farm. Another example is the land reintegration process in 2022 to the indigenous people Amanayé from the Sarauá indigenous land, who have been expelled by land grabbers in 2002, forming the communities Balalaica (river side and sede) and Roça Queimada.

Considering the deforestation historic, the without-project scenario would be invasions and practices of illegal activities in the region, as well as fires in the forest areas. In order to impede this scenario, the landowner of the properties involved in the CAAPII REDD+ Project took a series of actions since the acquisition of the lands to protect his properties and the Amazon Forest inside them. The actions were directed to increase the productivity of the land with a sustainable forestry management, maintaining the productivity, and to the protection of the area by monitoring and reinforcement of surveillance.

2.2.2 Most-Likely Scenario Justification (G2.1)

As pointed in the sectors 2.2.1. and 3.1.4., the most likely scenario in the Project Region for the land use is agriculture of soybeans, cattle raising and the exploration of timber. There are several assessments, studies and data that indicate the increase of these activities in the region of the project, associated with the increase in deforestation and illegal practices, such as logging.

Historically, the state of Para has its resources explored and forests deforested. Data from PRODES[74] shows that from 2004 to 2014 there has been a substantial decline in deforestation in the state, after a series of measures taken by the government to minimize deforestation in the Amazon. However, since 2017 the increase has grown 216.1% until 2021. This leap in deforestation in the last years is associated with the economic activities pointed in the most likely scenario of the land use that are directly affecting the Amazon Forest[75].

The soybean production is increasing: from 2009 to 2020, it has grown 964.3%[76] in quantity (figure 12) and 900.8% in area converted to its plantation. The cultivation of this grain is growing fast in the state, representing 50.13% of all agriculture-products exported from Pará[77]. According to the "Agência de Defesa Agropecuária do Estado do Pará" (Adepará), the state is the second largest producer in the North Region of Brazil, with 30% of the area for agriculture occupied with soybean cultivation. In addition, the value of this commodity in the international market has abruptly increase: In the period of one year from May 2020 to May 2021, there price jumped from US$19.6 to US$33.5, this means more than 70% growth[78]. In 26th April of 2022, it´s price is US$36.4 approximately[79].

[74] http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes
[75] https://oeco.org.br/noticias/relatorio-expoe-agronegocio-como-grande-motor-do-desmatamento-ilegal-de-florestas/
[76] https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?tipo=grafico&indicador=10370
[77] https://agenciapara.com.br/noticia/26151/
[78] https://www.farmnews.com.br/mercado/preco-da-soja-em-dolar-5/
[79] https://www.agrolink.com.br/culturas/soja/cotacoes

Figure 12 - Soybean production from 2009 to 2020 in the Pará state. Source: IBGE, 2020. Available on https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?tipo=grafico&indicador=10368. Accessed in 06/04/2022.

Considering the timber market, the state of Pará is also historically known for intense exploration. According to the IBGE[80], the production of wood log is elevated, producing in average 205,895.4 m^3 per year. The timber is also explored to produce charcoal and was responsible for 19,109 tons in 2020. The production of firewood had an increase from 2018 to 2020 of 2.94%, producing 6,500 m^3 in 2018 and 191,189 m^3 in 2020. Even though the timber exploration maintains a relatively stable production, the illegal logging is a great problem in the region.

The Monitoring System of Timber Exploration ("SIMEX" in Portuguese) of the IMAZON generated a report[81] using the data from 2017 to 2018, which assessed the situation of timber exploration in the Pará state. This report showed that in this period 38,573 ha of Amazon Forest were explored in logging, with 70% of this area explored illegally and without authorization. The reported also presented that 76% of the illegal exploration occurred in private properties,17% in protected areas (such as Conservation Units and Indigenous Territory) and 8% in settlement areas.

The Simex and Imazon report ranked the municipalities of Pará with more unauthorized- timber exploration and in first place is the city of Paragominas, then Tomé-Açu in second and the city of Ipixuna do Pará in the 5th place (table 21). As presented, the municipalities of the CAAPII Project showed deforestation of great areas of forest in the past years.

Table 21 - Top 5 cities in Pará state with more unauthorized- timber exploration.

Nº	City	Area (Hectare)
1	Paragominas	8,174
2	Tomé-Açu	2,834

[80] https://cidades.ibge.gov.br/brasil/pa/pesquisa/16/12705?tipo=grafico&indicador=12804
[81] https://imazon.org.br/publicacoes/sistema-de-monitoramento-da-exploracao-madeireira-simex-estado-do-para-2017-2018/

3	Dom Eliseu	2,384
4	Uruará	1,816
5	Ipixuna do Pará	1,432

Source: https://imazon.org.br/publicacoes/sistema-de-monitoramento-da-exploracao-madeireira-simex-estado-do-para-2017-2018/

Cattle ranching in Brazil is of great importance to the economy, as the country has the largest commercial herd in the world, is the second largest producer and the largest global exporter of beef (Carvalho;[82]; EMBRAPA[83]). According to Cezar et al. (2005), Carvalho (2007), McManaus et al. (2016) and Silva et al. (2018)[53], the advance in Brazilian cattle production was due to the pasture feeding regime. Thus, the expansion of areas for pasture for cattle raising happened expressively over the years and became a common practice in northern states of Brazil, like Pará.

Historically, the state of Pará had great stimuli for agricultural projects from the 1970s onwards, with livestock being the main vector of growth in the state. In quantitative terms, the cattle herd in the states of the Brazilian Legal Amazon jumped from 26.2 million heads in 1990 to 80.7 million heads in 2013, with the states of Mato Grosso and Pará together accounted for almost 60% of this variation[84]. Such economical and productive growth led to the formation of large population centres, such as Paragominas city and its surroundings.

Over the last few years, the number of cattle has remained relatively stable in the project's municipalities, but in large numbers. Historically the region carries out livestock practices as its main activity. In 2020, the herd of the 3 cities reached 598,840 heads of cattle[85].

A study by Chaves et al. (2018)[86] carried out in the city of Paragominas, observed that among the 143 properties analysed, 48% of them have large animals as their main activity, among 8 different activities categories. Regarding incomes, the raising of large animals is responsible for R$ 39,049,801.50, corresponding to 75.5% of the entire amount collected by the 143 properties, among all land use activities such as wood extraction, horticulture, small and medium-sized animals raising, temporary and permanent crops, among others. These results show that the raising of large animals is a consolidated and extremely profitable activity in this region.

As already mentioned in sector 2.1.14, the land tenure matter in the region brings many conflicts and is common in the Amazon. There are many invasions of properties by land grabbers and illegal exploration

[82] https://www.scielo.br/j/neco/a/jVyJbvTGbZKcvYg5NhzTFLk/?lang=pt&format=pdf

[83] https://www.embrapa.br/busca-de-noticias/-/noticia/62619259/brasil-e-o-quarto-maior-produtor-de-graos-e-o-maior-exportador-de-carne-bovina-do-mundo-diz-estudo
[84] http://repositorio.ipea.gov.br/bitstream/11058/9000/1/A%20Economia%20do%20Sudeste.pdf
[85] IBGE
[86] file:///C:/Users/Paula%20Ho/Downloads/scientia,+Gerente+da+revista,+u+ARTIGO+2361+-+2019-08-10.pdf

of timber especially in so-called unproductive areas. Thus, invasions of the properties are also considered eminent in the without-project scenario. As an example, in 2015 there was an attempt of invasion after a fire in the surroundings of the Maringá and Catarinense Farm. Another example is the land reintegration process in 2022 to the indigenous people Amanayé from the Sarauá indigenous land, who have been expelled by land grabbers in 2002, forming the communities Balalaica (river side and sede) and Roça Queimada.

Thus, considering the deforestation historic, the without-project scenario would be invasions and practices of illegal activities, as well as fires in the forest areas. The forest areas would be converted to pasture for livestock raising or soybean agriculture. In order to impede this scenario, the landowner of the properties involved in the CAAPII REDD+ Project took a series of actions since the acquisition of the lands to protect his properties and the Amazon Forest inside them. The actions were directed to increase the productivity of the land with a sustainable forestry management, maintaining the productivity, and to the protection of the area by monitoring and reinforcement of surveillance.

2.2.3 Community and Biodiversity Additionality (G2.2)

In the absence of the CAAPII REDD+ project, the without-project scenario (more details in sections 3.1.4 Baseline Scenario, 4.1.4. Without-Project Scenario: Community and 5.1.3. Without-Project Scenario: Biodiversity) would prevail and consequently affect the climate, community and biodiversity, mostly by deforesting great areas of native forest. Most important, the situation of the area would also stay immutable, since the activities predicted by the project would not happen and would not bring any beneficial addition for the conservation of area nor to the communities, climate and biodiversity.

The CAAPII REDD+ project has 4 goals for the project region: 1) conserve 33,766.64 hectare of the Amazon Forest; 2) bring better quality of life and well-being for the communities; 3) preserve the biodiversity; and 4) bring benefits to climate regulation as consequence. These goals will be achieved over the 30 years of the project, gradually, as the social, climate and biodiversity activities advance, by avoiding deforestation and consequently GHG emissions.

The absence of the CAAPII REDD+ project means an increase in deforestation of the Amazon Forest in the region and project zone, since it is historically known that the region has many conflicts regarding land tenure and invasions of properties unmonitored are common in the Amazon[87]. Following the common practice, the properties would be invaded, and then would be converted into pasture for cattle raising areas and/or cultivation of soybeans, that are the activities that deforest the most in this biome. Both activities would prevail after the removal of tons of timber by illegal logging of the forested area. The permanence of

[87] http://philip.inpa.gov.br/publ_livres/Preprints/Mss%20preprints/LAND-tenure-port-2.htm

the currently scenario means also the continue financing investments on agriculture and livestock production, that is already the scenario in the city of Paragominas[88], rather than investments in the education, health or environment.

Regarding existing laws, regulations, and governance arrangements, the main discussion on them is related to land tenure and the conflicts that are originated, especially on invasions of public lands, that is also common in the Amazon, being illegal and associated with illegal activities such as unauthorized deforestation. About invasions in private properties, there is the process of repossession of the land, secured by the private property rights, but the process can be slow and costly[89].

The costs in maintaining the security and monitoring activities around great areas of forest, in an environment with elevated precipitation in certain months, surrounded by conflicts and invasions attempts are very high compared with the income of the practices of soybean and livestock production. This fact justifies a financial barrier in the preservation of the forests inside the properties.

The recent regulation of the Carbon Credits in Brazil is also inserted on the topic of regulations, since it is still to be completed, but shows the attention and direction towards the reduction of GHG emissions and the awareness on climate and the environment.

The continue increase of deforestation in the region has many negative impacts for the community, environment, biodiversity and climate. The alteration of ground cover and phytophysiognomy brings habitat and biodiversity loss, soil erosion, nutrients loss, change in the local climate and rainfall regime, increase in fires, and many others[90]. The GHG emissions would also consequently get higher.

As detailed in the sections on “4.1 Community” on this Project Description, the socioeconomic conditions of the communities involved in this project are very poor, with lack of sanitation, garbage and waste (figure 13) low schooling, gender disparities, regular infrastructure, poor health conditions, and many others. Although the socioeconomic situation of the city of Paragominas seems to be better than in Ipixuna do Pará and Tomé-Açu, since its Human Development Index (HDI) is much higher than the other two[91], in general, the inequality between big companies of timber, pasture, agriculture, and the smaller local and rural communities of the municipalities is enormous. There are financial, technological, institutional and capacity barriers that do not allow the implementation of activities directed to the most urgent matters of the local population.

[88]Town Hall of Pragominas, official website. 2020. Caderno Diagnóstico da Realidade Municipal. Chapter 3 to 6. Page 259. Available on: https://paragominas.pa.gov.br/wp-content/uploads/2020/12/CADERNO-02-DIAGN%C3%93STICO-DA-REALIDADE-MUNICIPAL-CAP%C3%8DTULOS-3-a-6.pdf . Accessed 11/04/2022.
[89] https://www.scielo.br/j/resr/a/fd5CWmqcKBfxf7SGPnTtsrs/?lang=pt
[90] Imazon, 2022. Available on: https://imazon.org.br/planejamento-do-uso-do-solo-do-municipio-de-paragominas-utilizando-dados-economicos-e-ecologicos-n-9/. Accessed 11/04/2022.
[91] UNDP - United Nations Development Programme, 2022. Available on: https://www.br.undp.org/content/brazil/pt/home/idh0/rankings/idhm-municipios-2010.html . Accessed in 11/04/2022.

Figure 13 - Waste accumulation in the Vila Nova Community. Photo taken by Carbonext Team, in the field visit in the 29th April 2022.

The development of a REDD+ project in the area brings many benefits, that would not be implemented with de absence of the project. Not only the GHG emissions will decrease avoiding deforestation, but also the community and biodiversity will benefit from the activities of the project designed exclusively for the needs of the region and fauna and flora characterization. The implementation of the project brings carbon credits, that will be sold and allow the development of activities in education, sustainability, health, conservation, and other areas that are dependent on the carbon accreditation. In summary follows some of the beneficial impacts predicted with the implementation of the CAAPII REDD+ Project:

- Protection and conservation of 33,766.64 hectare.
- Avoidance of 28,677 ha of deforestation in 30 years in the Project Area.
- Avoidance of 14,128,193.11 tCO_2e of GHG emission in 30 years.
- Monitoring of biodiversity, including endangered fauna and flora species.
- Activities, workshops and courses on environmental education and sustainable practices for children and adults.
- Technical capacity building courses in different topics for men and women.
- Creation of work opportunities, directly or indirectly.
- Access to health care events in the communities.
- Increase of life quality and well-being in the communities.

2.2.4 Benefits to be used as Offsets (G2.2)

Not applicable. No community and biodiversity benefits will be used as offsets.

2.3 Stakeholder Engagement

2.3.1 Stakeholder Access to Project Documents (G3.1)

The complete CAAPII REDD+ project will be available on the VERRA website[92], as well as the projects documents, monitoring reports, and the project description that the public can consult. Thus, any stakeholder interested in learning about the project or obtaining more information will be able to access the project through the platform.

Information regarding the Project will also be distributed orally to the local communities, through local visits and meetings that will occur prior (Figure 14), during, and post Project implementation. Folders with the information of the CAAPII REDD+ Project and the results of every year after the monitoring will be distributed, in Portuguese. This is done to ensure that all can have access to the information and ask any questions that may arise. It is important to note that the activities to be developed by the Project were previously validated by the local community, who voiced their concerns and demands through social visits, and told the Project Proponents which activities they think should be developed in the Project Area.

Figure 14 - Carbonext team in a meeting with local population about the CAAPII REDD+ Project. Photo taken by Carbonext Team, in the field visit in the 6th April 2022.

The results obtained in the monitoring and verifications will be published and made available online through the Carbonext website (**carbonext.com.br**). All documents and information on the results of the monitoring and verification of the project will be published on the VCS and CCB standards platforms, as it is usually done.

[92] https://registry.verra.org/app/search/VCS/All%20Projects

Any person interested in the CAAPII REDD+ Project and it´s documents can also contact Carbonext[93] and the technical team by the email: redd.caapii@carbonext.com.br **. If there are any questions, the team will be glad in answering them.**

2.3.2 Dissemination of Summary Project Documents (G3.1)

Summary Documents regarding the Project are translated to Portuguese to ensure that all the local population can understand the project objectives and activities to be developed in the Project Area. This document is shared to all stakeholders through consultative workshops, training sessions, events and onsite visits in printed format in Portuguese and orally as well. A poster in Portuguese was made to be caried in the onsite visit for a better understanding of the project and was presented already in the meetings of onsite visits of April and May (Figure 15).

Figure 15 - Carbonext social team in a meeting with local population about the CAAPII REDD+ Project. Photo taken by Carbonext Team, in the field visit in the 27th April 2022.

The project description, project documentation, project summary, as well as the results obtained in the monitoring and verifications will be published and made available online through the Carbonext website (**carbonext.com.br**). All documents and information on the results of the monitoring and verification of the

[93] https://carbonext.com.br/

project will be published on the VCS and CCB standards platforms, as it is usually done (public available at VERRA website[94]).

Stakeholders will have access to project details during the public comment period. Summary information on monitoring results will be actively disseminated to the communities, on meetings, public consultations and onsite visits that will be periodically carried out, at least twice a year, orally and in printed folders. Especially for the communities without access to the internet, a translated hard copy of the summary and folders in Portuguese with main information of the CAAPII REDD+ Project will be available in strategic locations, such as communities' associations and secretariats.

2.3.3 Informational Meetings with Stakeholders (G3.1)

The project proponents assessed the local stakeholders identifying those that are potentially impacted, negatively or positively, by the project. The identification process of the public stakeholders and communities started with the identification of community leaders and associations, government agencies and regional environmental entities, non-government organizations, research institutes, national parks, conservation areas, settlements, and organizations or groups with similar interests in the outcome of the project activities, as mentioned in sector 2.1.8. with more details. The summary of the project was sent by email to all the stakeholder with email address identified on the 17th of March of 2022. Phone calls were also made to the same stakeholders, to guarantee the receiving of the project summary.

After the identification in the office, the meetings and onsite visits are scheduled together with the communities and the workers of the properties involved in the project, so the public consultation can occur. The REDD+ project process and its goals was explained, with a printed poster in the CAAPII Project. On these visits also happens the participative socioeconomic diagnosis, caried out by Carbonext with help of questionnaires. The diagnosis of each community is extremely important for the development and design of the project activities. The socioeconomic diagnosis set the mark of 20% of the community members to be interviewed in order to be representative, although sometimes it is not possible to reach this mark since it is dependent on the voluntary participation of the community.

In April and May of 2022, onsite visits were carried out in order to present the project to the communities and other stakeholders, as well as get to know the main leaderships, community area and infrastructure, have conversations with the local people and understand their reality and needs (Figure 16).

[94] https://registry.verra.org/

Figure 16 - a) Carbonext social team on field visit on the 7th April and b) in a meeting with local population about the CAAPII REDD+ Project. Photo taken by Carbonext Team, in the 27th April 2022.

Field visits are important to understand the relation between the surrounding community to the project area and its resources. The visits were conducted by a social specialist who applied a questionnaire gathering information of the livelihoods and social needs of the local residents in the communities within the 20-kilometer buffer of the project area demonstrated in the map 18 below.

Map 18 - Communities Visited in the Project CAAPII.

More information on the questionnaires are in sector ”4. Community”. In summary, most of them do not depend on forest resources from the project area for income. There are reports of using the area to hunt animals for own consumption. No one claimed to exploit wood or to own a large cattle livestock close to the project area. Regarding the main needs of the region, the most common topics were: poor health service, low incomes and job opportunities, lack of technical assistance by the governments, women as households, discouragement on the rural life, and many others presented further on sector 4.1.1.

Further visits to the communities will take place in 2022 and will be periodically and continually done during the project. The information gathered in all the meetings are and will be relevant to create and keep updated the social diagnosis, so the proponents can determine the activities that will be developed within the project area, which can benefit the communities, regarding life quality, and social and economic development of the region.

2.3.4 Community Costs, Risks, and Benefits (G3.2)

During the community consultations, which is held by a social specialist, who communicated intelligibly to all people present, information on the benefits of the project is provided to the community members. No costs will be passed on to the communities, since all the project activities will be funded by the project proponents. On the contrary, the activities are planned to increase the community well-being.

The socioeconomic diagnosis obtained from the interviews with community members indicated that the project area is not used by the communities to any activity. Thus, the activities on the project area and actions to monitor it are not predicted to interfere on the communities since they do not use the area.

As mentioned in sector 2.1.18., some risks were identified to the maintenance of the project, such as the discontinuity of the project activities on climate, community and biodiversity, bringing negative impacts; deforestation of forest areas in the project area, possibly causing decrease of ecosystems services, habitat and biodiversity loss; fire events (not related to the project activities), that lead to habitat and biodiversity loss, as well as emission of GHG and destruction of forest areas of the project; and inefficiency or negative impacts caused by project activities. The actions needed and designed to mitigate the risks are presented in sector 2.1.18. as well.

Other risks identified in the project region, which are not generated by the project, are the constant conflicts of land tenure and insecurity with invasions and the practice of illegal activities that put forest areas at risk, as indicated in sector 2.1.6. However, we emphasize that these conflicts are not originated by the CAAPII REDD+ Project, and are previously known by the communities, since they are historically common in the region.

All these identified risks mentioned above are presented to the communities during the community consultations and meeting.

During the project lifetime, an ongoing communication with the community will be held, in order to keep providing information on the project activities and to have an open channel for suggestions and comments.

2.3.5 Information to Stakeholders on Validation and Verification Process (G3.3)

The communication about the validation and verification process happens directly with the communities through the communication channels established (message apps for example) and preferably in-person on

the visits and meetings. These communities are identified by both GIS analysis (in official public geodatabases) and field visits, and then considered communities that may be impacted by the project.

On the meetings, the project is presented, and any doubts are clarified. Questionnaires are carried out with the population present about the local's living, habits, usage of area, characteristics in general etc. Communication on verification will be presented annually and as soon as the schedule of verification is established. The prediction is to, at least one week before the validation and verification process, make an onsite visit to the communities and communicate on the visit of auditors, for example.

Other institutional stakeholders were communicated about the project through email, where an overview material of the project was sent attached. The stakeholders were invited to comment on the project. As more visits are taking place, additional information may be added. The Carbonext team tried to contact per telephone the institutional stakeholders that were contacted by email, in order to guarantee the receivement, but not contacts responded.

2.3.6 Site Visit Information and Opportunities to Communicate with Auditor (G3.3)

Site visit will be communicated in the consultations held prior to every verification, as well as through communication channels, like email, phone contact, message apps or, in more isolated communities, by radio if necessary. There is a list with the community leaders that will be contacted before every verification. The communication will happen in a timely manner if in person, with at least one week in advance. The prediction is to, at least one week before the validation and verification process, make an onsite visit to the communities and communicate on the visit of auditors, for example.

If necessary Carbonext has social analysts allocated in the city of Belém in the state of Pará, who can travel to the region and inform the communities about an eventual audit visit. The owner of the properties and the technical support team partner in this project are allocated in the city of Paragominas and can also make this direct contact with the communities, if necessary.

The interviews are done by a direct and independent communication between communities, other stakeholders (or their representatives), and the auditors. The support for audit team is facilitated according to the audit plan sent in advance and arrangements.

2.3.7 Stakeholder Consultations (G3.4)

In the meetings of community consultation (figure 17) held in the communities involved in the CAAPII REDD+ Project, questionnaires were applied, with questions directed to their usual life, common activity, perceptions and characteristics of the communities. The questionnaires enable the identification of needs and sensitive points for improvement and development. This contact with the community facilitates the

development of an action plan and design based on the level of urgency of each point reported by the interviewed population of the area.

Figure 17 - Carbonext social team in the Community Diamantina on the 7th May on a meeting of public consultation about the CAAPII REDD+ Project. Photo taken by Carbonext Team, in the 7th May 2022

In the institutional consultation, the stakeholders were identified and then communicated per email and telephone about the sending of the summary of the project. The identified institutions were also informed that any suggestions and comments about the project could be sent directly to the e-mail redd.caapii@carbonext.com.br. The suggestions pointed by other stakeholders and institutions related to the project will be discussed, come together in terms and used directly to design and adapt the projects activities, considering the limits of the proponents. Until this moment, no institution has returned with any critics or suggestions of the project.

From the stakeholder's, institutional and social, consultation and community diagnostic, the project activities are designed and adapt, in order to attend the necessities identified.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

The project has an ongoing communication and consultation channel between the project proponents and communities and other stakeholders. The communication happens through the project team in the field and also in the office, by email and telephone. An Operation Procedure for this ongoing communication is being

implemented, in order to guarantee the best flow of communication, effectiveness of the project activities and receipt of feedbacks, suggestions and complaints. Before every verification, the communities and other stakeholders will be contacted and consulted in order to receive updates on the project activities and results, but also to give inputs and considerations on the project.

2.3.9 Stakeholder Consultation Channels (G3.5)

The consultations are undertaken directly with the communities and other stakeholders or their legitimate representatives during the meeting and onsite visits in person. They take place in the respective communities and the project is presented to the participants by social specialist of Carbonext (figure 18). All the participants and the local people interviewed sign an attendance list for the meetings, a declaration of image usage and a declaration that the project have been clearly informed and there is no opposition to it. For the stakeholders and institutions identified (detailed in the sector 2.1.9.), a project summary in Portuguese with adequate level of information was sent in attachment by email, and they were invited to comment and contact Carbonext, if wished.

Figure 18 - Thiago from Carbonext social team in the Community Distrito Canaã on the 7th May on a meeting of public consultation about the CAAPII REDD+ Project. Photo taken by Carbonext Team, in the 7th May 2022.

It is important to mention that meetings with the communities will happen continuously during the project lifetime. The public consultation is considering the 20% of local people that must be consulted to be representative, even though it is not always possible to reach this number because of the engagement of people and willingness to answer the questionnaires. The talking to leaderships of the communities is also important.

2.3.10 Stakeholder Participation in Decision-Making and Implementation (G3.6)

The consultations with the community and stakeholders aim to ensure local adherence and a full understanding of the subject. The community members are informed of the date in advance to organize a participatory meeting, where information for the socioeconomical diagnostic is gathered. Periodic onsite meetings will be held in the project lifetime, on a location of easy access inside the respective communities, conducted by at least one person of the social Carbonext. The community is invited to comment on the project and its activities and is stimulated to make propositions if any critical point or need is identified (Figure 19).

Figure 19 - Community Diamantina on the public consultation and meeting about the CAAPII REDD+ Project in the 7th May. Photo taken by Carbonext Team, in the 7th May 2022.

The proposals and suggestions are analyzed and the Carbonext team, together with the communities and stakeholders, design the best, the most reasonable and feasible solution within the project limitations.

The consultations are made to reach men and women of the communities involved in the project and other parts interested. In the first public consultation held on April of 2022, the proportion of women in the meetings was in average of 57% compared with men participation, with more feminine participation in some communities than in others (table 22).

Table 22 - Number of community members participating on the first community consultation and proportion of women.

Community	Total	Women	Men	Proportion of women (%)
Cachoeira do Potiritá	21	15	6	71%
Diamantina	14	7	7	50%
Nova Esperança	12	3	9	25%
Vila Nova	28	18	10	64%
TOTAL	**75**	**43**	**32**	**Average: 57%**

Local associations, culture- and gender-sensitivity groups identified in the project will be consulted as well, separately if desired by the groups.

In addition, the email address redd.caapii@carbonext.com.br is made available for communication for all communities. The identity of the sender can be preserved, if necessary.
It is important to mention that consultations will take place along the project period, ensuring proper and accurate project activities propositions, so the stakeholders can continuously participate and make decisions during the project implementation.

In this first monitoring period, the communities visited by the Carbonext team were (table 23):

Table 23 - Date of the onsite visit in the communities.

Community	Date of visit
Cachoeira do Potiritá	26/04/2022
Vila Nova Esperança	27/04/2022
Vila Nova	29/04/2022
Diamantina	07/05/2022
Distrito Canaã	08/05/2022

As explained in the sector 2.1.6., the communities Vila Bom Jesus and Vila Itapura were identified, but could not be accessed in the visit day. These communities will not be excluded from the project until further information, and the meetings with them is being rescheduled in the next monitoring period.

The first project social activities are examples of the stakeholder participation in decision-making and implementation. The choice of the environmental education activities that were conducted in the 14th and 15th of July of 2022 in the schools of the Cachoeiro do Potiritá and Vila Nova Esperança was decided

together with the teacher Ms. Nadia and the principal Ms. Lídia, that pointed the necessity of activities related to the environment, motivation on the school and waste disposal problem. Regarding these points, the environmental education activities were directed to the soil care, construction of vegetable garden, waste disposal, recycling and composter.

2.3.11 Anti-Discrimination Assurance (G3.7)

Carbonext has a Code of Ethics and Organizational Conduct, which prohibits any type of abuse or harassment, whether moral, sexual or discriminatory. It does not allow:

- Investments of a sexual or moral nature.
- Exposure of inappropriate material or any other inappropriate conduct.
- Humiliating treatment, offenses or threats of any kind.
- Jokes, prejudice and any offensive reference to sex, sexual orientation, race, age, colour and religion.
- Verbal of physical harassment of any kind.
- Use of violence and aggression.

Owners and stakeholders are informed about the Carbonexts' policy, before and during the project. The proponents and stakeholders are audited with administrative and judicial bodies, through documents and declarations, in order to verify the involvement with inappropriate conduct that could implicate any risk to the project. Their involvement within any of the points above can lead to serious implications, and have legal consequences according to the Brazilian law.

For the project farm workers, the Code of Ethics and Organizational Conduct is being implemented. The Code, the implementation and training of the workers is expected to be finished by 2023, for the second monitoring report.

2.3.12 Feedback and Grievance Redress Procedure (G3.8)

Carbonext considers communities participation and feedbacks very important to attend local needs as better as possible within project possibilities and boundaries. The project's feedback and grievance redress procedure are and will be present during the project lifetime. All stakeholders and communities were informed of the project email account, to where they can inform any kind of grievances. Meetings with the

communities and proponents' participants of the project will be held periodically, with the purpose of maintaining good and personal communication, gather constructive feedbacks and guarantee the project activities' quality. Grievances will be redressed through mitigation measures and new activities proposed according to the demands. The communities are also invited to personally contact the field workers and monitors whenever they have something to report. A group of local people representing their communities can be created if it facilitates the communication.

In the occasion of any conflict or grievance, Carbonext team has all the necessary mechanisms to mediate and resolve it. The process for receiving, hearing and responding to the grievances can take 15 working days from the receipt of the communication.

In this period, the Carbonext team will develop an attempt at resolution, mediate the conflict and solve it in the best way possible for all the parties involved. Depending on the severity of the conflict: if the conflict is simple to solve or the feedback is about changes in the activities of the project, it can take few days after the 15-working days of response; If the conflict is very complex, it can take more days to be solved since it can involve multiple stakeholders, that will be assessed according to the event. Even without an exact time limits, Carbonext ensures to take actions as best as possible, within fewer days as possible.

Carbonext´s official "Feedback and Grievance Redress Operation Procedure" is being implemented, in order to guarantee the best flow of communication and effectiveness. The implementation and training of the workers on this procedure is expected to be finished by 2023, for the second monitoring report.

2.3.13 Accessibility of the Feedback and Grievance Redress Procedure (G3.8)

Stakeholders and community have a direct communication channel with the project team, in which they can give feedbacks or report grievances, as mentioned in the above section. Carbonext considers communities' participation and feedbacks especially important to attend local needs as better as possible within project possibilities and boundaries. Meetings with the communities and proponents will be held at least once in the semester in each community. The dates will be defined together and previously communicated to others, with the purpose of maintaining good and personal communication, gather constructive feedbacks and guarantee the project activities' quality. Grievance will be redressed through mitigation measures and new activities proposed according with the demands. The communities are also invited to contact the field workers and monitors whenever they have something to report.

Feedbacks and grievance received during the public comment period will be publicly available in the communication channels established on the project and in the meetings minutes, released to the community in strategic locations.

As mentioned in the item above, Carbonext´s official “Feedback and Grievance Redress Operation Procedure” is being implemented, in order to guarantee the best flow of communication and effectiveness. The implementation and training of the workers on this procedure is expected to be finished by 2023, for the second monitoring report.

2.3.14 Worker Training (G3.9)

During the community consultation, it was raised information on the communities’ main characteristics, vulnerabilities and how the project can assist in the improvement of their life quality and socioeconomic condition. These consultations identified the demand on the topics small-familiar agriculture, safety, sustainable practices, surveillance poor health and governmental support, and many others, presented in the sector 4.1.1.. The onsite visit on the properties that happened in the 4th to the 8th of April also identified some points that need to be reinforced. A relevant set of trainings and courses are being planned and developed to take place at least once a year in each community with interested people and with the workers from the properties during the whole project period, aiming to assist in the needs identified according to each community (further presented also in sector 4.1.1.).

The workers of the properties involved in the CAAPII REDD+ Project will be trained different activities, considering their work and other abilities. Annual trainings will be implemented regarding security and safety on their operations, as well as fire brigade trainings. The first fire brigade training occurred on the 13th of June of 2022, for 16 employees of the Maringá e Catarinense farm, since it was identified as a priority with the begin of the dry season. All the workers received a certificate and can now act and prevent fire events in the forest areas (figure 20). Further fire brigade trainings will occur once in the year for employees and also community members closed to the project area, so the project area can be protected and GHG emissions can be prevented.

Figure 20 - Workers of the Maringá e Catarinense Farm that participated on the first Fire Brigada Training.

The Carbonext is establishing a partnership with the SENAR (National Service in Rural Learning[95]), which has a series of courses addressing rural and sustainable practices in agriculture, pasture and livestock, security, maintenance of equipment, tourism and others. The list of 176 courses offered by SENAR can be found on the website and with Carbonext. In addition, with the decrease of GHG emission and increase in the community participation on the project implementation, workshops and specific trainings on sustainable practices and environmental education will be held by specialized personnel, and whenever possible, by local labour. The participants will receive certificates attesting their participation.

Local capacity and governance will be stimulated and incorporated in the project activities, so the culture and local knowledge is preserved and valued within the workers. The project intents to improve local capacity to reach better work positions, creating a “good staff turnover” of the workers, that became more capacitated and get better job positions, enabling other to also get work positions. If staff turnover happens, the impacts will be low, since the courses and trainings, for example the fire brigade training, will be done periodically in less than 2 years-interval. In other words, the workers will receive trainings according to their job activity, preventing capacity loss through staff turnover.

2.3.15 Community Employment Opportunities (G3.10)

The activities of the Project are being developed and designed according to the communities’ needs and the socioeconomic diagnosis made by Carbonext social team. The actions intent to create employment opportunities for the local population and as soon as the activities are better structured, they will be offered

[95] https://sistemafaepa.com.br/senar/o-senar/

without any discrimination of gender, age, religion, marital status or ethnicity. The selection will be made according to the person that better qualifies for the requirements of the position, also taking into account inclusion processes that will be defined. Women and elderly will be encouraged to apply for positions. Once selected, the worker(s) will go through a training process and a trial period, which lasts 3 months. All the workers hired will be registered.

Since the sustainable forestry management is an activity already developed by the land owner, there is the possibility of structuring the hiring of the workers, so more local people can be employed. Any other activities of the properties that need personal staff hiring will also be evaluated and structured so more local people can be hired.

The Recruitment and Integration Operation Procedure is being implemented, in order to guarantee the effectiveness of the procedure. The implementation and training of the workers on this procedure is expected to be finished by 2023, for the second monitoring report.

2.3.16 Relevant Laws and Regulations Related to Worker's Rights (G3.11)

In Brazil, workers' rights are guaranteed by well-defined laws, such as the Consolidation of Labor Laws (CLT) Law No. 5.452/43, recently amended by law No. 13.467/2017 (labor reform). It is also worth to mention the existence of Law 5,889/73 which regulates specifically the rules applicable for rural employees. The CLT has Brazilian Regulatory Norms (also known as NR) that are cited in Chapter V, Title II, and were approved by Ordinance no. 3214, in June 1978. The Brazilian Regulatory Norms (NR) regulate and provide guidance on mandatory procedures related to occupational safety and health.

The main NR regulations for the project are the following:

- NR 4 - Specialized Occupational Health and Safety Services (Last update: MTPS Ordinance No. 510 of April 29, 2016);
- NR 5 - Internal Commission for Accident Prevention. (Last updated: SIT Ordinance No. 247 of July 12, 2011);
- NR6 - Personal Protective Equipment – PPE;
- NR 28 - Deals with the inspection and penalties that can be applied to companies that do not comply with the other rules established by the Federal Government
- NR31 - Safety and health at Work in Agriculture, Livestock forestry, forestry and Aquaculture[DO|C2]
- ILO Declaration on Fundamental Principles and Rights at Work;
- Conventions 87 and 98 - Dealing with union freedom and protection of the right to union and collective bargaining.

- Convention 11 - Right to Organize in Agriculture;

The project proponent complies with laws and regulations (as declared in the Partnership Agreement). These norms and laws will be presented for new workers as part of the Recruitment and Integration Operation Procedure. Current workers will go through a training on the topic.

2.3.17 Occupational Safety Assessment (G3.12)

Considering the region, baseline scenario, main activities practiced in the region and equipment, the risks to workers of the properties is currently related to security and safety in the practices. The project implementation predicts risks during the fire brigade training, regarding possible burns, dehydration and exposure to extreme heat. Operation procedure for the activity is being implemented, containing the guidelines that shall be followed in the events of fires, such as maximum exposure duration, use of PPE, among others.

In general, to minimize risk to workers, all necessary trainings in health and safety will be provided by specialized professionals of the areas, in agreement with the Brazilian Regulatory Norms (NR). First-aid kits will be available, and the use of personal protective equipment will be mandatory. The main Brazilian Regulatory Norms related to the project, that regulate and provide guidance on mandatory procedures related to occupational safety and health in Brazil, are the following:

- NR4 - Specialized Occupational Health and Safety Services;
- NR5 - Internal Commission for Accident Prevention;
- NR6 - Personal Protective Equipment – PPE;
- NR20 - Occupational Safety and Health with Flammable and Combustible
- NR23 - Fire Protection, and
- NR31 - Safety and health at Work in Agriculture, Livestock forestry, forestry and Aquaculture

In summary, the table below presents the risks to worker safety identified and measures to minimize them (table 24).

Table 24 - Risks identified for workers and measures to minimize them.

Activity	Risks	Measures to minimize the risk
Fire Fighting training	Burns, dehydration, exposure to extreme heat	Training on fire brigade will be offered every year prior to the fire season. Personal Protective Equipment and First-Aid Kits will be made available. An Operational Procedure for the activity is being implemented, containing the guidelines that shall be followed in the

Activity	Risks	Measures to minimize the risk
		events of fires, such as maximum exposure duration, use of PPE, among others.
Handling diesel for fuelling the vehicle	Explosion, fuel inhalation and contact with the eyes.	Training NR20, provision of Personal Protective Equipment and First-Aid Kits.
Health campaigns	Generation of hazardous waste	Provision of specialized storage and collection for hazardous waste.
Terrestrial monitoring and protection of the forest area in the PA	Conflict with deforestation agents and hunters	The Operating Procedure for Property Control and Fire Fighting will establish the conduct that should be used during the ground monitoring and how to act in the events of encounter with invaders. All involved in ground monitoring activities will be trained on the procedure.
Maintenance activities	Injuries by handling of tools and machinery	Use of Individual Protection Equipment, trainings the workers on the techniques, performed by a professional.

2.4 Management Capacity

2.4.1 Project Governance Structures (G4.1)

Carbonext is responsible for all the activities necessary to develop the Project Description in the standards and methodology compatible with the project, for the calculation of the generation of carbon credits and the assistance for the project validation and verification under VCS/CCB and registration process. The team responsible for the mentioned activities is divided into four principal interconnected areas (Figure 21):

I. Legal Department: Legal team specialized in legal matters of the properties, proponents, land tenure, and others. This analysis is made through certificates from the federal and state court of justice, presence of land conflicts, overlaps with public areas and possible risks of expropriation. The project only is approved after the Due Diligence Process.
II. REDD+ Project Development Analysts: Technical team specialized in the development of REDD+ projects, being the main responsible for the project design, selection of activities, determination of specific objectives, to provide technical support to the owner and to monitor that the activities are being carried out correctly.
III. GIS (Geographic Information System): Team responsible for determining and reviewing the project baseline, deforestation dynamics, project leakage and monitoring via satellite images the occurrence of deforestation in the project area.

IV. Social Analysts: Team responsible for socioeconomic analysis, engagement and articulation with communities and other stakeholders, development and implementation of social activities and indicators, in addition to monitoring socio-economic indicators.

Figure 21 - Carbonext internal Governance Structure in Project Management.

After the project is developed by Carbonext, the Project Activities Governance is also coordinated by Carbonext together with the owner of the properties. Both are responsible for monitoring the project area in order to avoid any invasions, changes in the biome or any other activity that could lead to deforestation and loss of biodiversity. The mutual contact between proponents will be maintained continuously during the project period. The communities and other stakeholders are essential to the development of the activities and is expected to have a participatory process to build the actions according to the communities' characteristics and needs.

Since the CAAPII REDD+ Project is a grouped project, in the case of new areas addition for the next project years, the governance processes will be respect as well and the same process will be applied to these areas.

Regarding the actions proposed by the project, the Carbonext and the proponents will manage and execute them according to the activities and the planning/schedule. The development of the project actions and activities will count on specialists such as biologists and teachers in environmental education, physicians

in medical actions, local leaderships etc. This means, professionals in each area of workshops and proposed activities.

2.4.2 Required Technical Skills (G4.2)

Carbonext's technical team has professionals with experience in several areas of knowledge important to the planning and monitoring of the project. The team is composed by forestry engineers, social workers, biologists, oceanographers, geoprocessing analysts and other related areas, as described in the next section.

Carbonext will carry out the monitoring of carbon stocks from deforestation rates and greenhouse gas emissions produced or avoided during the project, which will be developed by a specialized team that has previous experience with other REDD projects. The biodiversity assessments will be caried out by a hired company, specialized in this area with the support from Carbonext. The data obtained might be used in further studies after a partnership with universities and researchers is established. In addition, Carbonext has a team of social specialists with necessary skills to engage the community and stakeholders, ensuring community participation in the activities design and socioeconomic indicators monitoring.

For the fauna and flora inventory, a third-party team will be hired to collect data in the field and generate the diagnostic report. Preference will be given to local teams that have the knowhow of local conditions, but these activities will only take place after the first verification of the project and accreditation.

2.4.3 Management Team Experience (G4.2)

Carbonext was founded in 2010 with the objective of preserving the Amazon Forest through the elaboration of REDD+ carbon credit projects. Since then, the company has designed three REDD+ projects according to the VCS standard and have conserved more than 315,000 hectare until this date, with new projects in progress. In addition, Carbonext has a multidisciplinary technical team, composed by forest engineers, biologists, ecologists, geographers, social workers, and others that integrate a skilled team of researchers and specialists able to conduct the project activities.

For more information about Carbonext, visit our website: *https://carbonext.com.br/*.

Below are summaries of the expertise of the technical team dedicated to the validation and monitoring of the CAAPII REDD+ Project.

Name	Janaina Dallan
Position	Carbonext CEO
Education	Degree in Forestry Engineering from Luiz de Queiroz College of Agriculture (ESALQ) and a post-graduation/MBA in Environemental Economy by IBRADES - Brazilian Institute for Sustainable Development
Resume summary	Jana has been working with the carbon market since 2001 on projects around the world and, as CEO of Carbonext, she is directly involved in coordinating the development and implementation of carbon credit projects. Throughout her career, she has managed UNFCCC CDM (Clean Development Mechanisms) projects through several international companies such as Golder Associates, Global Energy Partners, Orbeo / Societé Generale, One Carbon and Ecofys. She is currently a member of the United Nations Framework Convention on Climate Change (UNFCCC), in which she has been a member of the Registration and Issuance Team (RIT) since 2013, she is president of the Brazil Alliance for Nature-Based Solutions and is a member of the experts for the Taskforce for Scaling Voluntary Carbon Markets (TSVCM).
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Name	Luiz Fernando de Moura
Position	Technical Director
Education	Degree in Forestry Engineer by Luiz de Queiroz College of Agriculture (ESALQ); with M.Sc. and Ph.D. in Wood technology by the Université Laval (Quebec, Canada).
Resume summary	Luiz is responsible to coordinate the technical group at Carbonext, working with projects for the Carbon Markets, including Forestry projects. Dr. de Moura had participation in the preparation of “Energia Verde Carbonization Project - Mitigation of Methane Emissions in the Charcoal Production of Grupo Queiroz Galvão, Maranhão, Brazil”, registered on March 21, 2011.

	Dr. de Moura has also participation as project designer in Florestal Santa Maria REDD+ Projet, Fortaleza Ituxi REDD+ project, UNITOR REDD+ project and Evergreen REDD+ project.
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Name	Francy Rosy Nava
Position	REDD+ Leader
Education	Degree in Environmental Engineering from the State University of Pará and a Master (PSM) in Engineering of Dam Safety from Universidade Federal do Pará.
Resume summary	Fracy is responsible for leading the team of analysts in the development of this project. Experience in developing REED+ projects, having participated in the elaboration of VCS – ID832 Cikel Brazilian Amazon REDD APD Project Avoiding Planned Deforestation. Francy has experience with prospecting and analysis of feasibility of carbon projects in the Amazon and Audit Internal for Sustainable Projects. Throughout her career, she has articulated public policies for the development of productive low-carbon economies in the State of Pará to reduce pressure on the State's forests.
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Name	Mateus Trez
Position	Remote Sensing & GIS Coordinator
Education	Environmental Engineer from School of Engineering of Piracicaba
Resume summary	Responsible for coordinating a team of analysts in the development of REDD+ projects, prospecting and analyzing the feasibility of new carbon projects in the Brazilian Amazon. Experience with GIS and Remote Sensing routines, processes and solutions for conservation projects, LULC management, biodiversity modeling and development of REDD+ projects,

	with participation in the elaboration of the VCS Santa Maria REDD Project, UNITOR REDD+ project and Evergreen REDD+ project.
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Name	Mariana Abreu
Position	REDD+ Analyst
Education	Degree in Environmental Engineer from Escola Politécnica da Universidade de São Paulo (EPUSP) and Master degree in Infrastructure and Sustainability from ITA. Currently, she's a PhD student in the same institution.
Resume summary	Experience with socio-environmental impact assessment, nature based solutions and modeling of multiple ecosystem services such as carbon, biodiversity, water and soil.
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Name	Henrique Shimada Lepore
Position	REDD+ Analyst
Education	Degree in Environmental Engineering by Universidade Estadual Paulista (UNESP) with post-graduation/MBA in Engineering of Work's Security from Universidade de São Paulo (USP). Technologist in Sanitation and Environmental Control from Universidade Estadual de Campinas (UNICAMP).
Resume summary	Experience as an environmental engineering trainee/intern in the Votorantim group at Companhia Brasileira de Alumínio - CBA ; Experience as an environmental manager of the hospitality department of the Hospital Municipal de Barueri HMB - Dr. Francisco Moran managed by the SPDM. Experience as auditor of the RENOVABIO program of the ANP by the SGS Brazil certification company.

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Name	Paula Dias Ho
Position	REDD+ Analyst
Education	Degree in Biological Sciences by the University of São Paulo (USP) with academic internship of one year with Science Without Boarders from CNPq in the Ludwig Maximillian's University (Munich, Germany). Currently studying Sustainability and Circular Economy by the Pontifical Catholic University of Rio Grande do Sul (post-graduation/ MBA).
Resume summary	Experience as laboratory technician with benthonic meiofauna in the project of characterization of the Santos Bay (Brazil) by Petrobrás in the University of São Paulo (USP). Paula also worked as an educacional assistentent in the biology subject at Escola Viva School, in São Paulo.
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Name	Levi Andrade
Position	REDD+ Analyst
Education	Agriculture and Livestock Technician Post Graduation Technologist in Managerial Processes. UNINTER University Center Training in Defensive Driving, First Aid, Management and Leadership, Fighting Forest Fires, Participation in Environmental Certification FSC and Ceflor.
Resume summary	Field Supervisor, leadership and teamwork in Forestry activities, elaboration of operational procedures, planning, hiring and training of staff, area cleaning, opening and construction of forest roads, soil preparation, planting and replanting, property acquisition, supervision of activities area cleaning, soil preparation, planting, replanting, maintenance of eucalyptus forests. Forestry supervisor, activities of soil preparation, planting, replanting, maintenance of eucalyptus forests.

	Agricultural Technician. Training, supervision of agricultural projects, technical assistance and rural extension of agricultural producers/livestock. Main crops/activities attended: pineapple, pumpkin, dry rice, coffee, coconut, beans (irrigated), papaya, manioc, watermelon, tomato, pasture formation, beef and milk cattle.
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Name	Thiago Manoel Sozinho dos Santos
Position	Social Analyst for REDD+
Education	Degree in Forestry Engineering from Amazonia Federal Rural University and a Master's in forestry econonomy in Paraná Federal University
Resume summary	He has ten years working on the follow themes: protected areas, environment, carbon market, community relations, research, geotechnologies, customer success, project management, BI and Data Science.
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Name	Alice Dias da Cruz
Position	REDD+ Analyst
Education	Degree in Sanitary and Environmental Engineering from Federal University of Santa Catarina.
Resume summary	Experience in developing REED+ projects, having participated in the elaboration of Unitor REDD+ and Evergreen REDD+ projects. Previous experiences in sustainability consultancy and GHG inventory.
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Name	Aline Ramos de Sousa
Position	REDD+ Analyst

Education	Bachelor in Environmental Engineering (FOC) and M.Sc. in Science and Environmental Technology (UFABC)
Resume summary	She accumulated expertise working as independent expert in non-profit sector, working on socio-environmental projects focusing on education, agriculture, climate change and sustainability. Her experiences include engagement with multiple stakeholders; mediation of relations between government and civil society; using environmental and climate management instruments.
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Name	Luciana Satiko Arasato
Position	GIS Specialist
Education	Degree in Biology from São Paulo State University (Unesp) and Master's degree in Remote Sensing from National Institute for Space Research (INPE). Studying MBA in Business Management at Luiz de Queiroz College of Agriculture (ESALQ/USP)
Resume summary	Experience remote sensing and geoprocessing for applications and development of solutions for the different terrestrial ecosystems (Cerrado, Caatinga, Atlantic Forest, Mangroves). Management, coordination and performance in agile and waterfall projects, R&D projects, environmental licensing processes, biodiversity modeling, risk analysis for agricultural insurance and ESG diagnostics based on geotechnology
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Name	Franciele Salvador
Position	Legal Manager e Compliance Officer
Education	Lawyer by the Cenecista College of Joinville

Resume summary	Responsible for managing Carbonext's legal group, working as a strategic support in projects for the Carbon Markets. Previous experience working in large companies, as well as specializations in Business Law, Compliance, Contract: Business Vision and Practice.
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Name	Rui Almeida
Position	Social Project REDD+ Coordinator
Education	Graduated in Education, attending post-graduation course in project management, attending master's course in Conflict Management.
Resume summary	Experience in projects in the Amazon with traditional communities, quilombolas and indigenous peoples. Experience with the implementation of a financial fund in quilombola communities. Sustainable development, social dialogue, and land and conflict mediation. Training in Nonviolent Communication and advanced knowledge of social dialogue tools, digital technologies, communication methodologies and development of support material for communication projects.
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Name	Jane Dones
Position	REDD+ Social Analyst
Education	Degree in Environmental Engineering from Faculdades Oswaldo Cruz

Resume summary	Experience with a social humanization project, inspired by Anthroposophy, at Monte Azul (São Paulo, Brazil). Experience with sociocultural projects, in traditional Brazilian cultures, developing workshops on musical experience and cultural training, at the AMJUS Institute (Rio Grande do Norte, Brazil). Experience in reforestation project with agroforestry systems and organic food plantation. Jane also created and coordinated a social action project for children in social vulnerability, at the AMJUS Institute.
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Name	Marco Nascimento
Position	Social Project REDD+ Senior Analyst
Education	Graduated in Civil Engeneering, attending post-graduation course in project management at Universidade de São Paulo.
Resume summary	Part of carreer in the Alumminium Sector working at Vale and Norsk Hydro Brazil. Experience seeing a Senior Analyst in the social license for operations of minning industries. Background with quilombolas communiities, social risks and impacts. Experience with the implementation and metodologies of social projects along the pipeline and transmission line, in rural areas. Training in Social dialogue, conflict mediation and stakeholder Engagement Profissional.
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Name	Lana Caroline Ferreira Farias
Position	REDD+ Social Analyst
Education	Fishery Engineer from the Federal Rural University of Amazonia (UFRA). Master in Oceanography from the Federal University of Pará (UFPA) with the dissertation theme "Participatory environmental governance as a tool for building sustainable actions on the coast of Pará.
Resume summary	Experience in the elaboration and management of socio-environmental projects in traditional communities, participatory methodologies, active listening, participatory environmental governance, advisory and consulting services for aquaculture projects.

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Name	Kim Marchesoni Mello
Position	Real Estate Practice Coordinator.
Education	Lawyer graduated by Pontifícia Universidade Católica of Sao Paulo - PUC. Real Estate Specialist by Escola Paulista de Direito. MBA in Agribusiness (conclusion in December, 2022) by Universidade de Sao Paulo - USP.
Resume summary	Responsible by Carbonext Real Estate Practice, working as a strategic support in projects for the Carbon Markets, especially (i) Real Estate Agreements; and (ii) Real Estate Due Diligence. Previous experience working in reference Law Offices of Real Estate Practices as well as large Agribusiness and Construction companies.
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Name	Danilo Barboza de Almeida
Position	Senior Lawyer
Education	Lawyer graduated by Univerdidade de Mogi das Cruzes - UMC. Civil Procedural Specialist, With an extension in Public Law by Damásio Educacional. MBA in Agribusiness Law (conclusion in November, 2022) by Legale Educacional.
Resume summary	Provides support to Carbonext Real Estate Practice, working as a strategic support in projects for the Carbon Markets, Real Estate Agreements, Environmental Law and Real Estate Due Diligence. Previous experience working in large companies.
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Name	Larissa Albino da Silva Santos
Position	REDD+ Analyst
Education	Master in Energy Planning (COPPE/PPE/UFRJ) and Bachelor in Oceanography (UFES)
Resume summary	Larissa has experience in climate change and sustainability through data analysis for the public and private sectors. She worked as a consultant and researcher at WayCarbon, Control ParGroup, and conducted consultancies for the German development bank KfW and for the German Agency for International Cooperation (GIZ). She also was the technical lead for the service sector and supported the transport sector of the greenhouse gas inventory of the Third Brazilian National Communication to the United Nations Framework Convention on Climate Change
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2.4.4 Project Management Partnerships/Team Development (G4.2)

As mentioned in section 2.4.2., for the fauna and flora inventory, a third-party company or independent specialists will be hired to carry out data collection in the field, giving preference to local companies that know the regional reality. These activities will take place after the first verification report, so the contracted company has not yet been defined. The data collect on the biodiversity can be shared with universities and researchers interested in partnerships to produce scientific studies on the conservation of the species and environment, if in accordance with all parties.

For the implementation of the project activities, partnerships might be established according to the necessity of specialized professionals and services. This is the case for the fire brigade trainings, caried out by SWAT INTERNATIONAL, specialized in safety and security trainings. The activities of environmental education caried out in the Conto de Fadas and Nova Esperança schools were held by the NGO Instituto Manguezal, hired by Carbonext, as they are specialized on environmental education activities. The health monitoring activities, technical workshops and other activities are examples of actions that will need specialized companies and personal to be implemented.

With respect to other capacities necessary for project development, no technical or administrative gaps have so far been identified that need to be filled by an entity. However, if during the monitoring work, the

need to contract the services of independent professionals or companies to carry out the work is identified, the project team will take the necessary steps to find, contract and then manage any subcontractors. In addition, the project team will determine the time, resources, and level of participation of any external entities that provide services to the project in accordance with the internal processes.

A contact with SENAR (National Service in Rural Learning[96]) has been established in order to build a partnership, since this institution is specialized in rural practices courses in the region. Other local partnerships will be established to implement the project activities.

2.4.5 Financial Health of Implementing Organization(s) (G4.3)

Carbonext has more than 10 years of experience with REDD+ projects with the objective of preserving the Amazon Forest. Since then, Carbonext has designed three REDD+ projects according to the VCS standard and has conserved more than 315,000 hectare to date. The company has new projects in progress.
Carbonext has a financial department that is responsible for taking care of the company's financial health, so that it can operate on a regular basis and execute projects without running financial risks. To this end, the company has an annual budgeting process that is periodically reviewed in order to give managers visibility of what the main expenses will be for the period, including expenses related to the execution of projects. In this way, a monetary amount is set aside for each project that will be executed, in order to avoid any cash flow risk.

Project proponents have the necessary funds to maintain the project activities until the start of the GHG revenue, as presented in the Non-Permanence Risk Report[97] and supporting evidence is going to be made available to the audit team, if wished. The project activities will be carried out with the support of the carbon credit's sale.

2.4.6 Avoidance of Corruption and Other Unethical Behavior (G4.3)

In Brazil, the two main legal instruments that aim to curb acts of corruption and unethical attitudes are Law 12,846/2013 (Anti-Corruption Law) and Law 8,429/1992 (Administrative Misconduct Law). Law no. 12,846/2013, known as the Anti-Corruption Law, establishes rules regarding the administrative liability and civil liability of legal entities in the case of practice of acts against the public administration, national and/or foreign. Under Law 8,429/1992, administrative improbity is an immorality qualified by the dishonesty and acts of bad faith by the public agent.

[96] https://sistemafaepa.com.br/senar/o-senar/
[97] Evidence presented to the auditors

Both practices, in addition to the legal risks, could represent enormous reputational risk to the project and to all that are involved. Due to this risks, Carbonext Legal Due Diligence aims to verify and, if possible, mitigate any involvement of the landowner (partner) with such practices.

The clearance certificates examined by Carbonext's legal team (applicable for all the project proponents/partners and real estate assets) during the Legal Due Diligence process cover a large spectrum of jurisdictional and administrative matters, such as, for example, consultation before State Courts of Justice and Superior Courts, State and Federal Public Prosecutors, Environmental Agencies, Protest Registry Offices, Real Estate Registry Offices, etc., significantly reducing the chances of both debts and/or acts of corruption (regarding the landowner partner or the real estate assets) go unnoticed. Eventual discovery of relevant debts and/or acts of corruption involving the landowner (partner) is one of the many reasons for the termination of the intended partnership, as provided for in the contract.

Carbonext also has an internal Anti-Corruption Policy and an internal Code of Ethics and Organizational Conduct, in order to ensure non-involvement with bad practices or corruption[98].

Through a complaints channel, employees, customers, partners, and other stakeholders can, with complete security and anonymity, report situations that are not in accordance with our values or with our Code of Ethics and Organizational Conduct and / or Compliance Policy. The channel will record, investigate, and promote decisions involving the complaints received, to ensure compliance and continuous improvement of processes and internal controls.

All entities involved in the project go through a background check to ensure the non-involvement with any form of corruption such as bribery, embezzlement, fraud, favoritism, cronyism, nepotism, extortion, and collusion.

To register your denunciation, send an e-mail to **compliance@carbonext.com.br** . The email will be directed only to the Compliance Officer, the denunciation will be investigated and the Committee of Ethics and Organizational Conduct will evaluate the case.

Anti-corruption policy, code of ethics and organizational conduct in force: **https://carbonext.com.br/governanca-corporativa/ .**

[98] Anti-corruption policy and code of ethics and organizational conduct in force: https://carbonext.com.br/governanca-corporativa/

2.4.7 Commercially Sensitive Information (*Rules* 3.5.13 – 3.5.14)

Some information required by the VCS and CCB standards is considered confidential or commercially sensitive and cannot be made public by the project proponent. This information will be supplied to the audit team, but not available for the public.
The documents are:

- Agreements and contracts between the parties involved;
- Financial evidence of the proponents' funds for the project;
- Property Right Documents.

2.5 Legal Status and Property Rights

2.5.1 Statutory and Customary Property Rights (G5.1)

For the implementation and development of the project, the business model and type of contract adopted by Carbonext is the partnership agreement, a modality in which the possession (and liabilities) and property (and liabilities) remain with the landowner (partner).

However, in order to guarantee the maintenance of the project, the contract provides "the right of first refusal" in the acquisition of the property by the Carbonext. Said right guarantees that if the owner wishes to sell the property, he must first offer it to Carbonext. However, if Carbonext do not exercise the right of first refusal, the third party that will/shall acquire the real estate asset must fully observe/comply with the carbon project, until its termination. In this way, the maintenance of the project and the generation of credits is protected.

Considering the maintenance of the project, another important aspect is the verification of eventual of liens/encumbrances and possible rights of third parties that may threaten the real estate asset disposition in some way. At this point, we can indicate as possible risks environmental fines and unpaid taxes, disputes over possession (possessory actions), disputes over property ("usucapião"), succession disputes (inventory not finalized with disputes over real estate assets), guarantees recorded in the real estate record files (mortgage, fiduciary alienation, etc.). In general, these are situations that at some point may imply a change in ownership of the real estate asset, leading to the termination of the project. In this sense, Carbonext conducts the Legal Due Diligence, aiming to verify risk scenarios, protecting, as much as possible, these occurrences.

The project development depends, among many others, on the legal premise that there are no real (real estate asset) or personal (landowner) matters that would make the project unfeasible.

2.5.2 Recognition of Property Rights (G5.1)

All the real estate assets in which the project will be developed are private (with some exceptions treated particularly, lawfully) property rights are recognized, respected and supported by Brazilian Law. Information regarding the ownership and number of registration (real estate record file) of each real estate asset is listed in the table below (25).

Table 25 - The properties involved in the CAAPII REDD+ Project, their respective area, Project area, ownership and registration number.

Property	City	Total Area (ha)	Project Area (ha)	Ownership	Rural property Registration Certificate (CCIR)
Fazenda Maringá e Catarinense	Ipixuna do Pará/ Tomé-Açu	39,190.58	30,322.2304	Matogrosso Participações LTDA	41711838213 e 38973713213
Fazenda do Lago	Paragominas	1,463.26	668.0742	José Gilvan de Oliveira Matogrosso Costa	43048850210
Fazenda Lagoa Grande	Paragominas	1,549.45	1,153.2229	Josrmar Gilson de Oliveira Matogrosso Costa	43057096213
Fazenda Catarinense	Ipixuna do Pará	1,499.55	1,006.1778	Dunorte AGROFLORESTAL LTDA	43212494213
Fazenda Santa Helena I	Paragominas	1,173.7	616.9306	Matogrosso Participações LTDA	43060018210
Total	-	44,876.54	33,766.6359		-

The ownership of the farms is in process to be all included as properties owned by the holding Matogrosso Participações LTDA, from the owner Josmar Gilson de Oliveira Matogrosso Costa. Documentation will be made available to the auditors.

2.5.3 Free, Prior and Informed Consent (G5.2)

The project will not trespass nor affect other private or public real estate assets, traditional communities or environmental protection areas. Traditional communities eventually bordering the project area were consulted[99].

The consent necessary for the development of the project is as required by Brazilian legislation for all transactions in general, this is, the landowner partner must be a fully capable agent, willing to voluntarily execute the project, free from defects of consent.

The contract was widely and freely negotiated, being accepted and signed by those who had the legal powers to do so, as demonstrated by the partnership agreement signed.

On this first monitoring period, 5 communities were visited in order to participate on the public consultation, on meetings about the CAAPII REDD+ Project and also to participate on the socioeconomic diagnosis. Vila Nova, Vila Nova Esperança, Cachoeiro do Potiritá, Vila Diamantina and Distrito Canaã were visited and the table below (25) shows the number of people that participated on the meetings. There were some children in the local of the meetings, but they were not accounted. The meeting in the Distrito Canaã was small, so a new one will be scheduled in order to reach more community members, together with the onsite visits in the Vila Bom Jesus and Vila Itapura.

Table 26 - Number of people present on the public consultation about the CAAPII REDD+ Project.

Community	Total	Women	Men
Cachoeira do Potiritá	21	15	6
Diamantina	14	7	7
Nova Esperança	12	3	9
Vila Nova	28	18	10
TOTAL	**75**	**43**	**32**

In addition, the socioeconomic diagnosis obtained from the interviews with community members indicated that the project area is not used by the communities to any activity. Thus, the protection of the project area

[99] Evidence available at the audit

and actions to monitor it do not interfere on the communities and so, the project will cause no encroachment, no allocation and no compensation to them as well.

2.5.4 Property Rights Protection (G5.3)

The Project activities will not cause involuntary removal or relocation of property rights holders from their lands or territories, neither will force right holders to relocate activities important to their culture or livelihood, if practiced in the Project Area. On the contrary, the project activities will help to protect the community lands and their culture, providing courses, activities and a better understanding of the importance of the forest to its conservation. The project area does not overlap with any community area or other lands. Also, no activity besides, according to the owner and the public consultation, it seems that monitoring and preservation are the only activities undertaken in the project area, since no use of the area was indicated by the local population.

On this first monitoring period, 5 communities within a 20 km buffer of the project area were visited in order to participate on the public consultation, on meetings about the CAAPII REDD+ Project and also to participate on the socioeconomic diagnosis. Vila Nova, Vila Nova Esperança, Cachoeiro do Potiritá, Vila Diamantina and Distrito Canaã were visited and 75 people participated on the meetings. There were some children in the local of the meetings, but they were not accounted. The meeting in the Distrito Canaã was small, so a new one will be scheduled in order to reach more community members, together with the onsite visits in the Vila Bom Jesus and Vila Itapura.

In addition, the socioeconomic diagnosis obtained from the interviews with community members indicated that the project area is not used by the communities to any activity. Thus, the protection of the project area and actions to monitor it do not interfere on the communities and so, the project will not lead to involuntary removal or relocation of property rights holders from their lands or territories and will not force rights holders to relocate activities important to their culture or livelihood.

2.5.5 Illegal Activity Identification (G5.4)

In the baseline scenario, the scenario without the project faces the threats of illegal deforestation due to illegal timber exploration, logging and cattle ranching, and conflicts consequence of land disputes, which are strong activities in the region. In order to reduce these activities, the monitoring and surveillance of the area will be enhanced with more securities trained, maintenance of their equipment and means of transport. The boundaries of the farm are already fenced but will be reinforced. Also, the project has remote monitoring by satellite images from different sensors (Sentinel and Landsat) and radar images (Sentinel), with a maximum frequency of 7 days. This allows the project proponents to identify any illegal trespassing and deforestation, and take rapid action.

A study published by the Imazon reports up to 70% of logging in Pará State is illegal, and that the municipalities of Paragominas, Tomé-Açú, Ipixuna do Pará, Dom Eliseu, Uruará are among those that have deforested the most. Paragominas is at the top of the list[100]. The map below, modified from the SIMEX study[101] (map 19), shows the concentration of illegal deforestation by logging in the Pará State, from 2017 to 2018[102]. In darker color and with great concentration of illegal logging (dots) are the municipalities of Paragominas, Ipixuna do Pará and Tomé-Açu, where the 5 properties of the CAAPII REDD+ Project are located. Still according to this study, 70% of the logging activity in Pará was illegal.

Map 19 - The map of the Pará state showing the concentration of the illegal lgging activity, with concentration in the municipalities where the properties of the CAAPII REDD+ Project are located. The figure is from the SIMES study, modified. The legend is in p ortuguese and brings in rose the indigenoues lands; in grey the concervancy units and militar areas; in dark red the illegal logging activity; and in dark blue the authorized timber exploration.

To reinforce the information about illegal timber extraction in the project municipalities, articles from the region were selected, such as "Operation combats illegal timber extraction in the rural zone of

[100] 70% of logging is illegal. Source: https://imazon.org.br/imprensa/imazon-avalia-exploracao-madeireira-ilegal-paraense/. Access:19/04/2022.
[101] https://imazon.org.br/wp-content/uploads/2020/04/SIMEX_madeira_2017-2018.jpg
[102] https://imazon.org.br/wp-content/uploads/2020/04/SIMEX_madeira_2017-2018.jpg

Paragominas"[103], where an area with illegal extraction of wood was identified, but no criminal was arrested. There is other report on illegal logging that occurred in Tomé-Açú: "Three men are arrested for illegal logging in Tomé-Açu, Pará"[104].

Another illegal activity identified in the project region is the hunting of wild animals. In Brazil, the federal law 5.197/1967 prohibits the hunting of animals of any species in the country, at any stage of development and that live naturally outside captivity. In order to reduce these activities, the enforcement of the monitoring and surveillance of the area are already important and will inhibit hunters. Also, the project is developing activities regarding environmental education, nutrition, sustainable farming and vegetable gardens, the importance to conserve the biodiversity and the endangered local species to promote environmental awareness and expand the possibilities without the need of hunting. Some reports were selected to demonstrate that hunting is common in the region, such as: "PM arrests wild and endangered animal hunters in Paragominas, PA"[105], which reported that a group had illegally hunted animals such as armadillos, pacas, and alligators in their car. Other selected report is: "Firearms and more than 100 rounds of ammunition seized in Ipixuna do Pará"[106], which reported that the detainees were hunting armadillos and pacas with firearms.

As already mentioned in sector 2.1.14, the land tenure matter in the region brings many conflicts and is common in the Amazon. There are many invasions of properties by land grabbers and illegal exploration of timber especially in so-called unproductive areas. As an example, in 2015 there was an attempt of invasion after a fire in the surroundings of the Maringá and Catarinense Farm. Another example is the land reintegration process in 2022 to the indigenous people Amanayé from the Sarauá indigenous land, who have been expelled by land grabbers in 2002, forming the communities Balalaica (river side and sede) and Roça Queimada.

Considering the deforestation historic, the without-project scenario would be invasions and practices of illegal activities in the region, as well as fires in the forest areas. In order to impede this scenario, the landowner of the properties involved in the CAAPII REDD+ Project took a series of actions since the acquisition of the lands to protect his properties and the Amazon Forest inside them. The actions were directed to increase the productivity of the land with a sustainable forestry management, maintaining the productivity, and to the protection of the area by monitoring and reinforcement of surveillance.

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[103] Illegal logging activity Paragominas. Source:https://g1.globo.com/pa/para/noticia/2019/01/29/operacao-combate-extracao-ilegal-de-madeira-na-zona-rural-de-paragominas.ghtml**.** Access:19/04/2022.

[104] Illegal logging activity Tomé-Açú. Source:https://g1.globo.com/pa/para/noticia/tres-homens-sao-presos-por-extracao-ilegal-de-madeira-em-tome-acu-no-para.ghtml**.** Access:19/04/2022.

[105] Illegal hunting. https://g1.globo.com/pa/para/noticia/2021/01/16/pm-prende-cacadores-de-animais-silvestres-e-ameacados-de-extincao-em-paragominas-no-para.ghtml. Access:19/04/2022.

[106] Illegal hunting. https://g1.globo.com/pa/para/noticia/2022/04/04/armas-de-fogo-e-mais-de-100-municoes-sao-apreendidas-em-ipixuna-do-para.ghtml. Access:19/04/2022.

2.5.6 Ongoing Disputes (G5.5)

There are no current disputes in the Project Area, neither current nor unresolved disputes over land rights, territories and resources of the properties included in the CAAPII REDD+ Project Fazenda Maringá e Catarinense, Catarinense, do Lago, Lagoa Grande and Santa Helena I. The *duo diligence* process, caried out by the legal department of Carbonext, did not identify disputes resolved in the last twenty years and also did not identify any risk for the properties and consequently nor for the project regarding legal disputes of the project area. In addition, there are no records of land conflicts related to agrarian reform, deviation from the social function of property or even non-compliance with environmental legislation of the properties involved in the project.

Regarding invasions, an attempt of invasion after intentional fire were reported by the property owner in the Fazenda Maringá e Catarinense, mentioned in sector 2.1.6 and that will be further detailed in the text below.

In complement to this topic, there were identified some conflicts offsite the project area but inside the Reference Region, that are described in the table 27 below, obtained by researched newspaper reports. Although the conflicts were out of the Project Area, the land tenure matter on the indigenous Land Sarauá/Amanayé borders the Maringá e Catarinense Farm, and there is tension reported by the landowner, since conflicts ant attempts of invasions already happened, for example in 2015, mentioned by the proponent.

Table 27 - Conflicts identified outside the Project area.

DATA	CONFLICT	REPORT LINK
2022-04-25	*Land tenure/ ownership repossession in the Colônia do Oriente*	https://www.jusbrasil.com.br/processos/61113706/processo-n-0000578-2520088140015-do-tjpa e https://www.jusbrasil.com.br/processos/158084281/processo-n-0008893-2320178140000-do-tjpa
2022-02-25	*Land tenure/ ownership repossession in the Sarauá/ Amanayé indigenous land*	Justiça dá 90 dias para invasores deixarem Terra Indígena Amanayé (PA) no Pará | Pará | G1 (globo.com)
2021-10-26	*Report on the invasion of the Sarauá/ Amanayé indigenous Land by illegal land grabbers and invaders, showing deforestation data*	Criminosos ambientais impedem que indígenas usem o próprio território, no PA | Pará | G1 (globo.com)

2021-10-04	*Report on the invasion of the Sarauá/ Amanayé indigenous Land by illegal land grabbers and invaders, showing data that in 2019 were 150 non-indigenous families living there*	MPF alerta para o risco de conflito que pode gerar 'uma tragédia sem precedentes' em Ipixuna do Pará | Pará | G1 (globo.com)
2021-09-04	*Report on the invasion of the Sarauá/ Amanayé indigenous Land by illegal land grabbers and invaders*	Pesquisas mostram que cresce a extração de madeira em áreas proibidas | Jornal Nacional | G1 (globo.com)
2015-03-06	*Land tenure/ownership repossession in the Beira-Rio Farm*	Reintegração de posse - Fazenda Beira-Rio (Paragominas)
2013-04-27	*Report on the communities that are invading the Sarauá/ Amanayé indigenous Land and practicing illegal activities*	https://al-pa.jusbrasil.com.br/noticias/100540224/comissao-de-direitos-humanos-visita-fazenda-balalaica
2010-10-05	*Report on the communities and farms that are invading the Sarauá/ Amanayé indigenous Land*	Tribunal confirma: fazenda Balalaica pertence à terra Amanayé | Drupal (terrasindigenas.org.br)

The indigenous territory Amanayé has been suffering for years with the invasion, most of the time violent by the non-indigenous people, in 2002 for example, the Amanayé indigenous were expelled from their territory, even though the land is legally declared from the Amanayé people[107]. The intruders have reconfigured the area, practicing illegal extraction of timber, burning areas to clean and develop farming activities or install villages, houses and other facilities inside the indigenous territory. These activities are going against the conservation of the area proposed by the indigenous lifestyle and their close interaction with the land.

The proponent reinforced this information, explaining how the dynamic of the neighbouring territory from the Project area - Farm Maringá e Catarinense - is, and how dangerous is the contact with these parties. As shown in sector 2.1.6, there has been a fire in 2015 in the Sarauá lands, intended to scare the property owner and invade the property. Measures such as fences and firebreaks were implemented at the time by the property owner/proponent of the project.

[107] http://www.mpf.mp.br/pa/sala-de-imprensa/noticias-pa/justica-federal-determina-que-nao-indigenas-desocupem-terra-indigena-saraua-pa-dentro-de-90-dias

The indigenous territory is going through a reintegration process, where the land has been officially returned to the indigenous people and the invaders must leave the area within 90 days[108]. The conflict is called "imminent" and there is a serious danger of a confrontation with the invaders pointed by the Federal Prosecution Service of Brazil. The Balalaica (riverside Capim River), Roça Queimada and Balalaica sede communities were created by the invaders and land grabbers, and therefore no contact was established with them nor with the indigenous people because a violent conflict can break out in the area. If this conflict ends in the future and it is no longer dangerous to establish contact, a consultation with the indigenous population and the Balaica riverside Capim River, Balalaica sede and Roça Queimada will be carried out and the indigenous land Amanayé/Sarauá can be included in the project zone with the other communities.

The community Colônia Oriente was identified and visited by the social team, but the exclusion of the project was defined after conflicts were identified regarding land tenure. Several processes can be consulted in the JusBrasil website[109]. In the future, it can be visited in a more opportune and less disturbed moment and can be included in the project activities.

Under Brazilian legislation, we can say that the certificates from environmental, administrative, jurisdictional and certifying bodies indicate that both possession and property belong to the proponent, being tame, peaceful, stabilized, fully legal and extensively documented and proven. In other words, the owner has full right to use, enjoy and dispose of the properties that make up the CAAPII REDD+ Project, having legitimacy to allow the project.

2.5.7 National and Local Laws (G5.6)

There is no specific governing legislation in Brazil about carbon credit projects or even for the carbon credits generation. However, Brazil is advancing on this theme, and there are draft bills being considered in the plenary (both Senate and Chamber of Deputies) regarding the carbon market, for example, PL 2148/2015 proposes the regulation of the carbon market in Brazil by creating a Brazilian system of emissions trading in accordance with the Paris agreement on climate change. In addition, it provides for the certification of carbon credits for alternative source power generation projects. Also, PL 415/2020 establishes the Amazon Fund, a non-profit civil association, whose objective is to allocate the value of donations to the realization of non-refundable investments in actions to prevent, monitor and combat deforestation and to promote conservation and sustainable use of the Legal Amazon. The Amazon Fund will be eligible for access to payments for results of REDD+ projects, achieved by the country and recognized by the United Nations

[108] http://www.mpf.mp.br/pa/sala-de-imprensa/noticias-pa/justica-federal-determina-que-nao-indigenas-desocupem-terra-indigena-saraua-pa-dentro-de-90-dias
[109] https://www.jusbrasil.com.br/processos/nome/40224281/fazenda-oriente

Framework Convention on Change of the Climate. In addition, PL 4516/2021 consolidates the incentive to issue green debentures, intended for investment projects in sustainable development. Although these proposals are being processed by the Brazilian legislature, please note that all projects must be aligned with the laws and principles that govern the legal sphere to be approved subsequently inserted to the Brazilian legal system.

In this context, there is a hierarchy between norms in the Brazilian legislation, which starts with the Federal Constitution as the main governing rule and, thereafter, subordinated to this are state and municipal laws. All branches of applicable and complementary laws to the carbon-generating project and their applicable rules have their origin, foundation, and validity in the Federal Constitution.
Regarding Environmental Law and the Environment, Article 225 of the Federal Constitution is the basis for all norms, principles, objectives, and policies. The National Land Policy is indicated in Article 184. Furthermore, rights such as possession, property, and free enterprise are also based on the Federal Constitution.

Thus, considering the premises contained in the brief explanation above, there are several rules applicable, directly, and indirectly, to the project generated from carbon credits, each one regulating a specific aspect.

- Law 11,284/2006 - Provides for the management of public forests for sustainable production, institutes the Brazilian Forest Service - SFB. Among other topics, this law deals with the management of public forests for sustainable production; Direct management; Forest concessions; Management and inspection bodies; Principles and concepts (http://www.planalto.gov.br/ccivil_03/_Ato20042006/2006/Lei/L11284.htm);
- Law 12,651/2012 (Forest Code) - The Forest Code establishes general rules on the protection of vegetation, Permanent Preservation areas and Legal Reserve areas, forest exploitation, the supply of forest raw materials, control of the origin of forest products and the control and prevention of forest fires. In addition, it provides economic and financial instruments to achieve its objectives. Creates the CAR which was later regulated by MMA Normative Instruction No. 2 of May 5, 2014 (http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm);

Regarding the Forest Code, the following definitions of the Brazilian Forest Code stand out as being relevant:

> *"III – Legal Reserve (LR): area located inside a rural estate, excluding the Area of Permanent Preservation, necessary for sustainable use of natural resources, conservation and recovering of ecological processes to conservation of biodiversity and to shelter and protection of native fauna and flora.*
> *VI – Legal Amazon: the States of Acre, Pará, Amazonas, Roraima, Rondônia, Amapá and Mato Grosso, and the regions located to the North of parallel 13ºS, in States of Tocantins and Goiás, and to the West of meridian 44ºW, of the State of Maranhão."*

Map 20 - The Brazilian Legal Amazon States Acre (AC), Amapá (AP), Amazonas (AM), Maranhão (MA), Mato Grosso (MT), Pará (PA), Rondônia (RO), Roraima (RR), Tocantins (TO). Source: IBGE (2019).

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

The LR allocation is a prerequisite to obtaining permission to exploit the native vegetation existing inside the rural estate. In order to obtain this Permit for Forestry Stewardship, the landowner must previously register the location of the LR in land property documents through the Real Estate Registry Office, before suppressing any kind of native vegetation.

According to Provisory Measure No. 2166-67 (Medida Provisória nº 2.166-67) of August 24, 2001:

"Article 16. The forests and other types of native vegetation, excepting those located in Areas of Permanent Preservation, as well as those not subject to the politics of restricted use or subject to specific legislation, are susceptible to suppression, as long as a portion of vegetation is preserved, as Legal Reserve, at a minimum:

I – eighty percent (80%), in rural estates located in forest zones located in the Legal Amazon."

However, according to article 13: When indicated by the state Ecological-Economic Zoning - ZEE, carried out according to a unified methodology, the federal public power may:

I - reduce, exclusively for regularization purposes, through recompositing, regeneration or compensation of the Legal Reserve of properties with consolidated rural area, located in a forest area located in the Legal Amazon, to up to 50% (fifty percent) of the property, excluding the priority areas for the conservation of biodiversity and water resources and ecological corridors.

The table 28 presents the properties of the CAAPII REDD+ Project, their area, the total of Legal Reserve and the proportion of the Legal Reserve in the property.

Table 28 - The proportion of Legal Reserve area in each property of the project[110].

Property	Property area (ha)	Legal Reserve (RL) declared in CAR* (ha)	% RL x property
Fazenda Lago Grande	1,499.55	894.65	59.66
Fazenda do Lago	1,549.45	1.251.93	80.80
Fazenda Santa Helena I	1,173.7	757.91	64.57
Fazenda Maringá e Catarinense	39,190.58	31.349.02	79.99
Fazenda Catarinense	1,463.26	808.26	55.24

- Law 9,433/1997 (The National Policy on Water Resources) - The National Policy on Water Resources is stablished based on the assumption that water is a limited natural resource, with economic value and public domain. Likewise, the management of water resources must always provide for the multiple use of water, and the management of water resources must be decentralized and count on the participation of the Public Power, users and communities (http://www.planalto.gov .br/ccivil_03/leis/l9433.htm);
- Law 12,305/2010 (National Solid Waste Policy) - The National Solid Waste Policy brings together the set of principles, objectives, instruments, guidelines, goals and actions adopted by the Federal Government, alone or in cooperation with states, the Federal District, municipalities or individuals, with a view to the integrated management and environmentally appropriate management of solid waste. This is a milestone in Brazilian environmental legislation, as it is the first federal standard created with a focus on the problem of solid waste. Thus, the afore mentioned law deals with relevant issues related to social, environmental, and

[110] https://www.car.gov.br/publico/imoveis/index

economic interests in practically all activities. It includes as instruments the environmental, sanitary and agricultural monitoring and inspection, technical and financial cooperation between the public and private sectors for the development of research on new products, methods, processes and technologies of management, recycling, reuse, waste treatment and final disposal environmentally sound tailings; scientific and technological research; environmental education, among others (http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm);

- Law 12,187/09 (National Policy on Climate Change - PNMC) - The PNMC's objectives are to make economic and social development compatible with the protection of the climate system, the reduction of anthropogenic greenhouse gas emissions in relation to their different sources , the strengthening of human removals by sinks of greenhouse gases in the national territory, the implementation of measures to promote adaptation to climate change by the 3 (three) spheres of the Federation, with the participation and collaboration of economic and social agents stakeholders or beneficiaries, in particular those especially vulnerable to its adverse effects; the preservation, conservation and recovery of environmental resources, with particular attention to the great natural biomes considered National Heritage; the consolidation and expansion of legally protected areas and the encouragement of reforestation and the recomposition of vegetation cover in degraded areas; and encouraging the development of the Brazilian Emissions Reduction Market – MBRE (http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/l12187.htm);
- Decree no. 9,578/2018 - Provides for the National Fund on Climate Change (FNMC), dealt with in Law no. 12,114, of December 9, 2009, and the National Policy on Climate Change, dealt with in Law n. 12,187, of December 29, 2009. Among the topics covered by the decree is the application of FNMC resources to projects to reduce carbon emissions from deforestation and forest degradation, with priority for natural areas threatened with destruction and relevant to conservation strategies biodiversity (art. 7, V) (http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2018/decreto/d9578.htm);
- Resolution no. 001/1986 of CONAMA - Deals with Environmental Licensing. It is an administrative procedure through which the Public Administration establishes conditions and limits for the exercise of certain activities (http://www.ibama.gov.br/sophia/cnia/legislacao/MMA/RE0001-230186.PDF);
- Law 9,985/2000 (SNUC Law) - This Law establishes the National System of Nature Conservation Units - SNUC, establishes criteria and norms for the creation, implementation and management of conservation units and presents a series of important concepts for a proper understanding of conservation units (http://www.planalto.gov.br/ccivil_03/leis/l9985.htm);
- Law 6,938/1981 (National Environmental Policy) - The National Environmental Policy has the objective of preserving, improving and recovering the environmental quality conducive to life,

aiming to ensure conditions for socio-economic development, the interests of national security and the protection of human dignity;

- (http://www.planalto.gov.br/ccivil_03/leis/l6938.htm);
- Law 10,406/2002 (Civil Code) - Deals with various rights and obligations, including possession, property and legal business (http://www.planalto.gov.br/ccivil_03/leis/2002/l10406compilada.htm);
- Law 6,015/1973 (Public Records Law) - The law deals with public records and, especially, in its chapter V it refers to the registration of rural properties, through which the ownership of rural property is demonstrated (http:/ /www.planalto.gov.br/ccivil_03/leis/l6015compilada.htm).
- State Law no. 7,389, of 04/01/2010: Defines the activities of local environmental impact in the State of Pará and other measures.
- State Law no. 7,381, of 03/16/2010: Provides for the restoration of the vegetation cover, of the riparian forests of the State of Pará.
- State Law no. 6,745, of 05/06/2005: Establishes the Ecological-Economic Macrozoning of the State of Pará and other measures.
- State Law no. 6,506 of 12/02/2002: It establishes the basic guidelines for the realization of the Ecological-Economic Zoning (EEZ) in the State of Pará and other measures.
- State Law no. 6,462, of 7/4/2002: Provides for the State Policy on Forests and other forms of vegetation.
- State Law no. 5,977, of 7/10/1996: Provides for the protection of wildlife in the State of Pará.
- State Law no. 5,887, of 5/9/1995: Provides for the State Environmental Policy and other measures.
- State Decree no. 254, of 08/08/2019: Establishes the Pará Forum on Climate Change and Adaptation and takes other measures.
- State Decree no. 216, of 9/22/2011: Provides for the environmental licensing of agrosilvopastoral activities carried out in altered and/or underutilized areas outside the legal reserve area and permanent preservation area in the rural properties of the State of Pará.
- State Decree no. 2,436, of 8/11/2010: Regulates the actions related, directly or indirectly, to agrosilvopastoral activities, carried out within the areas of alternative land use, considered to be of low environmental impact.
- State Decree no. 2,099, of 01/25/2010: It provides for the maintenance, recomposition, conduction of natural regeneration, compensation and composition of the Legal Reserve area of rural properties in the State of Pará and other measures.
- State Decree no. 941, of 08/03/2020: Establishes the State Plan Amazônia Agora (PEAA), creates the Scientific Committee of the Plan and the Permanent Center for Monitoring the Plan, and takes other measures.

- State Decree no. 1,148, of 7/17/2008: Provides for the Rural Environmental Registry - CAR-PA, Legal Reserve area and other measures.
- Normative Instruction no. 01, of 05/05/2017: Establishes the procedures and criteria for enrollment in the Register of Product Explorers and Consumers Forestry of the State of Pará - CEPROF and use of the Product Marketing and Transport System Forestry of the State of Pará - SISFLORA, and gives other measures.
- State Decree no. 2,141, of 03/31/2006: Regulates provisions of Law No. 6,462, of July 4, 2002, which provides for the State Policy on Forests and other Vegetation Forms, aiming to encourage the recovery of altered and/or degraded areas and the restoration of legal reserves, for energy purposes, lumber, fruit, industrial or others, through forest and agroforestry stand with native and exotic species and other measures
- Resolution no. 54, of 10/24/2007: Homologates the list of endangered species of flora and fauna in the State of Pará.

International Agreements:

- Convention on the International Trade in Endangered Species of Wild Flora and Fauna, 1973.
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity, 2000.
- International Tropical Timber Agreement, 1994.
- United Nations Convention on Biological Diversity, 1992.
- United Nations Framework Convention on Climate Change, 1992.
- United Nations Declaration of the Rights of indigenous Peoples, 2007.
- The Kyoto Protocol to the Convention on Climate Change, 1997.

2.5.8 Approvals (G5.7)

Brazil does not have a specific authority for the management and approval of projects that generate carbon credits, so there is no need for such approval. Furthermore, there is no traditional community inside the project area, since the properties involved in the CAAPII Project are private and the communities offsite the Project Area are shown in item 2.1.9., eliminating the need for approval at a public hearing or by the community management council. Even without the need of an official approval, the 7 communities within a buffer of 20km of the project area (identified in sector 2.1.6.) were consulted, including other stakeholders, and no manifestation against the project was registered.

Brazil does not have a specific authority for the management and approval of projects that generate carbon credits, so there was no need for such formal approval of any kind.

Approvals for the project were obtained internally within the structure of the proponents, being approved by the partners and boards of both companies, in addition to having been approved regarding the legal and technical feasibility.

Although there is no specific need for approval by any administrative agency, it is worth mentioning that the project was built and will be conducted strictly within the legal dictates and, consequently, within all the regulations and principles of administrative entities in Brazil, such as IBAMA, FUNAI, INCRA, ICMBIO, Palmares Cultural Foundation, etc.

Local stakeholders and communities were also consulted and there was no manifestation against or disapproval of the project.

2.5.9 Project Ownership (G5.8)

The proponents of the CAAPII REDD+ Project, as stated in item 2.1.3., are the legal owners of the 5 properties involved in the project (Maringá e Catarinense Farm, Lagoa Grade Farm, do Lago Farm, Santa Helena Farm and Catarinense Farm), it means the Dunorte Agroflorestal LTDA and Matogrosso Participações LTDA, in partnership with the Carbonext Tecnologia em Soluções Ambientais Ltda, which is responsible for the project development, project activities, support and monitoring. The partnership stablished by the proponents Dunorte Agroflorestal LTDA, Matogrosso Participações LTDA and Carbonext Tecnologia em Soluções Ambientais was established in a legal contract agreed and signed by the parties. The contract also states the rights over the carbon credits to the three proponents listed above and in the item 2.1.3.

The details and ownership of the properties included in the Project is in the table (29) below. However, it is important to note that these properties are in the process of being transferred to a single owner, the Matogrosso Participações LTDA holding company.

Table 29 - Properties of the CAAPII REDD+ Project, their location and area in hectare.

City	Properties of CAAPII REDD+ Project	CAR number	Ownership	Area (ha)	Project Area (ha)
Ipixuna do Pará/ Tomé-Açu	Fazenda Maringá e Catarinense	PA-1503457-3F89.1D88.E93B.4691.8715.FDB5.493B.EFB1	Matogrosso Participações LTDA	39,190.58	30,322.2304
Paragominas	Fazenda do Lago	PA-1505502-6984.A09B.29ED.4E73.9B27.DF23.C903.58C2	José Gilvan de Oliveira Matogrosso Costa	1,549.45	1,153.2229
Paragominas	Fazenda Lagoa Grande	PA-1505502-8A2F.CABB.AAA0.45BB.A7DC.A80D.8A23.98E8	Josrmar Gilson de Oliveira Matogrosso Costa	1,499.55	1,006.1778
Ipixuna do Pará	Fazenda Catarinense	PA-1503457-D95F.94DD.8CAC.432C.92AF.70DC.6F5F.D4D7	Matogrosso Participações LTDA	1,463.26	668.0742
Paragominas	Fazenda Santa Helena I	PA-1505502-091D.E3D7.5FF7.430C.A277.7FBE.6AEF.E045	Matogrosso Participações LTDA	1,173.7	616.9306

The location of the properties is presented in the map 21.

Map 21 - Location of the properties of the CAAPII REDD+ Project.

The partnership was signed by contract through an agricultural partnership, a modality in which the possession and property remain with the current owner of the farm, with no need to change the possessory or petition status of the property used to the generation of carbon credits. As stated in item 2.5.1, if the owner wishes to sell the property or any aspect of it, including ownership, he must first offer it to Carbonext. In this way, the maintenance of the project and the generation of credits is protected.

2.5.10 Management of Double Counting Risk (G5.9)

The project does not seek nor has received any form of environmental or social credit, including any tradable climate, community or biodiversity unit. For details on how double counting is avoided, see section 2.5.15.

2.5.11 Emissions Trading Programs and Other Binding Limits

Not applicable. The project's GHG emission reductions and removals will not be used for compliance under trading programs or mechanisms.

2.5.12 Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates.

2.5.13 Participation under Other GHG Programs

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

2.5.14 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs, since it has not participated on any other GHG program.

2.5.15 Double Counting (G5.9)

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 VCS Program has a central project database, which lists each approved project. The VCS Project Database is the central storehouse of information on all projects validated to VCS criteria and all Verified Carbon Units issued under the program. Every VCU can be tracked from issuance to retirement in the database, allowing buyers to ensure every credit is real, additional, permanent, independently verified, uniquely numbered and fully traceable online. This project has not been registered under any other credited activity, and no VCUs have been assigned to the project area so far. Thus, any possibility of double counting of credits is eliminated.

3. CLIMATE

3.1 Application of Methodology

3.1.1 Title and Reference of Methodology

For this project, Verified Carbon Standard (VCS) Approved Methodology VM0015 – Version 1.1, 3 December 2012 – Methodology for Avoided Unplanned Deforestation (AUD) was applied.

The tools VT0001 Tool for The Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities – Version 3.0, and AFOLU "Non-Permanence Risk Tool" VCS Version 4, Procedural Document, 19 September 2019, v4.0. were used.

3.1.2 Applicability of Methodology

The table below (30) brings the applicability conditions and how the project meets them.

Table 30 - Applicability Conditions for Project.

Applicability conditions	Project meet description
Baseline activities may include planned or unplanned logging for timber, fuel-wood collection, charcoal production, agricultural and grazing activities as long as the category is unplanned deforestation according to the most recent VCS AFOLU requirements	The baseline activities include planned authorized logging.
Project activities may include one or a combination of the eligible categories defined in the description of the scope of the methodology.	According to Table 1, from VM0015 the eligible category to this Project Activity falls into categories A and B, as it predominantly involves protection of forest with and without controlled logging (sustainable forest management), and the baseline consists of deforestation in old-growth forests without logging (performing clear cut). For this type of project activity, the carbon balance is represented as shown in the figure 21.
The project area can include different types of forest, such as, but not limited to, old-growth forest, degraded forest, secondary forests, planted forests and agro-forestry systems meeting the definition of "forest"	The project is an area covered only by forest for at least 10 years before the Project start date: the date when activities are initiated to protect against the risk of future deforestation. The Project Area meets the internationally accepted definition of forest, which may include mature forests, secondary forests, and degraded forests. More specifically, according to the Decision 11/CP.7 of the Marrakesh Accord, the following definition of forests

Applicability conditions	Project meet description
	is adopted (UNFCCC, 2002[111]): (a) "Forest" is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 meters at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily un-stocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.
At project commencement, the project area shall include only land qualifying as "forest" for a minimum of 10 years prior to the project start date	Were analysed project area images starting 10 years prior to project start date from 2008 to 2019 to identify the forest areas according to Brazil forest definition.
The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) as long as they do not grow on peat. Peat shall be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm. If the project area includes a forested wetlands growing on peat (e.g. peat swamp forests), this methodology is not applicable	The Project Area does not include forested lands growing on peat, as stated in section 2.1.5 of the present PD. The Project Area is area is composed by the following soil types, none of which meet the criteria for turf, cited in the VM0015 methodology: • Plintossolo Pétrico Concrecionário, • Latossolo Amarelo Distrófico, • Espedossolo Ferrihumilúvico Hidromórfico and • Gleissolo Háplico Tb Distrófico

The table 31 shows the VM0015 methodology scope, related to the project activities and the baseline.

[111] https://unfccc.int/cop7/documents/accords_draft.pdf

Table 31: Scope of the VM0015 methodology (Table 1 of the VM0015)

			PROJECT ACTIVITY	
			Protection without logging, fuel wood collection or charcoal production	Protection with controlled logging, fuel wood collection or charcoal production
BASELINE	Deforestation	Old-growth without logging	A	B
		Old-growth with logging	C[1]	D[1]
		Degraded and still degrading	E[1]	F[1]
		Secondary growing	G[1]	H[1]
	No-deforestation[2]	Old-growth without logging	No change	Degradation
		Old-growth with logging	IFM	IFM-RIL
		Degraded and still degrading	IFM	IFM
		Secondary growing	No change	Degradation

1. Accounting for carbon stock increase in the project scenario is optional and can conservatively be omitted.
2. If the baseline is not deforestation, the change in carbon stocks is not covered in this methodology.

D – Avoided Deforestation with Logging in the Baseline and Project Cases
+ Carbon Stock Increase (optional)

Figure 21 - Carbon balance in project category D of VM0015 methodology.

In this context, it is demonstrated that the VM0015 methodology is applicable to the proposed AUD project activity.

As mentioned in section 3.1.1 of this PD, "VT0001 Tool for the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities", Version 3.0, 1 February 2012, Sectoral Scope 14, was used in this project. The tool is applicable to this project, according to statements below:

> a) The project activity does not lead to violation of any applicable law, even if the law is not enforced;
>
> b) There is a baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario.

Section 3.1.1 of this VCS-PD also mentions the use of AFOLU "Non-Permanence Risk Tool" VCS Version 4, Procedural Document, 19 September 2019, v4.0, which is mandatory to be applied to GHG removals or avoided emissions through carbon sinks.

3.1.3 Project Boundary

Spatial Boundaries – PROJECT AREA

The project area, according to VM00015, is an area covered only by forest for at least 10 years before (as proven via evidence at audit) the Project start date: the date when activities are initiated to protect against the risk of future deforestation. The procedure excluded the deforested areas within the potential Project Area and included only areas covered in forest at start date: 08/07/2019. As a result, it was obtained an area of 33,766.64 hectare of forest as the Project Area (map 22-25 and tables 32-35 with their geographic coordinates). The planned deforestation areas within the activities of the sustainable forest management

plans (roads and stations, yards, and other infrastructure) will be discounted during future monitoring events, as they become available to the project proponents.

Map 22 - CAAPII's Project Area in the Maringá e Catarinense Farm. Source: Carbonext (2022).

Table 32 - Geographical coordinates of the project area in the Maringá e Catarinense farm. Projection/Datum: UTM 22S – Sirgas2000

Vertices	LATITUDE	LONGITUDE
P01	9650669,7425	812625,4420
P02	9662932,4790	798040,5453
P03	9671293,6232	805064,8002
P04	9672984,1251	810280,7720
P05	9670124,4274	809948,2946
P06	9669351,6943	807019,0617
P07	9666231,6916	810238,3401
P08	9668267,2510	812078,2363
P09	9674398,2107	812220,2404
P10	9675448,2107	813630,2404
P11	9669499,8264	820935,4217
P12	9667372,2196	819191,5876
P13	9664117,8174	823115,7074
P14	9660178,2107	819840,2404
P15	9661031,6471	818683,3675

Vertices	LATITUDE	LONGITUDE
P16	9657173,8912	815480,1715
P17	9654736,2808	818400,2404

Map 23 - CAAPII's Project Area in the Catarinense Farm.

Table 33 - Geographical coordinates of the project area in the Catarinense farm. Projeçtion/Datum: UTM 22S – Sirgas2000

Vertices	LATITUDE	LONGITUDE
P18	9644898,5828	820686,0275
P19	9646678,2107	819244,0871
P20	9647560,0289	821870,0351
P21	9646356,9567	822405,5872
P22	9647481,4745	822639,9164
P23	9648688,2107	821970,2404
P24	9647908,2107	823770,2404
P25	9646754,0648	824802,3059
P26	9647683,9614	825392,9142
P27	9649552,4016	823350,2404

Map 24 - CAAPII's Project Area in the Lagoa Grande and do Lago Farms.

Table 34 - Geographical coordinates of the project area in the Lagoa Grande and do Lago farm. Projection/Datum: UTM 22S – Sirgas2000

Vertices	LATITUDE	LONGITUDE
P28	9656273,1702	845257,8079
P29	9661258,5210	844946,8432
P30	9662090,1804	842749,4003
P31	9663759,1296	842319,7364
P32	9667278,0458	843589,6731
P33	9664664,9124	846480,1635
P34	9659638,2107	847680,2404
P35	9657088,2107	848128,9618

Map 25 - CAAPII's Project Area in the Santa Helena 1 Farms.

Table 35 - Geographical coordinates of the project area in Santa Helena 1 farm. Projection/Datum: UTM 22S – Sirgas2000

Vertices	LATITUDE	LONGITUDE
P36	9660652,4321	863910,2404
P37	9660917,2613	867840,2404
P38	9660990,1209	868960,1773
P39	9660328,2107	869250,2404
P40	9659848,2107	867990,2404
P41	9659157,8868	867570,2404
P42	9659098,2107	864030,2404

Spatial Boundaries – REFERENCE REGION

For delimitation of the Reference Region boundary and future deforestation projection, the main drivers of deforestation were defined:

- Accessibility of forests: The Reference region has a vast and dense network of primary, secondary and tertiary roads, as well as navigable rivers. The nearest locations of these paths will have a greater potential of deforestation.

- Distance from Deforestation (Proximity to forest edges): Given the accessibility and physiographic conditions, regions near the ancient deforestation and communities, districts, municipal centres also tend to have a higher probability and risk of future deforestation.

- Distance from sawmills.

The map below (map 26) shows the limits of the Project Area, the Reference Region and the Leakage Belt.

Map 26 - Location of the Reference Region, Project Area and Leakage Belt.

The Reference Region is the spatial demarcation for gathering information on rates, agents and patterns related to deforestation, which is used for historical analysis of land use change and projection of future deforestation, and its monitoring.

The Reference Region was defined based on the dynamics of deforestation as well as physical and ecosystem aspects of the landscape and its similarity to the Project Area. To define its spatial boundaries, protected areas (indigenous lands and protected areas) and INCRA settlements were excluded from the

Reference Region, as these are public areas with different agrarian and legal attributes compared to a private property.

The following are the main criteria used in defining the Reference Region:

a. Absence of a national or sub-national baseline in the region of the Project Area.

b. In view of the item a), the municipal boundaries with the greatest influence on the regional context were used to define the boundaries of the Reference Region.

c. Information on the agents, patterns, land ownership and other drivers of deforestation in the region were used to delimit the Reference Region.

d. The Reference Region encompasses an area larger than the Project Area.

e. The existing baseline covers at least the length of the baseline period (10 years) and is not outdated.

f. The existing baseline shows the location of deforestation annually.

g. The spatial resolution of existing baseline is equal to the smallest mappable unit considered in the monitoring period (1 hectare).The methods used are transparent, free for consultation and follow the precepts of VM00015 methodology, version 1.1.

As a result, we obtained a Reference Region of 741,288.95 hectare, which includes the Project Area of 33,766.64 hectare. VM0015 recommends that when the Project Area is under 100,000 hectare, the Reference Region must be 20 to 40 times larger than the Project Area – according to the footnote on p.18 of VM0015.

It is concluded that the deforestation in the Project Area is likely to occur in a manner similar to that observed in the Reference Region.

Similarity analysis between Reference Region and Project Area

Agents and drivers

In the absence of the present REDD project, it is assumed that the property would undergo deforestation at the same intensity, carried out by the same agents and motivated by the same drivers, as that which occurs in the Reference Area. There is historical evidence (described with more details in sector 2.2.1 and 2.2.2) to argue that the same deforestation pressures which apply to the Reference Region also act on the Project Area. These deforestation agents are mainly timber exploration (legal and illegal), cattle raising and

pasture, and soybean cultivation. The fire can also be pointed as driver to deforestation, since there are reports of fires near de Project Area, as mentioned before in sector 2.1.6 and 2.5.6. More information on the drivers are detailed in the sector 3.1.4 and 3.2.1.

Land occupation

The map 27 shows the land-use within the Reference Region, illustrating the main legally recognised protected areas. The following categories were included: Federal, State and Municipal Protected Areas ("Unidades de Conservação (UC)"), Indigenous Territories recognized by FUNAI, legally approved settlement projects, and private land certified by INCRA. The Figure also presents the location of the project properties.

Map 27 - Communities and Indigenous Land observed in the Reference Region (RR) and Project Area(PA).

Conservation areas ("Unidades de Conservação" – UC) were not found within and near the reference region. Within the Region Reference area and close to Project Area and Leaked Belt, only Sarauá Indigenous Land (Amanayé ethnicity) was observed; and close to the RR, it was observed the Tembé (Tomé-Açu ethnicity) and Barreirinha (Paragominas ethnicity) indigenous lands.

The conclusion on similarity in terms of land use, land tenure and legal status of the land: 100% of Project Area is similar to Reference Region in terms of land use, land tenure, and legal status, meeting methodology requirements. The project proponent has intentionally kept the maximum possible of private properties in the RR to guarantee similarity.

Forest classes

The dominant forest classes in the Reference Region are lowland dense ombrophilous forest, type "Db" according to IBGE, covering 92.98% of the RR, submontane dense ombrophilous forest ("Ds") occupied 4.85% of the RR and alluvial dense ombrophilous forest ("Da") 1.81%, according to the project's analysis of MMA data[112]. Regarding Project Area, 92.12% of its forests are classified as lowland dense ombrophilous ("Db"), 5.07% of area are submontane dense ombrophilous forest ("Ds") and 2.54% are alluvial dense ombrophilous forest ("Da"). The map (28) below shows the spatial representation of these vegetation types in the Project Area and Reference Region and the table 36 shows the proportion of each forest typologies.

Map 28 - Identification of forest typologies in the Reference Region and Project Area.

[112] MMA – Ministério do Meio Ambiente, 2022. Available on: http://mapas.mma.gov.br/geonetwork/srv/br/metadata.show?id=416 Accessed 11/03/21.

Table 36 - Forest typologies in the Reference Region (RR) and Project Area (PA).

Vegetation classes and other land uses	Class code	RR			PA		
		Area (ha)	% of Total	% Cumulative	Area (ha)	% of Total	% Cumulative
Lowland Dense Ombrophilous Forest (Db)	Db	689,215.60	92.98	92.98	31,107.40	92.12	92.12
Submontane Dense Ombrophilous Forest (Ds)	Ds	35,928.40	4.85	97.82	1,711.95	5.07	97.19
Alluvial Dense Ombrophilous Forest (Da)	Da	13,438.87	1.81	99.64	859.26	2.54	99.74
Bodies of water (Magua)	Vs	2,705.59	0.36	100	88.03	0.26	100

Conclusion on the similarity of forest types: 100% of the PA has forest classes that are in 99.64% of the RR, namely Dense Ombrophilous Forest classified in 3 subtypes: lowland ("Db"), submontane ("Ds") and alluvial ("Da"). Therefore, it meets the methodology requirement for this specific similarity criterion, that states: *"At least 90% of the project area must have forest classes or vegetation types that exist in at least 90% of the rest of the reference region"*.

Elevation analysis

To classify the altitude of the Project Area and the Reference Region, in accordance with methodology criteria, which requires similarity of 90% between both areas, a mosaic of digital elevation models was prepared using scenes 02S495_ZN, 02S48_ZN, 03S495_ZN, and 03S48_ZN; in TIFF format, provided by Topdata - INPE. The map (29) below shows the elevation levels of the Reference Region and Project Area. The following frequency graphs show the elevation distributions (Nº. of pixels x Altitude) in the Project Area and Reference Region, demonstrating the similarity between them (figures 22 and 23).

Map 29 - Elevation of the Reference Region and Project Area.

Figure 22 - Frequency of elevation in the Project Area.

Figure 23 - Frequency of elevation in the Reference Region.

Conclusion regarding elevation similarity: 100% of the Project Area has elevation ranging between 14.72 and 114.2 meters, while more than 90% the Reference Region is located in altitudes between 0.96-131.41 meters. Thus, the assessment of elevation similarity is superior to 90% and meets methodology requirements.

In this analysis, our main goal was to show that the elevation in the PA is within the range of elevation in RR, so justifying that elevation factor would not hinder deforestation inside the PA in a different way it could affect deforestation in the RR.

Slope analysis

To analyse slope within the Project Area and the Reference Region, in compliance with methodology criteria, which require 90% similarity between the areas, a mosaic of digital elevation models was created using scenes 02S495_SC, 02S48_SC, 03S495_SC, and 03S48_SC; in TIFF format, sourced from Topdata - INPE, in which each pixel represents the average slope of the land.

The map (30) below shows the similarity of the slope classes in the Reference Region and Project Area; and in the following table (37), these classes were quantified for both areas. Flat, Slightly-undulating, Undulating and Hilly classes are observed in both areas, Reference Region and Project Area. The mountainous class was only found in the RR area, occupying 16.36 ha, corresponding to just 0.002% of the RR area.

The most prevalent class was Slightly-undulating (3-8% slope), which covers 65.9% of RR and 68.3% of PA.

Map 30 - Landscape slope analysis in the Reference Region and Project Area

Table 37 - Slope Similarity in the Project Area and Reference Region.

N	Slope class	Reference Region (RR)		Project Area (PA)		Difference in % coverage in RR and PA
		Area (ha)	Area (%)	Area (ha)	Area (%)	
1	Flat	119,068.3385	16.062	7,514.7668	22.255	-6.193
2	Slightly undulating	488,532.2331	65.903	23,064.4331	68.305	-2.402
3	Undulating	129,264.8970	17.438	3,092.0447	9.157	8.281
4	Hilly	4,407.1303	0.595	95.3913	0.283	0.312
5	Mountainous	16.3557	0.002	-	-	-
6	Steep	-	-	-	-	-
	Total		**100%**		**100%**	**-**

Conclusion regarding slope class: the same three slope classes cover 100% of both the Project Area and the Reference Region, specifically: Flat, Slightly undulating, and Undulating. The difference of coverage percentage of the slope classes between RR and PA areas does not exceed 8.28%, with the Undulating

class showing the greatest proportional variation coverage between RR and PA. Thus, the assessment of slope similarity is superior to 90% and meets methodology requirements.

Precipitation

To assess the climate and its similarity between the Project Area and the Reference Region, we used a study by WorldClim. The data were created by Steve Fick and Robert Hijmans (2017)[113], represent average monthly climate data for 1970-2000. The map (31) below shows a map of the Annual Mean Precipitation of the Project Area and Region of Reference.

Map 31 -Rainfall analysis in the Reference Region and Project Area.

Table 38 - Range of average annual precipitation.

Precipitation (1970-2000 average prec. *in mm*)*			
Área	min	mean	max
PA	164.42	174.98	178.75
RR	164	179.85	194.08

[113] Fick, S.E. and R.J. Hijmans, 2017. WorldClim 2: new 1km spatial resolution climate surfaces for global land areas. International Journal of Climatology 37 (12): 4302-4315.

*source: WordClim 2.1, 2017[114]

Conclusion on rainfall climate similarity: Both areas, RR and PA, are similar considering climate characterization. The range annual mean precipitation in RR is similar to the observed in the Project Area (Table 38 above), varying in the mean and maximum value of rainfall. equatorial zone with a dry period of one to two months of the year, the average temperature is above 18ºC in all months of the year.

General Conclusion on Similarity between PA and RR

The similarity between the Project Area and the Reference Region has been proven according to the requirements of VM0015. The similarity was found to be above 90% for more than three criteria: Land Occupation (100%); Forest classes (100%); Elevation (more than 90%); Slope (more than 90%); and Rainfall (100%).

Spatial Boundaries – LEAKAGE BELT

The leakage belt is the land area or land areas surrounding or adjacent to the project area in which baseline activities could be displaced due to the project activities implemented in the project area.

To define the boundary of the leakage belt, Opportunity cost analysis (Option I) was tested, in accordance with Approved VCS Methodology VM0015 “Methodology for Avoided Unplanned Deforestation”, Version 1.1, 3 December 2012, Sectoral Scope 14.

The boundary of the leakage belt (map 32) will be revisited at the end of each fixed baseline period, as opportunity costs are likely to change over time. In addition, this boundary of the leakage belt may have to be revisited if other VCS-AFOLU projects are registered nearby the project area.

[114] Fick, S.E. and R.J. Hijmans, 2017. WorldClim 2: new 1km spatial resolution climate surfaces for global land areas. International Journal of Climatology 37 (12): 4302-4315.

Map 32 - Location of the Leakage Belt (yellow polygon) adjacent to PA.

Opportunity cost analysis (Option I) is applicable where economic profit is an important driver of deforestation. To test the applicability of Option I, historical records have shown that at least 80% of the area deforested in the reference region (or some of its strata) during the historical reference period has occurred at locations where deforesting was profitable for cattle ranching activities. In this context, literature studies, surveys and other credible and verifiable sources of information were used to demonstrate profitability of the main products of deforestation in the region: wood and cattle.

Based on Opportunity cost analysis (Option I) rationale, leakage can only occur in areas outside the project area where the total cost of establishing and raising cattle and transporting the products to market is less than the price of the products (i.e., opportunity costs are > 0). To identify this zone, the following steps were applied:

a) List the main land uses that deforestation agents are likely to implement within the project area in the baseline case: in the baseline case of this project, deforestation is carried out to obtain timber to finance cattle ranching

b) Find credible and verifiable sources of information on the following variables:

$\boldsymbol{S\$x}$ = Average selling price per ton of the main product (living cattle) that would be established in the project area in the baseline case:

Considering that the volume of timber from illegal deforestation is not reliably registered in any country statistics, living cattle was considered as the main and final product of deforestation in this assessment. Living cattle is usually sold and transported to slaughterhouses in the region.

The average selling price of living cattle was obtained from Brazil Agriculture and Livestock Confederation (Confederação da Agricultura e Pecuária do Brasil, CNA): R$ 17,730.00/ton[115]. Nevertheless, there is a great variety of fees and taxes [116] that must be discounted from the sale price. The discount on total selling price has been reduced, resulting in a total of R$ [16,657.34]/ton return on selling price after taxes.

$\boldsymbol{SPxi}$ = Most important points of sale (spatial locations) for each main product Px in the reference region. In this assessment, it was considered that the most important selling points for living cattle are slaughterhouses in the region, along the PA – 256 highways.

$\boldsymbol{PCxi}$ = Average in situ production costs per ton of product

The average production costs of living cattle were obtained from Brazil Agriculture and Livestock Confederation (Confederação da Agricultura e Pecuária do Brasil, CNA): R$ 13,884.67/ton [117] to obtain the net margin is necessary discount the IRPJ and CSLL[118] from the difference between the sales price and production cost resulting in R$ 942.71/ton.

$\boldsymbol{TCv}$ = Average transport cost per kilometre for one ton of product using the most typical transport technology available to the producer.

The most typical means of transportation available for cattle producers in the region is road transport by truck. Transportation costs are estimated at R$ 4.4/km and R$ 328.28 to load and unload the truck according to National Terrestrial Transportation Agency (Agência Naciona de Transportes Terrestres, ANTT) freight chart[119]. This cost indicates that cattle could be transported at approximately 91.6 km by

[115] https://www.cnabrasil.org.br/sevicos/custos-producao (accessed in 27/04/2022)
[116] PIS: 0% (https://www.campograndenews.com.br/artigos/produtor-rural-pessoa-juridica-x-pis/pasep-e-cofins); COFINS: 0% (https://www.campograndenews.com.br/artigos/produtor-rural-pessoa-juridica-x-pis/pasep-e-cofins); ICMS: 4,0% (https://online.sefaz.am.gov.br/silt/Normas/Legisla%C3%A7%C3%A3o%20Estadual/Resolu%C3%A7%C3%A3o%20GSEFAZ/Ano%202019/RG%20003_19.htm);INSS/FUNRURAL: 2,05% (https://www.agrolink.com.br/colunistas/funrural--o-imposto-que-o-produtor-rural-nao-pode-esquecer-_448507.html).
[117] https://www.cnabrasil.org.br/sevicos/custos-producao (accessed in 10/02/2022)
[118] IRPJ: 25% (http://www.planalto.gov.br/ccivil_03/leis/l8541.htm); CSLL: 9% (Receita regulamenta alterações de alíquotas da CSLL — Português (Brasil) (www.gov.br)).
[119] https://www.in.gov.br/en/web/dou/-/resolucao-n-5.959-de-20-de-janeiro-de-2022-375504795)

road. Considering that up to 91.6 km it will still be profitable for livestock production; we generate a resulting surface that represents the potential profitability of livestock in the reference region. PA - 256, closest to the project area, was used as the main parameter for the construction of the buffer.

In addition to the profitable areas, a second filter was carried out considering the lowest cost to reach the main Slaughterhouses in Paragominas. Therefore, areas with the shortest distance to reach PA - 256, the areas with the highest density of roads and forested areas adjacent to the project area were considered.

The Leakage Management Areas are non-forest areas located outside the project boundary, in which the project proponent intends to implement activities that will reduce the risk of activity displacement leakage. The boundary of leakage management areas is clearly defined using the common projection and GIS software formats used in the project.

The definition of the Leakage Management Areas took into account the deforested areas of private lands and the PA - 256 highway. The following spatial criteria were used for delimitation:

I. Non-forest classes;

II. Logistical proximity for the Project Proponents to conduct management near the REDD project, taking into account the main access point to the Project Area, with the objective of creating a barrier to stop deforestation entering the Project Area from the Reference Region;

III. high potential for land-use changes in these areas, considering their proximity to roads and other deforested areas.

AFOLU non-permanence risk analyses will be assessed for each new geographic area. Activity-shifting, market leakage and ecological leakage assessments will be reassessed where new instances of the project activity are included in the project.

1) The geographic area within which all project activity instances shall occur is delineated with the Reference Region set in this VCS-PD.

2) The determination of the baseline for the project activity is in accordance with the requirements of the methodology applied to the project.

3) The demonstrations of additionality for the project activity are in accordance with the requirements of the methodology applied to the project.

4) A set of eligibility criteria for the inclusion of new project activity instances at subsequent verification events is defined in this VCS-PD (above in this topic).

5) A description of the central GHG information system and controls associated with the project and its monitoring is provided in the Monitoring Plan.

It is important to notice that the Leakage Management areas originally inserted in the project design will be priority to recruit new project instances. If the new instances involve the original Leakage Management areas, new areas shall be identified and adopted to manage leakage.

Forest

The definition of forest is in accordance with *Decision 11/CP.7 of the Marrakesh Accord (UNFCCC, 2002)*[120]. Data from MapBiomas Program, an initiative of the Greenhouse Gas Emissions Estimation System (SEEG) from the Climate Observatory and produced by a collaborative network of co-creators made up of NGOs, universities and technology companies[121] was used to produce the forest cover banchmark map. The Minimum Mapping Unit (MMU) in Mapbiomas collection data corresponds to 5 pixels (30m x 30 m), about 0.5 hectare[122].

The table 39 presents the sources of the GHG included or excluded within the boundary of the proposed AUD project activity.

Table 39 - Sources and GHG included or excluded within the boundary of the proposed AUD project activity (Table 4 of VM0015).

Source		Gas	Included?	Justification/Explanation
Baseline	Biomass burning	CO_2	No	Counted as carbon stock change
		CH_4	Yes	Methane emissions during burning of biomass for land clearance.
		N_2O	Yes	Nitrous oxide emissions during burning of biomass for land clearance
		Other	-	Not applicable.
	Livestock emissions	CO_2	No	Not a significant source
		CH_4	No	Not a significant source
		N_2O	No	Not a significant source
		Other	-	Not applicable.
Project	Biomass burning	CO_2	No	Counted as carbon stock change
		CH_4	Yes	Methane emissions during burning of biomass for land clearance.

[120] https://unfccc.int/files/meetings/workshops/other_meetings/application/pdf/11cp7.pdf (page 5 do PDF)
[121] https://mapbiomas.org/en
[122] Mapbiomas General Handbook – Collection 6, version 1.0. Availble in https://mapbiomas-br-site.s3.amazonaws.com/Metodologia/ATBD_Collection_6_v1_January_2022.pdf. Consultado em 15/02/2022

Source		Gas	Included?	Justification/Explanation
		N_2O	Yes	Nitrous oxide emissions during burning of biomass for land clearance
		Other	-	Not applicable.
	Livestock emissions	CO_2	No	Not a significant source
		CH_4	No	Not a significant source
		N_2O	No	Not a significant source
		Other	-	Not applicable.

Avoiding conversion of forests to pasture can reduce emissions of N_2O and CH_4 that are associated with biomass burning, which is used to clear the land. These emissions have been included in emission reduction calculations. However, emissions attributed to fertilizer use, and other agricultural practices that would have occurred if the forests had been converted, were conservatively omitted.

Included in quantifications

The following table (40) indicates the recommendations of carbon pools to include, as described in the "VCS Methodology Requirements v4.0":

Table 40. Carbon Pools to be Considered in Methodologies (Source: VCS Methodology Requirements v4.0)

		Above-ground tree* biomass	Above-ground non-tree* biomass	Below-ground biomass	Litter	Dead wood	Soil	Wood products
REDD	Planned or unplanned deforestation/degradation (APD or AUDD) with annual crop as the land cover in the baseline scenario	Y	O	O	N	O	O	S

Y: Carbon pool shall be included in the project boundary.

S: Carbon pool shall be included where project activities may significantly reduce the pool, and may be included where baseline activities may significantly reduce the pool.

N: Carbon pool does not have to be included, because it is not subject to significant changes or potential changes are transient in nature.

O: Carbon pool is optional and may be excluded from the project boundary.

* For ARR, ALM and ACoGS projects, in place of "Aboveground tree" and "Aboveground non-tree", these two carbon pool categories should be read as "Aboveground woody" and "Aboveground non-woody" respectively.

Carbon pools were selected in a conservative manner. Conservative numbers and approaches were adopted to obtain 0% uncertainty in this component. The following carbon pools (table 41) were hence included and excluded in quantifications, in compliance with "VCS Methodology Requirements v4.0", as shown in the table below:

Table 41: Carbon pools included or excluded within the boundary of the proposed AUD project activity (Table 03 of VM0015)

Carbon pools	**Included/Excluded**	**Justification / Explanation**
Above-ground	Tree: Included	Is mandatory according to the VCS Methodology Requirements v4.0, as shown in the table above.
	Non-tree: Excluded	For conservativeness purposes.
Below-ground	Included	Included as recommended in the VM0015 Methodology.
Dead wood	Excluded	Justification detailed in the text below.
Harvested wood products	Included	Included as recommended in the VM0015 Methodology.
Litter	Excluded	It does not have to be included, according to the VCS Methodology Requirements v4.0, as shown in the table above.
Soil organic carbon	Excluded	Not to be measured in conversions to pasture grasses, which is the case in this project, according to VCS Program Update of May 24th, 2010.

Deforestation emissions were estimated for all forest strata (conservatively excluding non-tree biomass), of which the above- and belowground carbon pools were previously determined by means of a literature survey of data from the Project Area region. It is considered that a certain portion of logged wood is

converted into long-term wood products, which serve as carbon pools after deforestation. This was factored into the calculation of net deforestation emissions.

Justification for not including the dead wood carbon pool

The omission of the dead wood carbon pool was determined as a matter of conservativeness, given that in the baseline scenario this carbon pool is likely to have much lower values than in the project scenario. So, even though dead wood carbon pool is significantly lower in the baseline than in the project scenario, the project proponent opted not to include this carbon pool in accounting of VCU benefits.

3.1.4 Baseline Scenario

Forest land is expected to be converted to non-forest land in the baseline scenario. The landowners cannot afford efforts and costs to keep long-term vigilance of the project boundaries to avoid unplanned deforestation from uncontrolled invasions and fire. In this context, the project falls within the category AFOLU – REDD - Avoiding unplanned deforestation (AUD).

Selection of the most probable baseline scenario for the project

The project properties are unable to afford large-scale long-term costs and efforts for surveillance of their lands. There have been events of trespassing within the historical reference period. As presented in item 2.1.6 and 2.5.6, the attempt of invasion of the Fazenda Maringá e Catarinense happened in 2015. The invaders of the Indigenous Land Amanayé/Sarauá, that borders this property of the Project Area, set fire in the forest and tried to invade the farm and a conflict was established. According to the property owner, there have been other attempts of invasion in the followed years, so the maintenance on surveillance is essential to guarantee the prevention of future invasions. In addition, as demonstrated also in the sector 2.5.6., the recent reintegration process of this indigenous land is pointed as dangerous and can lead to a conflict in the region, according to the Federal Prosecution Service of Brazil[123]. Other smaller invasions to use the area for illegal purposes, such as wild animals hunting, were also reported by the land owner, with an incident of invasion for hunting report registered (figure 24).

[123] http://www.mpf.mp.br/pa/sala-de-imprensa/noticias-pa/justica-federal-determina-que-nao-indigenas-desocupem-terra-indigena-saraua-pa-dentro-de-90-dias

Figure 24 - This picture was taken by the Carbonext team on the onsite visits, showing hunters in the roads outside the properties.

Furthermore, the sustainable forest management conducted at the Fazenda Maringá e Catarinense is under considerable pressure from other economic activities conducted in areas surrounding the properties, related to land grabbing and to extensive cattle-raising, in addition to the difficulties inherent to the development of forestry stewardship, which is currently an undergoing crisis in Brazil.

The “VT0001 Tool for the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities”, Version 3.0, 1 February 2012, Sectoral Scope 14 was applied in order to select the most probable baseline scenario for the project. The stepwise approach is presented in section 3.1.5 “Additionality”.

Cattle Farming is the most probable baseline scenario for the present project, as fully described in section 3.1.5 below. As the main deforestation agent in the region, cattle farming (pasture) is expected to increase in the project region. After a decrease on the livestock production from 2004 to 2011 and a relative stability until 2018, from 2018 to 2020, there has been an increase of 29% in number of heads[124] in the municipality of Ipixuna do Pará, Paragominas and Tomé-Açu (figure 25). The amount of cattle in 2020 (with 357,189 heads) is the highest value since 2009 (with 335,180).

[124] IBGE | Cidades@ | Pará | Ipixuna do Pará | Pesquisa | Pecuária | Aquicultura | 2020

Figure 25: Historical growth of livestock numbers in the municipalities of Ipixuna do Pará, Paragominas and Tomé-Açú.

Therefore, the implementation of CAAPII REDD+ project can help to contain the deforestation pressure, which in the region is caused by the invasion of properties followed by expansion of cattle farming (pasture) and agricultural areas.

3.1.4.1 STEP 2: ANALYSIS OF HISTORICAL LAND-USE AND LAND-COVER CHANGE

3.1.4.1.1 Collection of appropriate data sources

Data from software Digital PRODES[125] were used for mapping land use and cover classes, available in vector format (shapefile). A total of 47 satellite images were used to map the classes Forest, Disturbed Vegetation (Deforestation), Hydrography, and Non-forest Vegetation. The images cover the historical reference period (2009 to 2018) and correspond to the following orbits/points of Landsat satellite: 231/66, 231/67, 232/65, 232/66 and 232/67 (Table 27). PRODES classification and evaluation was carried out using high spatial resolution images available on Google Earth.

PRODES uses LANDSAT class satellite images (20 to 30 meters of spatial resolution and 16-day revisit rate) in a combination that seeks to minimize the problem of cloud cover and ensure interoperability criteria. The images from the American LANDSAT-5/TM satellite were, historically, the most used by the project, but the images from the CCD sensor on board the CBERS-2/2B, satellites of the Sino-Brazilian remote

[125] INPE INPE, “Metodologia para monitoramento da floresta usada nos projetos PRODES e DETER,” São José dos Campos, 2021. Accessed: Jun. 07, 2022. [Online]. Available: http://mtc-m21c.sid.inpe.br/ibi/8JMKD3MGP3W34R/443GTAS. INPE, “Metodologia Utilizada nos Projetos PRODES e DETER,” 2019. Accessed: Jun. 07, 2022. [Online].

sensing program, were widely used. PRODES also made use of LISS-3 images from the Indian satellite IRS-1 and also images from the British UK-DMC2 satellite. It currently makes massive use of images from LANDSAT 8/OLI, CBERS 4 and IRS-2. Regardless of the instrument used, the minimum area mapped by PRODES is 6.25 hectares. The total of 46 images, composed of four scenes (orbits: 244, 245 and 246 / points: 64 and 65), were adopted to map the land use classes of interest in the reference region within the historical period. The table 42 shows the data used for the historical LU/LC change analyses.

Table 42: Data used for historical LU/LC change analysis (Table 05 of VM0015)

Vector (Satellite or Airplane)	Sensor	Resolution		Coverage	Acquisition date	Scene or Point identifier	
		Spatial	Spectral	km	(YYYY)	Path / Latitude	Row / Longitude
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2010	244	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2010	245	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2010	245	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2010	246	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2011	244	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2011	245	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2011	245	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2011	246	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	244	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	245	64
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	245	65
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	246	64

Vector (Satellite or Airplane)	Sensor	Resolution		Coverage	Acquisition date	Scene or Point identifier	
		Spatial	Spectral	km	(YYYY)	Path / Latitude	Row / Longitude
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	245	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	246	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	244	65
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	245	64
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	245	65

Vector (Satellite or Airplane)	Sensor	Resolution		Coverage	Acquisition date	Scene or Point identifier	
		Spatial	Spectral	km	(YYYY)	Path / Latitude	Row / Longitude
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	246	64

3.1.4.1.2. Definition of classes of land-use and land-cover

The land use and cover classes used (table 43), the description of each class and the existing area before the Project start year are shown below.

Table 43 - Land use and cover classes of the CAAPII REDD+ Project.

Prodes ID	Project ID	Land use description
1	1	Forest (Forest Land)
4	2	Others natural formations
3	2	Others natural formations
2	3	Hydrography
08	4	Non-Forest land (Anthropization)
09	4	Non-Forest land (Anthropization)
10	4	Non-Forest land (Anthropization)
11	4	Non-Forest land (Anthropization)
12	4	Non-Forest land (Anthropization)
13	4	Non-Forest land (Anthropization)
14	4	Non-Forest land (Anthropization)
15	4	Non-Forest land (Anthropization)
16	4	Non-Forest land (Anthropization)
17	4	Non-Forest land (Anthropization)
27	4	Non-Forest land (Anthropization)
29	4	Non-Forest land (Anthropization)
32	5	Cloud

Forest Land: areas of remaining forest. This class includes all areas classified as forest since 2010 and that have not changed class during the historical period. In other words, it has been a forest since the beginning of the historical period.

Non-Forest Land: areas occupied by any anthropic use at some point in the historical period.

Others natural formations: areas of natural formation, which, when vegetated, have a different physiognomy from the Forest (Savannah, Cerrado, Campo, etc.).

Hydrography: water bodies of any kind.

The list of all land use and land cover classes existing at the project start date within the reference region are shown in the table 44 below (Table 6 of VM0015).

Table 44: List of all land use and land cover classes existing at the project start date within the reference region (Table 6 of VM0015)

Class Identifier		Trend in Carbon stock[1]	Presence in[2]	Baseline activity[3]			Description (including criteria for unambiguo
ID_{cl}	Name			LG	FW	CP	
1	Forest Land	decreasing	RR; LK; LM; PA	yes	no	no	Determined by automated classification methods
2	Non-Forest Land	increasing	RR; LK; LM; PA	yes	no	no	Determined by automated classification methods

Source: Remote Sensing data from PRODES: database indicates that virtually all deforestation is converted in pasture.
1. Note if “decreasing”, “constant”, “increasing”
2. RR = Reference region, LK = Leakage belt, LM = Leakage management Areas, PA = Project area
3. LG = Logging, FW = Fuel-wood collection; CP = Charcoal Production (yes/no)
4. Each class shall have a unique identifier (IDcl). The methodology sometimes uses the notation icl (= 1, 2, 3, … Icl) to indicate “initial” (pre-deforestation) classes, which are all forest classes; and fcl (= 1, 2, 3, … Fcl) to indicate final” (post-deforestation) classes. In this table all classes (“initial” and “final”) shall be listed.

3.1.4.1.3 Definition of categories of land-use and land-cover change

The potential LU/LC-change categories that could occur within the Project Area and Leakage Belt during the project crediting period, in both the baseline and project case, are presented below (table 45 and 46).

Table 45: Potential land-use and land-cover change matrix (Table 7.a of VM0015).

BASELINE SCENARIO					
			Initial LU/LC class (2019)		Total (ha)
			Forest	*Pasture*	
		ID_{cl}	*I1*	*I2*	
Final LU/LC class (2049)	F1	*Forest*	572,175	0.0	**572,175**
	F2	*Pasture*	**221,214**	46,510	**267,724**
Total (ha)			**793,390.2**	**46,510**	**839,900**

Table 46: List of land-use and land-cover change categories (Table 7.b of VM0015).

IDct	Name	Trend in Carbon stock	Presence in	Activity in the			IDct	Name	Trend in Carbon	Presence in	Activity in the project		
				LG	FW	CP					LG	FW	CP
I1/F1	Forest / Forest	Constant	RR; LK; PA	yes	no	no	I1/F1	Forest / Forest	Constant	RR; LK; PA	yes	no	no
I1/F2	Forest / pasture	Decreasing	RR; LK; PA	yes	no	no	I1/F2	Forest / pasture	Decreasing	RR; LK; PA	yes	no	no
I2/F1	pasture / Forest	Increasing	RR; LK; PA	yes	no	no	I2/F1	pasture / Forest	Increasing	RR; LK; PA	yes	no	no
I2/F2	pasture / pasture	Constant	RR; LK; PA	yes	no	no	I2/F2	pasture / pasture	Constant	RR; LK; PA	yes	no	no

3.1.4.1.3 Analysis of historical land-use and land-cover change

Deforestation mapping data provided by PRODES[126] were used to analyse the history of land use changes. The main methodological steps conducted by PRODES to map deforestation in the Brazilian Amazon are as follows:

Pre-processing: the main images pre-processing procedures carried out by PRODES consist of selection images with less cloud incidence, with the acquisitionable date closest to the dry season in the Amazon, and with proper radiometric quality; georeferencing of the images with a spatial resolution of 30 meters with topographic maps at 1:100,000, and NASA orthorectified images in MrSID format.

Interpretation and classification: the satellite images classification method used by PRODES follows four main steps. First it generates a spectral mixture model identifying t the vegetation components, soil, and shade in the images. This technique is known as spectral linear mixture models (SLMM), which attempts to estimate the percentage of vegetation, soil, and shade components for each cell (pixel) of the image. The second step is the application of the segmentation technique, which identifies, in the satellite image, spatially adjacent regions (segments) with similar spectral characteristics. After segmentation, the classification of segments take place individually, to identify the forest, non-forest vegetation, hydrography, and deforestation (anthropic vegetation) classes Finally, the result of the classified segmentation is subjected to the editing process, or classification audit, performed by a specialist, ending with the creation of the state mosaics.

126 INPE, "Metodologia Utilizada nos Projetos PRODES e DETER," 2019. Accessed: Jun. 07, 2022. [Online].

Post-processing: The classification result is then subjected to an audit process conducted by a GIS analyst.

Map accuracy check: The mapping check conducted by PRODES was carried out by comparing each class of the most recent land use and coverage map class (2010), with a set of 89 points randomly distributed on the reference region. The reference data used for this step came from visual interpretation of high spatial resolution images available on Google Earth. Using the reference points and the 2010 land use and land cover map, it was possible to check the mapping performance through the analysis of the confusion matrix. The overall accuracy of the mapping for the different classes of land use and cover showed values greater than 80%. The overall accuracy of the forest cover reference map was of 97%.

STEP 3: ANALYSIS OF AGENTS, DRIVERS AND UNDERLYING CAUSES OF DEFORESTATION AND THEIR LIKELY FUTURE DEVELOPMENT

3.1.4.2.1 Identification of agents of deforestation

Pasture accounts for virtually all the deforested land occupation in the project region.

The following information is provided for the identified agent of deforestation:

a) Name of the main agent: Cattle Ranchers

b) Description of the main features of the main agent of deforestation: Cattle ranching (pasture) is usually financed by means of initial capital obtained in wood logging. Deforestation is considered to occur through clear-cutting of forests for logging followed by pasture installation. This deforestation pattern may be caused by private landowners themselves and also by professional land-grabbers, through invasions of unguarded areas. The final use of virtually all occupied lands would be cattle ranching (pasture). Thus, it can be affirmed that the deforestation agent group is composed by large and small-scale cattle ranchers supported by land-grabbers and loggers in the initial stage of deforestation.

c) This group is composed by private owners and itinerant land-grabbers. It can also be affirmed that this group of deforestation agents is culturally and economically adapted to this “business cycle” of deforestation, whose results are clearly demonstrated in the Reference Region during the reference period, 52.6% corresponds to pasture.

d) Assessment of the most likely development of the population size of the deforestation agent group in the Reference Region, Project Area and

Leakage Belt: As the main deforestation agent in the region, cattle ranching (pasture) is expected to increase in the project region. According to Mapbiomas[127], the states with the largest grazing area are Pará (21.5 million hectare), Mato Grosso (21 million) and Minas Gerais (19.3 million).

Map 33 - Land use in the RR, with the classes of Mapbiomas project.

3.1.4.2.2 Identification of deforestation drivers

In this step, the factors that drive the land-use decisions of the agent group are analysed to identify the immediate causes of deforestation. For this analysis, two sets of driver variables are distinguished:

For this analysis, two sets of driver variables are distinguished:

127 MAPBIOMAS https://mapbiomas.org/estatisticas

a) Driver variables explaining the quantity (hectares) of deforestation:

Cattle prices:

1) According to CEPEA (2022)[128], the price of cattle increased 257% over the 2012 to 2022 period. This economic phenomenon can be observed throughout the country. Young (1998) as cited in Rivero et al. (2009), evaluating the mechanisms that cause deforestation in the Legal Amazon, found a positive relation between the expansion of agricultural areas and the variation of prices of agricultural products. VEIGA et al.[129] describes in the paper the determining factors for the expansion of livestock in the state of Pará, that shows the production factors and the economic factor facilitate the installation of livestock (table 47).

Table 47 - Frequency of factors for livestock.

Temas	Factor	Impact
Sociocultural	Livestock tradition	79
Microeconomics	Safe and fast return	96
	Good liquidity	97
Market and production chain	Market for livestock products	96
	Socio-economic potential	84

2) This key driver variable is likely to have a major impact on cattle ranchers' decision to deforest. Considering that the higher is the cattle price, the higher are the profits obtained with pasture for cattle ranching, instead of maintaining standing forests;

3) The figure (26) below (CEPEA, 2022) clearly shows the increasing trend of cattle prices over the years;

4) The dynamics of cattle prices are regulated by micro and macroeconomic scenario throughout the country, and there are no applicable project measures that can be implemented to address this driver.

[128] Source (accessed: 16/03/22): CEPEA, https://www.cepea.esalq.usp.br/br/consultas-ao-banco-de-dados-do-site.aspx.
[129] VEIGA el al. (accessed: 15/06/22 https://ainfo.cnptia.embrapa.br/digital/bitstream/item/84029/1/9-4.pdf).

Figure 26: Cattle price in Brazil l (CEPEA, 2022)

Access to forests (existing roads and navigable rivers):

It is broadly recognized that deforestation is accelerated in regions that have denser road networks (IMAZON, 2021[130]).

The presence of roads and navigable rivers is a logical deforestation driver, since it facilitates the flow of wood and other products harvested from the forest. The capacity to transport wood logs, rapidly clear the land for pasture and place wood logs in sawmills, quickly obtaining revenues, certainly has a major impact on cattle ranchers' decision to deforest the most accessible forest areas; In the region we have the PA-126 highways, the main access between the municipalities and the Capim River, an important navigable river in the region.

Proximity to forest edges:

Studies on historical location of deforestation in the Reference Region provide evidence that this has also been a driver for deforestation over the historical reference period. Similarly, to the proximity to roads and navigable rivers, the effect of this driver on deforestation decisions is related to easier logistics when clearing areas and easier and quicker revenue from logging. The proximity to forest edges has been used in similar ways by other REDD projects, including the "The Suruí Forest Carbon Project", the "RMDLT Portel-Pará REDD Project", the "Florestal Santa Maria REDD Project". Furthermore, this deforestation driver has been used to explain the dynamics of deforestation in similar analyses (LAURANCE et al. 2009;

[130] Source (accessed 16/03/21): Imazon, https://imazongeo.org.br/

ROSA et al. 2013). According to ROSA et al. (2013), deforestation is contagious, such that local deforestation rates increase over time if adjacent locations are deforested.

3.1.4.2.3 Identification of underlying causes of deforestation

According to literature surveys and local interviews, it is concluded that the underlying causes of deforestation are as follows: -Land-use policies and their enforcement; -Poverty and wealth. Land-use policies and their enforcement: As previously mentioned in this PD, in spite of the legal provisions intended to preserve at least 80% of the Amazon Forest cover, the lack of law enforcement by local authorities along with the increase in production and prices of cattle has created a scenario of almost complete disregard of the mandatory provisions of the Forest Code. High rates of criminality associated with land disputes usually jeopardize efforts concerning law enforcement improvement. In addition to that, to cover vast distances of areas with low demographic density makes tracking of illegal activities and land surveillance very difficult for the authorities. Accordingly, policies implemented to address illegal deforestation only by means of command-and-control approaches have proven to be ineffective so far (IPAM, 2011). Analysis of land use, via project analysis of PRODES data indicate that on deforestation history show a cumulative data from 2009 to 2018 out of 48,724.7 hectare.

This key underlying cause has a strong effect on the decisions of the main deforestation agents, as they are at liberty to continue their illegal business activities with very low probability of being detained by authorities. The problem of lack of command-and-control measures to contain deforestation in the Amazon Biome is a widespread issue, which has been getting worse and worse every year, due to lack of personnel and infrastructure of legal authorities, in addition to schemes of corruption and violence established by illegal agents to maintain the status quo. In this context, the lack of law enforcement can be assumed to be a constant underlying cause of deforestation during the project lifetime. Although the project activity cannot solve the problem of lack of enforcement in Brazil, it can serve as a case of success, to encourage neighbours to adopt sustainable practices as a profitable land-use alternative. Recently, Mapbiomas[131] created alert tool that monitors inspection data with the issuance of suppression authorization, the latest data show that more than 90% of deforestation has an illegal origin.

Conclusion

Available evidence about the most likely future deforestation trend within the Reference Region and Project Area is deemed to be “Conclusive”. Meaning that the hypothesized relationships between agent groups, driver variables, underlying causes and historical levels of deforestation have been verified via literature studies and other verifiable local sources of information.

[131] https://plataforma.alerta.mapbiomas.org/monitor-da-fiscalizacao.

During the reference period, the deforestation rate in the Reference Region has consistently increased, year on year, over nine of the ten years of the historical reference period. In this context, the deforestation rate used in the projections can be approach "a" or develop a model (approach "c") (see step 4.1.1 of the VM0015 methodology: Selection of Baseline Approach). In this project, the "a" approach will be adopted.

3.1.4.2.4 Description of baseline scenario adopted

According to the descriptions above, it is expected that unplanned deforestation is most likely to occur in the Project Area in case of absence of the REDD Project. The rate of deforestation adopted for calculation of REDD Project benefits was obtained from the PRODES[132] database and the details are presented in item 3.2.1.

In the absence of the REDD project, it is assumed that the property would certainly undergo the same deforestation intensity as other neighbouring lands, specially under pressure of invasions and illegal logging, for example, in the indigenous land Amanayé/Sarauá. In sector 2.5.6. are more information on the conflicts in the area.

Above and belowground carbon pools were determined by means of a literature survey regarding the Project region. Considering that the baseline process of deforestation involves timber harvesting for commercial markets, the content of carbon fixed into long-term wood products was also considered in calculation of net deforestation emissions. It is assumed that the Project Activity preserves soil organic carbon and litter pools to a greater extent than BAU activities. However, for conservativeness purposes, the project proponents decided not to include the soil and litter carbon pools in the REDD Project benefits.

Fossil fuel emissions were not accounted for in the Reference Area (baseline case) or for the Project Activity because they are irrelevant. It is assumed that the Project Activity also reduces emissions from fossil fuel burning, in comparison with BAU activities. However, this factor was also not accounted for conservativeness purposes and difficulties in monitoring during the project period.

The carbon pools considered for the CAAPII REDD+ Project are presented in table 40, in sector 3.1.3.

3.1.5 Additionality

The Project's additionality is demonstrated further on this sector, according to "VT0001 Tool for the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities", Version 3.0, 1 February 2012, Sectoral Scope 14. The tool is applicable to this project, according to statements below:

[132] http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes.

a. The project activity does not lead to violation of any applicable law, even if the law is not enforced.
b. There is a baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario.

The tool instructs the proponent(s) to apply the four steps below:

- STEP 1. Identification of alternative land use scenarios to the AFOLU project activity.
- STEP 2. Investment analysis to determine that the proposed project activity is not the most economically or financially attractive of the identified land use scenarios; or
- STEP 3. Barrier's analysis; and
- STEP 4. Common practice analysis.

STEP 1. Identification of alternative land use scenarios to the AFOLU project activity

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

a) The identified credible non-excluding alternative land use scenarios to the proposed VCS AFOLU project activity include:

i) SCENARIO 1: <u>Continuation of the pre-project land uses:</u>

For the purposes of additionality analysis, the two categories of activity falling within the REDD+ project boundaries were grouped together into one scenario. The components of Scenario 1 can be described under the following categories:

Sustainable Forest Management Plans (SFMPs). Only one of the project's properties has SFMPs, with active operating licenses. Financial resources from forest management activities maintain the management of rural properties. According to the analyses, SFMP income is less attractive than livestock. And it is important to highlight that there is uncertainty regarding the annual execution of forest management due to delays in the processes of authorization/releasing activities by the competent environmental agency from the Pará State. As observed in table 48, the deadline for the emission of the authorization can take up to almost 8 months. Considering that sustainable forest management actions take place in the summer (months from June to November), such delays make the actions unfeasible in that year, compromising the expected income and the management of the properties. It is also possible to observe that the release between the months of October and November makes operational management actions more

expensive and reduces profits given the short time (60 days) for carrying out the management, which will require more labor and machinery for the execution in time.

Table 48 - Time between the protocol subscription to the authorization from the government to execute the forestry management from the past years in the Maringá e Catarinense Farm.

Request Year	Protocol Year	Authorization Date	Days
2018	07/02/2018	01/10/2018	236
2019	05/04/2019	08/10/2019	186
2020	10/02/2020	11/08/2020	183
2021	19/04/2021	26/08/2021	129

The projection was available at document Financial Analysis_Caapii available for auditors, and all specific information about activity costs, maintenance expenses, total expenses, activity revenue and annual profit are detailed in the financial analysis spreadsheet[133].

Cattle farming: The cattle farming ranches are excluded from the REDD Projected Area in accordance with applicable VCS Standard and VM0015 methodology requirements.

No economic activity: Four of the five project properties have no economic activity in the project area, generating no income, with a 100% loss rate, and display negative profit ratios and IRRs.

Scenario 1, continuation of pre-project land-uses was included in accordance with VT001 tool requirements.

ii) SCENARIO 2: <u>Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project</u>:

The same categories of activity as mentioned under Scenario 1 were taken into account, however, the costs for REDD+ monitoring, and implementation were added to create scenario 2. Therefore, the elements of Scenario 2 were defined as follows:

Sustainable Forest Management Plans (SFMPs): For one of the project properties with active SFMPs, considering only the annual permissible exploitation yield in the average area of 1,552.04 hectare. And as mentioned in the same item SFMP in SCENARIO I above, there is insecurity in the release of the document for exploitation due to the delay of the public agencies responsible for authorizing the activity of sustainable forest management, with less time for exploration and cost increases.

[133] Calculations available in spreadsheet: "Financial Analysis_Caapii"

No activity: Four of the five project properties have no economic activity, generating no income, with a 100% loss rate, as mentioned above.

REDD implementation with CCB shares, and monitoring costs: Costs with farm employees training, vehicles purchase and maintenance, terrestrial monitoring, implementation of community and biodiversity actions, and other project activities were added in to the 30-year cashflow.

Scenario 2: Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project was included in accordance with VT0001 tool requirements.

iii) SCENARIO 3: Invasion of the Lands and Illegal Wood harvesting, followed by Cattle Farming installation (Business as usual – BAU):

For this scenario it was considered the illegal invasion of the properties by third parties, illegal deforestation, and the sale of the timber, followed by the installation of pasture for cattle ranching. Between the reference period (2008 - 2019) 61,596 hectare were deforested in the reference region to install cattle farming, with 75.5% corresponding to pasture implementation.

If it is considered that sustainable forest management will not have a financial return in a given year, for reasons already mentioned such as the delay in the authorization to the forest extraction activity by the relevant bodies, the owner will not have the financial resources to continue monitoring and protection actions in the project areas. This scenario increases the risk of invasion, since the lands are unproductive, there is no protection or monitoring, and the circulation of people is low, which will cause illegal deforestation and the development of livestock production, as is common practice in the region. The proportion of invasion considered was the projection in the GIS simulations for the project area, considering the most common practice in the surroundings, which is deforestation followed by livestock.

It is important to make it clear that the practice of sustainable forest management inhibits land invasions, as it is a productive forest. However, this activity does **not completely prevent invasions from occurring**, due to the high costs of more effective actions that guarantee property security.

The state of Pará, which has deforested the most between the states of Brazil in recent years, was the second most deforested state in February 2022: 82km² (27%) of the total deforested in the legal Amazon[134]. Just in the first 5 months of the year 2022, the Amazon Forest lost more than two thousand soccer fields of native forest per day, which is the largest devastation in the

[134] https://imazon.org.br/imprensa/desmatamento-na-amazonia-cresce-quase-70-e-atinge-pior-fevereiro-em-10-anos/

last 15 years[135]. The figure 27 below was extracted from the Mapbiomas platform[136] and shows that since January of 2019, there were 60,857 deforestation alerts in the state, with 59,774 being indicatives of illegality and no action. Only 9.8 % of the areas deforested had authorization or inspection, while 90.2% did not have. Only in Paragominas, Ipixuna do Pará and Tomé-Açú, in the month that most deforestation occurred (March of 2021) were deforested 1,502.86 hectare[133].

Figure *27* - Deforestation alert; and alerts with indication of illegality and no action.

For the 30 years of the project, it is projected that these activities will deforest 371,720,00 hectare in the Reference Region and 28,677 hectare in the project area, corresponding to 7.7% of the RR. In this scenario, several negative impacts would occur in the social, economic, biodiversity, and climate spheres, such as the immediate loss of local biodiversity, habitat fragmentation, impact on water resources, reduction of ecosystem services, and many others. Furthermore, a common practice of these deforestation agents is to burn the area to clean forest residues before installing pasture, and this process emits large amounts of greenhouse gases, which cause pollution problems, respiratory diseases, and reduce climate resilience, in addition to making the remaining forests more susceptible to new forest fires.

b) All identified land use scenarios above may be deemed realistic and credible, as they currently exist and are technically feasible in the project region. For all land use scenarios, credibility is justified by current BAU practices attested by the literature and local observations.

c) Outcome of Sub-step 1a: The credible alternative land-use scenarios that could have occurred on the land within the project boundary are scenarios (i), (ii) and (iii), described above.

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

[135] https://umsoplaneta.globo.com/clima/noticia/2022/06/17/desmatamento-na-amazonia-chega-a-2-mil-campos-de-futebol-por-dia-em-2022-mostra-imazon.ghtml
[136] https://plataforma.alerta.mapbiomas.org/monitor-da-fiscalizacao

a) The following procedure was applied:

I. Demonstration that all land-use scenarios identified in the sub-step 1a are in compliance with all mandatory applicable legal and regulatory requirements: Scenarios (i) and (ii) are in accordance with current legislation and regulations regarding the implementation of sustainable forest management. The Law Nº 12,651 of May 25, 2012, provides for the protection of native vegetation, and recognizes sustainable forest management as a viable, low-impact activity to be carried out in the Legal Amazon. The Normative Instruction 5, of December 11, 2006, establishes the technical procedures for the preparation, presentation, execution, and technical evaluation of sustainable forest management plans, the main relevant rules being:

i. It falls under the category of Full Sustainable Forest Management (SFM), for the production of wood/timber, the one that foresees the use of machines for log skidding.

ii. Initial cutting cycle of at least 25 years and maximum of 35 years for the Full SFM and at least 10 years for the Low-Intensity SFM.

iii. Establishes the maximum cutting intensity to be authorized of 30m³/ha for the Full SFM with an initial cutting cycle of 35 years.

iv. Establishes the minimum diameter for cutting of 50cm for all species, for which the specific minimum diameter has not yet been established.

v. Maintenance of at least 10% of the number of trees per species, in the area of effective management, respecting the minimum maintenance limit of 3 trees per species per 100 ha.

In order to carry out sustainable forest management, the landowners have the forest management plan, which formalizes the total area authorized for exploitation and the volume allowed for management, including actions to mitigate the impacts of the operations. It is important to mention that the forest management plan predicts the process and operation of the forestry, however it can eventually suffer changes according to the execution of the management. The sustainable forest management plan is available for the auditors.

II. Demonstration that applicable mandatory legal requirements are systematically not enforced and that non-compliance with requirements is widespread:

Scenario 3 is not in compliance with applicable mandatory legal requirements, because they are systematically not enforced, and this scenario is widespread.

The State of Pará has the highest accumulated rate of deforestation, with 162,631 km² of deforested area. From 2019 to 2021, 14,328 km² of forest was deforested[137]. Illegal logging is prevailing in the region, reaching 55% of unauthorized timber exploration from 2019 to 2020. The municipalities that comprise this project were in the top of the ranking of municipalities that deforested the most in the state, number one of illegal action being Paragominas[138].

The common practice for private properties in the region, that have no monitoring, security, or even its well-defined area with fences around it or sentries, is to be invaded by third parties. Invaders and land grabbers performing illegal deforestation of the area to sell the timber illegaly and subsequently practice the most profitable activity in the region, which in this case is cattle raising.

One example for this invasion practice is present in this notice https://g1.globo.com/pa/para/noticia/2019/02/04/agricultores-interditam-trecho-da-rodovia-pa-256-em-paragominas.ghtml, were it is reported that small farmers invade the fazenda Oriente, and is currently under ownership repossession and land tenure conflict. The community Oriente formed in this farm is in the project region but was excluded from project activities due to this conflict.

b) Outcome of Sub-step1b: It has been demonstrated that scenarios i,ii and iii are plausible alternative land use scenarios to this VCS AFOLU project activity.

Sub-step 1c. Selection of the baseline scenario:

Outcome of sub-step 1c:

SCENARIO 3: Land Invasion and illegal Wood harvesting followed by cattle production, is considered baseline scenario, since it is the most common land use after deforestation identified by GIS analysis in the Reference Region.

STEP 2. Investment analysis

In accordance with the VT0001 tool, the aim of this step is to “determine whether the proposed project activity, without the revenue from the sale of GHG credits is economically or financially less attractive than at least one of the other land use scenarios”.

Sub-Step 2a. Determine appropriate analysis method:

[137] http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/rates
[138] https://imazon.org.br/imprensa/imazon-avalia-exploracao-madeireira-ilegal-paraense/ and https://imazon.org.br/imprensa/mais-da-metade-da-area-com-exploracao-madeireira-no-para-nao-foi-autorizada-pelos-orgaos-ambientais/

Given that the project operations do generate economic benefits other than VCU-related income, the investment comparison analysis (Option II) was applied.

Sub-step 2b. Option II. Apply investment comparison analysis

The investment analysis demonstrates that the proposed project activity without the revenue from the sale of GHG credits is far less economically attractive that baseline scenario. Evidence of all the estimated data in each scenario is available to the auditors. The Investment Rate of Return (IRR) is considered the most suitable financial indicator for the project type and decision-making context. It was used in other similar projects and has proven useful for interpreting the scenarios developed. The IRR is the discount rate that makes the net present value (NPV) of a project zero, presenting the annual expected rate-of return that will be earned on a project or investment.

Eq. $$IRR = NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0 = 0$$

Legend: Ct= Net cash inflow during the period t;

T = The number of time periods;

C_0 = Total initial investment costs;

R = The discount rate.

Sub-step 2c. Calculation and comparison of financial indicators

For this step analysis, the scenarios 1, 2 and 3 were compared:

- SCENARIO 1: Continuation of the pre-project land uses
- SCENARIO 2: Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project
- SCENARIO 3: Invasion of the Lands and Illegal Wood harvesting, followed by Cattle Farming installation (Business as usual – BAU)

The following methodological premises were followed:

- As required by “VT0001 tool for the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities”, Version 3.0,1 February 2012, Sectorial Scope 14, the IRR of the proposed VCS AFOLU project, with forest management (Scenario 1 – IRR: 1.49%) and without VCU revenues (Scenario 2 – IRR: 0.74%).

SCENARIO 1. For this scenario, it was considered only the annual permissible exploitation yield in the average area of 1,552.04 hectare according to the forest management plan for one of the properties with active SFMPs. The table 49 shows the maintenance costs involved on the pre-project scenario, the IRR and the NPV values over the 30-year project lifetime. The projection is available at document Financial Analysis CAAPII for auditors, together with all specific information about activity costs, maintenance expenses, total expenses, activity revenue and annual profit[139].

All information used to prepare this financial analysis was provided by the owner of the farm and the executor of the sustainable forest management, and will be available to auditors.

Table 49 - Financial scenario 1.

SCENARIO 1 PRE-PROJECT	
Total costs (R$)	138,709,914
Total revenue (R$)	174,553,212
Total profit (R$)	35,843,298
Net Present Value - NPV (R$)	17,781,469
IRR (%)	1.49%

SCENARIO 2. For this scenario, it was considered only the annual permissible exploitation yield in the average area of 1,552.04 hectare according to the forest management plan for one of the project properties with active SFMPs. For costs, it was considered the purchase of the vehicles (two cars, two motorcycles and one airplane), terrestrial monitoring and the respective distance inside and between the properties that acquire fuel, communication system (internet/radio), fixed workers of the farms, fire brigade training and CCB actions.

Considering all these costs mentioned above, the calculated IRR for the scenario 2 is 0.74% and the NPV over the 30-year project lifetime is R$ 4,842,303, present in the table (50) below. The projection is available at document Financial Analysis_Caapii available for auditors, and all specific information about activity costs, maintenance expenses, total expenses, activity revenue and annual profit are detailed in the financial analysis spreadsheet[140].

All information used to prepare this financial analysis was provided by the owner of the farm and the forest engineer responsible for the sustainable forest management, and will be available to auditors.

[139] Calculations available in spreadsheet: "Financial Analysis_Caapii"
[140] Calculations available in spreadsheet: "Financial Analysis_Caapii"

Table 50 - Financial scenario 2.

SCENARIO 2 WITH PROJECT	
Total costs (R$)	155,389,876
Total revenue (R$)	174,553,212
Total profit (R$)	19,163,336
Net Present Value - NPV (R$)	4,842,303
IRR (%)	0.74%

SCENARIO 3. For scenario 3, the invasion of the project area was considered, according to the GIS projection. Illegal deforestation was also considered in the area, this means, cutting clear all the wood existing in the area and selling, considered that in 1 hectare *of Dense submontane forest* there is a total of 77.4m³. -1ha[141] of wood (38.6m³ was discounted as a loss in the process – 1/3 of the total). The average sale value of wood was applied considering the years 2019, 2020 and 2021 of the management activities of the Maringá e Catarinense property, and thus, we obtain the total value that can be obtained in an exploitation at illegal levels in the area, which is R$ 20,881/ha. Considering the installation of cattle ranching in the area after deforestation, the profit of the cattle is R$ 319.91/head, whereas 1.15 head per hectare[142].

Associating these two pieces of information about cattle ranching and deforestation for timber sales, there is the table (51) below with IRR-15.95% and NPV-R$ 324,516,036.

Table 51 - Financial scenario 3.

SCENARIO 3 - BUSINESS AS USUAL		
Total costs (R$)	R$	164,006,472
Total gross revenue (R$)	R$	776,755,412
Total profit (R$)	R$	612,784,940
IRR (%)		15.94%
Net Present Value - NPV (R$/Ha)	R$	324,516,036

All information used to prepare this financial analysis will be available to auditors[124].

Comparatively scenarios i and ii lose out to scenario iii, thus, carbon credits are fundamental to maintain the security of the property and consequently keep the forest areas preserved, being additional to the

[141] VOLUME MADEIRA COMERCIAL
[142] https://www.sistemafaep.org.br/numero-de-bovinos-por-hectare-cresce-no-brasil-pela-primeira-vez/#:~:text=De%20acordo%20com%20os%20dados,hist%C3%B3ria%20do%20setor%20pecu%C3%A1rio%20brasileiro.

protection and monitoring of these areas. The profitability of cattle ranching linked to the sale of illegally harvested timber drives land invasions, and consequently causes deforestation. Then in a scenario with the sale of carbon credits, there is a reduction of financial risk for the landowner, which consequently guarantees that he will carry out the actions of monitoring the area, internal training, social actions, and biodiversity, and all actions include in this PD (that have been carried out or will be carried out).

STEP 4. Common practice analyses

According to the VT0001 "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities", the previous steps are to be complemented with an analysis of the extent to which similar activities have already spread in the geographical area of the proposed VCS AFOLU project activity. This test is a credibility check to demonstrate additionality that complements the investment analysis (Step 2). Other registered VCS AFOLU project activities shall not be included in this analysis.

These analyses had as objective a survey of similar activities in the region of the proposed project activity.

In the municipalities of Paragominas, Ipixuna do Pará and Tomé-Açú no privative conservation initiatives were found[143] , only some areas defined as Private Natural Heritage Reserves (PNHR)[144], which is a private domain conservation unit. **Thus it is not common practice in the region to conserve forested areas and conservation projects of great magnitude as the one proposed in this PD**, in the project areas Santa Helena 1, Fazenda do Lago, Fazenda Lagoa Grande, Catarinense. The table 52 below shows the PNHR registered in the states of Pará. None of them are considered in the CAAPII REDD+ Project, because they are not in the 20km buffer of the project areas.

Table 52 - PNRH located in Para State[133]

RPPN (nome)	Proprietário	Município	Área (ha)
RPPN Sumaúma	Hotel Sumaúma	Barcarena - PA	6,00
RPPN Osório Reimão	Maria de Jesus Girard de Reimão	Cametá - PA	8,80
RPPN Fazenda Pioneira	Companhia Siderúrgica do Pará - COSIPAR	Marabá - PA	400,00
RPPN Tibiriçá	Querubina Arrais Almeida	Marabá - PA	400,00
RPPN Nadir Júnior	Nadir Pinheiro do Nascimento	Moju - PA	2000,00
RPPN Klagesi	Iracy Corecha Jauffret	Santo Antônio do Tauá - PA	23,00

Also, the **practice of legal logging is an activity that is not common in the region like occurs in the Maringá e Catarinense Property.** A study published by Imazon[145], reports that about 70% of the timber exploited in Pará from August 2017 to July 2018 was illegal, in 38,000 hectare. Only 30% had authorization for exploitation. This study emphasizes the unauthorized logging was concentrated mainly

[143] https://sistemas.icmbio.gov.br/simrppn/publico/rppn/PA/
[144]What is RPPN/PNHR? Source: https://www.gov.br/icmbio/pt-br/servicos/crie-sua-reserva/perguntas-e-respostas-sobre-rppn#:~:text=1.,afeta%20a%20titularidade%20do%20im%C3%B3vel.
[145] https://imazon.org.br/imprensa/imazon-avalia-exploracao-madeireira-ilegal-paraense/

in private areas or under dispute (76%), followed by Indigenous Lands (12%), Settlements (8%) and Conservation Units (UCs) (5%).

In this context, the common practice in the region is land invasion for the illegal logging, livestock and the illegal use of land rights, as mentioned in the topic 2.1.6 Social Parameters. Thus, the history of invasion in the RR, demonstrate that is not common practice to implement a property security team or reinforced the property security practice, as well the monitoring these areas to avoid the deforestation and land invasion.

In accordance with the financial analysis as well the analysis of common practices in the region, this project proves to be additional. Given that no activities similar *to the proposed VCS AFOLU project activity were identified, Step 4 is satisfied (i.e.,similar activities are not likely to be carried out in the project region).*

Thus, the proposed VCS-CCB AFOLU project activities are not the baseline scenario and, hence, it is additional.

3.1.6 Methodology Deviations

The CAAPII REDD+ Project has only one deviation, which is the use of the average carbon stock change of wood products (for the forest class F2= Dense Ombrophilous Alluvial Forest) of initial forest class existing in the project area and leakage belt, since the uncertainty was only 11.40%, close to the 10%.

3.2 Quantification of GHG Emission Reductions and Removals

3.2.1 Baseline Emissions

For the quantification of the baseline emissions, the steps 4 to 6 of the VM0015 were applied. The definition of the baseline scenario was priory described in item **Erro! Fonte de referência não encontrada.**.

3.2.1.1 Projection of the quantity of future deforestation

This section refers to the following steps of the VM0015 Methodology: 4.1.1: Selection of the baseline approach; and Step 4.1.2: Quantitative projection of future deforestation.

The Modelling approach “a” has been chosen to project future deforestation, which involves estimation of deforestation as a function of the rate of baseline deforestation is assumed to be a continuation of the average annual rate measured during the historical reference period within the reference region.

The analysis of the deforestation history in the RR for the historical period (2009 to 2018) shows that the deforestation rate presented periods with a large increase in the deforestation rate, in the years 2010, 2013 and 2018. The behaviour of the rate corroborates the chain of deforestation events and factors already described in the baseline, such as extensive cattle ranching. The historical deforestation rate can be described linearly by the equation y = 0.0004x + 0.0146 (R^2 = 0.07). Since the linear relationship does not present a significant trend, the historical average of the period was adopted, equal to 0.852% (figure 28).

Figure 28 - Analysis of the deforestation history in the RR for the historical period (2009-2018).

3.2.1.2 Projection of the location of future deforestation

This section refers to Step 4.2 of the VM0015 Methodology.

The basic tasks to perform this analysis are as follows, which is also represented in the flowchart below (figure 29):

- Preparation of factor maps.
- Preparation of risk maps for deforestation.
- Selection of the most accurate deforestation risk map; and
- Mapping of the locations of future deforestation.

The table 53 shows the list of variables, maps and factor maps.

Table 53: List of variables, maps and factor maps (Table 10 of VM0015)

Source	Variable represented		Meaning of the categories or pixel value		Other Maps and Variables used to create factor map		Algorithm or Equation used	Comments
File Name	**Source**	**Unit**	**Description**	**Range**	**Meaning**	**File Name**	**File name**	
dist_to_4	PRODES (2009-2018)	meters	Distance to existing deforestation	0 - 100	Values close to 0 are closer to the deforestation	land use maps	Euclidean Distance - ArcGis (Esri)	N/A
d_roads	Imazon (2014)	meters	Distance to main roads	0-100	Values close to 0 are closer to main roads	dist_roads_v1.tif	Euclidean Distance - ArcGis (Esri)	N/A
d_rivers	ANA (2017)	meters	Distance to navigable rivers	0-100	Values close to 0 are closer to navigable rivers	dist_navig_rivers_v1.tif	Euclidean Distance - ArcGis (Esri)	N/A
d_localidade	IBGE (2010)	meters	Distance to urban areas	0-100	Values close to 0 are closer to urban areas	dist_communities_v1.tif	Euclidean Distance - ArcGis (Esri)	N/A
elevation	Topodata (INPE)	meters	Distance to elevation	0-1	Values close to 0 have low elevation	altitude_v1.tif	-	N/A
slope	Topodata (INPE)	degree	Distance to slope	0-1	Values close to 0 have low slope	slope_v1.tif	Slope/Surface toolset - ArcGis (Esri)	N/A

3.2.1.2.1 Definition of the Model

Future deforestation location projection was found through Dinamica-EGO software version 6.1.0. The selection for Dinamica-EGO was made the following reasons: a) it is a model available in the scientific publications of Soares-Filho et al. (2006), Yanai et al. (2012) and Vitel et al (2013)[146]; b) it holds transparent process for input and output of data and parameters processed with user-friendly graphical interface; c) it incorporates the use of appropriate data to explain the location of deforestation.

The main steps conducted with Dinamica-EGO at this stage was: (i) organization of maps on land use and land cover, and maps with deforestation explanatory factors; (ii) model calibration by determining the weight of evidence and analysing correlations between variables; (iii) assessment of model accuracy; (iv)

[146] The three articles are availables in PDF.

development of deforestation baseline scenarios. Dinamica-EGO used spatial data with 30 x 30 m pixel size, GeoTIFF format. The flowchart of the process type model developed in the program Dinamica-EGO is presented below (figure 29).

Figure 29: Flowchart of the process type model developed in the program Dinamica -EGO.

This study took the following drivers into account: distance from deforestation, distance from roads, distance from cities and communities, distance from navigable rivers, elevation and slope to evaluate the variables and combinations can better explain the dynamics of historical deforestation in the region.

This step used an empirical approach, defining functions to represent the probability of allocation of deforestation from five key spatial variables selected from among nine initial variables. The method used in Dinamica-EGO is called Weight of Evidence, a Bayesian method. This method requires that the variables used to produce the map of deforestation risk are independent. According to an interval of classes, for each variable, a weight of evidence will be assigned, for this, the classes of deforestation distance of 100 meters and for classes of elevation and inclination of 1 meter were used (Figure 30).

Figure 30 - Weight of Evidence model 2.

The calculation of weights of evidence for each variable (or factor) examines their historical influence in relation to the deforestation observed. This influence of the variable is obtained from the number of pixels representing forest area destroyed during the analysis period (the chosen calibration period was between 2017 and 2018).

During the analysis of deforestation dynamics in the Reference Region, the input data (explanatory variables) of network models were all analysed, despite the possibility of correlation and redundancy of information between them. The only assumption for the Weights of Evidence method is that the input maps must be spatially independent. A set of measures can be applied to assess this assumption, such as the Cramer test and the Joint-Uncertainty Information (Bonham-Carter, 1994). As a result, correlated variables must be disregarded or combined into a third that will replace the correlated pair in the model.

This model performs pairwise tests for categorical maps in order to test the independence assumption. Methods employed are the Chi^2, Cramer, the Contingency, the Entropy, and the Uncertainty Joint Information (Bonham-Carter, 1994). In addition to the links to be connected, the only parameter to be set in the Determine Weights of Evidence Correlation is the transition as follows.

Different models were tested, considering different sets of drives cited previously. The allocation pattern of new deforestation considered 25% for new patches and 75% for expansion of already deforested areas (patcher and expander) and alternating combinations of explanatory variables.

3.2.1.2.2 Quality Control of the Model

According to the VM0015 methodology, one of the evaluation techniques that can be used is the "Figure of Merit" (FOM) that confirms the prediction of the model in a statistical process (Pontius et al. 2007), which was the technique used for this project.

To evaluate the accuracy of the models, it was necessary to compare the land use map obtained by the prediction model with observed land use map at the same year: i) Estimated / modelled map up to 2018, and ii) actual observed deforestation map of 2018.

The FOM is a ratio of the intersection of the observed change (change between the reference maps in time 1 and time 2) and the predicted change (change between the reference map in time 1 and simulated map in time 2) to the union of the observed change and the predicted change. The FOM is a ratio of the intersection of the observed change and the predicted change to the union of the observed change and the predicted change.

The model selected with the best potential to explain the future of deforestation dynamics in the Reference Region presented a value of "Figure of Merit" (FOM) = 0.9032 (90.32%).

3.2.1.2.3 Projected Results from the Model

Location analysis of future deforestation within the Reference Region was performed with the most suitable model to determine the annual areas of deforestation within the Project Area and Leakage Belt (VM0015 step 4.2). Once location analysis has been completed, the proportion of annual areas of baseline deforestation within the project area and leakage belt was determined using GIS analysis.

The accumulated baseline deforestation projected to occur within the Reference Region was estimated as **371,720** hectare over the 30-year project lifetime (table 54), corresponding to an estimated average annual rate of deforestation is 12,391 hectare for the Reference Region.

Lowland Dense Ombrophilous Forest (Db) and Submontane Dense Ombrophilous Forest (Ds) compose class F1 because they present highly close values of biomass (respectively 421.87 t/ha and 420.66 t/ha of total biomass). The lower value of biomass was adopted to F1 class conservatively. Alluvial Dense Ombrophilous Forest (Da) make up class F2 (478.92 t/ha of total biomass).

Table 54: Annual areas of baseline deforestation in the reference region (Table 9.a of VM0015).

Year	Project year			Total - RR	
		F1	F2	annual $ABSLRR_t$ ha	cummulative ABSLRR ha
2019	1	14,341	113	14,455	14,455
2020	2	30,223	212	30,435	44,889
2021	3	27,921	160	28,081	72,971
2022	4	25,747	171	25,918	98,889
2023	5	23,778	137	23,915	122,804
2024	6	21,933	129	22,063	144,867
2025	7	20,241	126	20,367	165,234
2026	8	18,681	111	18,793	184,027
2027	9	17,227	116	17,342	201,369
2028	10	15,867	128	15,995	217,364
2029	11	14,643	122	14,764	232,128
2030	12	13,506	113	13,620	245,748
2031	13	12,436	123	12,559	258,306
2032	14	11,471	121	11,593	269,899
2033	15	10,579	120	10,699	280,598
2034	16	9,748	125	9,874	290,471
2035	17	8,984	122	9,106	299,577
2036	18	8,276	119	8,395	307,972
2037	19	7,639	121	7,760	315,733
2038	20	7,032	121	7,152	322,885
2039	21	6,485	116	6,600	329,485
2040	22	5,972	122	6,094	335,579
2041	23	5,526	96	5,622	341,201
2042	24	5,081	103	5,184	346,385
2043	25	4,709	81	4,789	351,174
2044	26	4,306	104	4,410	355,584
2045	27	3,973	95	4,068	359,652
2046	28	3,670	86	3,756	363,408
2047	29	3,377	82	3,459	366,868
2048	30	3,097	99	3,196	370,064
2049	31	1,611	45	1,656	371,720
TOTAL				**371,720**	
			average	**12,391**	

The accumulated baseline deforestation projected to occur within the Project Area over the 30-year project lifetime was estimated at 28,677 hectare (table 55). The estimated average annual rate of deforestation is 955.9 hectare for the Project Area.

Table 55 - Annual areas of baseline deforestation in the project area (Table 9.b of VM0015).

Year	Total - PA				
	Project year	F1 ha	F2 ha	annual $ABSLPA_t$ ha	cummulative ABSLPA ha
2019	1	266	12	278	278
2020	2	732	36	768	1,046
2021	3	833	33	866	1,912
2022	4	901	44	945	2,857
2023	5	1,002	44	1,046	3,903
2024	6	1,017	32	1,049	4,952
2025	7	1,070	32	1,102	6,054
2026	8	1,098	23	1,121	7,174
2027	9	1,118	29	1,147	8,321
2028	10	1,105	28	1,134	9,455
2029	11	1,079	25	1,104	10,559
2030	12	1,073	20	1,093	11,652
2031	13	1,059	18	1,077	12,730
2032	14	1,060	17	1,076	13,806
2033	15	1,087	18	1,105	14,911
2034	16	1,075	21	1,096	16,008
2035	17	1,055	15	1,071	17,079
2036	18	1,045	20	1,065	18,143
2037	19	1,043	13	1,056	19,199
2038	20	985	16	1,001	20,200
2039	21	967	14	981	21,181
2040	22	847	9	856	22,037
2041	23	831	6	837	22,874
2042	24	811	8	819	23,693
2043	25	809	8	818	24,510
2044	26	817	10	827	25,337
2045	27	823	6	829	26,166
2046	28	790	8	798	26,964

2047	29	695	10	704	27,668
2048	30	679	13	692	28,360
2049	31	314	4	318	28,677
TOTAL				**28,677**	
			Average	**955.9**	

The accumulated baseline deforestation projected to occur within the Leakage Belt over the 30-year project lifetime was estimated at 27,940 hectares (table 56). The estimated average annual rate of deforestation is 932 hectare for the Project Area.

Table 56. Annual areas of baseline deforestation in the leakage belt (Table 9.c of VM0015).

Year	Total - LK				
	Project year	F1 ha	F2 ha	annual $ABSLPA_t$ ha	cummulative ABSLPA ha
2019	1	925	4	929	929
2020	2	2,047	6	2,052	2,982
2021	3	1,964	6	1,970	4,952
2022	4	1,792	6	1,798	6,749
2023	5	1,673	1	1,674	8,424
2024	6	1,500	0	1,500	9,924
2025	7	1,397	4	1,402	11,326
2026	8	1,387	1	1,388	12,714
2027	9	1,226	1	1,227	13,941
2028	10	1,180	0	1,180	15,121
2029	11	1,121	1	1,122	16,243
2030	12	1,036	2	1,038	17,281
2031	13	994	2	996	18,278
2032	14	954	4	957	19,235
2033	15	907	1	908	20,143
2034	16	829	2	831	20,974
2035	17	732	1	733	21,707
2036	18	677	1	678	22,385
2037	19	640	2	642	23,027
2038	20	607	0	608	23,635
2039	21	601	3	604	24,238
2040	22	585	0	585	24,823
2041	23	532	0	533	25,356

Year	Total - LK				
	Project year	F1 ha	F2 ha	annual $ABSLPA_t$ ha	cummulative ABSLPA ha
2042	24	443	0	443	25,798
2043	25	439	0	439	26,237
2044	26	380	0	380	26,617
2045	27	337	0	337	26,955
2046	28	325	0	326	27,280
2047	29	279	0	279	27,559
2048	30	255	0	256	27,815
2049	31	149	0	149	27,964
TOTAL				**27,964**	

3.2.1.2.4 Location of future deforestation: Conclusion

The location of deforestation in the Reference Region was strongly influenced by the factor of accessibility of forests, contributing to the expansion and clearing of new areas in the entire region, mainly as extensions from the PA-256, that cross all RR area and it is the closest highway to PA area.

The Reference Region has a vast and dense network of primary, secondary and tertiary roads. Distance from previously deforested areas (i.e., proximity to forest edges) has also been an important deforestation driver: regions near old deforestation and communities, municipal centres, etc. tend to have a higher probability and risk of future deforestation.

All drivers related to the dynamics of land-use change caused by cattle ranching may increase the potential of the deforestation drivers. Thus, any fluctuations in the market of livestock-related products may affect the deforestation in the entire region, mainly in locations close to consumption clusters.

In parallel, demographic dynamics (i.e., changes in population density) are also important drivers, interacting with and amplifying all the other drivers mentioned above, as they cause an increase in food consumption and availability of labor, which directly affects deforestation. The following figure (31) shows the projection of deforestation up to 2049 in the RR and in the project area. The deforestation projection increases along the years and can cover almost the entire RR and PA until 2049.

Figure 31 - Mapping of cumulative annual deforestation projected up to 2049, covering the Reference Region and Project Area.

3.2.1.3 DEFINITION OF THE LAND-USE AND LAND-COVER CHANGE COMPONENT OF THE BASELINE

This section refers to Step 5 of the VM0015 Methodology, the goal of which step is to calculate activity data (hectare per year) of the initial forest classes (icl) that will be deforested and activity data of the post-deforestation classes (fcl) that would replace them in the baseline case.

After step 4, the area and location of future deforestation are both known and pre-deforestation carbon stocks were determined by matching the predicted location of deforestation with the location of forest classes with known carbon stocks.

3.2.1.3.1 Calculation of baseline activity data per forest class

(Step 5.1) According to MMA (Ministry of Environment) data, the Project Area displays 100% of its forests classified as dense ombrophylous forest (“D”). The data processing procedure in this step was the same as performed and explained in previous steps. Lowland Dense Ombrophilous Forest (Db) and Submontane Dense Ombrophilous Forest (Ds) compose class F1 because they present highly close values of biomass (respectively 421.87 t/ha and 420.66 t/ha of total biomass). The lower value of biomass was adopted to F1

class conservatively. Alluvial Dense Ombrophilous Forest (Da) make up class F2 (478.92 t/ha of total biomass).

The following table (57) shows the annual estimates of deforestation per forest class icl within the Project Area, obtained by means of modelling.

Table 57: Annual areas deforested per forest class icl within the project area in the baseline case (baseline activity data per forest class) (Table 11.b of VM0015).

Year	Area deforested per forest class icl within the project area				
	Name >	F1	F2	annual ABSLPAt	cummulative ABSLPA
	Project year *t*	ha	ha	ha	ha
2019	1	266	12	278	278
2020	2	732	36	768	1,046
2021	3	833	33	866	1,912
2022	4	901	44	945	2,857
2023	5	1,002	44	1,046	3,903
2024	6	1,017	32	1,049	4,952
2025	7	1,070	32	1,102	6,054
2026	8	1,098	23	1,121	7,174
2027	9	1,118	29	1,147	8,321
2028	10	1,105	28	1,134	9,455
2029	11	1,079	25	1,104	10,559
2030	12	1,073	20	1,093	11,652
2031	13	1,059	18	1,077	12,730
2032	14	1,060	17	1,076	13,806
2033	15	1,087	18	1,105	14,911
2034	16	1,075	21	1,096	16,008
2035	17	1,055	15	1,071	17,079
2036	18	1,045	20	1,065	18,143
2037	19	1,043	13	1,056	19,199
2038	20	985	16	1,001	20,200
2039	21	967	14	981	21,181
2040	22	847	9	856	22,037
2041	23	831	6	837	22,874
2042	24	811	8	819	23,693
2043	25	809	8	818	24,510
2044	26	817	10	827	25,337

Year	Area deforested per forest class icl within the project area				
	Name >	F1	F2	annual ABSLPAt	cummulative ABSLPA
	Project year *t*	ha	ha	ha	ha
2045	27	823	6	829	26,166
2046	28	790	8	798	26,964
2047	29	695	10	704	27,668
2048	30	679	13	692	28,360
2049	31	314	4	318	28,677
TOTAL		28,085	592	28,677	

The following table (58) shows the annual estimates of deforestation within the Leakage Belt, obtained by means of modelling.

Table 58: Annual areas deforested per forest class icl within the leakage belt area in the baseline case (baseline activity data per forest class) (Table 11.c of VM0015)

Year	Area deforested per forest class icl within the leakage belt area				
	Name >	F1	F2	annual ABSLPAt	cummulative ABSLPA
	Project year *t*	ha	ha	ha	ha
2019	1	925	4	929	929
2020	2	2,047	6	2,052	2,982
2021	3	1,964	6	1,970	4,952
2022	4	1,792	6	1,798	6,749
2023	5	1,673	1	1,674	8,424
2024	6	1,500	0	1,500	9,924
2025	7	1,397	4	1,402	11,326
2026	8	1,387	1	1,388	12,714
2027	9	1,226	1	1,227	13,941

Year	Area deforested per forest class icl within the leakage belt area				
	Name >	F1	F2	annual ABSLPAt	cummulative ABSLPA
	Project year *t*	ha	ha	ha	ha
2028	10	1,180	0	1,180	15,121
2029	11	1,121	1	1,122	16,243
2030	12	1,036	2	1,038	17,281
2031	13	994	2	996	18,278
2032	14	954	4	957	19,235
2033	15	907	1	908	20,143
2034	16	829	2	831	20,974
2035	17	732	1	733	21,707
2036	18	677	1	678	22,385
2037	19	640	2	642	23,027
2038	20	607	0	608	23,635
2039	21	601	3	604	24,238
2040	22	585	0	585	24,823
2041	23	532	0	533	25,356
2042	24	443	0	443	25,798
2043	25	439	0	439	26,237
2044	26	380	0	380	26,617
2045	27	337	0	337	26,955
2046	28	325	0	326	27,280
2047	29	279	0	279	27,559
2048	30	255	0	256	27,815
2049	31	149	0	149	27,964
TOTAL		27,916	48	27,964	

3.2.1.3.2 Calculation of baseline activity data per post-deforestation forest class (Step 5.2)

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

Pasture is responsible for most of the occupation of deforested land in the project region. An analysis of land use coverage in Ipixuna do Pará, Tomé-Açú and Paragominas over the years of the historical reference period shows that, of agricultural land uses, pastures represent more than 75% of the area in each analysed year. Thus, the post-deforestation class is considered exclusively as “pasture”.

The following table (59) shows the annual estimates of deforestation within the Project Area, obtained by means of modelling.

Table 59: Annual areas deforested in each zone within the project area in the baseline case (baseline activity data zone) (Table 13.b of VM0015).

Year	ID_z >	1	Total baseline deforestation in the project area	
	Name >	pasture		
	Project year *t*	ha	annual $ABSLPA_t$ ha	cummulative ABSLPA ha
2019	1	278	278	278
2020	2	768	768	1,046
2021	3	866	866	1,912
2022	4	945	945	2,857
2023	5	1,046	1,046	3,903
2024	6	1,049	1,049	4,952
2025	7	1,102	1,102	6,054
2026	8	1,121	1,121	7,174
2027	9	1,147	1,147	8,321
2028	10	1,134	1,134	9,455
2029	11	1,104	1,104	10,559
2030	12	1,093	1,093	11,652
2031	13	1,077	1,077	12,730
2032	14	1,076	1,076	13,806
2033	15	1,105	1,105	14,911
2034	16	1,096	1,096	16,008
2035	17	1,071	1,071	17,079
2036	18	1,065	1,065	18,143
2037	19	1,056	1,056	19,199
2038	20	1,001	1,001	20,200
2039	21	981	981	21,181
2040	22	856	856	22,037
2041	23	837	837	22,874
2042	24	819	819	23,693
2043	25	818	818	24,510
2044	26	827	827	25,337
2045	27	829	829	26,166

Year	ID_z >	1	Total baseline deforestation in the project area	
	Name >	pasture		
	Project year *t*	ha	annual $ABSLPA_t$ ha	cummulative ABSLPA ha
2046	28	798	798	26,964
2047	29	704	704	27,668
2048	30	692	692	28,360
2049	31	318	318	28,677
TOTAL		28,677	28,677	57,355

The following table (60) shows the annual estimates of deforestation within the Leakage Belt, obtained by means of modelling.

Table 60: Annual areas deforested in each zone within the leakage belt area in the baseline case (baseline activity data per zone) (Table 13.c of VM0015).

Year	ID_z >	1	Total baseline deforestation in the project area	
	Name >	pasture		
	Project year *t*	ha	annual $ABSLPA_t$ ha	cummulative ABSLPA ha
2019	1	929	929	929
2020	2	2,052	2,052	2,982
2021	3	1,970	1,970	4,952
2022	4	1,798	1,798	6,749
2023	5	1,674	1,674	8,424
2024	6	1,500	1,500	9,924
2025	7	1,402	1,402	11,326
2026	8	1,388	1,388	12,714
2027	9	1,227	1,227	13,941
2028	10	1,180	1,180	15,121
2029	11	1,122	1,122	16,243
2030	12	1,038	1,038	17,281
2031	13	996	996	18,278
2032	14	957	957	19,235
2033	15	908	908	20,143
2034	16	831	831	20,974
2035	17	733	733	21,707

Year	ID_z >	1	Total baseline deforestation in the project area	
	Name >	pasture		
	Project year *t*	ha	annual $ABSLPA_t$ ha	cummulative ABSLPA ha
2036	18	678	678	22,385
2037	19	642	642	23,027
2038	20	608	608	23,635
2039	21	604	604	24,238
2040	22	585	585	24,823
2041	23	533	533	25,356
2042	24	443	443	25,798
2043	25	439	439	26,237
2044	26	380	380	26,617
2045	27	337	337	26,955
2046	28	326	326	27,280
2047	29	279	279	27,559
2048	30	256	256	27,815
2049	31	149	149	27,964
TOTAL		27,964	27,964	55,928

3.2.1.4 ESTIMATION OF BASELINE CARBON STOCK CHANGES AND NON-CO2 EMISSIONS

This section refers to Step 6 of the VM0015 Methodology, which has as goal to finalize the baseline assessment by calculating:

- Baseline carbon stock changes; and (optionally)

- Baseline non-CO2 emissions from forest fires used to clear forests.

3.2.1.4.1 Estimation of baseline carbon stock changes

The use of carbon stock estimates in similar ecosystems derived from local studies, literature and IPCC defaults is permitted, provided the accuracy and conservativeness of the estimates are demonstrated.

As noted under section 3.1.3, Project Boundary, the project area contains 100% Dense Ombrofilous Forest (DOF). Biomass data were taken from literature[147], which contains data relating to the total carbon stocks

[147] Third National Communication of Brazil to the United Nations Framework Convention on Climate Change – Executive Summary/ Ministry of Science, Technology and Innovation. Brasília: Ministério da Ciência, Tecnologia e Inovação, 2016.

in Dense Ombrophilous Forest (D). In order to calculate the above and below-ground data, it was applied the root-to-shoot ratio of 0.37 in the total biomass.

The table (61) below shows the carbon stock per hectare of Dense Ombrophilous Forest present in the project area and leakage belt. As said before, the F1 class represents Lowland Dense Ombrophilous Forest (Db) and Submontane Dense Ombrophilous Forest (Ds) because they have highly similar values of biomass (respectively 421.87 t/ha and 420.66 t/ha of total biomass)[148]. The lower value of biomass was adopted to F1 class conservatively. Alluvial Dense Ombrophilous Forest (Da) make up class F2 (478.92 t/ha of total biomass).

Table 61: Carbon stocks per hectare of initial forest classes icl existing in the project area and leakage belt: Estimated values (Table 15.a of VM0015).

Year	Initial forest class *icl* Name: F1 ID $_{icl}$ 1 Average carbon stock per hectare ± 90% CI											
	Cab $_{icl}$		Cbb $_{icl}$		Cwp $_{icl}$						Ctot $_{icl}$	
					short lived		*medium lived*		*long lived*			
	C *stock*	± 90% CI	C *stock*	± 90% CI	C *stock*	± 90% CI	C *stock*	± 90% CI	C *stock*	± 90% CI	C *stock*	± 90% CI
	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2019												
2020		498.43		140.72		0		0		30.65		608.49
2021	515.86		145.64		0		0		31.68		629.82	
...		533.30		150.56		0		0		32.71		651.15
2049												

[148] Third National Communication of Brazil to the United Nations Framework Convention on Climate Change – Executive Summary/ Ministry of Science, Technology and Innovation. Brasília: Ministério da Ciência, Tecnologia e Inovação, 2016.

Year	Initial forest class icl Name: F2 ID icl 2 Average carbon stock per hectare ± 90% CI											
	Cab icl		Cbb icl		Cwp icl						Ctot icl	
					short lived		medium lived		long lived			
	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI	C stock	± 90% CI
	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1	t CO2e ha-1
2019												
2020		567.48		160.20		0		0		34.86		692.82
2021	587.33		165.81		0		0		39.34		713.79	
...		607.18		171.41		0		0		43.83		734.76
2049												

90% Confidence Intervals have been used to define whether the most suitable choice would be the average or the lower limit of the range, to mitigate uncertainties in estimates, as shown in the table below.

In the present case, the averages of above and below-ground biomass were used for calculations; while the lower limit of the interval was used for the calculations related to the wood products carbon pool, for conservativeness purposes and mitigation of uncertainties.The table (62) below shows the carbon stock per hectare of initial forest classes icl present in the project area and leakage belt.

Table 62: Carbon stocks per hectare of initial forest classes icl existing in the project area and leakage belt: Values to be used after discounts due to uncertainties (Table 15.b of VM0015)

Year	Initial forest class *icl* Name F1 ID $_{icl}$ 1 Average carbon stock per hectare ± 90% CI											
	Cab $_{icl}$		Cbb $_{icl}$		Cwp $_{icl}$						Ctot $_{icl}$	
					short lived		*medium lived*		*long lived*			
	C *stock*	C *stock change*	C *stock*	C *stock change*	C *stock*	C *stock change*	C *stock*	C *stock change*	C *stock*	C *stock change*	C *stock*	C *stock change*
	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2019 2020 2021 ... 2049	515.86	0.00	145.64	0.00	0.00	0.00	0.00	0.00	31.68	0.00	629.82	0.00

Year	Initial forest class *icl* Name F2 ID $_{icl}$ 2 Average carbon stock per hectare ± 90% CI											
	Cab $_{icl}$		Cbb $_{icl}$		Cwp $_{icl}$						Ctot $_{icl}$	
					short lived		*medium lived*		*long lived*			
	C *stock*	C *stock change*	C *stock*	C *stock change*	C *stock*	C *stock change*	C *stock*	C *stock change*	C *stock*	C *stock change*	C *stock*	C *stock change*
	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2019 2020 2021 ... 2049	587.33	0.00	165.81	0.00	0.00	0.00	0.00	0.00	39.34	0.00	713.79	0.00

The same reasoning is applicable to post-deforestation classes, for which the upper limit of the interval was taken in the case of above-ground biomass, below-ground biomass and wood products carbon pool, for conservativeness purposes and mitigation of uncertainties.

The tables 63 and 62 present the long-term (20-year) average carbon stocks per hectare of post-deforestation LU/LC classes present in the Reference Region and the long-term (20-year) area weighted average carbon stock per zone, respectively.

Table 63: Long-term (20-year) average carbon stocks per hectare of post-deforestation LU/LC classes present in the Reference Region (Table 16 of VM0015).

Year	Post deforestation class *fcl* Name Pasture ID $_{fcl}$ 1 and 2 Average carbon stock per hectare ± 90% CI											
	Cab $_{fcl}$		Cbb $_{fcl}$		Cwp $_{fcl}$ *short lived*		Cwp $_{fcl}$ *medium lived*		Cwp $_{fcl}$ *long lived*		Ctot $_{fcl}$	
	average stock t CO_2e ha^{-1}	± 90% CI t CO_2e ha^{-1}	*average stock* t CO_2e ha^{-1}	± 90% CI t CO_2e ha^{-1}	*average stock* t CO_2e ha^{-1}	± 90% CI t CO_2e ha^{-1}	*average stock* t CO_2e ha^{-1}	± 90% CI t CO_2e ha^{-1}	*average stock* t CO_2e ha^{-1}	± 90% CI t CO_2e ha^{-1}	*average stock* t CO_2e ha^{-1}	± 90% CI t CO_2e ha^{-1}
2019												
2020		7.10		11.34		0		0		0		18.45
2021	11.37		18.15		0		0		0		29.52	
...		15.63		24.96		0		0		0		40.59
2049												
Average	11.37		18.15		0		0		0		29.52	
Average to be used in calculations	15.63		24.96		0		0		0		40.59	

Table 64: Long-term (20-year) area weighted average carbon stock per zone (Table 17 of VM0015)

Zone		Post -deforestation LU/LC-class *fcl* Name: Pasture ID $_{fcl}$ 1 and 2			Area weighted long-term (20 years) average carbon stocks per zone *z*			
		Cab $_{fcl}$ *C stock*	Cbb $_{fcl}$ *C stock*	Cwp $_{fcl}$ *C stock*	Cab $_z$ *C stock*	Cbb $_z$ *C stock*	Cwp $_z$ *C stock*	Ctot $_z$ *C stock*
IDz	Name	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
1	RR	15.63	24.96	0.00	15.63	24.96	0.00	40.59

The carbon stock change factors shown below were calculated based on VM0015 premises, using Method 2, as activity data are available for categories (table 65 and 64).

Table 65: Carbon stock change factors for land-use change categories for forest class Ds (ct or ctz) (Method 2) (Table 20.c of VM0015)

Year after deforestation		$\Delta Cab_{ctz,t}$	$\Delta Cbb_{ctz,t}$	$\Delta Cwp_{ctz,t}$ long-lived
1	2019	-514.3004	-12.07	0
2	2020	1.56	-12.07	0
3	2021	1.56	-12.07	0
4	2022	1.56	-12.07	0
5	2023	1.56	-12.07	0
6	2024	1.56	-12.07	0
7	2025	1.56	-12.07	0
8	2026	1.56	-12.07	0
9	2027	1.56	-12.07	0
10	2028	1.56	-12.07	0
11	2029	0	0	0
12	2030	0	0	0
13	2031	0	0	0
14	2032	0	0	0
15	2033	0	0	0
16	2034	0	0	0
17	2035	0	0	0
18	2036	0	0	0
19	2037	0	0	0
20	2038	0	0	0
21	2039	0	0	0
22	2040	0	0	0
23	2041	0	0	0
24	2042	0	0	0
25	2043	0	0	0
26	2044	0	0	0
27	2045	0	0	0
28	2046	0	0	0
29	2047	0	0	0
30	2048	0	0	0
31	2049	0	0	0

Table 66: Carbon stock change factors for land-use change categories for forest class Da (ct or ctz) (Method 2) (Table 20.c of VM0015)

Year after deforestation		$\Delta Cab_{ctz,t}$	$\Delta Cbb_{ctz,t}$	$\Delta Cwp_{ctz,t}$ long-lived
1	2019	-585.76	-12.07	0
2	2020	1.56	-12.07	0
3	2021	1.56	-12.07	0
4	2022	1.56	-12.07	0
5	2023	1.56	-12.07	0
6	2024	1.56	-12.07	0

Year after deforestation		$\Delta Cab_{ctz,t}$	$\Delta Cbb_{ctz,t}$	$\Delta Cwp_{ctz,t}$ long-lived
7	2025	1.56	-12.07	0
8	2026	1.56	-12.07	0
9	2027	1.56	-12.07	0
10	2028	1.56	-12.07	0
11	2029	0	0	0
12	2030	0	0	0
13	2031	0	0	0
14	2032	0	0	0
15	2033	0	0	0
16	2034	0	0	0
17	2035	0	0	0
18	2036	0	0	0
19	2037	0	0	0
20	2038	0	0	0
21	2039	0	0	0
22	2040	0	0	0
23	2041	0	0	0
24	2042	0	0	0
25	2043	0	0	0
26	2044	0	0	0
27	2045	0	0	0
28	2046	0	0	0
29	2047	0	0	0
30	2048	0	0	0
31	2049	0	0	0

The following tables (67 to 69) show the calculation of baseline carbon stock changes in above-ground biomass, below-ground biomass and wood products in the Project Area, using the carbon stock change factors presented in the table immediately above.

Table 67: Baseline carbon stock change in the above-ground biomass in the project area (Table 22.b.1 of VM0015).

Year	Project year t	Activity data per category x Carbon stock change factor for above-ground biomass in the project area				Total baseline carbon stock change in the project area	
		F1		F2		annual	cumulative
		$ABSLPA_{ct,t}$	$\Delta Cab_{ct,t}$	ABSLPAct,t	$\Delta Cab_{ct,t}$	$\Delta CabBSLPA_t$	$\Delta CabBSLPA$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2019	1	266	-514	12.48	-586	-143,964	-143,964

Year	Project year t	Activity data per category x Carbon stock change factor for above-ground biomass in the project area				Total baseline carbon stock change in the project area	
		F1		F2		annual	cumulative
		$ABSLPA_{ct,t}$	$\Delta Cab_{ct,t}$	ABSLPAct,t	$\Delta Cab_{ct,t}$	$\Delta CabBSLPA_t$	$\Delta CabBSLPA$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2020	2	732	-377	35.90	-434	-397,118	-541,082
2021	3	833	-233	32.91	-236	-445,893	-986,974
2022	4	901	-169	43.67	-204	-486,192	-1,473,166
2023	5	1,002	-137	44.15	-152	-536,608	-2,009,774
2024	6	1,017	-109	32.01	-92	-535,751	-2,545,524
2025	7	1,070	-93	31.88	-79	-561,146	-3,106,671
2026	8	1,098	-80	23.16	-52	-568,652	-3,675,322
2027	9	1,118	-70	29.30	-59	-580,692	-4,256,014
2028	10	1,105	-61	28.48	-52	-572,139	-4,828,154
2029	11	1,079	-54	24.73	-43	-555,163	-5,383,317
2030	12	1,073	-52	20.36	-37	-548,821	-5,932,138
2031	13	1,059	-50	18.38	-35	-540,155	-6,472,294
2032	14	1,060	-50	16.76	-35	-539,323	-7,011,616
2033	15	1,087	-51	18.25	-42	-554,309	-7,565,926
2034	16	1,075	-50	21.09	-52	-549,871	-8,115,796
2035	17	1,055	-49	15.37	-40	-536,268	-8,652,065
2036	18	1,045	-49	19.92	-53	-533,536	-9,185,601
2037	19	1,043	-49	12.84	-37	-528,596	-9,714,198
2038	20	985	-47	16.21	-50	-500,778	-10,214,976
2039	21	967	-46	13.77	-45	-490,529	-10,705,505
2040	22	847	-41	8.63	-30	-425,824	-11,131,329
2041	23	831	-41	5.74	-21	-416,078	-11,547,407
2042	24	811	-41	8.06	-32	-407,631	-11,955,038
2043	25	809	-43	8.37	-36	-407,466	-12,362,504
2044	26	817	-44	9.91	-47	-412,559	-12,775,063
2045	27	823	-46	6.25	-32	-413,779	-13,188,842
2046	28	790	-45	7.57	-44	-398,381	-13,587,223
2047	29	695	-41	9.58	-58	-350,775	-13,937,998
2048	30	679	-42	12.50	-80	-345,019	-14,283,017
2049	31	314	-20	4.01	-28	-152,402	-14,435,419

Table 68: Baseline carbon stock change in the below-ground biomass in the project area (Table 22.b.2 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for below-ground biomass in the project area				Total baseline carbon stock change in the project area	
		F1		F2		annual	cumulative
		$BBSLPA_{ct,t}$	$\Delta Cbb_{ct,t}$	$BBSLPA_{ct,t}$	$\Delta Cbb_{ct,t}$	$\Delta CbbBSLPA_t$	$\Delta CbbBSLPA$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2019	1	266	-12.07	12.48	-12.07	-3,357	-3,357
2020	2	732	-12.07	35.90	-12.07	-12,626	-15,983
2021	3	833	-12.07	32.91	-12.07	-23,072	-39,055
2022	4	901	-12.07	43.67	-12.07	-34,478	-73,533
2023	5	1,002	-12.07	44.15	-12.07	-47,100	-120,634
2024	6	1,017	-12.07	32.01	-12.07	-59,762	-180,395
2025	7	1,070	-12.07	31.88	-12.07	-73,057	-253,453
2026	8	1,098	-12.07	23.16	-12.07	-86,584	-340,037
2027	9	1,118	-12.07	29.30	-12.07	-100,425	-440,462
2028	10	1,105	-12.07	28.48	-12.07	-114,108	-554,569
2029	11	1,079	-12.07	24.73	-12.07	-124,073	-678,642
2030	12	1,073	-12.07	20.36	-12.07	-127,997	-806,639
2031	13	1,059	-12.07	18.38	-12.07	-130,552	-937,192
2032	14	1,060	-12.07	16.76	-12.07	-132,136	-1,069,328
2033	15	1,087	-12.07	18.25	-12.07	-132,854	-1,202,182
2034	16	1,075	-12.07	21.09	-12.07	-133,425	-1,335,607
2035	17	1,055	-12.07	15.37	-12.07	-133,053	-1,468,660
2036	18	1,045	-12.07	19.92	-12.07	-132,375	-1,601,035
2037	19	1,043	-12.07	12.84	-12.07	-131,278	-1,732,312
2038	20	985	-12.07	16.21	-12.07	-129,676	-1,861,988
2039	21	967	-12.07	13.77	-12.07	-128,194	-1,990,183
2040	22	847	-12.07	8.63	-12.07	-125,329	-2,115,511
2041	23	831	-12.07	5.74	-12.07	-122,422	-2,237,934
2042	24	811	-12.07	8.06	-12.07	-119,317	-2,357,251
2043	25	809	-12.07	8.37	-12.07	-115,847	-2,473,098
2044	26	817	-12.07	9.91	-12.07	-112,590	-2,585,688
2045	27	823	-12.07	6.25	-12.07	-109,669	-2,695,357
2046	28	790	-12.07	7.57	-12.07	-106,449	-2,801,806
2047	29	695	-12.07	9.58	-12.07	-102,206	-2,904,012
2048	30	679	-12.07	12.50	-12.07	-98,474	-3,002,486
2049	31	314	-12.07	4.01	-12.07	-90,466	-3,092,952

Table 69: Baseline carbon stock change in the wood products in the project area (Table 22.b.6 of VM0015).

Year	Project year t	Activity data per category x Carbon stock change factor for wood products biomass in the project area				Total baseline carbon stock change in the project area	
		F1		F2		annual	cumulative
		$WPSLPA_{ct,t}$	$\Delta Cwp_{ct,t}$	$WPSLPA_{ct,t}$	$\Delta Cwp_{ct,t}$	$\Delta CwpBSLPA_t$	$\Delta CwpBSLPA$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2019	1	265.70	0	12.48	0	0	0
2020	2	732.11	0	35.90	0	0	0
2021	3	832.69	0	32.91	0	0	0
2022	4	901.42	0	43.67	0	0	0
2023	5	1,001.78	0	44.15	0	0	0
2024	6	1,017.11	0	32.01	0	0	0
2025	7	1,069.82	0	31.88	0	0	0
2026	8	1,097.70	0	23.16	0	0	0
2027	9	1,117.52	0	29.30	0	0	0
2028	10	1,105.32	0	28.48	0	0	0
2029	11	1,079.17	0	24.73	0	0	0
2030	12	1,072.84	0	20.36	0	0	0
2031	13	1,058.94	0	18.38	0	0	0
2032	14	1,059.56	0	16.76	0	0	0
2033	15	1,087.11	0	18.25	0	0	0
2034	16	1,075.41	0	21.09	0	0	0
2035	17	1,055.46	0	15.37	0	0	0
2036	18	1,044.81	0	19.92	0	0	0
2037	19	1,043.02	0	12.84	0	0	0
2038	20	984.85	0	16.21	0	0	0
2039	21	967.40	0	13.77	0	0	0
2040	22	847.10	0	8.63	0	0	0
2041	23	830.77	0	5.74	0	0	0
2042	24	810.97	0	8.06	0	0	0
2043	25	809.43	0	8.37	0	0	0
2044	26	816.72	0	9.91	0	0	0
2045	27	822.52	0	6.25	0	0	0
2046	28	790.36	0	7.57	0	0	0
2047	29	694.72	0	9.58	0	0	0
2048	30	679.30	0	12.50	0	0	0
2049	31	313.57	0	4.01	0	0	0

The following tables (70 to 72) show the calculation of baseline carbon stock changes in above-ground biomass, below-ground biomass and wood products in the Leakage Belt, using the carbon stock change factors;

Table 70: Baseline carbon stock change in the above-ground biomass in the leakage belt area (Table 22.c.1 of VM0015)

Year	Project year t	Activity data per category x Carbon stock change factor for above-ground biomass in the leakage belt				Total baseline carbon stock change in the leakage belt	
		F1		F2		annual	cumulative
		$ABSLLK_{ct,t}$	$\Delta Cab_{ct,t}$	$ABSLLK_{ct,t}$	$\Delta Cab_{ct,t}$	$\Delta CabBSLLK_t$	$\Delta CabBSLLK$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2019	1	925	-514	4	-586	-478,184	-478,184
2020	2	2,047	-354	6	-342	-1,054,524	-1,532,708
2021	3	1,964	-204	6	-222	-1,008,938	-2,541,646
2022	4	1,792	-136	6	-158	-917,241	-3,458,887
2023	5	1,673	-101	1	-28	-850,650	-4,309,537
2024	6	1,500	-77	0	-5	-758,369	-5,067,906
2025	7	1,397	-62	4	-97	-705,806	-5,773,712
2026	8	1,387	-55	1	-26	-696,208	-6,469,920
2027	9	1,226	-44	1	-24	-611,388	-7,081,307
2028	10	1,180	-39	0	-6	-585,187	-7,666,495
2029	11	1,121	-36	1	-11	-554,772	-8,221,267
2030	12	1,036	-36	2	-51	-513,480	-8,734,748
2031	13	994	-37	2	-58	-493,256	-9,228,004
2032	14	954	-38	4	-124	-474,577	-9,702,581
2033	15	907	-38	1	-27	-450,243	-10,152,824
2034	16	829	-37	2	-54	-411,385	-10,564,209
2035	17	732	-35	1	-34	-362,137	-10,926,347
2036	18	677	-35	1	-38	-334,800	-11,261,147
2037	19	640	-35	2	-80	-316,926	-11,578,073
2038	20	607	-35	0	-17	-300,217	-11,878,290
2039	21	601	-37	3	-90	-299,158	-12,177,448
2040	22	585	-39	0	2	-289,834	-12,467,282
2041	23	532	-37	0	-14	-263,708	-12,730,989
2042	24	443	-33	0	2	-218,086	-12,949,075
2043	25	439	-36	0	-2	-216,871	-13,165,946
2044	26	380	-33	0	2	-187,376	-13,353,322
2045	27	337	-32	0	2	-165,805	-13,519,126
2046	28	325	-33	0	-31	-160,295	-13,679,421
2047	29	279	-30	0	2	-136,780	-13,816,201
2048	30	255	-30	0	-50	-125,362	-13,941,563
2049	31	149	-19	0	2	-71,132	-14,012,695

Table 71: Baseline carbon stock change in the below-ground biomass in the leakage belt area (Table 22.c.2 of VM0015).

Year	Project year t	Activity data per category x Carbon stock change factor for below-ground biomass in the leakage belt				Total baseline carbon stock change in the leakage belt	
		F1		F2		annual	cumulative
		$BBSLLK_{ct,t}$	$\Delta Cbb_{ct,t}$	$BBSLLK_{ct,t}$	$\Delta Cbb_{ct,t}$	$\Delta CbbBSLLK_t$	$\Delta CbbBSLLK$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2019	1	925	-12.07	4	-12.07	-11,214	-11,214
2020	2	2,047	-12.07	6	-12.07	-35,984	-47,199
2021	3	1,964	-12.07	6	-12.07	-59,759	-106,958
2022	4	1,792	-12.07	6	-12.07	-81,455	-188,413
2023	5	1,673	-12.07	1	-12.07	-101,662	-290,075
2024	6	1,500	-12.07	0	-12.07	-119,766	-409,840
2025	7	1,397	-12.07	4	-12.07	-136,684	-546,525
2026	8	1,387	-12.07	1	-12.07	-153,435	-699,959
2027	9	1,226	-12.07	1	-12.07	-168,245	-868,205
2028	10	1,180	-12.07	0	-12.07	-182,488	-1,050,692
2029	11	1,121	-12.07	1	-12.07	-184,811	-1,235,503
2030	12	1,036	-12.07	2	-12.07	-172,573	-1,408,076
2031	13	994	-12.07	2	-12.07	-160,822	-1,568,898
2032	14	954	-12.07	4	-12.07	-150,679	-1,719,577
2033	15	907	-12.07	1	-12.07	-141,432	-1,861,009
2034	16	829	-12.07	2	-12.07	-133,354	-1,994,363
2035	17	732	-12.07	1	-12.07	-125,285	-2,119,648
2036	18	677	-12.07	1	-12.07	-116,720	-2,236,368
2037	19	640	-12.07	2	-12.07	-109,652	-2,346,020
2038	20	607	-12.07	0	-12.07	-102,743	-2,448,763
2039	21	601	-12.07	3	-12.07	-96,492	-2,545,256
2040	22	585	-12.07	0	-12.07	-91,017	-2,636,272
2041	23	532	-12.07	0	-12.07	-85,421	-2,721,693
2042	24	443	-12.07	0	-12.07	-79,210	-2,800,902
2043	25	439	-12.07	0	-12.07	-73,546	-2,874,448
2044	26	380	-12.07	0	-12.07	-68,110	-2,942,558
2045	27	337	-12.07	0	-12.07	-63,331	-3,005,889
2046	28	325	-12.07	0	-12.07	-59,075	-3,064,964
2047	29	279	-12.07	0	-12.07	-54,697	-3,119,661
2048	30	255	-12.07	0	-12.07	-50,448	-3,170,110
2049	31	149	-12.07	0	-12.07	-44,962	-3,215,072

Table 72: Baseline carbon stock change in the wood products in the leakage belt area (Table 22.c.6 of VM0015).

Year	Project year t	Activity data per category x Carbon stock change factor for wood products biomass in the leakage belt area				Total baseline carbon stock change in the leakage belt area	
		F1		F2		annual	cumulative
		$WPSLLK_{ct,t}$	$\Delta Cwp_{ct,t}$	$WPSLLK_{ct,t}$	$\Delta Cwp_{ct,t}$	$\Delta CwpBSLLK_t$	$\Delta CwpBSLLK$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2019	1	925	0	3.89	0	0	0
2020	2	2,047	0	5.50	0	0	0
2021	3	1,964	0	5.79	0	0	0
2022	4	1,792	0	5.67	0	0	0
2023	5	1,673	0	1.11	0	0	0
2024	6	1,500	0	0.26	0	0	0
2025	7	1,397	0	4.46	0	0	0
2026	8	1,387	0	1.31	0	0	0
2027	9	1,226	0	1.28	0	0	0
2028	10	1,180	0	0.40	0	0	0
2029	11	1,121	0	0.55	0	0	0
2030	12	1,036	0	2.03	0	0	0
2031	13	994	0	1.94	0	0	0
2032	14	954	0	3.64	0	0	0
2033	15	907	0	0.82	0	0	0
2034	16	829	0	1.70	0	0	0
2035	17	732	0	0.88	0	0	0
2036	18	677	0	0.97	0	0	0
2037	19	640	0	2.08	0	0	0
2038	20	607	0	0.48	0	0	0
2039	21	601	0	2.67	0	0	0
2040	22	585	0	0.00	0	0	0
2041	23	532	0	0.36	0	0	0
2042	24	443	0	0.00	0	0	0
2043	25	439	0	0.05	0	0	0
2044	26	380	0	0.00	0	0	0
2045	27	337	0	0.00	0	0	0
2046	28	325	0	0.33	0	0	0
2047	29	279	0	0.00	0	0	0
2048	30	255	0	0.33	0	0	0
2049	31	149	0	0.00	0	0	0

3.2.1.5.2 Baseline non-CO2 emissions from forest fires

Conversion of forest to non-forest involving fires is a source of emissions of non-CO_2 gases (CH_4 and N_2O). Sources report a steady increase in the number of fire alerts in the RR over the historical reference period. Furthermore, data published by INPE[149], reveal that the greatest focus of fires occurs in areas that are recently deforested.

Frequency of forest fires in municipalities of Tomé-Açu, Ipixuna de Pará and Paragominas where it is located the Reference Region, for years 1985 –2020 was accessed in Mapbiomas. In figure below (Figure 32), it is observed that the size of burned areas has decreased in relation to the observed history. Only in 2015, which showed an outlier of burning in the municipalities where the project is located. This is the same year that a great fire happened in the surroundings of the Maringá e Catarinense Farm, as shown also in sector 2.1.6. The values of deforestation area per year vary, reaching the average of 25.588 ha .

Figure 32 - Historical of total fire alerts for the municipalities of Tomé-Açu, Ipixuna de Pará and Paragominas, where the project is located, Fonte: Mapbiomas – Fogo

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

[149] Source . INPE/Terrabrasilis - http://terrabrasilis.dpi.inpe.br/app/dashboard/fires/biomes/aggregated/ (last visited on 05/02/2022).

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

$$EBBtot_{icl,t} = EBBN20_{icl,t} + EBBCH4_{icl,t}$$

Where:

$EBBtot_{icl,t}$	Total GHG emission from biomass burning in forest class icl at year t; tCO_2-e ha^{-1}
$EBBN20_{icl,t}$	Total GHG emission from biomass burning in forest class icl at year t; tCO2-e ha^{-1}
$EBBCH4_{icl,t}$	CH_4 emission from biomass burning in forest class icl at year t; tCO2-e ha^{-1}

$$EBBN20_{icl,t} = EBBCO2_{icl,t} * 12/44 * NCR * ER_{N20} * 44/28 * GWP_{N20}$$

$$EBBCH4_{icl,t} = EBBCO2_{icl,t} * 12/44 * ER_{CH4} * 16/12 * GWP_{CH4}$$

Where:

$EBBCO2_{icl,t}$	Per hectare CO_2 emission from biomass burning in slash and burn in forest class icl at year t; tCO_2-e ha^{-1}
$EBBN20_{icl,t}$	Per hectare N_20 emission from biomass burning in slash and burn in forest class icl at year t; tCO_2-e ha^{-1}
$EBBCH4_{icl,t}$	Per hectare CH_4 emission from biomass burning in slash and burn in forest class icl at year t; tCO_2-e ha^{-1}
NCR	Nitrogen to carbon ratio (IPCC default value = 0,01); dimensionless
ER_{N20}	Emission ratio for N_2O (IPCC default value = 0,007)
ER_{CH4}	Emission ratio for CH_4 (IPCC default value = 0,012)
GWP_{N20}	Global Warming Potential for N_2O (IPCC default value = 265 for the first commitment period)
GWP_{CH4}	Global Warming Potential for CH_4 (IPCC default value = 28 for the first commitment)

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

Where:

$EBBCO2_{icl,t}$	Per hectare CO_2 emission from biomass burning in slash and burn in forest class icl at year t; tCO_2-e ha^{-1}
$Fburnt_{icl}$	Proportion of forest area burned during the historical reference period in the forest class icl; %
$C_{p,icl,t}$	Average carbon stock per hectare in the carbon pool p burnt in the forest class icl at year t; tCO2-e ha-1
$Pburnt_{p,icl}$	Average proportion of mass burnt in the carbon pool p in the forest class icl; %
$CE_{p,icl}$	Average combustion efficiency of the carbon pool p in the forest class icl; dimensionless
p	Carbon pool that could burn (above-ground biomass, dead wood, litter)
icl	1, 2, 3, …Icl (pre-deforestation) forest classes
t	1, 2, 3 … T, a year of the proposed project crediting period; dimensionless

The table 73 below presents the parameters used to calculate non-CO_2 emissions from forest fires.

Table 73: Parameters used to calculate non-CO2 emissions from forest fires (Table 23 of VM0015).

Initial Forest Class		Parameters								
		Fburnt$_{icl}$	***Cab***	***Pburnt$_{ab,icl}$***	***CEab,icl***	***ECO2-ab***	***EBBCO2-tot***	***EBBN2O$_{icl}$***	***EBBCH4$_{icl}$***	***EBBtot$_{icl}$***
IDcl	**Name**	**N/A**	**tCO_2e ha^{-1}**	**N/A**	**N/A**	**tCO_2e ha^{-1}**	**tCO_2e ha^{-1}**	**tCO_2e ha^{-1}**	**tCO_2e ha^{-1}**	**tCO_2e ha^{-1}**
1	F1	1.0	515.9	0.85	0.5	220.2	220.2	1.75	26.9	28.7
2	F2	1.0	587.3	0.86	0.5	253.0	253.0	2.01	30.9	32.9

The table 74 below presents Baseline of non-CO_2 emissions from forest fires in the project area.

Table 74: Baseline non-CO2 emissions from forest fires in the project area (Table 24 of VM0015).

Year	Project year t	Emissions of non-CO2 gasses from baseline forest fires		Emissions of non-CO2 gasses from baseline forest fires		Total baseline non-CO2 emissions from forest fires in the project area	
		F1		*F2*		annual	cumulative
		$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$EBBBSLPA_t$	EBBBSLPA
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2019	1	266	28.7	12	32.9	8,025	8,025
2020	2	732	28.7	36	32.9	22,161	30,186
2021	3	833	28.7	33	32.9	24,944	55,130
2022	4	901	28.7	44	32.9	27,268	82,398
2023	5	1,002	28.7	44	32.9	30,160	112,558
2024	6	1,017	28.7	32	32.9	30,200	142,758
2025	7	1,070	28.7	32	32.9	31,706	174,463
2026	8	1,098	28.7	23	32.9	32,217	206,681
2027	9	1,118	28.7	29	32.9	32,988	239,669
2028	10	1,105	28.7	28	32.9	32,611	272,279
2029	11	1,079	28.7	25	32.9	31,738	304,018
2030	12	1,073	28.7	20	32.9	31,413	335,431
2031	13	1,059	28.7	18	32.9	30,949	366,380
2032	14	1,060	28.7	17	32.9	30,914	397,294
2033	15	1,087	28.7	18	32.9	31,752	429,046
2034	16	1,075	28.7	21	32.9	31,511	460,557
2035	17	1,055	28.7	15	32.9	30,751	491,308
2036	18	1,045	28.7	20	32.9	30,595	521,903
2037	19	1,043	28.7	13	32.9	30,311	552,214
2038	20	985	28.7	16	32.9	28,755	580,969
2039	21	967	28.7	14	32.9	28,174	609,143
2040	22	847	28.7	9	32.9	24,558	633,701
2041	23	831	28.7	6	32.9	23,995	657,696
2042	24	811	28.7	8	32.9	23,504	681,200
2043	25	809	28.7	8	32.9	23,470	704,670
2044	26	817	28.7	10	32.9	23,730	728,400
2045	27	823	28.7	6	32.9	23,776	752,175
2046	28	790	28.7	8	32.9	22,897	775,073
2047	29	695	28.7	10	32.9	20,223	795,296
2048	30	679	28.7	13	32.9	19,877	815,173
2049	31	314	28.7	4	32.9	9,118	824,291

3.2.2 Project Emissions

Ex ante estimation of actual carbon stock changes

These carbon stock changes are due to the following:

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

Carbon stock changes due to possible future catastrophic events cannot be predicted and are therefore excluded from the ex-ante assessment. Certain discrete areas of forest within the project area will be subject to project activities that will change the carbon stocks of these areas compared to the baseline. In this Project Activity, such activities are related to planned controlled timber logging (sustainable forest management).

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

To allow ex ante projections to be made, the project proponent shall make a conservative assumption about the effectiveness of the proposed project activities and estimate an Effectiveness Index (EI) between 0 (no effectiveness) and 1 (maximum effectiveness). The estimated value of EI is used to multiply the baseline projections by the factor (1 - EI) and the result shall be considered the ex-ante estimated emissions from unplanned deforestation in the project case.

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

Where:

$\Delta CUDdPA_t$	Total ex ante actual carbon stock change due to unavoided unplanned deforestation at year t in the project area; tCO_2-e GHG emission from biomass burning in forest class icl at year t; tCO_2-e ha^{-1}
$\Delta CBSL_t$	Total baseline carbon stock change at year t in the project area; tCO_2-e
EI	Ex ante estimated Effectiveness Index; %
t	1, 2, 3 … T, a year of the proposed project crediting period; dimensionless

The results are listed in the tables (75 - 77) below.

Table 75: Ex ante estimated actual carbon stock decrease due to planned logging activities in the project area (Table 25b of VM0015).

Year	Project year t	Areas of planned logging activities x Carbon stock change (decrease) in the project area		Areas of planned logging activities x Carbon stock change (decrease) in the project area		Total carbon stock decrease due to planned logging activities	
		IDcl = 1		*IDcl* = 2		annual	cumulative
		$APLPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$APLPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$\Delta CPLdPA_t$	$\Delta CPLdPA$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2019	1	1,054.51	88.40	0	0	93,219	93,219
2020	2	1,186.10	88.40	0	0	104,852	198,071
2021	3	925.35	88.40	0	0	81,801	279,872
2022	4	925.35	88.40	0	0	81,801	361,674
2023	5	690.50	88.40	0	0	61,041	422,714
2024	6	1,267.00	88.40	0	0	112,003	534,718
2025	7	914.70	88.40	0	0	80,860	615,578
2026	8	1,596.10	88.40	0	0	141,096	756,674
2027	9	2,219.10	88.40	0	0	196,170	952,843
2028	10	1,779.30	88.40	0	0	157,291	1,110,135
2029	11	1,416.60	88.40	0	0	125,228	1,235,363
2030	12	1,699.40	88.40	0	0	150,228	1,385,591
2031	13	1,433.90	88.40	0	0	126,758	1,512,348
2032	14	1,686.30	88.40	0	0	149,070	1,661,418
2033	15	1,556.60	88.40	0	0	137,604	1,799,022
2034	16	1,473.00	88.40	0	0	130,214	1,929,236
2035	17	1,637.20	88.40	0	0	144,729	2,073,966
2036	18	186.30	88.40	0	0	16,469	2,090,435
2037	19	1,004.00	88.40	0	0	88,754	2,179,189
2038	20	842.80	88.40	0	0	74,504	2,253,693
2039	21	467.60	88.40	0	0	41,336	2,295,029
2040	22	1,017.50	88.40	0	0	89,948	2,384,977
2041	23	1,057.60	88.40	0	0	93,492	2,478,469
2042	24	1,122.30	88.40	0	0	99,212	2,577,681
2043	25	690.50	88.40	0	0	61,041	2,638,721
2044	26	1,267.00	88.40	0	0	112,003	2,750,725
2045	27	914.70	88.40	0	0	80,860	2,831,585
2046	28	1,596.10	88.40	0	0	141,096	2,972,681
2047	29	2,219.10	88.40	0	0	196,170	3,168,851
2048	30	1,779.30	88.40	0	0	157,291	3,326,142
2049	0.00	0.00	88.40	0	0	0	3,326,142

Table 76: Ex ante estimated carbon stock increase following planned logging activities in the project area (Table 26.b of VM0015).

Year	Project year t	Areas of planned logging activities x Carbon stock change (increase up to maximum long-term average)				Total carbon stock increase due to planned logging activities	
		F1		*F2*		annual	cumulative
		$APLPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$APLPA_{icl,t}$	$\Delta Ctot_{icl,t}$	$\Delta CPLiPA_t$	$\Delta CPLiPA$
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2019	1	1,054.5	3.03	0	0	3,190	3,190
2020	2	1,186.1	3.03	0	0	6,778	9,968
2021	3	925.4	3.03	0	0	9,577	19,545
2022	4	925.4	3.03	0	0	12,376	31,921
2023	5	690.5	3.03	0	0	14,465	46,386
2024	6	1,267.0	3.03	0	0	18,298	64,684
2025	7	914.7	3.03	0	0	21,065	85,748
2026	8	1,596.1	3.03	0	0	25,893	111,641
2027	9	2,219.1	3.03	0	0	32,606	144,247
2028	10	1,779.3	3.03	0	0	37,988	182,234
2029	11	1,416.6	3.03	0	0	42,273	224,508
2030	12	1,699.4	3.03	0	0	47,414	271,922
2031	13	1,433.9	3.03	0	0	51,751	323,673
2032	14	1,686.3	3.03	0	0	56,852	380,525
2033	15	1,556.6	3.03	0	0	61,561	442,087
2034	16	1,473.0	3.03	0	0	66,017	508,104
2035	17	1,637.2	3.03	0	0	70,970	579,073
2036	18	186.3	3.03	0	0	71,533	650,606
2037	19	1,004.0	3.03	0	0	74,570	725,176
2038	20	842.8	3.03	0	0	77,120	802,296
2039	21	467.6	3.03	0	0	78,534	880,830
2040	22	1,017.5	3.03	0	0	81,612	962,442
2041	23	1,057.6	3.03	0	0	84,811	1,047,254
2042	24	1,122.3	3.03	0	0	88,206	1,135,460
2043	25	690.5	3.03	0	0	90,295	1,225,755
2044	26	1,267.0	3.03	0	0	94,128	1,319,883
2045	27	914.7	3.03	0	0	96,895	1,416,778
2046	28	1,596.1	3.03	0	0	101,723	1,518,500
2047	29	2,219.1	3.03	0	0	108,436	1,626,936
2048	30	1,779.3	3.03	0	0	113,818	1,740,754
2049	31	0.0	3.03	0	0	113,818	1,854,572

Table 77: Ex ante estimated net carbon stock change in the project area under the project scenario (Table 27 of VM0015).

Year	Project year t	Total carbon stock decrease due to planned logging activities		Total carbon stock increase due to planned logging activities		Total carbon stock decrease due to unavoided unplanned deforestation		Total carbon stock change in the project case	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		$\Delta CPLdPA_t$	$\Delta CPLdPA$	$\Delta CPLiPA_t$	$\Delta CPLiPA$	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2019	1	93,219	93,219	3,190	3,190	-14,732	-14,732	-104,761	-104,761
2020	2	104,852	198,071	6,778	9,968	-40,974	-55,706	-139,048	-243,810
2021	3	81,801	279,872	9,577	19,545	-46,896	-102,603	-119,121	-362,930
2022	4	81,801	361,674	12,376	31,921	-52,067	-154,670	-121,492	-484,423
2023	5	61,041	422,714	14,465	46,386	-58,371	-213,041	-104,946	-589,369
2024	6	112,003	534,718	18,298	64,684	-59,551	-272,592	-153,257	-742,626
2025	7	80,860	615,578	21,065	85,748	-63,420	-336,012	-123,216	-865,842
2026	8	141,096	756,674	25,893	111,641	-65,524	-401,536	-180,727	-1,046,569
2027	9	196,170	952,843	32,606	144,247	-68,112	-469,648	-231,676	-1,278,245
2028	10	157,291	1,110,135	37,988	182,234	-68,625	-538,272	-187,928	-1,466,172
2029	11	125,228	1,235,363	42,273	224,508	-67,924	-606,196	-150,879	-1,617,051
2030	12	150,228	1,385,591	47,414	271,922	-67,682	-673,878	-170,496	-1,787,547
2031	13	126,758	1,512,348	51,751	323,673	-67,071	-740,949	-142,077	-1,929,624
2032	14	149,070	1,661,418	56,852	380,525	-67,146	-808,094	-159,363	-2,088,987
2033	15	137,604	1,799,022	61,561	442,087	-68,716	-876,811	-144,759	-2,233,746
2034	16	130,214	1,929,236	66,017	508,104	-68,330	-945,140	-132,527	-2,366,273
2035	17	144,729	2,073,966	70,970	579,073	-66,932	-1,012,072	-140,692	-2,506,965
2036	18	16,469	2,090,435	71,533	650,606	-66,591	-1,078,664	-11,527	-2,518,492
2037	19	88,754	2,179,189	74,570	725,176	-65,987	-1,144,651	-80,171	-2,598,663
2038	20	74,504	2,253,693	77,120	802,296	-63,045	-1,207,696	-60,430	-2,659,093
2039	21	41,336	2,295,029	78,534	880,830	-61,872	-1,269,569	-24,674	-2,683,767
2040	22	89,948	2,384,977	81,612	962,442	-55,115	-1,324,684	-63,451	-2,747,218
2041	23	93,492	2,478,469	84,811	1,047,254	-53,850	-1,378,534	-62,531	-2,809,749
2042	24	99,212	2,577,681	88,206	1,135,460	-52,695	-1,431,229	-63,700	-2,873,450

Year	Project year t	Total carbon stock decrease due to planned logging activities		Total carbon stock increase due to planned logging activities		Total carbon stock decrease due to unavoided unplanned deforestation		Total carbon stock change in the project case	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		$\Delta CPLdPA_t$	$\Delta CPLdPA$	$\Delta CPLiPA_t$	$\Delta CPLiPA$	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2043	25	61,041	2,638,721	90,295	1,225,755	-52,331	-1,483,560	-23,077	-2,896,527
2044	26	112,003	2,750,725	94,128	1,319,883	-52,515	-1,536,075	-70,391	-2,966,917
2045	27	80,860	2,831,585	96,895	1,416,778	-52,345	-1,588,420	-36,310	-3,003,227
2046	28	141,096	2,972,681	101,723	1,518,500	-50,483	-1,638,903	-89,856	-3,093,083
2047	29	196,170	3,168,851	108,436	1,626,936	-45,298	-1,684,201	-133,032	-3,226,116
2048	30	157,291	3,326,142	113,818	1,740,754	-44,349	-1,728,550	-87,822	-3,313,938
2049	31	0	3,326,142	113,818	1,854,572	-24,287	-1,752,837	89,531	-3,224,407

Ex ante estimation of actual non-CO_2 emissions from forest fires

Where forest fires have been included in the baseline scenario, non-CO_2 emissions from biomass burning must be included in the project scenario. This is done by multiplying the baseline emissions by the factor (1 – EI).

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

Where:

$EBBPSPA_t$ Total ex ante actual non-CO_2 emissions from forest fires due to unavoided unplanned deforestation at year t in the project area; tCO_2-e

$EBBBSPA_t$ Total non-CO_2 emissions from forest fires at year t in the project area; tCO_2-e

EI Ex ante estimated Effectiveness Index; %

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

The values of total ex ante estimated actual emissions of non-CO2 gases due to forest fires and Total ex ante estimated actual of net carbon stock changes and emissions of non-CO2 gases both in the project area are presented in tables 78 and 79 respectively.

Table 78: Total ex ante estimated actual emissions of non-CO2 gases due to forest fires in the project area (Table 28 of VM0015).

		Total ex ante estimated actual non-CO2 emissions from forest fires in the Project area	
		annual	**cumulative**
		$EBBPSPA_t$	**EBBPSPA**
Year	**Project year t**	**tCO_2-e**	**tCO_2-e**
2019	1	802	802
2020	2	2,216	3,019
2021	3	2,494	5,513
2022	4	2,727	8,240
2023	5	3,016	11,256
2024	6	3,020	14,276
2025	7	3,171	17,446
2026	8	3,222	20,668
2027	9	3,299	23,967
2028	10	3,261	27,228
2029	11	3,174	30,402

Year	Project year t	Total ex ante estimated actual non-CO2 emissions from forest fires in the Project area	
		annual	cumulative
		$EBBPSPA_t$	EBBPSPA
		tCO_2-e	tCO_2-e
2030	12	3,141	33,543
2031	13	3,095	36,638
2032	14	3,091	39,729
2033	15	3,175	42,905
2034	16	3,151	46,056
2035	17	3,075	49,131
2036	18	3,060	52,190
2037	19	3,031	55,221
2038	20	2,876	58,097
2039	21	2,817	60,914
2040	22	2,456	63,370
2041	23	2,399	65,770
2042	24	2,350	68,120
2043	25	2,347	70,467
2044	26	2,373	72,840
2045	27	2,378	75,218
2046	28	2,290	77,507
2047	29	2,022	79,530
2048	30	1,988	81,517
2049	31	912	82,429

Table 79: Total ex ante estimated actual net carbon stock changes and emissions of non-CO2 gases in the project area (Table 29 of VM0015).

Year	Project year t	Total ex ante carbon stock decrease due to planned activities		Total ex ante carbon stock increase due to planned activities		Total ex ante carbon stock decrease due to unavoided unplanned deforestation		Total ex ante net carbon stock change		Total ex ante estimated actual non-CO2 emissions from forest fires in the project area	
		annual $\Delta CPAdPA_t$ tCO_2-e	cumulative $\Delta CPAdPA$ tCO_2-e	annual $\Delta CPAiPA_t$ tCO_2-e	cumulative $\Delta CPAiPA$ tCO_2-e	annual $\Delta CUDdPA_t$ tCO_2-e	cumulative $\Delta CUDdPA$ tCO_2-e	annual $\Delta CPSPA_t$ tCO_2-e	cumulative $\Delta CPSPA$ tCO_2-e	annual $EBBPSPA_t$ tCO_2-e	cumulative $EBBPSPA$ tCO_2-e
2019	1	93,219	93,219	3,190	3,190	-14,732	-14,732	-104,761	-104,761	802	802
2020	2	104,852	198,071	6,778	9,968	-40,974	-55,706	-139,048	-243,810	2,216	3,019
2021	3	81,801	279,872	9,577	19,545	-46,896	-102,603	-119,121	-362,930	2,494	5,513
2022	4	81,801	361,674	12,376	31,921	-52,067	-154,670	-121,492	-484,423	2,727	8,240
2023	5	61,041	422,714	14,465	46,386	-58,371	-213,041	-104,946	-589,369	3,016	11,256
2024	6	112,003	534,718	18,298	64,684	-59,551	-272,592	-153,257	-742,626	3,020	14,276
2025	7	80,860	615,578	21,065	85,748	-63,420	-336,012	-123,216	-865,842	3,171	17,446
2026	8	141,096	756,674	25,893	111,641	-65,524	-401,536	-180,727	-1,046,569	3,222	20,668
2027	9	196,170	952,843	32,606	144,247	-68,112	-469,648	-231,676	-1,278,245	3,299	23,967
2028	10	157,291	1,110,135	37,988	182,234	-68,625	-538,272	-187,928	-1,466,172	3,261	27,228
2029	11	125,228	1,235,363	42,273	224,508	-67,924	-606,196	-150,879	-1,617,051	3,174	30,402
2030	12	150,228	1,385,591	47,414	271,922	-67,682	-673,878	-170,496	-1,787,547	3,141	33,543
2031	13	126,758	1,512,348	51,751	323,673	-67,071	-740,949	-142,077	-1,929,624	3,095	36,638
2032	14	149,070	1,661,418	56,852	380,525	-67,146	-808,094	-159,363	-2,088,987	3,091	39,729
2033	15	137,604	1,799,022	61,561	442,087	-68,716	-876,811	-144,759	-2,233,746	3,175	42,905
2034	16	130,214	1,929,236	66,017	508,104	-68,330	-945,140	-132,527	-2,366,273	3,151	46,056
2035	17	144,729	2,073,966	70,970	579,073	-66,932	-1,012,072	-140,692	-2,506,965	3,075	49,131
2036	18	16,469	2,090,435	71,533	650,606	-66,591	-1,078,664	-11,527	-2,518,492	3,060	52,190
2037	19	88,754	2,179,189	74,570	725,176	-65,987	-1,144,651	-80,171	-2,598,663	3,031	55,221
2038	20	74,504	2,253,693	77,120	802,296	-63,045	-1,207,696	-60,430	-2,659,093	2,876	58,097
2039	21	41,336	2,295,029	78,534	880,830	-61,872	-1,269,569	-24,674	-2,683,767	2,817	60,914
2040	22	89,948	2,384,977	81,612	962,442	-55,115	-1,324,684	-63,451	-2,747,218	2,456	63,370
2041	23	93,492	2,478,469	84,811	1,047,254	-53,850	-1,378,534	-62,531	-2,809,749	2,399	65,770
2042	24	99,212	2,577,681	88,206	1,135,460	-52,695	-1,431,229	-63,700	-2,873,450	2,350	68,120

Year	Project year t	Total ex ante carbon stock decrease due to planned activities		Total ex ante carbon stock increase due to planned activities		Total ex ante carbon stock decrease due to unavoided unplanned deforestation		Total ex ante net carbon stock change		Total ex ante estimated actual non-CO2 emissions from forest fires in the project area	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		$\Delta CPAdPA_t$	$\Delta CPAdPA$	$\Delta CPAiPA_t$	$\Delta CPAiPA$	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$	$EBBPSPA_t$	$EBBPSPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2043	25	61,041	2,638,721	90,295	1,225,755	-52,331	-1,483,560	-23,077	-2,896,527	2,347	70,467
2044	26	112,003	2,750,725	94,128	1,319,883	-52,515	-1,536,075	-70,391	-2,966,917	2,373	72,840
2045	27	80,860	2,831,585	96,895	1,416,778	-52,345	-1,588,420	-36,310	-3,003,227	2,378	75,218
2046	28	141,096	2,972,681	101,723	1,518,500	-50,483	-1,638,903	-89,856	-3,093,083	2,290	77,507
2047	29	196,170	3,168,851	108,436	1,626,936	-45,298	-1,684,201	-133,032	-3,226,116	2,022	79,530
2048	30	157,291	3,326,142	113,818	1,740,754	-44,349	-1,728,550	-87,822	-3,313,938	1,988	81,517
2049	31	0	3,326,142	113,818	1,854,572	-24,287	-1,752,837	89,531	-3,224,407	912	82,429

3.2.3 Leakage

Project emission will be calculated according to the VM0015 methodology. Below are presented the equations that will be used. The results will be added to the topic in the final PD.

The goal of this step (STEP 8) is to provide an ex-ante estimate of the possible decrease in carbon stock and increase in GHG emissions (other than carbon stock change) due to leakage.

Two sources of leakage are considered in this methodology and must be addressed:

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

Ex ante estimation of the decrease in carbon stocks and increase in GHG emissions due to leakage prevention measures

If leakage prevention measures include tree planting, agricultural intensification, fertilization, fodder production and/or other measures to enhance cropland and grazing land areas, a reduction in carbon stocks and/or an increase in GHG emissions may occur compared to the baseline case. If this decrease in carbon stocks or increase in GHG emissions is significant, it must be accounted for, and monitoring will be required. If it is not significant, it must not be accounted for, and ex post monitoring will not be necessary.

The following activities in leakage management areas could occasion a decrease in carbon stocks or an increase in GHG emissions:

- Carbon stock changes due to activities implemented in leakage management areas;
- Methane (CH_4) and nitrous oxide (N_2O) emissions from livestock intensification (involving a change in the animal diet and/or animal numbers).

In the case of this project activity, this component of the calculation is not applicable. The present project activity does not involve a decrease in carbon stocks or increase in GHG emissions associated with leakage

prevention activities. In this project, leakage prevention activities do not involve any carbon stock reduction due to deforestation or additional emissions caused by increased grazing activities.

Ex ante estimation of the decrease in carbon stocks and increase in GHG emissions due to activity displacement leakage

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

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

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

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

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

The results of ex ante estimated leakage due to activity displacement (table 80), and ex-ante estimated total leakage are presented below (table 81).

Table 80: Ex ante estimated leakage due to activity displacement (Table 34 of VM0015).

Year	Project year t	Total ex ante estimated decrease in carbon stocks due to displaced deforestation		Total ex ante estimated increase in GHG emissions due to displaced forest fires	
		annual $\Delta CADLK_t$ tCO_2-e	cumulative $\Delta CADLK$ tCO_2-e	annual $EADLK_t$ tCO_2-e	cumulative $EADLK$ tCO_2-e
2019	1	-7,366	-7,366	401	401
2020	2	-20,487	-27,853	1,108	1,509
2021	3	-23,448	-51,301	1,247	2,757
2022	4	-26,033	-77,335	1,363	4,120
2023	5	-29,185	-106,520	1,508	5,628
2024	6	-29,776	-136,296	1,510	7,138
2025	7	-31,710	-168,006	1,585	8,723
2026	8	-32,762	-200,768	1,611	10,334
2027	9	-34,056	-234,824	1,649	11,983
2028	10	-34,312	-269,136	1,631	13,614
2029	11	-33,962	-303,098	1,587	15,201
2030	12	-33,841	-336,939	1,571	16,772
2031	13	-33,535	-370,474	1,547	18,319
2032	14	-33,573	-404,047	1,546	19,865
2033	15	-34,358	-438,405	1,588	21,452
2034	16	-34,165	-472,570	1,576	23,028
2035	17	-33,466	-506,036	1,538	24,565
2036	18	-33,296	-539,332	1,530	26,095
2037	19	-32,994	-572,326	1,516	27,611
2038	20	-31,523	-603,848	1,438	29,048
2039	21	-30,936	-634,784	1,409	30,457
2040	22	-27,558	-662,342	1,228	31,685
2041	23	-26,925	-689,267	1,200	32,885
2042	24	-26,347	-715,614	1,175	34,060
2043	25	-26,166	-741,780	1,173	35,234
2044	26	-26,257	-768,038	1,186	36,420
2045	27	-26,172	-794,210	1,189	37,609
2046	28	-25,241	-819,451	1,145	38,754
2047	29	-22,649	-842,101	1,011	39,765
2048	30	-22,175	-864,275	994	40,759
2049	31	-12,143	-876,419	456	41,215

Ex ante estimation of total leakage

The ex-ante total leakage estimated is presented in table 81.

Table 81: Ex-ante estimated total leakage (Table 35 of VM0015).

		Total ex ante increase in GHG emissions due to displaced forest fires		Total ex ante decrease in carbon stocks due to displaced deforestation		Total net carbon stock change due to leakage		Total net increase in emissions due to leakage	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
Year	Project year t	$EADLK_t$ tCO_2-e	EADLK tCO_2-e	$\Delta CADLK_t$ tCO_2-e	$\Delta CADLK$ tCO_2-e	ΔCLK_t tCO_2-e	ΔCLK tCO_2-e	ELK_t tCO_2-e	ELK tCO_2-e
2019	1	401	401	-7,366	-7,366	-7,366	-7,366	401	401
2020	2	1,108	1,509	-20,487	-27,853	-20,487	-27,853	1,108	1,509
2021	3	1,247	2,757	-23,448	-51,301	-23,448	-51,301	1,247	2,757
2022	4	1,363	4,120	-26,033	-77,335	-26,033	-77,335	1,363	4,120
2023	5	1,508	5,628	-29,185	-106,520	-29,185	-106,520	1,508	5,628
2024	6	1,510	7,138	-29,776	-136,296	-29,776	-136,296	1,510	7,138
2025	7	1,585	8,723	-31,710	-168,006	-31,710	-168,006	1,585	8,723
2026	8	1,611	10,334	-32,762	-200,768	-32,762	-200,768	1,611	10,334
2027	9	1,649	11,983	-34,056	-234,824	-34,056	-234,824	1,649	11,983
2028	10	1,631	13,614	-34,312	-269,136	-34,312	-269,136	1,631	13,614
2029	11	1,587	15,201	-33,962	-303,098	-33,962	-303,098	1,587	15,201
2030	12	1,571	16,772	-33,841	-336,939	-33,841	-336,939	1,571	16,772
2031	13	1,547	18,319	-33,535	-370,474	-33,535	-370,474	1,547	18,319
2032	14	1,546	19,865	-33,573	-404,047	-33,573	-404,047	1,546	19,865
2033	15	1,588	21,452	-34,358	-438,405	-34,358	-438,405	1,588	21,452
2034	16	1,576	23,028	-34,165	-472,570	-34,165	-472,570	1,576	23,028
2035	17	1,538	24,565	-33,466	-506,036	-33,466	-506,036	1,538	24,565
2036	18	1,530	26,095	-33,296	-539,332	-33,296	-539,332	1,530	26,095
2037	19	1,516	27,611	-32,994	-572,326	-32,994	-572,326	1,516	27,611
2038	20	1,438	29,048	-31,523	-603,848	-31,523	-603,848	1,438	29,048
2039	21	1,409	30,457	-30,936	-634,784	-30,936	-634,784	1,409	30,457
2040	22	1,228	31,685	-27,558	-662,342	-27,558	-662,342	1,228	31,685
2041	23	1,200	32,885	-26,925	-689,267	-26,925	-689,267	1,200	32,885
2042	24	1,175	34,060	-26,347	-715,614	-26,347	-715,614	1,175	34,060
2043	25	1,173	35,234	-26,166	-741,780	-26,166	-741,780	1,173	35,234
2044	26	1,186	36,420	-26,257	-768,038	-26,257	-768,038	1,186	36,420
2045	27	1,189	37,609	-26,172	-794,210	-26,172	-794,210	1,189	37,609
2046	28	1,145	38,754	-25,241	-819,451	-25,241	-819,451	1,145	38,754
2047	29	1,011	39,765	-22,649	-842,101	-22,649	-842,101	1,011	39,765
2048	30	994	40,759	-22,175	-864,275	-22,175	-864,275	994	40,759
2049	31	456	41,215	-12,143	-876,419	-12,143	-876,419	456	41,215

3.2.4 Net GHG Emission Reductions and Removals

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

The net anthropogenic GHG emission reduction (STEP 9 of the VM0015 Methodology) of the proposed AUD project activity is calculated as follows:

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

Where:

$\Delta REDD_t$ Ex ante estimated net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t; tCO_2e

$\Delta CBSLPA_t$ Sum of baseline carbon stock changes in the project area at year t; tCO_2e

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

$EBBBSLPA_t$ Sum of baseline emissions from biomass burning in the project area at year t; tCO_2e

$\Delta CPSPA_t$ Sum of ex ante estimated actual carbon stock changes in the project area at year t; tCO_2e of baseline emissions from biomass burning in the project area at year t; tCO_2e

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

$EBBPSPA_t$ Sum of (ex ante estimated) actual emissions from biomass burning in the project area at year t; tCO_2e

ΔCLK_t Sum of ex ante estimated leakage net carbon stock changes at year t; tCO_2e

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

ΔELK_t Sum of ex ante estimated leakage emissions at year t; tCO_2e

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

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

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

$$VCU_t = REDD_t - VBC_t$$

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

Where:

VCU_t Number of Verified Carbon Units that can be traded at time t; tCO_2-e

$REDD_t$ Ex-ante estimated net anthropogenic greenhouse gas emission reductions attributable to the AUD project activity at year t; tCO_2-e ha^{-1}

VBC_t Number of Buffer Credits deposited in the VCS Buffer at time t; tCO_2-e

$CBSLPA_t$ Sum of baseline carbon stock changes in the project area at year t; tCO_2e

$CPSPA_t$ Sum of ex ante estimated actual carbon stock changes in the project area at year t; tCO_2-e ha^{-1}

RF_t Risk factor used to calculate VCS buffer credits; %

Note: RF_t is a risk factor to be determined using the latest version of the VCS-approved AFOLU Non-Permanence Risk Tool,

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

It is specified that the risk rating according to the AFOLU Non-Permanence Risk Tool is 10, being sub-divided into Internal Risk (7,0), External Risk (0) and Natural Risk (2,5), which is rounded up to 10 points,

The ex ante estimated net anthropogenic GHG emissions reductions is 14,128,193.11 tCO_2e (and voluntary carbon units (VCUs)) (table 82).

Table 82: Ex ante estimated net anthropogenic GHG emission reductions (ΔREDDt) and Voluntary Carbon Units (VCUt) (Table 36 of VM0015).

Year	Estimated baseline emissions (tCO2e)	Estimated project emissions (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions (tCO2e)
2019	155,346	105,564	7,767	42,015
2020	431,905	141,265	21,595	269,045
2021	493,909	121,615	24,695	347,598
2022	547,938	124,219	27,397	396,322
2023	613,868	107,962	30,693	475,212
2024	625,712	156,277	31,286	438,149
2025	665,910	126,386	33,295	506,228
2026	687,453	183,949	34,373	469,132
2027	714,104	234,974	35,705	443,425
2028	718,858	191,189	35,943	491,726
2029	710,975	154,052	35,549	521,373
2030	708,231	173,637	35,412	499,183
2031	701,657	145,172	35,083	521,402
2032	702,373	162,455	35,119	504,800
2033	718,915	147,935	35,946	535,035
2034	714,806	135,678	35,740	543,388
2035	700,072	143,767	35,004	521,301
2036	696,507	14,587	34,825	647,095
2037	690,185	83,202	34,509	572,473
2038	659,209	63,305	32,960	562,943
2039	646,898	27,492	32,345	587,061
2040	575,711	65,907	28,786	481,019
2041	562,495	64,931	28,125	469,440
2042	550,452	66,051	27,523	456,879
2043	546,783	25,424	27,339	494,020
2044	548,879	72,764	27,444	448,671
2045	547,223	38,688	27,361	481,174
2046	527,727	92,146	26,386	409,195
2047	473,205	135,054	23,660	314,490
2048	463,371	89,810	23,169	350,392
2049	251,985	-88,620	12,599	328,006
Total	**18,352,662**	**3,306,836**	**917,633**	**14,128,193**

The ex-ante tradable VCUs and Buffer Credits is presented next (table 83).

Table 83: Ex-ante Tradable VCUs and Buffer Credits.

year	Ex ante VCUs tradable		Ex ante buffer credits	
	annual VCU_t tCO_2-e	cumulative VCU tCO_2-e	annual VBC_t tCO_2-e	cumulative VBC tCO_2-e
2019	37,759	37,759	4,256	4,256
2020	241,975	279,734	27,070	31,326
2021	312,614	592,348	34,984	66,310
2022	356,404	948,753	39,918	106,228
2023	427,336	1,376,089	47,876	154,104
2024	393,924	1,770,012	44,226	198,329
2025	455,129	2,225,141	51,099	249,428
2026	421,681	2,646,822	47,451	296,879
2027	398,480	3,045,303	44,944	341,823
2028	441,894	3,487,197	49,832	391,655
2029	468,538	3,955,735	52,836	444,491
2030	448,550	4,404,285	50,632	495,123
2031	468,539	4,872,824	52,863	547,986
2032	453,590	5,326,415	51,210	599,196
2033	480,794	5,807,209	54,240	653,436
2034	488,312	6,295,521	55,077	708,513
2035	468,438	6,763,959	52,863	761,376
2036	581,657	7,345,615	65,438	826,814
2037	514,503	7,860,118	57,970	884,785
2038	505,941	8,366,059	57,002	941,787
2039	527,656	8,893,715	59,405	1,001,192
2040	432,248	9,325,964	48,770	1,049,962
2041	421,843	9,747,807	47,597	1,097,559
2042	410,554	10,158,361	46,325	1,143,884
2043	443,997	10,602,357	50,024	1,193,908
2044	403,195	11,005,552	45,476	1,239,383
2045	432,461	11,438,013	48,714	1,288,097
2046	367,698	11,805,711	41,497	1,329,594
2047	282,495	12,088,206	31,995	1,361,589
2048	314,825	12,403,031	35,567	1,397,157
2049	294,766	12,697,797	33,240	1,430,396

3.3 Monitoring

3.3.1 Data and Parameters Available at Validation

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

Data / Parameter	**44/12**
Data unit	Dimensionless
Description	Carbon mass to CO_2e mass conversion factor
Source of data	From scientific literature: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 AFOLU

Value applied	44/12
Justification of choice of data or description of measurement methods and procedures applied	Conversion from C to CO_2 based on molecular weights
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	IPCC standard value

Data / Parameter	**R**
Data unit	t root d,m,t^{-1} shoot d,m,
Description	Root to shoot ratio appropriate to species or forest type biome; note that as defined here, root to shoot ratio is applied as belowground biomass per unit area: aboveground biomass per unit area (not on a per stem basis)
Source of data	The “2006 IPCC Guidelines for National Greenhouse Gas Inventories”, V, 4, Ch, 4, AFOLU, pg, 4,49, Table 4-4,
Value applied	0.37
Justification of choice of data or description of measurement methods and procedures applied	Local values are not known, and the IPCC is a conservative value,
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions

	• Calculation of leakage
Comments	Peer-reviewed work performed in the region of the Project Area, with a similar vegetation typology. The statistical quality of model is in accordance with methodology requirements.

Data / Parameter	**BEF**
Data unit	Dimensionless
Description	Biomass Expansion Factor
Source of data	According to "Brown, S,, A, J, R, Gillespie, and A, E, Lugo, 1989. Biomass estimation methods for tropical forests with applications to forest inventory data, Forest Science, 35:881-902", (Table 4; pg, 890; minimum value deducted from lowest limit.: 1.743 – 0.083 = 1,66)
Value applied	1,66
Justification of choice of data or description of measurement methods and procedures applied	BEF was applied for conversion of merchantable volume to total aboveground tree biomass
Purpose of Data	• Determination of baseline scenario (AFOLU projects only) • Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Comments	N/A

Data / Parameter	**Cab_{icl}**

Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the above-ground biomass carbon pool of initial forest class icl
Source of data	Third Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions and Removals, pg, 95, table 12. The conversion from total biomass to above-ground biomass is explained in Section 3.2.1.
Value applied	483 for Dense Ombrophilous Submontane Forest (Ds) and 550 for Dense Ombrophilous Alluvial Forest (Da)
Justification of choice of data or description of measurement methods and procedures applied	Other secondary data was consulted, however the data from the Third Brazilian Inventory was chosen for being the most conservative, In order to convert the value from total biomass to above-ground biomass, the root-to-shoot ratio (0.37) was applied to calculate the above-ground biomass,
Purpose of Data	• Calculation of baseline emissions
Comments	NA

Data / Parameter	$\mathbf{Cbb_{icl}}$
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the below-ground biomass carbon pool of initial forest class icl
Source of data	Third Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions and Removals, pg, 95, table 12,
Value applied	178.7 for Dense Ombrophilous Submontane Forest (Ds) and 203 for Dense Ombrophilous Alluvial Forest (Da)

Justification of choice of data or description of measurement methods and procedures applied	Other secondary data was consulted, however the data from the Third Brazilian Inventory was chosen for being the most conservative, In order to convert the value from total biomass to below-ground biomass, first the root-to-shoot ratio (0.37) was applied to calculate the above-ground biomass, The below-ground is the difference between the total and the above-ground biomass,
Purpose of Data	• Calculation of baseline emissions
Comments	N/A

Data / Parameter	**$Cabfcl_{grassland}$**
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the above-ground biomass carbon pool of final post-deforestation class fcl for grassland conversion
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, V.4.Chapter 6: Grassland, pg, 6,27, Table 6,4 (for Pasture)
Value applied	15.63
Justification of choice of data or description of measurement methods and procedures applied	Conservative default value from IPCC, to estimate post-deforestation land use carbon stock.
Purpose of Data	• Calculation of baseline emissions
Comments	*Conservative upper limit to be used in calculations, based on uncertainties in source values,*

Data / Parameter	**$Cbbfcl_{grassland}$**
Data unit	tCO_2e/ha
Description	Average carbon stock per hectare in the below-ground biomass pool of final post-deforestation class fcl for grassland conversion
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, V, 4, Chapter 6: Grassland, pg, 6,27, Table 6,4 (for Pasture)
Value applied	24.96
Justification of choice of data or description of measurement methods and procedures applied	Conservative default value from IPCC, to estimate post-deforestation land use carbon stock.
Purpose of Data	• Calculation of baseline emissions
Comments	Conservative upper limit to be used in calculations, based on uncertainties in source values.

Data / Parameter	**EI**
Data unit	N/A
Description	Ex ante estimated effectiveness index
Source of data	Local assessment
Value applied	0.9

Justification of choice of data or description of measurement methods and procedures applied	The project design team conservatively considers that surveillance activities are able to attain 90% of effectiveness in avoiding unplanned deforestation inside the Project Area.
Purpose of Data	• Calculation of project emissions
Comments	This value is an ex-ante estimate. Accurate and actual values will be monitored and reported in verification periods.

Data / Parameter	**DLF**
Data unit	N/A
Description	Displacement Leakage Factor
Source of data	Local assessment
Value applied	0.05
Justification of choice of data or description of measurement methods and procedures applied	If deforestation agents do not participate in leakage prevention activities and project activities, the Displacement Factor shall be 100%, Where leakage prevention activities are implemented, the factor shall be equal to the proportion of the baseline agents estimated to be given the opportunity to participate in leakage prevention activities and project activities. The project design team estimates that 100% of potential deforestation agents in the Reference Region will be given the opportunity to participate in leakage prevention activities. Projections of deforestation within the Leakage Belt have duly been made as part of the present project, according to projections of deforestation presented in Section 3.2.3.. The project proponent has conservatively allowed 5% leeway on this estimate, which is unlikely to be surpassed. If this allowance is surpassed, an assessment of how much is due to the project will be conducted during monitoring. Thus,

	the "Displacement Leakage Factor" (DLF) was conservatively defined as 0.05. Leakage fighting activities are also listed in this PD, as fire brigade trainings, sustainable cattle raising etc.
Purpose of Data	• Calculation of leakage
Comments	This value is an ex-ante estimate. Accurate and actual values will be monitored and reported in verification periods

Data / Parameter	**Deforestation**
Data unit	ha
Description	Maps of forest cover areas converted into non-forest areas
Source of data	Measured through data from PRODES (if available) or supervised classification.
Value applied	Yearly variable: deforestation values are presented for the Reference Region, Leakage Belt and Project Area (projections) in this PD
Justification of choice of data or description of measurement methods and procedures applied	The project area is located within a region that is subject to a monitoring program that is approved or sanctioned by the national government (*PRODES/INPE*). The data generated by this program is used in this project, *PRODES* data are applicable for use in this project, according to the criteria listed below (Methodology VM0015): i) *PRODES* monitoring occurs in the entire project area and leakage belt, ii) *PRODES* monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period, iii) *PRODES* monitors conversion of forest land to non-forest land, iv) Monitoring occurred during the entire fixed baseline period, v) data accuracies are acceptable according to the methodology criteria,

	An order of preference of data applies to the available sources of data: 1) PRODES in first order of preference; 2) MapBiomas in second place; and 3) place self-classification of images.
Purpose of Data	• Calculation of baseline emissions
Comments	N/A

3.3.2 Data and Parameters Monitored

Data / Parameter	**ACPAt**
Data unit	ha
Description	Annual area within the Project Area affected by catastrophic events at year t
Source of data	- Remote sensing data and GIS - Supervisor reports
Description of measurement methods and procedures to be applied	The following sources will be monitored: - INMET (INMET, Instituto Nacional de Meteorologia), https://www,gov,br/agricultura/pt-br/assuntos/inmet?r=home/page&page=%20rede_estacoes_conv_graf - Periodic reports from area supervisor, - INPE (INPE, Instituto Nacional de Pesquisas Espaciais, https://queimadas,dgi,inpe,br/queimadas/portal - items 1 and 5)
Frequency of monitoring/recording	Each time a catastrophic event occurs
Value applied	The value will be calculated ex-post each time a catastrophic event occurs, when significant
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September.

	2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	Calculation of project emissions,
Calculation method	Remote sensing and GIS
Comments	N/A

Data / Parameter	**ABSLLKt**
Data unit	ha
Description	Annual area of baseline deforestation within the leakage belt at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	Deforestation in the leakage belt area will be considered activity displacement leakage. Activity data for the leakage belt area will be determined using the same methods applied to monitoring deforestation activity data in the project area.
Frequency of monitoring/recording	Annually
Value applied	Indicated in the Monitored Report
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters, Image acquisition is performed

	during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix, The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Analysis of satellite images and maps
Comments	Where strong evidence can be collected that deforestation in the leakage belt is attributable to deforestation agents that are not linked to the project area, the detected deforestation will not be attributed to the project activity, thus not considered leakage.

Data / Parameter	**ABSLPAt**
Data unit	ha
Description	Annual area of baseline deforestation in the project area at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	Forest cover change due to deforestation is monitored through periodic assessment of classified satellite imagery covering the project area.

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

Data / Parameter	**ΔCADLKt**
Data unit	tCO_2e

Description	Total decrease in carbon stocks due to displaced deforestation at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	Deforestation in the leakage belt area will be considered activity displacement leakage. Activity data for the leakage belt area will be determined using the same methods applied to monitoring deforestation activity data in the project area.
Frequency of monitoring/recording	Annually
Value applied	Indicated in the Monitored Report
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. *4)* Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Emissions from deforestation are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.

Comments	N/A

Data / Parameter	**ΔCPAdPAt**
Data unit	tCO_2e
Description	Total decrease in carbon stock due to all planned activities at year t in the project area.
Source of data	Documents, remote sensing and GIS
Description of measurement methods and procedures to be applied	The planned activities in the project area that result in carbon stock decrease will be subject to monitoring, when significant.
Frequency of monitoring/recording	Annually
Value applied	Indicated in the Monitored Report
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.

Purpose of data	• Calculation of project emissions
Calculation method	Emissions from all planned activities are estimated by the sum of the emissions from planned deforestation and emissions from planned logging activities.
Comments	N/A

Data / Parameter	**ΔCPSLKt**
Data unit	tCO_2e
Description	Total annual carbon stock change in leakage management areas in the project case
Source of data	- Activity reports related to leakage prevention measures. - Field assessments. - Remote sensing and GIS.
Description of measurement methods and procedures to be applied	The planned activities in leakage management areas that result in carbon stock decrease will be subject to monitoring, when significant.
Frequency of monitoring/recording	Annually
Value applied	Indicated in the Monitored Report
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition

	is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. *4)* Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Emissions from *planned activities in leakage management areas* are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	N/A

Data / Parameter	**ΔCUDdPAt**
Data unit	tCO_2e
Description	Total actual carbon stock change due to unavoided unplanned deforestation at year t in the project area
Source of data	Remote sensing and GIS
Description of measurement methods and procedures to be applied	Forest cover change due to unplanned deforestation is monitored through periodic assessment of classified satellite imagery covering the project area.

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

Data / Parameter	**EBBPSPAt**
Data unit	tCO_2e

Description	Sum of (or total) actual non-CO_2 emissions from forest fire at year t in the project area
Source of data	Remote sensing data and GIS - Supervisor reports
Description of measurement methods and procedures to be applied	If forest fires occur, these non-CO_2 emissions will be subject to monitoring and accounting, when significant.
Frequency of monitoring/recording	Annually
Value applied	Indicated in the Monitored Report
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of project emissions
Calculation method	Analysis of satellite images and maps to determine the incidence of deforestation and multiplying it by the respective emission factors.

Comments	If forest fires occur, these non-CO_2 emissions will be subject to monitoring and accounting, when significant.

Data / Parameter	**EADLKt**
Data unit	tCO2e
Description	Total ex ante increases in GHG emissions due to displaced forest fires at year t
Source of data	Remote sensing data and GIS
Description of measurement methods and procedures to be applied	When significant, GHG emissions due displaced forest fires will be monitored.
Frequency of monitoring/recording	Annually
Value applied	Indicated in the Monitored Report
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS: 1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, within July and September. 2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images.

	3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analyzing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Analysis of satellite images and maps to determine the incidence of deforestation and multiplying it by the respective emission factors
Comments	Where strong evidence can be collected that forest fires in the leakage belt is attributable to deforestation agents that are not linked to the project area, the detected deforestation will not be attributed to the project activity, thus not considered leakage.

Data / Parameter	**RFt**
Data unit	%
Description	Risk factor used to calculate VCS buffer credits
Source of data	- VCS Non-Permanence Risk Report (v3,1). - Remote sensing data and GIS. - Supervisor report. - Literature data.
Description of measurement methods and procedures to be applied	All sources of data from the VCS Non-Permanence Risk Report will be used to measure the various risk factors

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

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

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

Data / Parameter	**ΔCabBSLLKt**
Data unit	tCO_2e
Description	Total baseline carbon stock changes for the above-ground biomass pool in the leakage belt
Source of data	Calculated

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

	4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• Calculation of leakage
Calculation method	Analysis of satellite images and maps to determine deforestation in Leakage Belt and multiplying it by the carbon stocks previously set.
Comments	N/A

3.3.3 Monitoring Plan

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

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

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

a) Technical description of the monitoring tasks.

b) Data to be collected.

c) Overview of data collection procedures.

d) Quality control and quality assurance procedures.

e) Data archiving.

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

Figure 33 - General overview of the staff in the Project Area.

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

3.3.3.1.1 Monitoring of project implementation

a) Technical description of the monitoring tasks.

Project activities implemented within the project area will be monitored to be consistent with the management plans of the project area and the PD/ as required in VM00015 1.1 methodology.

b) Data to be collected.

Monitoring of deforestation-avoidance activities will be performed by means of evaluations of the surveillance rounds and using satellite imagery to continuously inspect the forest condition within the Project Area. All images, maps and records generated during project implementation should be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has actually been implemented.

Monitoring of social and biodiversity parameters of project implementation will be based on data presented in sections 4.4.2 and 5.4.2 respectively, which attest those foreseen activities are being effectively designed

and implemented. A system will be implemented to record data on costs and investments, based on invoices, receipts and contracts related to activity implementation, as well as signed attendance lists,

c) Overview of data collection procedures.

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

d) Quality control and quality assurance procedures.

The project proponent will train personnel to collect and keep all documentation in a secure place, according to the Operating Procedure of Document and Record Control. All electronic documentation should also be sent to Carbonext to further security and checking.

e) Data archiving.

All maps and records generated during project implementation will be conserved and made available to VCS verifiers at verification. Backup copies of files should be available in the project proponent facilities, as well as in Carbonext facilities. All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

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

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

a. Technical description of the monitoring tasks.
   Monitoring of land-use and land-cover change within the Project Area will be performed annually by analyzing satellite imagery of the Project Area.
   Imagery analysis of land use will be based on secondary information from PRODES Digital (INPE, 2014), referring mainly to the classes "Forest Land" and "Non-Forest Land".

b. Data to be collected.

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

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

The satellite images used will be four scenes of satellite Landsat 8 TM (orbits 001/65, 001/66. 233/65, and 233/66) to the total geographic scope of the Project Area and Reference Region.

c. Overview of data collection procedures.

The project area is located within a region that is subject to a monitoring program that is approved or sanctioned by the national government (PRODES). The data generated by such program is used in this project. PRODES data are applicable for use in this project, according to the criteria listed below (Methodology VM0015):

i) PRODES monitoring occurs in the entire project area and leakage belt.

ii) PRODES monitoring occurs in the entire reference region and covers the beginning. middle and end of the fixed baseline period.

iii) PRODES monitors conversion of forest land to non-forest land.

iv) Monitoring occurred during the entire fixed baseline period.

d. Quality control and quality assurance procedures.

The validation of land-use data used for modeling of land use will be performed by using the confusion matrix, in order to calculate the overall index of success by period and by class. Three specific classes will be used: forest, accumulated deforestation and other (hydrography, not forest, clouds, roads, residues, unclassified objects, and others).

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

With the help of the "Create Random Points" tool in ArcGIS 10.0, 100 random points will be generated for each class / year as samples for evaluation, using satellite images as reference, making it possible to generate a confusion matrix for calculation of the accuracy indexes, and the Kappa index (indicators for validation of mapping accuracy).

Land use classes must have higher values than 90% accuracy for the accuracy and Kappa index. as required in VM00015 1.1 methodology.

e) Data archiving,

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

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

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

All satellite imagery assessments will be performed by Carbonext, also responsible for reporting and data archiving, according to VM0015, and for providing assistance during verification audits.

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

a) Technical description of the monitoring tasks

Monitoring of carbon stocks is mandatory in the following cases:

Within the project area:

- Areas subject to unplanned and significant carbon stock decrease, e.g. due to uncontrolled forest fires and other catastrophic event., In these areas, carbon stock losses must be estimated as soon as possible after the catastrophic event.

Within leakage management areas:

- Areas subject to planned and significant carbon stock decrease in the project scenario according to the ex-ante assessment. In these areas, carbon stocks must

be estimated at least once after the planned event that caused the carbon stock decrease.

b) Data to be collected.

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

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

Decreases in carbon stocks and increases in GHG emissions (e.g., in case of forest fires) due to natural disturbances (such as hurricanes, earthquakes, volcanic eruptions, tsunamis, flooding, drought, fires, tornados or winter storms) or man-made events, including those over which the project proponent has no control (such as acts of terrorism or war), are subject to monitoring and must be accounted under the project scenario, when significant.

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

Summarize the results of all ex-post estimations in the project area using the same table format used for the ex-ante assessment, as presented on this PD/ as required in VM00015 1.1 methodology.

c) Overview of data collection procedures.
The project area is located within a region that is subject to a monitoring program that is approved or sanctioned by the national government (PRODES). The data generated by such program is used in this project, PRODES data are applicable for use in this project, according to the criteria listed below (Methodology VM0015):

i) PRODES monitoring occurs in the entire project area and leakage belt.

ii) PRODES monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period.

iii) PRODES monitors conversion of forest land to non-forest land.

iv) Monitoring occurred during the entire fixed baseline period.

d) Quality control and quality assurance procedures.
The validation of land-use data used for modeling of land use will be performed by using the confusion matrix, in order to calculate the overall index of success by period and by class. Three specific classes will be used: forest, accumulated deforestation and other (hydrography, not forest, clouds, roads, residues, unclassified objects, and others).

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

With the help of the "Create Random Points" tool in ArcGIS 10.0, 100 random points will be generated for each class / year as samples for evaluation, using satellite images as reference, making it possible to generate a confusion matrix for calculation of the accuracy indexes, and the Kappa index (indicators for validation of mapping accuracy).

Land use classes must have higher values than 90% accuracy for the accuracy and Kappa index, as required in VM00015 1.1 methodology.

e) Data archiving.

All maps and records generated during project implementation will be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has actually been implemented. All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

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

All satellite imagery assessments will be performed by Carbonext, also responsible for reporting and data archiving, according to VM0015, and for providing assistance during verification audits.

3.3.3.2 Monitoring of leakage

a) Technical description of the monitoring tasks.
The sources of leakage identified as significant in the ex-ante assessment are subject to monitoring. Two sources of leakage are potentially subject to monitoring:

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

This Project Activity does not involve decrease in carbon stocks and increase in GHG emissions associated with leakage prevention activities. In this project, leakage prevention activities do not involve any carbon stock reduction due to deforestation or additional emissions caused by increased grazing activities, in this case, only the decrease in carbon stocks and increase in GHG emissions in due to activity displacement leakage will be monitored.

b) Data to be collected.

Deforestation above the baseline in the leakage belt area will be considered activity displacement leakage, The result of the ex-post estimations of carbon stock changes must be reported using the same table formats used in the ex-ante assessment of baseline carbon stock changes in the leakage belt, as presented on this PD/ as required in VM00015 1.1 methodology.

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

To estimate the increased GHG emissions due to forest fires in the leakage belt area the assumption is made that forest clearing is done by burning the forest. The parameter values used to estimate emissions shall be the same used for estimating forest fires in the baseline as presented on this PD/ as required in VM00015 1.1 methodology, except for the initial carbon stocks (Cab, Cdw) which shall be those of the initial forest classes burned in the leakage belt area. Report the result of the estimations using the same table formats used in the ex-ante assessment of baseline GHG emissions from forest fires in the project area, as presented on this PD/ as required in VM00015 1.1 methodology.

c) Overview of data collection procedures.

The project area is located within a region that is subject to a monitoring program that is approved or sanctioned by the national government (PRODES). The data generated by such program is used in this

project, PRODES data are applicable for use in this project, according to the criteria listed below (Methodology VM0015):

i) PRODES monitoring occurs in the entire project area and leakage belt.

ii) PRODES monitoring occurs in the entire reference region and covers the beginning, middle and end of the fixed baseline period.

iii) PRODES monitors conversion of forest land to non-forest land.

iv) Monitoring occurred during the entire fixed baseline period.

d) Quality control and quality assurance procedures.

The validation of land-use data used for modeling of land use will be performed by using the confusion matrix, in order to calculate the overall index of success by period and by class. Three specific classes will be used: forest, accumulated deforestation and other (hydrography, not forest, clouds, roads, residues, unclassified objects, and others).

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

With the help of the "Create Random Points" tool in ArcGIS 10.0, 100 random points will be generated for each class / year as samples for evaluation, using satellite images as reference, making it possible to generate a confusion matrix for calculation of the accuracy indexes, and the Kappa index (indicators for validation of mapping accuracy).

Land use classes must have higher values than 90% accuracy for the accuracy and Kappa index, as required in VM00015 1.1 methodology.

e) Data archiving.

All maps and records generated during project implementation will be conserved and made available to VCS verifiers at verification for inspection to demonstrate that the AUD project activity has actually been implemented. All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

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

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

3.3.3.3 Ex post calculation of net anthropogenic GHG emission reduction

a) Technical description of the monitoring tasks.

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

b) Data to be collected.

Report the ex post estimated net anthropogenic GHG emissions and calculation of Verified Carbon Units (VCUt, and VBCt) using the same table format used for the ex-ante assessment, as presented on this PD/ as required in VM00015 1.1 methodology.

c) Overview of data collection procedures.

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

d) Quality control and quality assurance procedures.

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

e) Data archiving.

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

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

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

All satellite imagery assessments will be performed by Carbonext, also responsible for reporting and data archiving, according to VM0015, and for providing assistance during verification audits.

3.3.3.4 Revisiting the baseline projections for future fixed baseline period

According to VM0015, the baseline will be revisited every 6 years. Thus, the first revision of the baseline is scheduled for 2025. For this purpose, the following tasks will be carried out:

• Updating information on agents, drivers and underlying causes of deforestation, which involves the following sub-tasks:

-Collecting information that is relevant to understand deforestation agents, drivers and underlying causes;

-Redoing step 3 of the ex-ante methodology, as specified in the methodology;

-Recalibrating the model for projection of future deforestation, using new “Factor Maps” for the subsequent fixed baseline period.

• Adjusting the land-use and land-cover change component of the baseline, which involves reassessing the following components of the baseline projections:

-The annual areas of baseline deforestation.

-The location of baseline deforestation.

-Adjustment of the annual areas of baseline deforestation.

-Adjustment of the location of the projected baseline deforestation.

Adjusting, as needed, the carbon component of the baseline (this task will only be carried out if more accurate methods for carbon stocks estimates are available in the occasion of baseline revision).

3.3.4 Dissemination of Monitoring Plan and Results (CL4.2)

Monitoring plan and results will be publicly available at Verra and Carbonext’s website and the stakeholders will be informed through the communication channels. A summary of the results will be presented for the communities and other stakeholders during the consultations and visits.

3.4 Optional Criterion: Climate Change Adaptation Benefits

The CAAPII REDD+ Project does not seek to be validated to the Gold Level for Climate change adaptation benefits.

3.4.1 Regional Climate Change Scenarios (GL1.1)

The CAAPII REDD+ Project does not seek to be validated to the Gold Level for Climate change adaptation benefits.

3.4.2 Climate Change Impacts (GL1.2)

The CAAPII REDD+ Project does not seek to be validated to the Gold Level for Climate change adaptation benefits.

3.4.3 Measures Needed and Designed for Adaptation (GL1.3)

The CAAPII REDD+ Project does not seek to be validated to the Gold Level for Climate change adaptation benefits.

4. COMMUNITY

4.1 Without-Project Community Scenario

4.1.1 Descriptions of Communities at Project Start (CM1.1)

As described in item 2.1.6. fourteen communities were identified by literature and research within a buffer of 20 km of the project area. However, on the onsite visits and public consultation, 7 communities were identified as suitable for project activities' development in which action would be focused: Vila Nova, Distrito Canaã, Vila Nova Esperança, Cachoeiro do Potiritá, Vila Bom Jesus, Vila Itapura and Diamantina Community; painted in green (map 34).

The Vila Bom Jesus and Vila Itapura were identified by GIS in the buffer of 20km from the project area, but during the onsite visits and community consultation, there was a logistic problem, that did not allow the

visitation of the social Team: the bridge was broken and the path was interrupted. Both communities will be visited as soon as possible to verify the possibility of project activities with them.

Map 34 - Map with the location of the communities identified in a 20km buffer of the project area.

The reasons why some communities were excluded vary (and are explained in sector 2.1.6.), In summary, the indigenous land Amanayé/Sarauá borders with the property Fazenda Maringá e Catarinense from the project area, but this land has many conflicts regarding land tenure, Since 2002 the indigenous people were expelled from their land and the area is now used by land grabbers to explore timber illegaly[150] and practice other illegal activities such as invasions followed by implementation of livestock raising and soybean production, and hunting of wild animals. These land grabbers formed the community Balalaica (riverside of the Capim River), Balalaica sede and the Roça Queimada Community, the three excluded from project activities.

[150] http://www.mpf.mp.br/pa/sala-de-imprensa/noticias-pa/justica-federal-determina-que-nao-indigenas-desocupem-terra-indigena-saraua-pa-dentro-de-90-dias

To illustrate the conflict, in 2015, there was a fire followed by an attempt to invade the private property of the proponent, reported by the landowner of the Maringá e Catarinense farm. Since 2018, there is a process of dispatch of the invaders. A new order to leave in 90 days the area by the invaders was dispatched in 25/02/2022. The Federal Prosecution Service of Brazil points that can be dangerous conflicts in the areas soon[151].

The Vila Rainha da Selva was not located by the Carbonexts' social team, as well as the Colônia do Uraim. Instead of the community Colônia do Uraim, the community Cachoeiro do Potiritá was found, consulted and included in the project. The community Colônia Oriente was identified and visited by the social team, but the exclusion of the project was defined after it was identified conflicts regarding invasions and land tenure. Several legal processes can be consulted in the JusBrasil website[152].

The 5 communities suitable for project activities and that were visited are mainly small villages (with exception of the Distrito Canaã and Vila Nova), with an estimated population of fourteen thousand inhabitants[153]. Most of them work with familiar agriculture and farming. The diagnosis indicated some deficiencies and difficulties in the region, such as lack of specialized doctors in the health centres, poor sanitation, access of water through wells, scholarity up to the elementary school, discouragement in the rural work, gender disparities, and many other points reporting the vulnerabilities of each community. With the assistance of the questionnaires, local visits and the socioeconomic diagnosis made by the social team, the vulnerabilities of each community were identified and actions to improve the situation were design to bring actual and effective benefits to them. Insofar as the project advance through the years, the feedbacks, the periodic meetings, suggestions and further diagnosis will bring information to adapt activities, if necessary, to create new ones and to implement them according to the project schedule. Negative impacts, if detected or reported, will also be mitigated, and minimized as fast as possible.

The table below (84) presents the points of vulnerability of each community involved in the CAAPII REDD+ Project, the activities designed and the objectives to be reach with them. The activities have transversal topics to attend more than one identified vulnerability.

[151] https://g1.globo.com/pa/para/noticia/2022/02/25/justica-da-90-dias-para-nao-indigenas-deixarem-terra-saraua-pa-no-para.ghtml
[152] https://www.jusbrasil.com.br/processos/nome/40224281/fazenda-oriente
[153]Spredsheet named "Planilha memorial de cálculo"
https://painel.incra.gov.br/sistemas/Painel/ImprimirPainelAssentamentos.php?cod_sr=14&Parameters%5BPlanilha%5D=Nao&Parameters%5BBox%5D=GERAL&Parameters%5BLinha%5D=1

Table 84 -The vulnerabilities identified in each community visited based on the socioeconomic diagnosis and the project activities proposed, as well as the objectives that they aim to reach.

Community	**Points of vulnerability**	**Project Activity proposed**	**Objetive**
Vila Nova	• Low income; • Limited access to health services; • Pollution and waste problem; • Presence of unpreserved headwaters; • Gender disparities; • Demotivation;	• Trainings on multiple topics (sustainable practices, environmental education, regular education, capacity and professionalizing courses); • Health, safety and nutrition workshops and periodically treatments; • Environmental education events; • Diagnosis of the headwater situation; • Trainings, events and lectures directed exclusively to women; • Workshops on motivation of the rural work, sports, school and studies, and others,	• Increase technical knowledge and skills to achieve job positions; • Income diversification;
Cachoeiro do Potiritá	• Low income; • Limited access to health services; • School infrastructure; • Gender disparities;	• Trainings on multiple topics (sustainable practices, environmental education, regular education, capacity and professionalizing courses); • Health, safety and nutrition workshops and periodically treatments; • Improvements in school infrastructure;	• Increase technical knowledge and skills to achieve job positions; • Income diversification;

		• Trainings, events and lectures directed exclusively to women;	
Vila Nova Esperança	• Low income; • Limited access to health services; • Gender disparities;	• Trainings on multiple topics (sustainable practices, environmental education, regular education, capacity and professionalizing courses); • Health, safety and nutrition workshops and periodically treatments; • Trainings, events and lectures directed exclusively to women;	• Increase technical knowledge and skills to achieve job positions; • Income diversification;
Distrito Canaã	• Low income; • Limited access to health services; • Gender disparities;	• Trainings on multiple topics (sustainable practices, environmental education, regular education, capacity and professionalizing courses); • Health, safety and nutrition workshops and periodically treatments; • Trainings, events and lectures directed exclusively to women;	• Increase technical knowledge and skills to achieve job positions; • Income diversification;
Diamantina	• Low income; • Limited access to health services; • Gender disparities;	• Trainings on multiple topics (sustainable practices, environmental education, regular education, capacity and professionalizing courses); • Health, safety and nutrition workshops and periodically treatments; • Trainings, events and lectures directed exclusively to women;	• Increase technical knowledge and skills to achieve job positions; • Income diversification;

The district of Canaã has 3,500 inhabitants and Vila Nova has 4,500 inhabitants, according to local leaders. They are the most populous villages of the RR and both have basic sanitation problems such as inadequate waste disposal, precarious sewage collection or no collection, precarious infrastructure of the streets and sidewalks (gullies caused by rain) and sexual exploitation of minors.

There is a health post with good infrastructure, but there is a lack of doctors and health professionals to attend to the population on a regular basis. This post serves the inhabitants of Vila Nova Esperança, which does not have a health post in their community. These two communities meet with some frequency to take demands to the city hall of Ipixuna do Pará.

Instead of the community Colônia do Uraim, the Cachoeiro do Potiritá community was found. The school in the Cachoeira do Potiritá community has a precarious structure, there is no security or surveillance system, so it is vulnerable to theft and vandalism. There is no wall surrounding the school, for example, this school serves children who live up to 70 km away from the site.

Certainly, the set of municipalities in the RR has shown demographic growth in recent years, but this growth did not mean better living conditions for the resident population of all municipalities. In general, Brazil - therefore, the state of Pará as well - shows territorially concentrated demographic growth, and a continuous process of urbanization.

Of the total number of rural properties located in the RR, we can see the presence of large properties, but also small rural properties. The economic dynamics in the region that makes up the RR is composed, mostly, by family farming activity in the smaller farms, In the big properties other activities are present, such as: livestock raising, monocultures, fish farming, mining activities and logging.

In RR, in general, the population that lives in the settlements and villages generally lives in simple wooden houses. A few are made of masonry. These houses are supplied by artesian wells and rudimentary cesspools are the main destination for human waste.

The general population has low income and low education, most earn their living as rural workers. Those who have their own farming find it difficult to earn enough income to maintain their family with quality of life, Women normally do not work outside the home and are housewives, without financial independence,

More detailed mapping and identification of communities was carried out with the participation of more than 70 respondents, carried out during the months of April and May 2022 and collected in 5 different communities that live in the buffer area of 20 km around the UC, located in the municipalities of Ipixuna do Pará, Paragominas and Tomé Açu, as shown in the table (85) below.

Table 85 - Results from the Socioeconomic diagnosis.

Main Economic Activities	As a majority, government assistance and retirement, family agriculture (vegetable garden, cassava, corn, beans). In small numbers, employees of a private palm oil production company and employees of municipal governments (teachers, school coordinators, health agent).
Religion	Catholicism and protestantism, for the most part,
Adults Educational Level	Elementary Education
Housing infrastructure	Houses made of wood (more than 70%) and masonry. Precarious bathrooms, no sanitation system. It does not have water treatment for consumption. No garbage collection.
School	Only one community has an elementary and high school, Others, the presence of a school, all with regular quality. And there is a community that does not have kindergarten,
Health Quality	Bad quality. Most communities do not have a health center or transport resources to get around. Only one community has a health center, but it does not have a doctor or specialized professionals.
People living below de poverty line	Yes. In some communities, the number of members is greater, in others the number is smaller, but present.
Community Infrastructure	All communities have access to water supply through the public network, through artesian wells, but the water is not treated, Some with inadequate piping. They have access to electricity connected to the public grid. The roads are dirt, with precarious access bridges, which sometimes collapse in times of rain, leaving the residents isolated. None of the community have sanitation system.

Women	Represents more than half of the population and works with agriculture and domestic work. There are no leisure activities for women. There are no leisure activities for women.
Motherhood	Average of 80% of women are mothers, with as average of 2 children, and first pregnancy at the age of 15 to 17 years old.
Children	The children go to school and help the family with household activities. There is a community that children do not study because they do not have kindergarten.
Climate Change Impacts	Heat throughout the year with rainy season from December to June. Humidity always above 50%.
Vulnerabilities	Risk of forest fires during the dry season. During the rainy season, parts of the road are impassable.
Traditional Cultural Activities	The main cultures identified are the planting that passed from generation to generation and the festivals in June.
Health and Safety	Health and safety practices are lacking in the activities carried out. In general, the only objects used for protection in field work are hats and long-sleeved shirts.
Conflicts	No conflicts were identified in the project area.
Leadership	All communities have an Association, with the presence of a leader.

4.1.2 Interactions between Communities and Community Groups (CM1,1)

The interaction between the project and the community groups was successful. The two field trips were conducted, from April to May of 2022, in order to run the public consultation, the socioeconomic diagnosis

of the communities' characteristics and vulnerabilities, that lasted overall 16 days. Five communities were visited and are interesting in participating on the project activities. As stated in the sector 2.1.11., the strategy to reach the communities with trust and support is to approach through the schools, that have been so far receptive and are glad about the project.

In June of 2022, one more field trip occurred to implement the first fire brigade training with the employees of the Farm and to conduct the first activities of environmental education with the students of two different communities, in two different schools, with children from 6 to 11 years old. More information on the activities is in sector 2.1.11. and on the MR1.

Traveling to the communities was considered to be easily accessible, with some adversities along the way, such as the dirt roads, some crossing via ferry and passing with the car in the middle of a flood of the river, due to the rainy season. However, the Vila Bom Jesus and Vila Itapura could not be visited due to logistic problems, because one bridge was broken and the path was interrupted, so the Carbonext team could not pass. These two communities will be visited for the next monitoring report to verify the possibility of project activities with them.

The project team was well received by the communities, with peaceful communication and of great interest by the groups, who were open and willing to meet and understand the project and the conservation areas. Each of the 5 communities identified in sector 4.1.1. received two visits: one for the first contact, identification of leadership and scheduling the meeting; and the other, to hold a meeting with the whole group, in order to pass on about the CAAPII REDD+ Project information and carry out social surveys in order to obtain a realistic socioeconomic diagnosis of them,

The scenario of the communities was seen with organization and union among the residents, although all families experience difficulties with basic resources, such as food and access to health care, the entire set of communities described in the project has a history of partnership and community spirit between them, In the interactions that take place between communities, those considered of greater value are food aid between families, exchanges of groceries, the culture of solidarity economy. The food base depends directly on family farming, and with little or no resources for soil maintenance and planting, With the lack of training on agriculture practices, low investments from the government and low income, harvests became smaller and smaller, intensifying poverty and mainly hunger.

Other interactions of great value, which also help to maintain good community life, are leisure interactions and traditional celebrations. The most celebrated traditional celebration is that of São João, which is part of the famous June festivals, a very important cultural celebration in Brazil, celebrated in the month of June, This celebration is directly related to the season of abundance in the harvest of food planted in the gardens,

meaning for the families' security regarding their food, This is the time of greatest happiness in the villages, During leisure time, communities gather for soccer championships, with teams only for men, "vaquejadas", horseback riding and combinations of meetings for river bathing.

It is important to emphasize that every community has a representative leader, in political decisions, internal and external matters, communities come together, discuss problems, and thus make decisions together.

All the information mentioned in sector 4 about the communities involved in the CAAPII REDD+ Project was collected in the social surveys carried out in onsite meetings with the community members.

4.1.3 High Conservation Values (CM1,2)

The High Conservation Value (HCV) identified and related to community in this project is the HCV 4 (table 86).

Table 86 - Community HCV,

High Conservation Value	HCV 4 – Ecosystem services and cultural value: The Capim River and its importance for water and food provision, transport and cultural value
Qualifying Attribute	The project area is located in the Capim River Bay, an important river extended for approximately 764,820 km, associated with the Guamá River. The Capim River bay can be subdivided in 25 sub-basins, important for many communities. The basin has historically economic, social and cultural importance, since the start of its explorations in the 18th century with the beginning of agriculture and pasture activitie., Besides provisioning water for the population, the Capim river has also a cultural importance, because provides fishes, other food sources such as tortoises and caimans, helps with transport and several settlements and indigenous lands use the river and are dependent on it, The Capim River has a great ecological role, since provides water for the forests and the fauna associated, as well as regulates the climate,
Focal Area	It is necessary to conserve and protect the Capim River, that passes through the project area and have influence on the communities of the project, since the river provides water for

	consumption and agriculture, and food as fishes, being economically, socially and culturally essential for the life in the region. The activities will focus on making a diagnosis of the situation of permanent preservation areas (APP in Portuguese) of the Capim River region in the properties of the CAAPII REDD+ Project, monitoring them in order to guarantee the preservation of the river and consequently bringing benefits to the forest, biodiversity, climate regulation, the ecosystem services and also to the communities. The project will evaluate the possibility of protection of the river and regeneration of the associated vegetation.

4.1.4 Without-Project Scenario: Community (CM1,3)

In April and May of 2022, the Carbonext team visited the communities within the project zone to identify needs and the main characteristics of each community (other details about the field visit in sector 2.1.6 and further in the item 4. Community), an important and essential step to the design and development of the project´s activities and actions specially according to the local necessities and participatory diagnosis. All the information of this item were obtained in the observations, interviews and meetings at the onsite visits.

The communities suitable for project activities are mainly small villages, with exception of the Vila Nova and Distrito Canaã, that have around 3.5 to 4.5 thousand inhabitants, according to local leaders. Most of the smaller communities have similar characteristics and consequently also similar points of vulnerability. Some aspects are bigger in one community and another aspect can be worrisome in the other, but in general there were identified the same factors. The diagnosis indicated that most of them work with familiar agriculture and farming. There are some deficiencies and difficulties in the region, such as lack of specialized doctors in the health centres, poor sanitation, access of water through wells, low scholarity among the adults (only to the elementary school), discouragement in the rural work, gender disparities, and other points.

With the assistance of the questionnaires, local visits and this diagnosis made by the social team, the vulnerabilities of each community were identified and actions to improve the situation were design to bring actual and effective benefits to them, Insofar as the project advance through the years, the feedbacks, the periodic meetings, suggestions and further diagnosis will bring information to adapt activities, if necessary,

to create new ones and to implement them according to the project schedule. Negative impacts, if detected or reported, will also be mitigated and minimized as fast as possible.

The table 84 presented in sector 4.1.1. shows the vulnerabilities of each community involved in the CAAPII REDD+ Project. In summary, the vulnerabilities are related to: limited access to secondary, high school and higher education; Pollution and waste problem; School infrastructure; Low income; Limited access to health services; Lack of work; Lack of technical assistance by governments; Gender disparities. Most of the smaller communities have similar points,

In the without-project scenario, the communities in general are expected to maintain the same vulnerabilities pointed above and the same socioeconomic conditions as prior to the project beginning: stagnant and without other opportunities to develop. Most of the communities are characterized by a low social and economic well-being, depending on subsistence farms and familiar agriculture activities, such as cattle raising and crops of ananas, rice, manioc, açaí and others. This scenario would hardly change without courses, trainings and workshops about other activities that can be developed in the area, sustainable practices, for example, that are being designed and predicted in the communities.

Regarding education, for example, the school´s infrastructure is described as regular, but scholarity of the adults is poor, achieving only the first years of elementary school, with presence of illiteracy. The field interviews identified that some adults want to study, and the project proposes educational activities and motivation, to the children and to the adults. Without the project this situation would remain the same, the project intents to stimulate actions in the schools and build a close relationship with teachers, students, parents, and families along the project lifetime, so it intent to change the present situation. Motivation activities and events are being developed to encourage studies, sports and new opportunities.

In the visit of the Carbonext team to the communities, it was also identified that women from the communities visited have higher average of children (4) than the national Brazilian average of 1.9. Another point is that the women become mothers with 15.6 years old in average, Without the project, there would be no change in this scenario, harming women, their future and the children in the region since the socioeconomic conditions would not be changed, since the project predicts actions, activities, capacity trainings and lectures on several topics specially to women empowerment, financial independence, professionalization and education that could mean changes in their lives.

Another important point is health. It would stay unchanged, and the communities would not improve their life quality. But the project predicts events regarding nutrition, general health, safety and medical/ dental

assistance, that could imply in beneficial impacts on their health, the leisure activities to women can also bring better well-being to them and their children.

4.2 Net Positive Community Impacts

4.2.1 Expected Community Impacts (CM2.1)

The anticipated impacts expected as result from the CAAPII REDD+ Project activities for each community group is presented in the tables below, resulting from the socioeconomic diagnosis made by Carbonext.

Community Group	All communities will have activities and workshops on **nutrition and healthy habits** with local resources
Impact(s)	-Improve in quality of life, nutrition and health.
Type of Benefit/Cost/Risk	This action is predicted to happen in the period of the project, is actual and will directly benefit the communities
Change in Well-being	Improve in health of all 7 communities involved in the CAAPII REDD+ Project.

Community Group	All communities will have activities, courses and workshops on **sustainable practices** in activities such as agriculture and cattle raising.
Impact(s)	- Improve in livestock practices and quality. - Improve in agriculture practices and quality of the crops. - Increase productivity without damaging and degrading the forest. - Prevent new areas from being converted to pasture and agriculture. - Qualification and specialization of the local workforce.
Type of Benefit/Cost/Risk	This action is predicted to happen in the period of the project, is actual and will directly benefit the communities, livestock and quality of food.

Change in Well-being	Improve in livelihood conditions of the local population, Improve in health of all 7 communities involved in the CAAPII REDD+ Project.

Community Group	All communities will have activities and workshops with children and adults on **environmental education** about biodiversity, pollution, recycling and many other topics.
Impact(s)	- Reduce environmental degradation and consequences like erosion and landslides. - Create environmental awareness and knowledge of ecosystem services. - Conservation of species and their habitats. - Reduce pollution and waste production. - Improve in the quality of resources such as water.
Type of Benefit/Cost/Risk	The activities in environmental education are predicted to happen in the period of the project, are actual and will directly benefit the communities, livestock and quality of food.
Change in Well-being	Strengthening the relationship with environment; Improve in health of all 7 communities involved in the CAAPII REDD+ Project.

Community Group	All communities will have activities and workshops directed to the **women** about empowerment, entrepreneurship, other livelihood activities, maternity and other topics. Leisure activities for women will also be implemented.
Impact(s)	- Improve in health and quality of life. - Specialization of the local women. - Perspectives of new livelihood activities to women. - Empowerment and financial independence. - Leisure.

Type of Benefit/Cost/Risk	The activities aimed to the women are predicted to happen in the period of the project, are actual and will directly benefit the local women population, their life´s quality and consequently of their children as well.
Change in Well-being	Improve in life quality of the local women of all 7 communities involved in the CAAPII REDD+ Project. Improve in health of women and children of all 7 communities involved in the CAAPII REDD+ Project. Strengthening the relationship among women.

Community Group	All communities will have activities and actions on health, medical care and (possibly) dentist.
Impact(s)	-Improve quality of life. -Improve in health.
Type of Benefit/Cost/Risk	This action is predicted to happen in the period of the project, it is actual and will directly benefit the communities.
Change in Well-being	Improve in health of all 7 communities involved in the CAAPII REDD+ Project.

Community Group	All communities and employees of the properties of the CAAPII Project will have fire brigade training.
Impact(s)	- protect the houses in the communities and forest areas near them. - prevent great fire events. - capacity training.
Type of Benefit/Cost/Risk	This action is predicted to happen in the period of the project, it is actual and predicted, and will directly benefit the communities.
Change in Well-being	Prevention and control of fires for a group of people from each one of the 7 communities involved in the CAAPII REDD+ Project.

Community Group	All communities will have events for motivation on study, sports, jobs, and others.
Impact(s)	- increase engagement with the schools and studies. - increase in practice of physical activity and leisure. - motivation for getting a job and being independent. - increase in citizenship and involvement with the community members.
Type of Benefit/Cost/Risk	This action is predicted to happen in the period of the project, it is actual and predicted, and will directly benefit the communities.
Change in Well-being	Prevention and control of fires for a group of people from each one of the 7 communities involved in the CAAPII REDD+ Project.

On this first monitoring period, 5 communities were visited in order to participate on the public consultation, on meetings about the CAAPII REDD+ Project and also to participate on the socioeconomic diagnosis, that identified the main characteristics of each community and their vulnerabilities. The project activities are designed based on this important socioeconomic diagnosis. Vila Nova, Vila Nova Esperança, Cachoeiro do Potiritá, Vila Diamantina and Distrito Canaã were visited and the table below (87) shows the number of people that participated on the meetings. There were some children in the local of the meetings, but they were not accounted. The meeting in the Distrito Canaã was small, so a new one will be scheduled in order to reach more community members, together with the onsite visits in the Vila Bom Jesus and Vila Itapura.

Table 87 - Number of people present on the public consultation about the CAAPII REDD+ Project.

Community	**Total**	**Women**	**Men**
Cachoeira do Potiritá	21	15	6
Diamantina	14	7	7
Nova Esperança	12	3	9
Vila Nova	28	18	10
TOTAL	**75**	**43**	**32**

Further specific proposals will be made by Carbonext throughout the implementation of the project, according to deeper analysis of the area to generate more beneficial impacts. The activities are dependent on the local needs, accreditation, and sale of carbon credits.

4.2.2 Negative Community Impact Mitigation (CM2.2)

The Carbonext CAAPII REDD+ project intends to preserve part of the Amazon Forest, maintaining the habitat of species present in the project region, preventing deforestation through actions to reduce and control threats suffered by the biotic community, presented, and more detailed in the sector **5 BIODIVERSITY** of this project description. The activities and actions predicted to benefit the communities of the project zone do not intent to negatively affect the communities and will study every activity with careful and accompanied by a specialist in the field of the activity, so the precautionary principle will not be discarded. If any negative impact is detected along the 30 years of the project, mitigation measures will be developed to act rapidly and directly to minimize and mitigate the situation.

Furthermore, the activities planned for the project related to climate, community and biodiversity will strengthen the local community in terms of environmental awareness and sustainable development through environmental education, capacity building, and so on, always aiming to conserve the environment and the biodiversity. Many other actions and mitigation measures will be proposed as local demands and impacts are identified during the project, since the Carbonext team will stay in touch with the communities over the project time. Thus, the proposals made will be more effective and significant, resulting in more robust, relevant, and beneficial changes on the local community, its surroundings, on biodiversity and climate as well. The responses and mitigation measures will be also more precise and direct in the impacts if it occurs.

For the next community consultations, it is necessary to design tools to enhance the ability of community's articulation to facilitate the identification of impacts and their respective mitigation.

4.2.3 Net Positive Community Well-Being (CM2.3, GL1.4)

Community activities are anticipated to bring only positive impacts in the communities and the environment, The net community impacts predicted to happen are as follows:

- Increase in the communities' well-being and health.
- Increase in the access to education.
- Improvement in local nutrition.
- Increase in the environmental awareness on subjects as climate change, biodiversity conservation and restoration.
- Increase in the socioeconomic conditions through trainings, workshops and courses in sustainable practices, and others.
- Increase in health of the communities.

These net community impacts listed above are predicted to be achieved by the project activities, designed based on the vulnerabilities of the communities, identified in the socioeconomic diagnosis. The activities proposed are presented in table 14 in sector 2.1.11. and in table 83 in sector 4.1.1..

Onsite visits and periodic diagnostics of the communities' conditions are going to be caried out during the entire project. This fact will allow continuous monitoring and the development of activities and actions more relevant and aligned with the needs of the communities over the project time.

4.2.4 High Conservation Values Protected (CM2.4)

The project activities aim to avoid deforestation and maintain forest cover by creating environmental awareness, stimulating sustainable economic activities, working with the locals, improving their well-being and preparing the communities and landowners to deal with eventual episodes of degradation. Therefore, there are no negative environmental impacts planned, and consequently there are no negative effects on the HCVs anticipated.

In addition, the environmental education activities regarding pollution and waste, as well as the conservation of the resources, together with the diagnosis of the Permanent Preservation Areas (APP) in the parts of the Capim River in the Project area, intent to bring benefits to this HCV and as consequence to the community, climate and biodiversity as well.

4.3 Other Stakeholder Impacts

4.3.1 Impacts on Other Stakeholders (CM3.1)

The Project is designed to generate only positive impacts on the well-being of all the stakeholders, and it will not generate negative impacts during the lifetime. No other stakeholders have been identified to use or depend on the resources in the Project Area or Reference Region. The positive impacts that are projected to occur are:

- Increase of awareness on environmental conservation and REDD+ projects.
- Increase number of effective REDD+ projects with other landowners of the surroundings.
- Partnership with universities in research projects.
- Strengthen ties between the communities, landowners and other stakeholders.

4.3.2 Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

As mentioned in the previous item, there are no negative offsite and well-being impacts expected on other stakeholders, thus, no mitigation strategies are required. If the necessity of mitigation measures on other stakeholders arises over the project time, the proponents will rapidly respond, design, and implement them according to the situation.

4.3.3 Net Impacts on Other Stakeholders (CM3.3)

The project activities aim only to benefit the region, the communities, the biodiversity and other stakeholders. Thus, there are no expected negative impacts on other stakeholders, only positive impacts. Therefore, the net impacts are positive.

4.4 Community Impact Monitoring

4.4.1 Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

One of the goals of the CAAPII REDD+ Project is the improvement on the life quality and well-being of the local communities near the Project Area. The project's activities and actions are developed based on the communities' characteristics and needs, identified in the meetings and onsite visits, interviews with the local population and feedbacks from the communities involved in the project. The project activities will suffer alterations and adaptations during the project lifetime, due to suggestions, feedbacks and continues diagnosis on changes of the local situation, in order to be updated with the volatile reality.

Among the proposed activities, the project proponent predicts the organization of trainings focusing on sustainable practices and sustainable development in, for example, cattle ranching, familiar agriculture, composter, and many others. Furthermore, fire brigade teams will be trained, workshops and capacity trainings will be offered, so new income opportunities are expected to be created. The implementation of the activities is depending on the sale of the carbon credits. Once the activities are implemented, they will be monitored considering the social indicators described in the table below (88).

Table 88 - Social parameters to be monitored.

Variable	Community, community group and other stakeholders	Aspect	Unity	Frequency	Indicator	Assessment (types of measurements and sampling methods)
Community life quality and well-being monitoring	Properties' employees+ 7 Communities within 20km buffer	Health improvement	Number of people	*Annual*	Maintenance or change (increase/decrease) on community members' access to healthcare	Data from official public surveys; Observation of changes regarding: infrastructure, habit, behaviour, environmental awareness, decrease in unsustainable practices/pollution/waste and increase in sustainable; Public consultation through interviews and questionnaires with the community members (men, women and others, without discrimination of gender, ethnicity, age, sexual.
	Female properties' employees+ women from 7 Communities within 20km buffer	Gender equality	Number of women	*Annual*	Maintenance or change (increase/decrease) on the number of women empowered through job positions, provision of income to the family and/ or practicing activities that were not provided before de projects' activities	
	Properties' employees+ 7 Communities within 20km buffer	Sustainable development through trainings, courses and workshops	Number of people	*Annual*	Maintenance or change (increase/decrease) on the number of people with trainings certificate and practicing activities that were not provided before de projects' activities	

	Properties' employees+ 7 Communities within 20km buffer	Employment and new opportunities (direct and indirect)	Number of people	*Annual*	Maintenance or change (increase/decrease) on the number of people with jobs and new opportunities in career	
	Properties' employees+ 7 Communities within 20km buffer	Well-being	Number of people	*Annual*	Maintenance or change (increase/decrease) on the number of people with better life quality in different aspects (culture, leisure, studies, better jobs, and others)	
	Properties' employees+ 7 Communities within 20km buffer	Livelihoods	Number of people	*Annual*	Maintenance or change (increase/decrease) on the number of people with different livelihood than before the projects' activities	
	Properties' employees+ 7 Communities within 20km buffer	Education and environmental awareness	Number of people	*Annual*	Maintenance or change (increase/decrease) on the number of people engaged in school and environmental education projects/activities	

The following forms will be applied after any of the trainings, or the health and safety workshops/activities are completed for data collection:

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

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

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

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

The Project Proponent is responsible for financing, implementing, and monitoring social aspects within the Project Area.

4.4.2 Monitoring Plan Dissemination (CM4,3)

The results obtained in the monitoring and verifications will be published and made available online through the Carbonext website (**Carbonext.com.br**). All documents and information on the results of the monitoring and verification of the project will be published on the VCS and CCB standards platforms, as it is usually done. Additionally, the results and activities of this project will be presented to the stakeholders in proper moments, such as trainings, verifications, field visit periods, and others, orally and also in printed folders always aiming to improve and materialize the importance and effectiveness of the CAAPII REDD+ Project.

4.5 Optional Criterion: Exceptional Community Benefits

The CAAPII REDD+ Project seeks to be validated to the Gold Level for exceptional community benefits.

4.5.1 Exceptional Community Criteria (GL2,1)

The information from this sector has as source the IBGE document[154] that synthesizes the analysis of social parameters of Brazilian Population (2020). The quantitative results presented below for the calculations were based on official population census from 2010 from IBGE, the most reliable data available of Brazil, since the data from the 2022 population census are still in process.

The CAAPII REDD+ Project meets the criterion necessary to seek the validation to the Gold Level for exceptional Community benefits, since the criterion specifies that project zone of the CAAPII REDD+ Project is in an administrative area of a medium human development country in which at least 50% of the households within the communities are below the national poverty line. The field observation and answers of the socioeconomic diagnosis, together with the research on the economic conditions of the region using as source the IBGE official data from 2010, indicated the attendance of the criterion. The project activities are designed based on the socioeconomic diagnosis from each community, and so the activities are directed to improve the well-being of the communities, to reach the Gold Level for exceptional community benefits and effectively affect them positively.

The poverty lines indicate the population considered in poverty situation when the percentage of people are under the limit established by the World Bank. In order to compare the poverty between countries, the Work Bank Group established 3 poverty lines, depending on the financial situation of the countries. For Brazil, the purchasing power parity (known as PPP) is US$ 5.50 per day, establishing the poverty line adopted for the further calculations. There are 46 countries, including Brazil, among this group that uses the U$5.50 PPP value as reference to poverty diagnosis. Between the 43 countries that have available information on the database of the World Bank, Brazil presents the 21^{rst} more elevated poverty rate, with approximately 20% of its population under this PPP poverty line.

Considering the Brazilian states, Pará is among the poorest ones, with proportion between 42.2% - 52.2% of its population with incomes under U$5.50 PPP per day (figure 34), standing below the national proportion (of 20%) of the population under the poverty line in Brazil (based on the year 2019).

[154] Síntese de indicadores sociais : uma análise das condições de vida da população brasileira : 2020 / IBGE, Coordenação de População e Indicadores Sociais. - Rio de Janeiro : IBGE, 2020. 148 p. : il. - (Estudos e Pesquisas. Informação Demográfica e Socioeconômica, ISSN 1516-3296 ; n. 43). Available on: https://biblioteca.ibge.gov.br/visualizacao/livros/liv101760.pdf . Accessed in: 24/05/2022

Figure 34 - Brazilian states and the proportion of people with incomes under U$5.50 PPP der day (based on the year 2019). Source: IBGE. 2020.

On the onsite visits and meetings in the communities of the project, the perception of the Social Team indicated several vulnerabilities present that characterize precarious situation and poverty. However, the lack of reliable data of the communities involved in the CAAPII REDD+ Project forced the analysis of the municipal data from Ipixuna do Pará, Tomé Açu and Paragominas from the 2010 population census from IBGE, since it is the only reliable and available official data.

In order to verify the number of people under de poverty line of U$5.50 PPP, the calculation used the number of people over 10 years old that received up to ½ minimum wage, In that year (2010), the Brazilian minimum wage value was in average R$ 525.00[155] per month and the currency exchange rate was R$ 1.7575 Real/BRL in average to US$ 1.00 Dollar/USD[156], This means, that people that received ½ minimum wage had U$5.00 per day of income, which is above the poverty line of U$5.50 PPP, Based on these official values, on the average of the dollar value for 2010 and on the poverty line established by the World Bank

[155] https://audtecgestao.com.br/capa.asp?infoid=1336
[156] www.aasp.org.br/suporte-profissional/indices-economicos/atualizacao-mensal/dolar/

of U$5.50 PPP value from 2011, there was almost **58.06%** of the population over 10 years old with income up to U$5.00 in Ipixuna do Pará, Tomé Açu and Paragominas (table 89), i,.e., under the national poverty line.

Table 89 - Average of people over 10 years old in Ipixuna do Pará, Tomé Açu and Paragominas under the poverty line of U$5.50 PPP in 2010.

	Ipixuna do Pará	Tomé Açu	Paragominas
Number of people over 10 years old with income up to U$5.00 per municipality (1/2 minimum in 2010):	27,233	24,097	38,719
Total of people over 10 years old per municipality (in 2010):	39,929	43,610	76,343
Percentage (%):	68.20	55.26	50.72
Average (%):	**58,06**		

Even with insufficient recent data from the communities, it is probable that their situation has worsen. There are recent studies showing the increase in the social disparities and in the number of people living in poverty situation, which has its numbers aggravated in the last years with the Covid-19 Pandemic in Brazil. According to a projection from the Getúlio Vargas Foundation[157], there has been an increase from August 2020 of people under the poverty line: from 9.5 million people (representing 4.5% of Brazilian population) to 27.2 million of people in February 2021 (representing 12.8% of the Brazilian population)[158].The extreme poverty has higher values in the Northeast region of Brazil followed by the North Region, where the Pará state is located (Figure 35).

Population under the Extreme Poverty Line (U$1.99 PPP) per region in Brazil

[157] https://www.cps.fgv.br/cps/bd/docs/Desigualdade_de_Impactos_Trabalhistas_na_Pandemia_Marcelo-Neri_FGV-Social.pdf
[158] https://www.ecodebate.com.br/2021/05/21/a-pandemia-agravou-a-desigualdade-de-renda-e-a-pobreza-no-brasil/

Figure 35 - Regions of Brazil and their population living under the Extreme Poverty Line established by the World Bank in U$1.99 PPP. Source: IBGE , IBRE/FGV,Available on: https://www,ecodebate,com,br/2021/05/21/a-pandemia-agravou-a-desigualdade-de-renda-e-a-pobreza-no-brasil/

Therefore, the CAAPII REDD+ Project seeks to improve life quality and well-being of the communities involved in the project through activities and actions aligned with the Sustainable Development Goals of the ONU directed to their needs and vulnerabilities, aiming to bring positive changes on their lives, achieving the Community Gold Level Standard.

4.5.2 Short-term and Long-term Community Benefits (GL2.2)

The CAAPII REDD+ Project is targeting short-, medium- and long-term net positive benefits for the local communities in the Project Zone: Vila Nova, Vila Nova Esperança, Vila Bom Jesus, Vila Itaupura, Comunidade Cachoeiro do Potiritá, Diamantina and Distrito Canaã. Such benefits will be shared equitably and gradually according to the activities schedule and the accreditation.

Short-term activities aim at a first diagnosis of the vulnerabilities and the development of a good relationship and communication with the communities through the schools and also with the employees of the properties. These activities have already begun to be implemented in April, May and June, together with the onsite visits, public consultation, meetings and project activities such as the fire brigade training to 16 employees of the properties to be protected in the CAAPII REDD+ Project, and so as the environmental education activities in the Schools Conto de Fadas (in Cachoeiro do Potiritá) and Nova Esperança (in Vila Nova Esperança), achieving a total of 106 children and 5 adults.

More short-term actions will take place after the Project's validation and verification. Thus, the net short-term benefit will be positive for the community members because the project will embrace and support them.

Short-term activities include in the first years of the CAAPII REDD+ Project are:

1) Gender equitability: Increase of empowerment for women through trainings, lectures, and courses.

2) Health and Safety: Fire Brigade Trainings (for employees and the community as well) and implementation of Operating Procedures.

3) Health and Safety: events on medical, nutritional, and dental care treatments and diagnosis of common diseases such as high blood pressure.

4) Capacity training: Training and courses on sustainable practices in the agriculture, entrepreneurship, and others.

5) Motivation: leisure and sport activities for women and others in the communities.

6) Environment, biodiversity and education: activities with the schools in several topics such as the biodiversity of the region, waste, pollution, recycling, composter, and many others.

7) Emergency matters: combat hunger and sub nutrition.

The medium-term activities will be the continuation of the first activities but with more adaptations according to each community priority and deepening on their vulnerabilities. The outcomes will become beneficial impacts and long-term benefits on the communities, improving their well-being and quality of life.

Some of the long-term net positive benefits expected for local communities are:

1) Sustainable development and income diversification.

2) Better salaries and job opportunities.

3) Women empowerment and gender equitability.

4) Environmental Awareness and preservation of the biodiversity, the Amazon Forest and ecosystem services.

5) Improve in health, nutrition, and safety.

6) Decrease of pollution.

Indicators of the well-being impacts from the project activities will be incorporated into the community impact monitoring plan's, based on Basic Necessity Survey and Participatory Assessment.

4.5.3 Community Participation Risks (GL2.3)

The eventual risks for the communities involved in the project will be identified through a participatory process, during meetings and onsite visits. The social team will also stay in communication with the community's representatives. Strategies and actions will be developed to avoid negative impacts, prioritizing communities most in need and dependent on the social actions undertaken by the project. Families and people with the greatest degree of vulnerability will be identified and will be closely followed through the socioeconomic indicators related to livelihood conditions.

In addition, the socioeconomic diagnosis obtained from the interviews with community members indicated that the project area is not used by the communities to any activity. Thus, the protection of the project area and actions to monitor it do not interfere on the communities and so, the project will cause no encroachment, no allocation, and no compensation to them as well.

4.5.4 Marginalized and/or Vulnerable Community Groups (GL2.4)

According to Socioeconomic Diagnosis conducted, all the visited communities in the Reference Region are relatively marginalized and vulnerable due the difficult in accessing public policies and services that ensure basic rights such as infrastructure in health, education, transportation, communication, as discussed in items 2.1.6. and 4.1.1..

In this sense, an important measure for access to public policies and the guarantee of exceptional rights in communities, is community empowerment, strengthening and improvement of socioeconomic indicators, through capacity trainings, education and consolidation of social organizations (table 90).

Table 90 – Net positive impacts, benefit access and negative impacts on Marginalized and/or vulnerable communities.

Community Group	Communities involved in the CAAPII REDD+ Project
Net positive impacts	The project activities are anticipated to generate net positive impacts on the well-being of all identified marginalized and/or vulnerable community (as shown in the sectors below). The community's participation and need have been part in the project activities design, thus, only positive benefits will be generated.
Benefit access	There are no barriers or risks that might prevent benefits access to marginalized and/or vulnerable smallholder/community members, since the management of the activities will be a responsibility of the project proponents, thus ensuring that the activities will happen to all and no deviations will occur. The community actions are a core of this project and the proponents have shown commitment with the project activities implementation.
Negative impacts	During the project lifetime, the community members, included marginalized and/or vulnerable smallholders/community members, will be consulted on the project. This consultation will have identified any suggestions and complaints on the project activities, as well as make a continuous diagnosis of the communities and project activities impacts, In the case of the identification of any negative impacts on any community member, including marginalized and/or vulnerable members. Carbonext has a team of social experts capacitated to mitigate the impacts. No project activity is expected to generate negative impacts, other than presented in sector 2.1.18.

4.5.5 Net Impacts on Women (GL2.5)

During the community diagnosis it was identified that the main occupation of the women of the communities is householding and helping the men in the agricultural activities, generally without payment. Thus, it is demonstrated that the women do not have a big participation in the family income, as well as financial

autonomy. The public consultation also assessed that woman have fewer leisure practices than the men (Figure 36).

Figure 36 - Two members of the Vila Diamantina community with the CAAPII poster. Photo taken by: Levi, Carbonext social team.

The project activities were designed to help improve the women well-being and empowerment, as shown in the table below (table 91). As the project advances in time, trust will be built and new information on women will be gathered, thus new activities can be proposed, especially related to women violence and sexual education. These topics will not be directly contemplated in this first approach, so conflicts can emerge and cause negative impacts to women on the communities.

Table 91- Activities Designed for Positive Impact on Women.

Activity	Net Impact on Women
Presence of women in the activities	Increase the participation of women in the project activities, generating increase in technical knowledge, in addition to promoting the equitability, empowerment, and independence of women.
Activities for the economic and sustainable development	Technical capability in different economic activities, making it possible to perform other types of activities rather than householding and agriculture. Also, the increase in knowledge also brings empowerment.
Health, nutrition and safety workshops/activities	Improvement on the women health, by increasing the access to healthcare, nutrition and safety information.
Creation of jobs position, directly or indirectly	The CAAPII REDD+ Project, intends to hire local community members, giving preference to integrate and promote diversity. The participation on the employment opportunities will be offered without any discrimination of gender, age, religion, marital status, or ethnicity, but will stimulate the hiring of women and other less favored groups to have equality. Especially, women will be encouraged to apply for the position.
Leisure activities directed to girls and women	Activities such as sport and hobby practices to women.

4.5.6 Benefit Sharing Mechanisms (GL2.6)

Community members have participated effectively on the decision-making process and the distribution mechanism for benefit sharing through a participatory process in the meetings with their representatives.

The date collected to characterize the communities were fully used to the design of the activities in all aspects such as health, gender equality and environmental education. As an example, the teacher Nádia from the Nova Esperança school and the principal Lídia from Conto de Fadas school participated directly on the choice of the topics to be introduced to the students from their schools, and this helped to direct the best way to begin the activities in the schools. The success of the events was so good that we intent to replicate for the other schools of the other communities identified for the CAAPII REDD+ Project.

The transparency of project will be ensured through accountability reports that will be shared with the communities and their representatives, itemizing all the expenses with the project activities.

4.5.7 Benefits, Costs, and Risks Communication (GL2.7)

Benefits, costs, and risks of the project were communicated to community during onsite visits and meetings, in addition, the Project Proponents or their representatives, and a social team member of the project will stay continuously in touch with communities through visits scheduled and consented by the community leaders and representatives and communication channels established such as the use of “whatsapp”. An official communication channel is being implemented to regularly update the communities.

The communication of benefits, costs and risks have already started in the onsite visits and meetings that took place on April, May and June 2022, when a member of social team personally visited the 6 communities located within the buffer of 20km of the project area. The community also shared their concerns of participating in the Project. As mentioned prior in the sector 2.3.4. no costs are passed on to the communities, since all the project activities will be funded by the project proponents.

In order to ensure the understanding of the project, the members of the communities signed a form.

4.5.8 Governance and Implementation Structures (GL2.8)

The project is managed and implemented by the project proponents that will, during the project lifetime, incorporate the communities in the project’s decisions making. Operating Procedures on the effectiveness

of the communication with the communities is being implemented in order to guarantee full and successful participation in the project. Participatory meetings will be held to collect feedbacks and make any necessary changes in the project design and activities.

For the participation on the project activities, the communities' members will be consulted based on their social representation in order to verify those interested in participating in the project's actions, including the internal community of farm workers. For this purpose, an organogram chart will be defined jointly through the participation of community members and local leaders.

4.5.9 Smallholders/Community Members Capacity Development (GL2.9)

Local leaders and community members will be invited to actively participate of the project's activities in its conception, implementation, management, and monitoring actions. All instances will have the active participation of genuine community representatives selected from themselves, promoting the empowerment of women and youth as well.

Among the project's goals are the improvement and diversification of income, with an increase in the standard of well-being and life quality conditions of community members. A strong involvement in biodiversity and climate issues is planned as well, to support and build local capacity to solve problems, conserve the forest and have a sustainable development.

5. BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions (B1.1)

As described in section 2.1., the Project Area and Zone are located in three different cities in the Pará state, in Brazil: Paragominas, Ipixuna do Pará and Tomé-Açu. These cities are under the influence of the Amazon Forest Biome, the largest Brazilian biome. The biodiversity in the region is extremely high due to the diverse vegetation and the Capim River Bay that have influence directly in the fauna and flora. It is estimated that

the biome is home to at least 10% of all known biodiversity in the world, and it also contains numerous endemic and endangered species[159].

For the project's biodiversity analysis, secondary data from scientific studies and publications in the region were used, as well as official data from federal government platforms (Ministry of the Environment - MMA[160] and Chico Mendes Conservation of Biodiversity Institute - ICMBIO[161]), Database platforms for occurrence, sightings and vulnerability status were also used, such as Wikiaves[162], The IUCN Red List of Threatened Species[163], the Red Book of the Brazilian Fauna Threatened with Extinction[164] and the CNCFlora's 2014 Red List of Threatened Brazilian Flora[165].

No fauna survey has been conducted ex ante to the project, Biodiversity survey and monitoring fields to be conducted by Carbonext are planned for the Monitoring Report verification phase.

5.1.1.1 Amazon Biodiversity

The total area of the Amazon Biome is 6.7 million km² and covers 8 countries: Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana and Suriname, also including the overseas territory of French Guyana. This biome is defined by its predominantly dense tropical rainforest vegetation cover, but with the presence of several other types of vegetation such as savannas, floodplain forests, grasslands, swamps, bamboo and palm forests[41].

Within this immense territory lies the largest hydrographic basin in the world: the Amazon basin, it covers about 6 million km², with 1,100 tributaries. Its main river, the Amazon River, crosses the continent flowing into the Atlantic Ocean, discharging into the sea about 175 million liters of water per second[42].

In Brazil, the Amazon biome extends over more than 40% of the national territory, with an immense cultural and biodiversity wealth. It is commonly agreed in the scientific community that the species of fauna and flora have not yet been fully documented and several new species are frequently described[41]. According to

[159] WWF, 2022. Available on: https://wwf.panda.org/discover/knowledge_hub/where_we_work/amazon/about_the_amazon/. Acessed in: 15/02/2022.
[160] MMA - MINISTÉRIO DO MEIO AMBIENTE. Offical website of the Ministry of Environment. Available on: https://antigo.mma.gov.br/biomas/amaz%C3%B4nia.html. Accessed in 15/02/2022.
[161] ICMBIO - Instituto Chico Mendes de Conservação da Biodiversidade. Offical website: https://www.icmbio.gov.br/portal/centrosdepesquisa/biodiversidade-amazonica. Accessed in 15/02/2022.
[162] WikiAves, a Enciclopédia das Aves do Brasil. Offical website: http://www.wikiaves.com.br. Accessed in : 15/02/2022.
[163] IUCN. 2022. The IUCN Red List of Threatened Species. Version 2021-3. https://www.iucnredlist.org. Accessed in: 15/02/2022.
[164] ICMBIO 2018 - Livro Vermelho da Fauna Brasileira Ameaçada de Extinção: Volume I / -- 1. ed. -- Brasília, DF: ICMBio/MMA, 2018.
[165] CNCFlora, 2014. Offical website: https://www.wikiaves.com.br/index.php. Accessed in 15/03/3022.

the MMA[42], there are more than 2,500 species of trees in the Amazon (which corresponds to one-third of all tropical wood in the world) and more than 30,000 species of plants[41].

According to the Society, Population and Nature Institute[166], the Amazon biome is the most biodiverse biome in Brazil, with more than 73% of the mammal's species and 80% of the bird species existing in the country. The number of catalogued species is almost 3 million, which 2.3 million are only invertebrates such as arthropods (insects, arachnids, crustaceans, etc). There are known at least 311 species of mammals, 1,300 of birds, 273 of reptiles, 232 amphibians and 1,800 fishes of fresh water in the Amazonian biome.

Although there is this great abundance present in the Amazon Forest, all that biodiversity is also in great danger: 15.3% of all the endangered species in Brazil are from the Amazon Biome. According to the Portal Amazônia[167], the Red Book of endangered Fauna of Brazil (ICMBIO, 2014) cited 180 species, of which 124 are endemic from this biome.

The main factor of pressure to continental species is a result of anthropic activities such as farming and large constructions such as hydroelectric dams. Each of these activities threatens approximately 94 different species (Portal Amazônia). Hunting, fishing, and capture affect 52 important species, ranking third in threats to the fauna of the Amazon. Although hunting and fishing provide food for consumption by local communities, they are also practiced for sport and in retaliation for the predation of livestock, such as the persecution suffered by the big cats that sporadically feed on cattle ranches (Portal Amazônia). The capture of live individuals is practiced to sustain the wild animal trafficking. There are many other legal and, especially, illegal practices that threaten the biodiversity of the Amazon biome, such as logging, road and residential construction, mining, housing development, unorganized tourism and increased urbanization[168].

5.1.1.2. Biodiversity in the region of the project

The Amazon Biome can be sub-divided according to different criteria: geographical, sociocultural, political, and many others. In terms of biodiversity, this biome can be distinguished in endemism areas, according to the concentration of restricted distribution of species in specific areas[169]. Currently, there are 8 endemism's areas delimited in the Amazon: Imeri, Guiana, Napo, Inambari, Belém, Rondônia, Tapajós and

[166] ISPN – Instituto Sociedade População e Natureza. Available on: https://ispn.org.br/biomas/amazonia/fauna-e-flora-da-amazonia/ . Accessed in 15/02/2022.
[167] Portal Amazônia. Available on: https://portalamazonia.com/amazonia/livro-vermelho-da-fauna-amazonia-tem-180-especies-sob-risco-de-extincao. Accessed in 15/02/2022.
[168] ICMBIO 2018 - Livro Vermelho da Fauna Brasileira Ameaçada de Extinção: Volume I / -- 1. ed. -- Brasília, DF: ICMBio/MMA, 2018.
[169] Conservation Internacional. Available on: https://www.conservation.org/brasil/onde-trabalhamos/centro-de-endemismo-belem. Accessed in 15/02/2022.

Xingu. The cities of the project (Paragominas, Ipixuna do Pará and Tomé-Açu) are located in the Belém Endemism Area.

The Belém Endemism Area has an extremely rich biodiversity, but at the same time it is indicated as the most threatened are of endemism in Brazil, mainly due to habitat loss, consequence of deforestation for expansion of agriculture and cattle raising activities in the region. More than 70% of its forest's covers are already turn in to other uses of land such as cattle raising, agriculture of soybeans and other grains, occupation for housing and logging, illegal in many cases (according to the agronomic engineer Thiara Fernandes, from the Peabiru Institute, in interview[170]).

In order to evaluate the biodiversity of the project region, data from specific studies close to the region were accessed, such as scientific papers[171] [172] and an "Socio-environmental atlas: cities of Tomé-Açú, Aurora do Pará, Ipixuna do Pará, Paragominas and Ulianópolis'[173]. The Study of Environmental Impact ('EIA") of the construction of the Pará railroad[174], made by Terra Meio Ambiente, was also assessed, For the specific Avifauna of the municipalities of this project the WikiAves data platform was used.

In addition to the secondary data survey, the threat and vulnerability status was confirmed on The IUCN Red List of Threatened Species, in the Red Book of the Brazilian Fauna Threatened with Extinction (ICMBio) and the Red List of Threaten of Brazilian Flora of the National Center of Flora Conservation (CNCFlora) (all cited above).

Legend for the vulnerability status (IUCN):

CR= Critically Endangered
EN= Endangered
VU= Vulnerable
NT= Near Threatened

Increased threat level

[170] Diálogo Florestal, 2020. 'Centro de Endemismo Belém: desafios e diálogo". Report written by Juliane Ferreira. Available on: https://dialogoflorestal.org.br/centro-de-endemismo-belem-desafios-e-dialogo/ .Accessed in 14/03/2022.
[171] Maués, P. C. R .A; Bueno; A. S., Palmeirim, A. F.; Peres, C.; Oliveira, A . A. M. (2022). Assesing assemblage-wide mammals responses to different types of habitat modification in Amazonian forests. Scientific reports at Nature Portfolio. Available on: https://doi.org/10.1038/s41598-022-05450-1. Accessed in 17/03/2022.
[172] de Souza, E. B; de Melo, L. E. M. (2020). "A ocorrência da mastofauna terrestre em áreas mineradas submetidas a métodos de restauração florestal em Paragominas, Pará." Undergraduation project – Forestry Engineering, Campus Universitário de Paragominas, Universidade Federal Rural Da Amazônia, Paragominas. Professor: Prof. Anderson Gonçalves da Silva Da Silva. Available on: http://bdta.ufra.edu.br/jspui/bitstream/123456789/1707/1/TCC%20-%20Edu%20e%20Layla%20%28DEF%29.pdf . Accessed in: 10/03/2022.
[173] "Atlas socioambiental: municípios de Tomé-Açú, Aurora do Pará, Ipixuna do Pará, Paragominas e Ulianópolis". Maurílio de Abreu Monteiro, Maria Célia Nunes Coelho, Estêvão José Silva Barbosa; Belém: NAEA, 2008.
[174] EIA - Estudo de impacto ambental : Ferrovia Paraense S.A. 2017. Volume VI.Terra Meio Ambiente.

The species were classified according to the Red List´s criteria, and the legend of the classification is showed above. Based on the biodiversity survey carried out with secondary data obtained from the above-mentioned works, 1,609 species of flora and vertebrate fauna can be found in the region of the project (Table 92).

Table 92 - Fauna and Flora expected in the project area, Source: IUCN (2022), Wikiaves (2022), ICMBio (2018), CNCFlora (2018) and EIA Ferrovia Pará (2017).

Vertebrate Group and Flora	Number of species
Avifauna	530
Mammals	82
Herpetofauna	109
Ichthyofauna	107
Flora	618
Total biodiversity	**1609**

Avifauna

To evaluate the avifauna, bird sighting data from WikiAves for the municipalities of Paragominas, Ipixuna do Pará and Tomé- Açu and the article from Aleixo et al. (2013)[175] were used, A total of 530 species are expected in the project region, of which 26 are threatened in some level and/or are endangered (Table 93).

Table 93 - Avifauna species under some degree of threat in the IUCN lists and in the Red Book of the Brazilian Fauna Threatened with Extinction, Source: IUCN (2022), ICMBio (2018).

Nº	Família	Espécie	Nome popular	Red List IUCN	Livro Vermelho
1	**Tinamidae**	***Tinamus guttatus***	**Inhambu-galinha**	**NT**	
2		***Tinamus tao***	**Azulona**	**VU**	**VU**
3	**Cracidae**	***Penelope superciliaris***	**Jacupemba**	**NT**	
4		***Penelope pileata***	**Jacupiranga**	**VU**	**VU**
5	**Cuculidae**	***Neomorphus geoffroyi***	**Jacu-estalo**	**VU**	**VU**
6	**Psophiidae**	***Psophia obscura***	**Jacamim-de-costas-escuras**	**CR**	**CR**

[175] Aleixo, A. et al. 2013. Paragominas: a quantitative baseline inventory of an eastern Amazonian avifauna. Revista Brasileira de Ornitologia - Brazilian Journal of Ornithology, [S.l.], v. 20, n. 48, p. 26. ISSN 2178-7875. Available on: http://www.revbrasilornitol.com.br/BJO/article/view/4703. Accessed in 09/03/2022.

Nº	Família	Espécie	Nome popular	Red List IUCN	Livro Vermelho
7	Ardeidae	*Zebrilus undulatus*	Socoí-zigue-zague	NT	
8	Cathartidae	*Sarcoramphus papa*	Urubu-rei		NT
9	Accipitridae	*Harpia harpyja*	Harpia	VU	VU
10		*Spizaetus ornatus*	Gavião de penacho	NT	NT
11	Ramphastidae	*Ramphastos tucanus*	Tucano-de-papo-branco	VU	
12		*Ramphastos vitellinus*	Tucano-de-bico-preto	VU	
13		*Pteroglossus bitorquatus*	Araçari-de-pescoço-vermelho	EN	NT
14	Falconidae	*Falco deiroleucus*	Falcão-de-peito-laranja	NT	
15		*Pyrilia vulturina*	Curica-urubu	VU	VU
16	Psittacidae	*Amazona farinosa*	Papagaio-moleiro	NT	
17		*Pionites leucogaster*	Marianinha-de-cabeça-amarela	EN	
18		*Pyrrhura coerulescens*	Tiriba-pérola	NT	VU
19		*Pyrrhura amazonum*	Tiriba-de-Hellmayr	EN	
20		*Pyrrhura lepida*	Tiriba-pérola	VU	VU
21		*Guaruba guarouba*	Ararajuba	VU	VU
22	Grallariidae	*Hylopezus paraensis*	Torom-do-pará		VU
23		*Dendrocolaptes medius*	Arapaçu-barrado-do-leste		VU
24	Pipridae	*Lepidothrix iris*	Cabeça-de-prata	VU	EN
25	Cotingidae	*Xipholena lamellipennis*	Anambé-de-rabo-branco	NT	
26	Tyrannidae	*Contopus cooperi*	Piuí-boreal	NT	NT

Nº	Família	Espécie	Nome popular	Red List IUCN	Livro Vermelho

The birds are very threatened by the habitat loss, but the hunting for sports and for food are also contributing to the decline of the populations[176]. All species mentioned in the lists of threatened species, both globally and nationally, should always be a point of attention and priority in preservation projects. For the avifauna in the region of this project, the species *Tinamos tao*, *Penelope pileata, Neomorphus geoffrovi, Harpia harpyja, Pyrilia vultina* and *Pyrrhura lepida* should be highlighted for their "VU" status in both Red Lists of Endangerd Fauna (IUCN and ICMBio).

The presence of the species *Harpia harpyja,* indicates that the environment is good and preserved, since this bird is a top predator and is consider a bioindicator species. However, its population trend is decreasing because of hunting, poaching and persecution of this species in the region[177], *Guaruba guaruba* is also vulnerable in both lists, and appears with the same status at the resolution n° 54 from the Pará state[178] ("List of Species Threatened with Extinction from Pará State", 2007). In addition, this species in only found in the Endemism Centre of Belém, being endemic from the Brazilian Amazon[179]. The species *Lepidothrix íris, Pteroglossus bitoruqatus, Pionites leucogaster, Pyrrhura amazonum, Xiphrorhynchus guttatoides* and *Psophia obscura* should receive even more attention due to their elevated threat status. Some of these species are shown below (figure 37 a-c).

[176] Parque das Aves, 2022. Available on: https://www.parquedasaves.com.br/nosso-trabalho/o-problema/caca/. Accessed in 23/03/2022.
[177] IUCN. 2022. Available on: https://www.iucnredlist.org/species/22695998/197957213 . Accessed in 11/04/2022.
[178] Semas – Secretaria do Meio Ambiente e Sustentabiliade do Estado do Pará. Resolution n°54. Available on: https://www.semas.pa.gov.br/anexos_legislacao/Anexo_resolucao_054%20coema.pdf. Accessed in 11/04/2022.
[179] https://www.ioc.fiocruz.br/pages/diretoria/noticias/julho03/mat04.htm

Figure 37 a, b and c - In order from left to rigth: *Psophia obscura, Lepidothrux íris and Pyrrhura amazonum*, Photos: Wikiaves[180].

Mammals

The secondary data survey of mammals present in the region was based on data from two scientific articles conducted in the city of Paragominas (Maés et al.; de Souza et al,), on the Study of Environmental Impact of the Pará railroad[56] and on the Plano de Manejo of the Maringá e Catarinense Farm[181], Considering these projects, 82 mammals species occur in the region, Of these, 16 species are classified with some degree of threat (Table 94).

Table 94 - Mammals species under some level of threat in the region of the CAAPII Project. Source: IUCN (2022), ICMBio (2018).

Nº	Família	Espécie	Nome popular	Red List IUCN	Livro Vermelho
1	Myrmecophagidae	*Myrmecophaga tridactyla*	Tamanduá-bandeira	VU	VU
2	Atelidae	*Alouatta belzebul*	Guariba-de-mãosruivas	VU	VU
3		*Ateles paniscus*	Macaco-aranha	VU	
4	Cebidae	*Cebus kaapori*	Caiarara	CR	CR
5		*Sapajus libidinosus*	Macaco-prego	NT	NT
6	Callitrichidae	*Saguinus niger*	Sagui-una	VU	VU

[180] https://www.wikiaves.com.br/
[181] Forestry plan of the Fazenda Maringá e Catarinense. 2019.

Nº	Família	Espécie	Nome popular	Red List IUCN	Livro Vermelho
7		*Saguinus ursulus*	Sagui-una	VU	
8	Pitheciidae	*Chiropotes satanas*	Cuxiú-preto	EN	CR
9	Dasypodidae	*Priodontes maximus*	Tatu-canastra	VU	VU
10	Tapiridae	*Tapirus terrestris*	Anta	VU	VU
11	Tayassuidae	*Tayassu pecari*	Queixada	VU	VU
12	Canidae	*Atelocynus microtis*	Cachorro-do-mato-de-orelhas-curtas	NT	VU
13		*Speothos venaticus*	Cachorro-vinagre	NT	VU
14	Felidae	*Leopardus wiedii*	Gato-maracajá	NT	VU
15		*Panthera onca*	Onça-pintada	NT	VU
16		*Puma concolor*	Onça-parda		VU

Mammals are fundamental to the maintenance of ecosystems[182] and, consequently, to the generation of associated ecosystem services. Small mammals, for example, play an important role at the base of the food chains of many other creatures. Furthermore, together with primates (such as *Alouatta belzebul, Ateles paniscus, Cebus kaapori, Sapajus libidinosus, Saguinus niger, Saguinus ursulus* and *Chiropotes satanas*), bats and big herbivores such as the tapirs (*Tapirus terrestris*), they are essential in the maintenance of the ecosystems because of seed dispersal[183]. Carnivores on the top of the food chain (like *Atelocynus microtis, Speothos venaticus, Leopardus wiedii, Panthera onca* e *Puma concolor*) play a fundamental role in the conservation of biodiversity (ICMBIO). They regulate and structure the communities through predation and are therefore considered key species, Carnivores also function as "umbrella species", since efforts to

[182]ICMBIO - Mamíferos Ameaçados de Extinção no Brasil, in Livro Vermelho da fauna brasileira Ameaçada de extinção. VOLL II, Pag, 687. Available on: https://www.icmbio.gov.br/portal/images/stories/biodiversidade/fauna-brasileira/livro-vermelho/volumeII/Mamiferos.pdf. Accessed in 11/04/2022.
[183] Barcelos, A. R. C. W. Dieta frugívora e potencial de dispersão de sementes de Tapirus terrestris (Mammalia, Perissodactyla) em um mosaico de floresta. Manaus. 2011. Dissertação (Biologia (Ecologia)) - Instituto Nacional de Pesquisas da Amazônia. Available on: https://bdtd.inpa.gov.br/handle/tede/1813 . Accessed in 11/04/2022.

conserve their populations end up also preserving other species in the community and are therefore essential targets for conservation projects (ICMBIO).

Considering their indispensable role for the preservation of the ecosystem, the mammals' species are in general crucial for conservation and monitoring programs globally, ensuring also the preservation of other species as direct consequence. All mammal species threatened in the project region are medium to large size, these are the most hunted animals, they are very sensitive to disturbances to the environment and habitat loss. These mammals need large areas, a balanced environment with quality resources, allowing their adequate feeding, reproduction, safety, and survival in general. Only than they are capable of maintaining the homeostasis of the ecosystem[61]. Special attention should be given to *Chiropotes satanas e Cebus kaapori,* because of their appearance on at least one of the red lists with a critical status (EN / CR), being important target priorities for conservation projects (Figure 38 a and b).

Figure 38 - The primates a) Cebus kaapori and b) Chiropotes satanas, both extremely endangered species. Source of the images: photo by Val Campos (https://conexaoplaneta.com.br/blog/mais-700-animais-entram-na-lista-nacional-de-especies-ameacadas-de-extincao-que-dobrou-de-tamanho-em-oito-anos/) and Fábio N. Manfredini (https://faunafloraextincao.blogspot.com/2015/03/cuxiu-preto.html).

In addition to the vulnerability status, there are other criteria that must be always consider. The species *Alouatta belzebul, Cebus kaapori*[184], *Saguinus niger*[185] and *Chiropotes satanás* are even more relevant because they are exclusive to the Belém Endemism Area[186]. This fact shows the necessity to maintain and conserve these species and the own Belém Endemism Area itself.

Herpetofauna

[184] https://ava.icmbio.gov.br/mod/data/view.php?d=17&rid=2491
[185] https://repositorio.inpa.gov.br/bitstream/1/11911/1/Disserta%C3%A7%C3%A3o_%20INPA.pdf
[186] https://www.ioc.fiocruz.br/pages/diretoria/noticias/julho03/mat04.htm

To evaluate the herpetofauna of the region, data from the "Socio-environmental Atlas" was used. The following groups were considered in this survey: amphibians, snakes, chelonians, amphisbaenians, lizards and alligators. There are 109 species registered in the region of the project, of which two species of Chelonians are threatened according to the global and national red lists (table 95).

Table 95 - Chelonian species under some level of threat. Source: IUCN (2022) , ICMBio (2018).

Nº	Família	Espécie	Nome popular	Red List IUCN	Livro Vermelho ICMBIO
1	**Podocnemididae**	***Podocnemis unifilis***	**Tracajá**	**VU**	**NT**
2		***Podocnemis expansa***	**Tartaruga-da-Amazônia**		**NT**

Both species showed above are chelonians present in the Capim River (figure 39 a and b). These species are majorly threatened because the local population consume their meat, having their eggs, young individuals and adults widely hunted. According to narratives from the Atlas, alligators are also hunted in the waters of the Capim River, and it has already caused the local extinction of the "jacaré-açu" (*Melanosuchus niger*) in some areas of the river.

Figure 39 – a) Podocnemis unifilis – Tracajá (photo from Rafael Balestra, available on https://www,icmbio,gov,br/portal/faunabrasileira/estado-de-conservacao/7426-repteis-podocnemis-unifilis-tracaja - last access in 18/03/2022); Picture b) Podecnemis expansa – tartaruga da Amazônia (Photo by Rafael Valadão, available on https://www,icmbio,gov,br/portal/faunabrasileira/estado-de-conservacao/7431-repteis-podocnemis-expansa-tartaruga-da-amazonia2 - accessed in 18/03/2022),

Ichthyofauna

A total of 119 fresh water fish species from the Capim River were found in the data available on the Socio-environmental Atlas and in the book "Fishes of the Madeira River"[187]. None of the species found are on the red lists of fauna (IUCN and ICMBIO), however, it is worth to mention that there are few studies about the Ichthyofauna in the region[188], and the absence of any species in the red list does not mean that it is not threatened, it can imply lack of data and the necessity of more studies. Highlight for the species *Argonectes robertsi*, considered by the book of Fishes of the Madeira River limited to the Tapajós, Xingu, Tocantins and Capim amazonian rivers (Figure 40). The main threats to this group are the pollution and disturbances on the environment and the excessive fishing.

Figure 40 - Argonectes robertsi – Jatuarana (photo taken by Gabriel Lelis Togni, available on https://www,fishbase,de/summary/Argonectes-robertsi,html, Accessed in 18/03/2022),

Flora

The Floristic Survey was based on the secondary data from the Atlas. Considering this study, 791 species of flora were found. Of these, 8 species are consider threatened (table 96).

Table 96 - Flora species with some degree of threat on the global (IUCN, 2018) and national (CNCFlora, 2014) red lists.

Nº	Família	Espécie	Nome popular	Red List IUCN	Livro Vermelho CNCFlora
1	Sapotaceae	*Pouteria krukovii*	Maparajuba	VU	
2		*Pouteria oppositifolia*	Abiurana	VU	NT

[187] Queiroz, L. J. et al. 2013. Peixes do Rio Madeira. 1. ed. São Paulo. Dialeto Latin American Documentary, 2013. Several authors. Organization by: Gislene Torrente-Vilara, Willian Massaharu Ohara, Tiago Henrique da Silva Pires, Jansen Zuanon, Carolina Rodrigues da Costa Doria.
[188] Castro, R. M. C. Evolução da ictiofauna de riachos sul-americanos: padrões gerais e possíveis processos causais. 1999. In "Atlas socioambiental: municípios de Tomé-Açú, Aurora do Pará, Ipixuna do Pará, Paragominas e Ulianópolis". Maurílio de Abreu Monteiro, Maria Célia Nunes Coelho, Estêvão José Silva Barbosa; Belém: NAEA, 2008.

Nº	Família	Espécie	Nome popular	Red List IUCN	Livro Vermelho CNCFlora
3	Fabaceae	*Apuleia leiocarpa*	Cumaru Cetim		VU
4		*Mora paraensis*	Pracaúba Branca	NT	
5		*Vouacapoua americana*	Acapu	CR	EN
6	Myristicaceae	*Virola surinamensis*	Ucuúba	EN	VU
7	Rutaceae	*Euxylophora paraensis*	Pau Amarelo	EN	EN
8	Bignoniaceae	*Handroanthus serratifolius*	Ipê-amarelo	EN	

Among these important species, the *Handroanthus serratifolius*, *Voucapoua americana, Virola surinamensis* and *Euxylophora paraenses* are endangered due to the exploration of their timber (figure 41 a to d), overexploitation by the industry and illegal logging as well. Some of these species are also used to local medications and oils (local production).

Figure 41 -a) *Handroanthus serratifolius* (Photo by Geof Gallice, available on https://live,staticflickr,com/65535/50291272947_3d906a016d_z,jpg, Accessed in 04/04/2022), b) *Voucapoua americana* (Photo available on http://www,amazonflora,com,br/product-page/acap%C3%BA , last accessed in 04/04/2022), c) Bowl made of *Euxylophora paraenses* (Photo available on https://madeireiracedrotatui,com,br/blog/tipos-de-madeira/madeira-pau-amarelo-amarelao/ , last accessed in 04/04/2022), c) Fuits, seeds and leaves from *Virola surinamensis* (Photo by Dr, Robin B, Foster, available on https://plantidtools,fieldmuseum,org/pt/nlp/catalogue/3671302 , Accessed in 04/04/2022).

5.1.2 High Conservation Values (B1.2)

The High Conservation Values (HCVs) identified and related to biodiversity in this project were HCV 1 - Diversity of Species and HCV 3 - Ecosystems and Habitats, presented in the following tables (97 and 98).

Table 97 - Biodiversity HCV identified.

High Conservation Value	HCV 1 – Diversity of Species: rich biodiversity and 11 priority species for conservation (species are specified in sector 5,5,1)
Qualifying Attribute	The project area has great areas with remaining native forests and the biodiversity of the region is very rich. The project area is habitat for priority species such as threatened, endemic and endangered species, specially of birds and mammals. The list of species with some degree of threat and priority species are presented in sector 5.1.1. and 5.5.1. respectively.
Focal Area	It is necessary to conserve and protect in totality the current vegetation in the project area (33,766.64 ha), maintaining biodiversity monitoring and carrying out educational-environmental activities in order to present more sustainable practices and create environmental awareness on the importance of biodiversity and conservation. The monitoring and the activities of environmental education will be applied in the project region, and this will benefit the outside-project area as well.

Table 98 - Another biodiversity HCV identified for the CAAPII REDD+ Project.

High Conservation Value	HCV 3 – Ecosystems and Habitats: Threatened/rare ecosystems
Qualifying Attribute	The Amazon is the largest tropical forest in the world, being very important and responsible for the provision of ecosystem services (such as water production and climate regulation), it is habitat for threatened and key species of biodiversity, it provides medicinal substances and local medicinal knowledge, the forest is home to

	traditional communities and promotes genetic variability of species, and many others. There are more than 24 million people living in the Amazon Forest region, and they are dependent on the forest for shelter, water, food, source of income, recreation and tourism[189], with a unique cultural value. The Central Amazon Humid Forest is considered "vulnerable" (VU) in the IUCN Red List of Ecosystems[190].
Focal Area	It is necessary to conserve and protect in totality the current vegetation in the project area (33,766.64 hectare), maintaining constant monitoring to protect it from illegal exploration, degradation, fires, invasion, and others.

5.1.3 Without-project Scenario: Biodiversity **(B1.3)**

The state of Pará has an enormous history of deforestation in the Amazonian Forest, and this is the most important factor that must be considered in the without-project scenario, regarding fauna and flora. The less forest there is, the greater the biodiversity loss. The without-project scenario in the region shows that deforestation for soy culture, expansion of pasture areas for cattle raising, legal and illegal logging will likely continue to increase in the coming years.

The implementation of the Carbonext CAAPII REDD+ Project will protect 33,766.64 ha of the Amazon Forest, an essential area for biodiversity and environmental integrity, avoiding fragmentation, destruction and conversion of native forest into other land use activities presented above, which would likely happen in the next few years without the project. Thus, it is intended to prevent the removal of plant and animal individuals, soil degradation and the loss of genetic diversity, loss of habitat, evasion and death of fauna and flora.

It is planned in the conservation of the biodiversity, the periodic monitoring of the fauna and flora species of the project area. This is a project activity relevant to the evaluation of the impacts of the project, but it is also important to the conservancy of species in terms of scientific research and data provision to studies, only knowing the biodiversity, it is possible to protect it.

[189] Greenpeace, 2022. Available on https://www.greenpeace.org/usa/issues/brazil-and-the-amazon-forest/. Accessed in 18/03/2022.
[190] The IUCN Red List of Ecossystems, 2022. Available on https://assessments.iucnrle.org/assessments/299. Accessed 11/04/2022.

The CAAPII REDD+ Project also aims to conserve the biodiversity through the implementation of several environmental education activities with the communities to decrease the pollution of nature, the pressure of hunting and bring environmental awareness on the importance of the life of the species. Besides their intrinsic importance, they are also essential to the ecosystem services that directly benefits all the living beings, including the humans.

Other actions aimed at health, professionalization and sustainable practices are being planned and developed to be implemented with the communities in the region. These activities and actions aim to benefit social and environmental aspects, directed, for example, to reduce hunting, decrease on the impact of the activities through sustainable development, bring knowledge of ecosystem services arising from the influence of biodiversity on nature, training to prevent fires that would also benefit the local fauna and flora, activities related to conservation of priorities species of fauna and flora, zoonoses, among others.

In conclusion, in the without-project scenario, the protection of 33,766.64 ha of Amazon Forest, the implementation of biodiversity monitoring, the environmental education activities, the trainings on fire brigade and sustainable practices would not happen and would not bring benefits to biodiversity, climate nor the community.

5.1.3.1. Deforestation

According to data from Terra Brasilis[191] , based on Prodes/IBGE, since 2006, the state of Pará has been the one that most deforests in Brazil, for 16 consecutive years. In 2021, Pará deforested approximately 43% of all deforested areas in Brazil. Such exploitation of the Amazon region is associated with historical incentive policies by the Brazilian government since the 1970s: the government promoted investments in mining, logging, expansion of agricultural frontiers and infrastructure construction. One of the projects developed was the Trans-Amazonian Highway, in the Amazon, to stimulate the country's development through the exploitation of natural resources and occupation of the North region of Brazil.

Deforestation of large areas of native tropical forest threatens biodiversity in several ways. Whether by decline of quality or habitat loss, the consequences are: loss of genetic variability, insufficient resources, greater intra- and interspecific competition, proximity to the cities and hunting, contamination by pesticides and other agriculture poisons, mining wastes and garbage, and many others.

[191] Terra Brasilis. 2022. Available on: http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/amazon/increments. Accessed in 11/04/2022.

There are several different deforestation causes in the state, all of which are associated with anthropic activities. The main causes are: logging and timer exploration, expansion of agricultural frontiers, increase in the production and in the value of soybean, other crops and cattle/meat.

5.1.3.2. Soybean cultivation and production

Soybean in Pará is produced on a large scale and its production has been growing rapidly over the last few years. In 2017, the state of Pará produced 1,632,115.00 tons of soybeans in approximately 500 thousand hectares, with about 85.16% of this production produced in the Pará Southeast Mesoregion[192]. Belonging to this region, the municipality of Paragominas has soybean cultures as one of the main points of its economy. Still according to Oliveira et al., in the same year of 2017, the city produced approximately 440 thousand of this grain, which corresponds to 31.6% of all production of Pará Southeast. This production increased from 121,800 tons in 2014 to 486,000 tons in 2019, showing an upward trend (Figure 42). Despite occurring on a smaller scale, the municipality of Ipixuna do Pará follows the same trend of increasing soybean production: in 2015, 2,310 tons were produced and this amount increased by approximately 939% until the year 2019, with production of 21,700 tons.

[192] Oliveira, L. S. et al. 2019. SPATIOTEMPORAL ANALYSIS OF PLANTED AREA AND SOYBEAN PRODUCTION OF PARAGOMINAS MICROREGION, SOUTHEAST OF PARÁ. Available on: https://cointer.institutoidv.org/inscricao/pdvagro/uploadsAnais2020/AN%C3%81LISE-ESPA%C3%87O-TEMPORAL-DA-%C3%81REA-PLANTADA-E-PRODU%C3%87%C3%83O-DE-SOJA-DA-MICRORREGI%C3%83O-DE-PARAGOMINAS,-SUDESTE-DO-PAR%C3%81.pdf (accessed in 06/06/2022)

Figure 42 - Soybean production *(in tons) from 2014 to 2019 in the cities of Paragominas and Ipixuna do Pará, in Pará State. Source: IBGE, 2021.*[193] [194]

Some factors were pointed out as the main facilitators for increasing this production in the region: cheaper land, strategic location close to highways and ports, topography compatible with mechanized agriculture and a favourable climate for soybean culture[195]. Still according to Pastana Filho[76], another factor that encourages its extensive plantation is profitability in relation to other activities. In this way, several areas have been incorporated into the soybean production system and many others are seen as potential for conversion into culture, with a tendency to expand the agricultural limits of this grain over non-consolidated areas/forest areas.

5.1.3.3. Cattle raising

In the Amazon biome region, the growth of agriculture and cattle raising corresponds to 14% across the country, and the state of Pará alone holds 9.4% of the entire cattle herd in Brazil, According to Carvalho et al.[196], in Paragominas in the period from 2008 to 2014 there was an expansion of the livestock area of clean pasture by 369%, Livestock farming has been identified as the activity that most deforests new areas in Pará: in the municipality of Paragominas, changes in land use occur due to the relative profitability of each activity, where, for example, dirty pastures are converted into crops; and forest areas are deforested and converted into clean pastures as they are more productive and therefore more profitable (Rosário 2020)[197].

5.1.3.4. Timber exploration and logging

The extraction of wood to produce charcoal, firewood and timber in logs/roundwood in the cities of Paragominas, Ipixuna do Pará and Tomé-Açu is another relevant economic activity. The production of

[193] IBGE , 2021. Available on: https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/14/10193?tipo=grafico&indicador=10368 . Accessed in 11/04/2022.
[194] IBGE, 2021. Available on: https://cidades.ibge.gov.br/brasil/pa/ipixuna-do-para/pesquisa/14/10193?tipo=grafico&indicador=10368 Accessed in 11/04/2022.
[195] Pastana Filho, H. E.S. F; Araújo, I. O.; Lins, B. S; da Silva, N. S. G.; Maciel, G. P. EVOLUÇÃO DA PRODUÇÃO DE SOJA DO MUNICÍPIO DE PARAGOMINAS, SUDESTE PARAENSE. 2019. Apresentação de pôster no IV Congresso Internacional das Ciências Agrárias. Cointer – PDVAgro 2019. Available on: https://cointer.institutoidv.org/inscricao/pdvagro/uploadsAnais2020/EVOLU%C3%87%C3%83O-DA-PRODU%C3%87%C3%83O-DE-SOJA-DO-MUNIC%C3%8DPIO-DE-PARAGOMINAS,-SUDESTE-PARAENSE.pdf. Accessed in 14/03/2022.

[196] Carvalho, F.S.; Thompson, K.N.N ; Lima, W.A.S. ; Melo, M.R.S.; Núbia de Fátima Alves Santos, N.F.A.S.; Borges, L.S.B ; Souza,V.Q. ; Guerreiro, A.C. DINÂMICA DE USO DA TERRA, NO SETOR AGROPECUÁRIO, EM PARAGOMINAS – PA Agroecossistemas, v. 9, n. 2, p. 148 – 163, 2017, ISSN online 2318-0188. Available on: file:///C:/Users/Paula%20Ho/Downloads/5074-18807-1-PB%20(3).pdf. Accessed in 11/04/2022.
[197] https://www.ppgsp.propesp.ufpa.br/ARQUIVOS/teses_e_dissertacoes/dissertacoes/2018/201820%20-%20ROS%C3%81RIO.pdf

roundwood and firewood in 2020 in the municipalities corresponded to 449,161.00 m³ of wood removed[198]. The extraction of wood to produce charcoal in the project cities corresponded to 26,816.00 tons of wood, equivalent to 37.1% of all production in the state of Pará in 2020[199]. In addition to this high volume extracted legally, there is also illegal logging. According to data from the study carried out by the Simex Network[200], illegal logging in the state of Pará reached 27,595 hectare (from 2019-2020), In the period of 2018-2019. this value was 22,906 ha, which represents an increase of 20% from one period to another. The ranking of the cities that most explore illegal logging shows Paragominas as the city with the largest logged area, with 8,073 ha, The city of Tomé-Açu is the seventh on the list (Figure 43).

Figure 43 - Ranking with the top 10 cities of Pará that most explore illegal logging between 2019-2020. Source: Imazon and Simex (2021).

An alternative to reduce invasions and illegal logging could be the sustainable forest management, However, selective timber exploration in the Amazon Forest cannot even provide enough wood and products for domestic demand and market, resulting in the expansion of logging areas in primary forests. Low intensity and long cutting cycles fail to produce enough wood in time to regenerate the necessary

[198]IBGE, 2020. **Cidades Paragominas**. Available on: https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/16/12705. Accessed in 14/04/2022.
[198] IBGE, 2020. Cidades: Tomé-Açu. Available on: https://cidades.ibge.gov.br/brasil/pa/tome-acu/pesquisa/16/12705. Accessed in 14/04/2022.
[198] IBGE, 2020. Cidades: Ipixuna do Pará. Available on: https://cidades.ibge.gov.br/brasil/pa/ipixuna-do-para/pesquisa/16/12705
[199] https://cidades.ibge.gov.br/brasil/pa/pesquisa/16/12705. Accessed in 14/04/2022.
[200] SIMEX – Sistema de Monitoramento de Exploração de Madeira. Programa do IMAZON - Instituto do Homem e Meio Ambiente da Amazônia. Available on: https://imazon.org.br/wp-content/uploads/2021/09/Simex_Para_2019-2020.pdf . Accessed in 14/04/2022.

volume, making intensive exploitation unsustainable. Furthermore, increased deforestation, forest degradation and climate change will certainly worsen this illegal activity in the future.

5.1.3.5. Other factors that threatened biodiversity and the presence of the CAAPII REDD+ Project

As mentioned in item 5.1.3., the without-project scenario in the region shows that deforestation for soy culture, expansion of pasture areas for cattle raising, legal and illegal logging will likely continue to increase in the coming years. The implementation of the Carbonext CAAPII REDD+ Project will protect 33,766.64 ha of the Amazon Forest, an essential area for biodiversity and environmental integrity, avoiding fragmentation, destruction and conversion of native forest into other land use activities presented above, which would likely happen in the next few years without the project. Thus, it is intended to prevent the removal of plant and animal individuals, soil degradation and the loss of genetic diversity, loss of habitat, evasion and death of fauna and flora.

Other actions aimed at health, environmental education, professionalization and sustainable practices are being planned and developed to be implemented with the communities in the region. These activities and actions aim to benefit social and environmental aspects, directed, for example, to reducing hunting, knowledge of ecosystem services arising from the influence of biodiversity on nature, training to prevent fires that would also benefit the local fauna and flora, activities related to conservation of priorities species of fauna and flora, zoonoses, among others. In the no-project scenario, these actions would not happen and would not benefit biodiversity nor the community.

5.2. Net Positive Biodiversity Impacts

5.2.1. Expected Biodiversity Changes (B2.1)

In the project area, the following beneficial changes to biodiversity are expected (tables 99 to 101):

Table 99 - Expected beneficial changes in the fauna with the CAAPII REDD+ Project.

Biodiversity Element	Fauna
Estimated Change	Habitat / Biodiversity Conservation (positive)
Justification of Change	The activities of the Project aim to decrease deforestation and forest degradation, consequences of the change of soil usage by other activities such as agriculture, cattle raising, logging, and many others. The focus will be in practices of deforestation monitoring, patrimonial surveillance, and technical assistance service. Thus, generating a

	positive impact on habitat preservation, climate regulation and on biodiversity conservation. The maintenance of the vegetation cover allows adequate living conditions for the countless Amazonian species present in the region. The avoidance of deforestation of 955.9 hectare in average per year minimizes threats to fauna species, reducing habitat loss and fragmentation. This project also aims on monitoring birds, mammals, amphibians, reptiles, other animal groups and plant species with different status of threat and endemism, producing good data for scientific studies and mitigation measures proposition, for an example. Partnerships with universities and science centres are being consider producing conservation articles and science, in general. The presence of the CAAPII REDD+ project prevents the expansion of new pasture, agriculture, or logging areas, which may lead to soil contamination, suppression of ecosystem services such as water provision, pollination, climate regulation and others, which affects entire biotic communities and their consuming trophic chain, including local human populations[201].

Table 100 - Expected beneficial changes in the flora with the CAAPII REDD+ Project.

Biodiversity Element	Flora
Estimated Change	Habitat / Biodiversity Conservation (positive)
Justification of Change	The CAAPII REDD+ Project consists of avoiding deforestation of Amazonian Forest ecosystems. The presence of the project prevents vegetation removal, degradation, and deforestation of 955.9 hectare in average per year, minimizing threats to flora species. They have an essential role on the provision of ecosystem services as well as habitat for the local fauna biodiversity.

Table 101 - Expected beneficial changes in the fauna and flora with the CAAPII REDD+ Project.

Biodiversity Element	Fauna and Flora

[201] https://www.e-publicacoes.uerj.br/index.php/rdc/article/view/50980

Estimated Change	Encouraging conservation through building of Environmental Awareness, developing sustainable practices and changing habits.
Justification of Change	The CAAPII REDD+ project will promote environmental education and sustainable development activities with local communities (detailed in item 2.1.11. and 4.1.1. of this PD). The development and implementation of these actions aim to build an environmental awareness and consequent change of habit in the population, in short, medium and long-term on the importance of biodiversity and "live native forests". In the long term along the generations, these actions aim to create a feeling of belonging and proximity to nature and to the living beings that depend on the preserved environment. Thus, the project will stimulate the conservation of biodiversity, and in general, of the Amazon ecosystem and its communities.

5.2.2. Mitigation Measures (B2.3)

The Carbonext CAAPII REDD+ project intends to preserve part of the Amazon Forest, maintaining the habitat of species present in the project region, preventing deforestation through actions to reduce and control threats suffered by the biotic community, such as: periodic monitoring of fauna and flora, surveillance and security of the project area. Furthermore, the activities planned for the project related to climate, community and biodiversity will strengthen the local community in terms of environmental awareness and sustainable development through environmental education. Many other actions and mitigation measures will be proposed as local demands and impacts are identified during the project. Thus, the proposals made will be more effective and significant, resulting in more robust, relevant and beneficial changes on the region, its surroundings and on biodiversity.

Table 102 presents activities that can be implemented over the 30 years of the project period to conserve the HCVs identified by the CAAPII REDD+ project and avoid and mitigate any negative impact on the area, the community and biodiversity. These actions will be analysed, evaluated and implemented as the project and the sale of carbon credits advance.

Table 102 - Mitigation measures proposed by the project, through analysis and assessment carried out by Carbonext's technical and social team.

Strategic lines	Main activities to be implemented
Illegal Logging Prevention	• Maintain and reinforce the surveillance and security of the project area. • Environmental education activities to raise sustainable practices in the community. • Possibility of professional training, upon demand from the community/economy/local commerce and other factors will be evaluated.
Fire Prevention	• Orientations to prevent and fight fires. • Fire brigade trainings with the workers of the properties and population close to forest areas.
Biodiversity loss prevention	• Maintain and reinforce the surveillance and security of the project area. • Promote environmental education to raise awareness about the importance of conservation of nature and species about local biodiversity, sustainable practices, deforestation, waste products and pollution, nutrition, focus on priority species and with economic value, and so on. • Periodic monitoring of species and evaluation of the environment. • Generate data for further studies and other conservation projects.
Deforestation prevention	• Implementation of Carbonext´s deforestation Alert System named “Monitora Carbon” in the project region. • Promote the education of future generations about the importance of the forest on ecosystem services, bioeconomy principles and valuation. • Building of environmental awareness. • Carbonext System Deforestation Monitoring.
Others	• Periodic environmental education activities and actions will be directed to different topics over the 30 years of the project, according to local assessments and proposals, changes in the

Strategic lines	Main activities to be implemented
	needs, identification of negative impacts and other analysis by Carbonext. These can be directed to: professional courses/workshops, preparation of a vegetable garden, composter, recycling and reuse of materials, nutrition, gastronomy, health and zoonoses, among many others. • Periodic events over the 30 years, such as: medical visits, nutritionist visits, solidarity actions, among others, which are foreseen to be implemented during the project.

Further proposals will be made by Carbonext throughout the implementation of the project, according to deeper analysis of the area to reduce and mitigate impacts on biodiversity. During the project period more details and onsite analysis of the biodiversity's and community's potential and characteristics will be gathered, guaranteeing suitable activities for the conservancy of biodiversity and rapid response if mitigation measures are needed. The activities are dependent on accreditation and sale of carbon credits.

5.2.3. Net Positive Biodiversity Impacts (B2.2, GL1.4)

Without the activities and actions of the CAAPII REDD+ project, as seen in item 5.1.3. the remaining forest on the properties involved in this project and the biodiversity associated with it would likely be affected by land use conversion and degradation in the coming years, mostly due to the increase of cattle raising, agriculture and wood extraction in the region, which are economically attractive activities and in constant search for new areas for expansion.

The CAAPII REDD+ project will conserve a significant area of native Amazon Forest, which is a fundamental habitat for several species of flora, birds, mammals, amphibians, reptiles, lizards, invertebrates and all its microbiota, enabling their growth (both at an individual and population level), reproduction, nutrition, genetic diversity, and so on. The fact that this project is located in a region historically exploited by deforestation makes its protection even more important for the species that live in the remaining forest fragments. These animals have progressively less and less area of habitat and resources, leading to decrease of population and even local extinction.

Considering that the project only makes beneficial propositions for preservation and conservation, its resulting impact will be positive, enabling the survival and coexistence of biotic communities in the region. The project aims to promote sustainable development actions with the local community, quickly minimizing and mitigating a possible negative impact that may eventually occur during the period of operation. All the environmental education actions that will be carried out will be essential for the long-term maintenance of

the Amazon Forest in the region, as it is expected that environmental awareness will be built and carried in the next generations, also influencing other people preserve the environment and to develop conservation projects as well.

5.2.4. High Conservation Values Protected (B2.4)

The project activities aim to avoid deforestation and maintain Amazon Forest cover by creating environmental awareness, stimulating sustainable economic activities, and preparing local communities and landowners to deal with eventual episodes of degradation and other events that threaten the conservation of the project area, The HCV 1 – Diversity of Species and presence of endangered species, and the HCV 3 - Ecosystems & Habitats (both detailed in sector 5.1.2.) are not going to be negatively affected by the project, since there are no negative impacts on the environment and biodiversity anticipated.

5.2.5. Species Used (B2.5)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.6. Invasive Species (B2.5)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.7. Impacts of Non-native Species (B2.6)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.8. GMO Exclusion (B.7)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.9. Inputs Justification (B2.8)

This item is not applicable in this project, since there is no restoration activity planned.

5.2.10. Waste Products (B2.9)

The production of waste will vary according to the activities that will be proposed, defined and implemented over the 30 years of the project period.

The first actions will be related to the monitoring of fauna and flora, events and activities related to environmental education and sustainable practices. Such planned activities must generate common waste and paper products by printed material. This type of residue, according to the normative ABNT NBR 10004, is classified as class II A and B – non-hazardous and A) non-inert (for materials as rubber, aluminium, glass and polystyrene), and B) inert (organic material and plastic). Another waste generated is the emission of gases by the transport and displacement of the teams for monitoring and field trips.

Any residue produced will be separated to recycling or composter, whenever possible. As new activities are selected to compose the project, the identification, classification, and management of their waste products will be properly conducted.

5.3. Offsite Biodiversity Impacts

5.3.1. Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2)

There is no expectation of potential negative impacts on biodiversity outside the project zone with the implementation of activities. In addition, the proposed actions were developed to minimize and mitigate any possible leakage or other negative effects.

The proposed actions are intended to develop sustainable practices and promote approximation of the population with environmental causes and biodiversity also in the next generations of the communities involved. Thus, mitigation measures are related to environmental education activities and soil improvement training, for example, to prevent and minimize degradation, deforestation, hunting, and other threats to biodiversity and its habitat.

If any negative impacts on biodiversity, both locally and outside the project zone, are observed as a result of project actions, propositions will be made and implemented as soon as possible to avoid and mitigate it.

5.3.2. Net Offsite Biodiversity Benefits (B3.3)

The impacts on biodiversity outside the CAAPII REDD+ Project zone are positive. The project proposes activities that will bring substantial benefits to the fauna and flora of the project area, with no anticipated negative impacts beyond the project boundaries. In the long term, the development of environmental awareness with environmental education and sustainability actions with communities also aims to bring benefits to the entire biodiversity of the region.

In case any negative impact is observed both for biodiversity inside and outside the project zone, the proponents are prepared to mitigate and solve any unforeseen event, after analysis by technical professionals carried out by Carbonext.

5.4. Biodiversity Impact Monitoring

Monitoring impacts on biodiversity aims to manage the consequences that the project may have on fauna and flora, It will examine the quality of the environment, changes in population growth and behaviour, habitat usage, occurrence of species in the region, and other data relevant to conservation. Impact monitoring also evaluates the development of proposed actions, as well as prevent fires and illegal practices within the project area, ensuring that the project activities strengthen the protection of Amazonian fauna and flora.

5.4.1. Biodiversity Monitoring Plan *(B4.1, B4.2, GL1.4, GL3.4)*

The maintenance of the native forest as well as the conservation of Amazonian flora and fauna species are extremely necessary to ensure the prosperity of the ecosystem, thus allowing ecosystem services to be generated and benefit the communities involved in the project, Indirectly, they also end up benefiting other inhabitants of the surroundings and especially the biodiversity associated with the areas. The expansion of deforestation reduces the remaining forest areas in this biome, however, the mechanisms of REDD+ projects and their resources generated by the sale of carbon credits contribute to preventing deforestation, fragmentation, loss of habitat and biodiversity. To ensure the effectiveness of the project, biodiversity monitoring is a fundamental tool, allowing the measurement of the positive and, if any, negative impacts arising from the project's activities. It provides data for evaluating the actions implemented, which may indicate the need for adjustments, adaptation, creation of new activities or other mitigation measures.

For the CAAPII REDD+ project, monitoring of the areas will be carried out systematically by an outsourced company specialized in biodiversity and/or eventually with partnerships with universities and research institutions. Data collected on existing conditions and impacts on fauna and flora will be evaluated through forest inventories and reports, following the standard criteria. Monitoring will be carried out aiming at short-, medium- and long-term impacts throughout the project period, in this case, for 30 years. According to the results of the assessment made from the monitoring data, improvements and new actions to promote biodiversity during the project execution time will be constantly evaluated and implemented. The general monitoring of the conservancy state, as well as the climate, social and biodiversity project activities are designed by the Carbonext's team, but the parameters, methods, periodicity and areas to be monitored will

be indicated by the company specialized in biodiversity monitoring, that is going to be defined, hired and will act in the area of the project after the first carbon credit sale.

The fauna and flora parameters that will be monitored are available in table 103. The realization of this task is dependent on the sale of carbon credits.

Table 103 - Monitoring plan activities of the CAAPII REDD+ Project.

Variable	**Area**	**Aspect**	**Unity**	**Inventory Period**	**Frequency**	**Indicator**	**Assessment**
Fauna, Flora and Biomass monitoring	Project Area	Carbon stock/ Biomass	tCO2 per hectare	*Ex-post*	Every 5 years	Maintenance or change of carbon stock	Increase in surveillance and security: field and remote monitoring, Development of conservation practices and environmental awareness; Specialist consultation,
	Project Area	Threatened fauna species	Number of threatened fauna species and sightings	*Ex-post*	Every 2 or 3 years	Maintenance or change on the number of endangered species and sightings	
	Project Area	Total fauna species	Total number of fauna species and sightings	*Ex-post*	Every 2 or 3 years	Maintenance or change on the total number of fauna species	
	Project Area	Threatened flora species	Number of threatened flora species and sightings	*Ex-post*	Every 2 or 3 years	Maintenance or change on the number of endangered species and sightings	
	Project Area	Total of flora species	Total number of flora species	*Ex-post*	Every 2 or 3 years	Maintenance or change on the total number of flora species	

5.4.2. Biodiversity Monitoring Plan Dissemination *(B4.3)*

The results obtained in the monitoring of Biodiversity will be published and made available online through the Carbonext website (**Carbonext.com.br**). All documents and information on the results of the monitoring and verification of the project will be published on the VCS and CCB standards platforms, as it is usually done. Additionally, the results obtained in this project will be presented to the stakeholders in proper moments, such as trainings, verifications, field visit periods, and others, always aiming to improve and materialize the importance and effectiveness of the CAAPII REDD+ Project. If there is a consensus established between the parties, the data obtained in the monitoring can be proudly used in scientific studies and articles for the conservation of biodiversity.

5.5. Optional Criterion: Exceptional Biodiversity Benefits

The region of the Carbonext CAAPII REDD+ Project is very abundant and rich in terms of biodiversity species, due to its hydrology and diversity of phytophysiognomy, characteristic of the Amazon Forest. The presence of endangered, rare, endemic and conservation priority species of fauna and flora obtained through the review of secondary data was verified according to the IUCN Global Red List of Threatened Species[202], the Brazilian Red List of Threatened Species of the ICMBIO[203] and CNCFlora's Red List of Threat of Brazilian Flora[204], presented in item 5.1.1.2..

5.5.1. High Biodiversity Conservation Priority Status (GL3.1)

According to the biodiversity survey with secondary data, in the CAAPII REDD+ Project region there are 11 species considered “critically endangered” and/or “endangered” (CR and EN) and, in addition to these, 29 species are classified as “vulnerable” (VU). The list of the 11 species with CR and/or EN status and their respective population trends is presented in table 104 below. The main threat to fauna species is the loss of habitat through deforestation and hunting, both activities related to anthropic actions, For the plant species indicated in the table, logging and use in traditional medicine and cultural habits are the main causes of population decline.

Throughout the project, more data will be obtained on the endangered species in the project region with the monitoring of fauna and flora, after accreditation, for a better understanding of priorities for biodiversity

[202]Red List of Threatened Species of the International Union for Conservation of Nature. 2022. IUCN Red List. Available on: https://www.iucnredlist.org/ . Accessed on 09/04/2022
[203] Livro Vermelho da Fauna Brasileira Ameaçada de Extinção. ICMBIO. 2018. Available on: https://www.icmbio.gov.br/portal/images/stories/comunicacao/publicacoes/publicacoes-diversas/livro_vermelho_2018_vol1.pdf. Accessed in 09/04/2022/
[204] Lista Vermelha de Ameaça da Flora Brasileira. Centro Nacional de Conservação da Flora – CNCFlora. 2014 Available on: https://specieslist.sibbr.gov.br/speciesListItem/list/drt1565629935045?q=astrocaryum&lang=pt_BR. Accessed in 09/04/2022.

conservation. If monitoring of biodiversity identifies other priority species, these can be added to project activities for their conservation.

Table 104 - Species of fauna and flora classified as CR and EN on the IUCN, ICMBIO and CNCFlora threatened lists.

Kingdom	**Taxon**	**Species**	**Common name (portuguese) and image**	**Red List IUCN**	**Red list CNCFlora/Icmbio**
Plantea	Fabaceae (Ordem Fabales)	*Vouacapoua americana*	Acapú[205]	CR	EN
	Myristicaceae (Ordem Magnoliales)	*Virola surinamensis*	Ucuubeira[206]	EN	VU
	Rutaceae (Ordem Sapindales)	*Euxylophora paraensis*	Pau Amarelo [207]	EN	CR
	Bignoniaceae (Ordem Lamiales)	*Handroanthus serratifolius*	Ipê-amarelo[208]	EN	
Animalia	Pitheciidae (Ordem Primates)	*Chiropotes satanas*	Cuxiú-preto [209]	EN	CR

[205] http://www.amazonflora.com.br/product-page/acap%C3%BA
[206] https://plantidtools.fieldmuseum.org/pt/nlp/catalogue/3671302
[207] https://lpf.florestal.gov.br/pt-br/?option=com_madeirasbrasileiras&view=especieestudada&especieestudadaid=112
[208] https://www.soflor.com.br/produto/ipe-amarelo-sementes-handroanthus-serratifolius/
[209] https://www.ecoamazonia.org.br/black-bearded-saki-chiropotes-satanas-in-the-amazonchiropotes-satanas-cuxiu-preto/

Kingdom	**Taxon**	**Species**	**Common name (portuguese) and image**	**Red List IUCN**	**Red list CNCFlora/Icmbio**
	Cebidae (Ordem Primates)	*Cebus kaapori*	Caiarara [210]	CR	CR
	Psophiidae (Ordem Gruiformes)	*Psophia obscura*	Jacamim-de-costas-escuras[211]	CR	CR
	Ramphastidae (Ordem Piciformes)	*Pteroglossus bitorquatus*	Araçari-de-pescoço-vermelho[212]	EN	NT
	Psittacidae (Ordem Psittaciformes)	*Pionites leucogaster*	Marianinha-de-cabeça-amarela[213]	EN	
		Pyrrhura amazonum	Tiriba-de-Hellmayr[214]	EN	

[210] https://mamiferosdomundo.blogspot.com/2018/04/cebus-kaapori-macaco-prego-do-maranhao.html
[211] Wikiaves
[212] Wikiaves
[213] Wikiaves
[214] https://avibase.bsc-eoc.org/species.jsp?avibaseid=A950292F22812378

Kingdom	Taxon	Species	Common name (portuguese) and image	Red List IUCN	Red list CNCFlora/Icmbio
	Pipridae (Ordem Passeriformes)	*Lepidothrix iris*	Cabeça-de-prata [215]	VU	EN

5.5.2. Trigger Species Population Trends (GL3.2, GL3.3)

According to the list of identified endangered (EN) and critically endangered (CR) species, consider in the CAAPII REDD+ Project as trigger species (presented above in sector 5.5.1.), the trends on their populations, the threats on these species and the activities to address them are presented in this sector below (Tables 104 to 115). After the execution of the fauna and flora inventory, the species here identified as trigger species, may suffer alteration according to primary data and assessment.

Table 105 - Populational trend of the *Handroanthus serratifolius.*

Trigger Species	*Handroanthus serratifolius* (Bignoniaceae)
Population Trend at Start of Project	*Handroanthus serratifolius* is an endangered species (endangered – EN) with a decreasing population trend (IUCN 2022). According to data from the IUCN Red List website, this species is the most exploited by the timber industry, under the name of “Ipê-amarelo”, Brazil is its largest exporter. Ipê is exploited only in native forests, since there are no plantation/culture of *H. serratifolius.* This fact encourages illegal exploitation, affecting directly this species. According to IUCN/TRAFFIC (2019), the demand for Ipê wood and its value increased more than 500% from 1998 to 2004. Additionally, this species has slow growth and cutting cycles of 30-year, which does not allow its population regeneration due to over-exploitation, considered unsustainable.

[215] https://ebird.org/species/opcman1?siteLanguage=pt_PT

	Deforestation caused by settlements, agriculture, expansion of roads, mining, logging, among other factors, are responsible for the decline of its population.
Without-project Scenario	With the increase in demand and value of *Handroanthus serratifolius* wood on the market, in addition to the expansion of agricultural activities in the project municipalities, the forest present in the 33,766.64 ha of the project area would, over time, be explored, deforested and converted into other land use activities. Consequently, this species, along with many others, would decline in terms of population and biodiversity, in general, would also decline rapidly. According to data presented by the IUCN (2022), it is assumed that in 100 years, the decline of H. *serratifolius* population will be of 50%.
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and improving biodiversity conservation. In addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation, With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc. which encourages the preservation and prevention of logging. Sustainable development activities and professional training workshops can provide new perspectives for obtaining resources and income for the communities that extract this wood, for example. Thus, it is expected that there will be greater conservation of *Handroanthus serratifolius* in the project area, maintaining or increasing the population trend.

Table 106 - Populational trend of the *Vouacapoua americana.*

Trigger Species	*Vouacapoua americana* (Fabaceae)
Population Trend at Start of Project	*Vouacapoua americana* is a species classified as "critically endangered" (endangered – EN) with a decreasing population trend (Alves et al, 2015)[216] due to overexploitation in legal and illegal logging. Deforestation caused by settlements, agriculture, expansion of roads, mining, logging and among other factors, are responsible for the decline of its population.
Without-project Scenario	The timber production of *V. americana* has high commercial value due to its intense use in the furniture industry and civil construction, thus being super-exploited in the Amazon. With the increase in demand and value of wood in the market, in addition to the expansion of agricultural activities in the project municipalities, the forest present in the 33,766.64 ha of the project area would, over time, be deforested and converted into other land use activities. Consequently, this species, along with many others, would decline in terms of population and biodiversity, in general, would also decline rapidly.
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and improving biodiversity conservation. In addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation, With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc., which encourages the preservation and prevention of logging. Sustainable development activities and professional training workshops can provide new perspectives for obtaining resources and income for the communities that extract this wood, for example.

[216] https://www.alice.cnptia.embrapa.br/handle/doc/1036697

	Thus, it is expected that there will be greater conservation of *Vouacapoua americana* in the project area, maintaining or increasing the population trend.

Table 107 - Populational trend of *Virola surinamensis.*

Trigger Species	*Virola surinamensis* (Myristicaceae)
Population Trend at Start of Project	*Virola surinamensis* is a species classified as "endangered" (EN) in the global Red List and "vulnerable" (VU) in the national Red List of Flora, with tendency of populational decline[217]. The main cause of this decline is the over-exploitation of timber (legal and illegal), Other cause is de deforestation due to settlements, agriculture, pastures, expansion of roads, mining, and many other factors.
Without-project Scenario	This specie is popularly known as "mucuíra", and has a great value in the timber and pharmaceutical industry. The local communities, riverdwelen and indigenous communities also use this resource, which can compose 50% of their income after its commercialization. There are reports of local extinction in some areas due to over- exploration, leading to decline of 90% of the population in years[218]. Considering the growth cycle of 30 years, *V. surinamensis* population is not able to regenerate. With the increase of the demand and value of the timber in the market, added with the expansion of the agriculture and pasture in the municipalities of the project, the forest in the area of 33,766.64 haof the project would be deforested, converting the Amazon Forest present in land for other activities. Consequently, this species, along with many others, would decline in terms of population and biodiversity, in general, would also decline rapidly.

[217] CNCFlora, 2012. Available on: http://cncflora.jbrj.gov.br/portal/pt-br/profile/Virola%20surinamensis. Accessed 11/04/2022.
[218] PINÃ-RODRIGUES, F,C,; MOTA, C.G. Análise da atividade extrativa de Virola (Virola surinamensis) no estuário amazônico. Floresta e Ambiente, v. 7, n. 1, p. 40-53, 2000. Available on: http://cncflora.jbrj.gov.br/portal/pt-br/profile/Virola%20surinamensis. Accessed 25/03/2022.

With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and improving biodiversity conservation. In addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation, With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc, which encourages the preservation and prevention of logging. Sustainable development activities and professional training workshops can provide new perspectives for obtaining resources and income for the communities that extract this wood, for example. Thus, it is expected that there will be greater conservation of *Virola surinamensis* in the project area, maintaining or increasing the population trend.

Table 108 - Populational trend of *Euxylophora paraensis.*

Trigger Species	*Euxylophora paraensis* (Rutaceae)
Population Trend at Start of Project	*Euxylophora paraensis* is an endemic Brazilian species classified as “endangered” (EN) in the global Red List and “critically endangered” (CR) in the national Red List of Flora, with tendency of populational decline[219]. The main cause of this decline is the over-exploitation of timber (legal and illegal), This timber is largely used in construction industry, wooden floor and music instruments. According to CNCFlora[220], estimates point that in the past 60 years, its population declined 80%.

[219] IUCN, 2012. Available on: https://www.iucnredlist.org/species/61958701/176125940. Accessed 11/04/2022.
[220] http://cncflora.jbrj.gov.br/portal/pt-br/profile/Euxylophora%20paraensis

	The deforestation caused by settlements, expansion of agriculture and pasture, road constructions, mining, timber exploration and other factors are responsible for the drastic decline of their population.
Without-project Scenario	With the increase in demand and value of the timber of *"pau amarelo"* on the market, in addition to the expansion of pasture and agriculture activities in the project municipalities, the forest present in the 33,766.64 ha of the project area would, over time, be explored, deforested and converted into other land use activities. Consequently, this species, along with many others, would decline rapidly.
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation, minimizing habitat loss and improving biodiversity conservation. In addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation. With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc, which encourages the preservation and prevention of logging. Sustainable development activities and professional training workshops can provide new perspectives for obtaining resources and income for the communities that extract this wood, for example. Thus, it is expected that there will be greater conservation of *Euxylophora paraensis* in the project area, maintaining or increasing the population trend.

Table 109 - Populational trend of *Chiropotes satanas*.

Trigger Species	*Chiropotes satanas* (Pitheciidae)

Population Trend at Start of Project	*Chiropotes satanas,* the "cuxuí-preto", is an endemic species of Pará, classified as "endangered" (EN) by the IUCN and "critically endangered" (CR) by ICMBIO, with tendency of populational decline[221]. According to IUCN, the hunting, habitat loss and fragmentation are arising in the Belém Endemism Area, threatening the survival of this species, It is considered locally extinct in many regions already.
Without-project Scenario	With the increase in demand and value of timber on the market, in addition to the expansion of pasture, agriculture, urbanization and roads in the project municipalities, the forest present in the 33,766.64 ha of the project area would, over time, be explored, deforested and converted into other land use activities. All the wild biodiversity associated with the forest would be destroyed, consequently, this species' population, along with many others, would decline rapidly. The individuals of *Chiropotes satanas* are present and depend on the Amazon forest remaining fragments, that are under great pressure of deforestation, Studies estimate the population decline of 80% due to continuous habitat loss[222].
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation of 33,766.64 ha of Amazon Forest. The project intents to minimize habitat loss and fragmentation of areas, consequently conserving the biodiversity. In addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation. With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem,

[221] https://www.iucnredlist.org/species/39956/191704509
[222] https://www.iucnredlist.org/species/39956/191704509

	their relationship with other species, etc., which encourages the preservation and prevention of logging and hunting of wild animals. Sustainable development activities and professional training workshops, actions about nutrition, health, diseases, among others, can provide new perspectives for obtaining resources and income for the communities which can prevent and reduce deforestation. Thus, it is expected that there will be greater conservation of *Chiropotes satanas* in the project area, maintaining or increasing the population trend.

Table 110 - Populational trend of *Cebus kaapori.*

Trigger Species	*Cebus kaapori* (Cebidae)
Population Trend at Start of Project	*Cebus kaapor*i, is an endemic species of Pará, classified as "critically endangered" (CR) by IUCN and ICMBIO, with tendency of populational decline[223] . According to IUCN, the hunting, habitat loss and fragmentation are arising in the Belém Endemism Area, threatening the survival of this species. It is considered locally extinct in many regions already.
Without-project Scenario	With the increase in demand and value of timber on the market, in addition to the expansion of pasture, agriculture, urbanization and roads in the project municipalities, the forest present in the 33,766.64 ha of the project area would, over time, be explored, deforested and converted into other land use activities. All the wild biodiversity associated with the forest would be destroyed, consequently, this species' population, along with many others, would decline rapidly. The individuals of *Cebos kaapori* are present and depend on the Amazon Forest remaining fragments, that are under great pressure of deforestation. According to a study cited by IUCN[224], the removal of fructiferous trees from the forest in the region affects negatively the

[223] https://www.iucnredlist.org/species/40019/191704766
[224] Lopes, M. A. 1993. Conservação do Cuxiú-preto, *Chiropotes satanas satanas* (Cebidae: Primates) e de outros Mamíferos na Amazônia Oriental. Dissertação de Mestrado, Universidade Federal do Pará . In: https://www.iucnredlist.org/species/40019/191704766

	Caiarara's diet and food availability. This species is under great hunting pressure and there are reports of use as domestic pets in indigenous villages[225].
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation of 33,766.64 ha of Amazon Forest. The project intents to minimize habitat loss and fragmentation of areas, consequently conserving the biodiversity. In addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation. With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc, which encourages the preservation and prevention of hunting of wild species. Sustainable development activities and professional training workshops, actions about nutrition, health, diseases, among others, can provide new perspectives for obtaining resources and income for the communities which can prevent and reduce deforestation. Thus, it is expected that there will be greater conservation of *Cebus kaapori* in the project area, maintaining or increasing the population trend.

Table 111 - Populational trend of *Psophia obscura.*

Trigger Species	*Psophia obscura* (Psophiidae)
Population Trend at Start of Project	*Psophia obscura* is an endemic species of Pará, classified as "critically endangered" (CR) by IUCN and ICMBIO, with tendency of populational decline[226].

[225] Queiroz, H. L. 1992. A new species of capuchin monkey, genus Cebus Erxleben 1977 (Cebidae, Primates), from eastern Brazilian Amazonia. Goeldiana Zoologia 15: 1–3. In: https://www.iucnredlist.org/species/40019/191704766

[226] https://www.iucnredlist.org/species/45470702/125706121

	On a study presented by IUCN, it is estimated that until 2032 this species will lose between 77-88% of its natural habitat in the Amazon Forest, leading to 87% of population decline for the same period. According to IUCN, the hunting, habitat loss and fragmentation are arising in the Belém Endemism Area, threatening the survival of this species. It is considered locally extinct in many regions already, with evidence of only two population groups left.
Without-project Scenario	With the increase in demand and value of timber on the market, in addition to the expansion of pasture, agriculture, urbanization and roads in the project municipalities, the forest present in the 35,101 ha of the project area would, over time, be explored, deforested and converted into other land use activities. All the wild biodiversity associated with the forest would be destroyed, consequently, this species' population, along with many others, would decline rapidly. The individuals of *Psophia obscura* are present and depend on the Amazon Forest remaining fragments of the Belém Endemism Area, under great pressure of deforestation.
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation of 33,766.64 of Amazon Forest. The project intents to minimize habitat loss and fragmentation of areas, consequently conserving the biodiversity. In addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation, The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation. With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc., which encourages the preservation and prevention of hunting. Sustainable development activities and professional training workshops, actions about nutrition, health, diseases, among others,

	can provide new perspectives for obtaining resources and income for the communities which can prevent and reduce deforestation. Thus, it is expected that there will be greater conservation of *Psophia obscura* in the project area, maintaining or increasing the population trend.

Table 112 - Populational trend of *Pteroglossus bitorquatus.*

Trigger Species	*Pteroglossus bitorquatus* (Ramphastidae)
Population Trend at Start of Project	*Pteroglossus bitorquatus* is an endemic species of Brazil, classified as "endangered" (EN) by IUCN, with tendency of populational decline[227] . On a study presented by IUCN, it is estimated that until 2032 this species will lose between 45-58% of its natural habitat in the Amazon Forest. Even though this species is considered relatively tolerant to deforestation, it is estimated 70% of population decline for the same period. The habitat loss, fragmentation, together with the capture for domestic pets are the main threats to the survival of this species.
Without-project Scenario	With the increase in demand and value of timber on the market, in addition to the expansion of pasture, agriculture, urbanization and roads in the project municipalities, the forest present in the 33,766.64 ha of the project area would, over time, be explored, deforested and converted into other land use activities. All the wild biodiversity associated with the forest would be destroyed, consequently, this species' population, along with many others, would decline rapidly. The individuals of *P. bitorquatus* are present and depend on the Amazon forest remaining fragments, under great pressure of deforestation.
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation of 33,766.64 ha of Amazon Forest. The project intents to minimize habitat loss and fragmentation of areas, consequently conserving the biodiversity, in addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into

[227] https://www.iucnredlist.org/species/22728132/94971638

	other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation. With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc, which encourages the preservation and prevention of hunting. Sustainable development activities and professional training workshops, actions about nutrition, health, diseases, among others, can provide new perspectives for obtaining resources and income for the communities which can prevent and reduce deforestation. Thus, it is expected that there will be greater conservation of *Pteroglossus bitorquatus* in the project area, maintaining or increasing the population trend.

Table 113 - Populational trend of *Pionites leucogaster.*

Trigger Species	*Pionites leucogaster* (Psittacidae)
Population Trend at Start of Project	*Pionites leucogaster is* classified as “endangered” (EN) by IUCN, with tendency of populational decline[228]. According to Soares-Filho[229] (et al 2016), the main threat of this species is the increase of deforestation, that leads to habitat loss and fragmentation. Although the presence of this species is common in preserved areas, P. leucogaster does not occur in secondary forests nor areas with agriculture.
Without-project Scenario	With the increase in demand and value of timber on the market, in addition to the expansion of pasture, agriculture, urbanization and roads in the project municipalities, the forest present in the 33,766.64 ha of the project area would, over time, be explored, deforested and converted into other land use activities.

[228] https://www.iucnredlist.org/species/22728132/94971638
[229] https://www.nature.com/articles/nature04389

	All the wild biodiversity associated with the forest would be destroyed, consequently, this species' population, along with many others, would decline rapidly. The individuals of *P. leucogaster* are present and depend on the Amazonforest remaining fragments, under great pressure of deforestation.
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation of 33,766.64 ha of Amazon Forest. The project intents to minimize habitat loss and fragmentation of areas, consequently conserving the biodiversity, on addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation. With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc, which encourages the preservation and prevention of hunting. Sustainable development activities and professional training workshops, actions about nutrition, health, diseases, among others, can provide new perspectives for obtaining resources and income for the communities which can prevent and reduce deforestation. Thus, it is expected that there will be greater conservation of *Pionites leucogaster* in the project area, maintaining or increasing the population trend.

Table 114 - Populational trend of *Pionites leucogaster.*

Trigger Species	*Pyrrhura amazonum* (Psittacidae)

Population Trend at Start of Project	*Pyrrhura amazonum* is an endemic species of Pará state, classified as "endangered" (EN) by IUCN, with tendency of populational decline[230]. According to Soares-Filho[231] (et al 2016), the main threat of this species is the increase of deforestation, that leads to habitat loss and fragmentation, The capture for illegal animal trafficking can be significantly high.
Without-project Scenario	With the increase in demand and value of timber on the market, in addition to the expansion of pasture, agriculture, urbanization and roads in the project municipalities, the forest present in the 33,766.64 ha of the project area would, over time, be explored, deforested and converted into other land use activities. All the wild biodiversity associated with the forest would be destroyed, consequently, this species' population, along with many others, would decline rapidly. The individuals of *P. amazonum* are present and depend on the Amazon Forest remaining fragments, under great pressure of deforestation.
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation of 33,766.64 ha of Amazon Forest. The project intents to minimize habitat loss and fragmentation of areas, consequently conserving the biodiversity. In addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species behaviour, mitigation measures, among others, contributing even more to their conservation. With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc, which encourages the preservation and prevention of hunting.

[230] https://www.iucnredlist.org/species/45422118/95149950
[231] https://www.nature.com/articles/nature04389

	Sustainable development activities and professional training workshops, actions about nutrition, health, diseases, among others, can provide new perspectives for obtaining resources and income for the communities which can prevent and reduce deforestation. Thus, it is expected that there will be greater conservation of *Pyrrhura amazonum* in the project area, maintaining or increasing the population trend.

Table 115 - Populational trend of *Pionites leucogaster.*

Trigger Species	*Lepidothrix iris* (Psittacidae)
Population Trend at Start of Project	*Lepidothrix iris* is an endemic Amazonian species, classified as "vulnerable" (VU) by the IUCN and "endangered" by the ICMBIO, with tendency of population decline of 30% or more until the next decade[232]. The main threat of this species is the increase of deforestation, that leads to habitat loss and fragmentation,
Without-project Scenario	With the increase in demand and value of timber on the market, in addition to the expansion of pasture, agriculture, urbanization and roads in the project municipalities, the forest present in the 33,766.64 ha of the project area would, over time, be explored, deforested and converted into other land use activities. All the wild biodiversity associated with the forest would be destroyed, consequently, this species' population, along with many others, would decline rapidly. The individuals of *L. iris* are present and depend on the Amazon Forest remaining fragments, under great pressure of deforestation.
With-project Scenario	The CAAPII REDD+ Project aims to mitigate and reduce deforestation and forest degradation of 33,766.64 ha of Amazon Forest. The project intents to minimize habitat loss and fragmentation of areas, consequently conserving the biodiversity. In addition, the project provides periodic monitoring of fauna and flora with a focus on priority and threatened species, which helps to combat conversion of forest into other land use activities, responsible for deforestation. The data obtained from the monitoring are important for evaluations and scientific studies on population trends, taxa, natural history, species

[232] https://www.iucnredlist.org/species/22701033/171677370

	behaviour, mitigation measures, among others, contributing even more to their conservation. With the environmental education actions, the target species will be presented to the communities as well as their role in the ecosystem, their relationship with other species, etc, which encourages the preservation and prevention of hunting. Sustainable development activities and professional training workshops, actions about nutrition, health, diseases, among others, can provide new perspectives for obtaining resources and income for the communities which can prevent and reduce deforestation. Thus, it is expected that there will be greater conservation of *Lepdothrix iris* in the project area, maintaining or increasing the population trend.