YBYRÁ REDD+ PROJECT

YBYRÁ
REDD+ Project
By Carbonext

Document Prepared By Carbonext

Contact Information (optional)

Project Title	Ybyrá REDD+ Project
Version	01
Date of Issue	04/09/2023
Project Location	State of Pará, Brazil
Project Proponent(s)	Carbonext Tecnologia em Soluções Ambientais Ltda, R. Gomes de Carvalho, 1510 – 19º andar – Vila Olímpia, São Paulo – SP, Brazil, 04547-005, EMAIL: redd.ybyra@carbonext.com.br ; COOPERCARBON – Cooperativa dos produtores de crédito de carbono do Pará e da Amazônia, Rua do Contorno, 190, room 1, Célio Miranda, CEP: 68625-245, Paragominas – PARÁ, Brasil, EMAIL: justiniano@acampoverde.com.br. *More details on item 2.1.3.
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Project Lifetime	January 31st of 2022 – January 30th of 2052; 30-year lifetime;
GHG Accounting Period	January 31st of 2022 – January 30th of 2052; 30-year lifetime;
History of CCB Status	Not applicable
Gold Level Criteria	Not applicable
Expected Verification Schedule	October of 2023

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1 Summary of Project Benefits

1.1 Unique Project Benefits

The table below (1.1) presents the expected benefits of the YBYRÁ REDD+ Project.

Table 1.1 - YBYRÁ REDD+ Project's expected benefits

Outcome or Impact Estimated by the End of Project Lifetime	Section Reference
1) Protection and conservation of 76,481.34 hectare of Amazon Forest;	2.1.11; 3.2 and 3.3
2) Promote adaptations for Climate Change, with the reduction of 12,044,741.50 tCO_2 emission due to avoidance of deforestation and initiatives to recompose/protect Permanent Preservation Areas (PPAs).	2.1.17; 3.2 and 3.3
3) Improve the quality of life for the local community, providing new perspectives of income, activities of education, health and gender equality in partnership with municipal institutions.	4.4.1
4) Conserve biodiversity in the forest areas of the PA through environmental awareness, protection of the PA and increase of connectivity between forest fragments;	5.1.2

1.2 Standardized Benefit Metrics

The table below (table 2) presents the estimation of net benefits that the YBYRÁ 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 Reports, as detailed in the Monitoring Plans in sectors 3.3; 4.4 and 5.4.

Table 2 - Estimated net benefits of the YBYRÁ REDD+ Project.

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
GHG emission	Net estimated emission removals in the project area, measured against the without-project scenario	Not applicable	N/A

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
reductions or removals	Net estimated emission reductions in the project area, measured against the without-project scenario	12,044,741.50 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	38,259.07 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 expected to occur as a result of project activities, measured against the without-project scenario	Not applicable	N/A
	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

[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
	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
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,	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])
[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
	measured against the without-project scenario		
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
	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	38,259.07 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	15	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

[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

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.

2. GENERAL

2.1 Project Goals, Design and Long-Term Viability

2.1.1 Summary Description of the Project (G1.2)

The YBYRÁ REDD+ Project is a unique REDD+ Project, composed by 74 rural properties with a project area of 76,481.34 hectare of Amazon rainforest. The project area is located in four municipalities: Paragominas, Ipixuna do Pará, Tomé-Açu and Ulianópolis, all in the state of Pará, Brazil. The main goals are forest conservation and reduction of GHG emissions of 12,044,741.50 tCO_2 in 30 years by avoiding deforestation of 38,259.07 ha in 74 rural properties that compose the Project area.

Pará explores unsustainably the Amazon Forest since its historical occupation. In 2019, the state was responsible for 40% of all Amazonian deforested area, destroying 3,862 km^2 [12]. In 2021, almost 25% deforested areas in Brazil were in Pará[13]. Considering the municipalities, the document known as “Deforestation Arc” presented a list with 52 cities considered priority for prevention, monitoring, and control actions against deforestation[14] in the Amazonian region (decree nº 6.321/2007 (2007) and Ordinance n° 428 (2018) by the Ministry of Environment). Paragominas and Ulianópolis were included in the list in 2008 but left it in 2011. However, in 2021, the city of Ulianópolis returned to the list[15].

The deforestation of the amazon forest in the region of the project is due to three main anthropic activities: timber exploration, pasture for cattle raising and agriculture of soybeans. The pressure on turning forest areas into non-forested areas is consequence of the expansion of these economic activities, leading to invasions of private properties, becoming common practice. From

[12] Source: https://g1.globo.com/natureza/noticia/2019/11/18/quatro-estados-respondem-por-mais-de-80percent-do-desmatamento-na-amazonia.ghtml
[13] https://s3.amazonaws.com/alerta.mapbiomas.org/rad2021/RAD2021_Completo_FINAL_Rev1.pdf
[14] Priority Municipalities. Source: http://combateaodesmatamento.mma.gov.br/municipios-prioritarios. Access:05/05/2022
[15] https://www.in.gov.br/en/web/dou/-/portaria-mma-n-475-de-21-de-outubro-de-2021-354624937

2018 to 2021[16], Paragominas increased in 33% the heads of cattle. Ipixuna do Pará presented an increase of 46% in the same period, while in Tomé-Açu the growth was 27% and 47% in Ulianópolis. In 2021, the 4 municipalities produced 52% of all charcoal from timber in Pará. The production of soybean in the state has grown from 2009 to 2021 in 981%[17] and its price increased almost 350% (May/2015 to March/2022[18]). The cultivation area also increased[19] from 71,410ha (2009) to 753,781ha (2021), corresponding to 955% increase. Therefore, the pressure to convert forest areas into pasture and/or cultivation areas is constant and extremely high.

In relation to the social aspects, most of the communities are formed by rural farmers with social vulnerabilities, with presence of food insecurity, low income and lack of job opportunity.

Considering the aspects presented above, the YBYRÁ REDD+ Project's main goals, through conservation of forest areas and combating deforestation and degradation of the Amazon Forest, are: 1) To promote adaptations to climate change in the region; 2) To improve the quality of life of the population that lives close to the forest and 3) To conserve biodiversity and ecosystem services, through environmental education actions and foment initiatives to connect forest fragments of the PA. All these goals are directly related to the protection of forest areas of 76,481.34 ha and to the avoided emission of 12,044,741.50 tCO2 in 30 years.

2.1.2 Project Scale

The table 2.1 presents the Project Scale.

Table 2.3 – YBYRÁ's project scale.

Project Scale	
Project	
Large project	X

The YBYRÁ REDD+ Project has an annual average calculated for the 30 years of the project lifetime of more than 300,000 tones of tCO_2, as presented in item 2.1.17..

2.1.3 Project Proponent (G1.1)

The tables below (2.2a, b and c) show the proponents of the project.

[16]IBGE.https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/18/16459?localidade1=150345&localidade2=150800&tipo=grafi co&indicador=16533https://cidades.ibge.gov.br/brasil/ac/bujari/pesquisa/18/16459?tipo=grafico&indicador=16533
[17] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?tipo=grafico&indicador=10370. Accessed in 11/04/2022.
[18] https://sisdep.conab.gov.br/precosiagroweb/
[19] https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?ano=2009

Table 2.4– Project proponents of the YBYRÁ REDD+ Project.

Organization name	Carbonext Tecnologia em Soluções Ambientais LTDA
Contact person	Janaina Dallan
Title	CEO
Address	R. Gomes de Carvalho, 1510 – 19º andar – Vila Olímpia, São Paulo – SP, Brazil, 04547-005
Telephone	+ 55 (11) 3045-1970
Email	redd.ybyra@carbonext.com.br

Organization name	COOPERCARBON – Cooperativa dos produtores de crédito de carbono do Pará e da Amazônia
Contact person	João Bosco Gabriel
Title	President of the cooperative
Address	Rua do Contorno, 190, room 1, Célio Miranda, CEP: 68625-245, Paragominas – PARÁ, Brasil.
Telephone	+55 91 99254-9200
Email	justiano@acampoverde.com.br

2.1.4 Other Entities Involved in the Project

The table below (2.3 a and b) show other entities involved in the project till the date of the issuance of the PDD.

Table 2.5 – a Other entities involved in the YBYRÁ REDD+ Project.

Organization name	Campo Verde Agência de Negócios Imobiliários e Serviços Ambientais Ltda
Role in the Project	Support on project execution
Contact person	Fabio Roberto Niedermeier
Title	Associated
Address	Rua do Contorno, 190, Bairro Célio Miranda, CEP 68625972 – Paragominas/PA, Brazil

Telephone	+ 55 (91) 3729-4835
Email	fabio_niedermeier@yahoo.com.br

Table 2.3 -b Other entities involved in the YBYRÁ REDD+ Project.

Organization name	GEOMASTER GEOTECNOLOGIA AMBIENTAL LTDA
Role in the project	Local support on Georeferencing and monitoring
Contact person	Fabio Roberto Niedermeier
Title	Founder of the company
Address	Avenida Deputado Fausto Fernandes, 132; Tiao Mineiro Paragominas, PA, Brasil CEP: 68.630-721
Telephone	+ 55 (91) 3729-4835
Email	

2.1.5 Physical Parameters (G1.3)

The Ybyrá REDD+ project is composed by 74 rural and private properties, that will be presented in the sector 2.1.6. and in 2.1.7. The area of these farms is distributed in four municipalities: Ipixuna do Pará, Tomé-Açu, Paragominas and Ulianópolis. According to IBGE (2017), the Pará State is subdivided in six mesoregions[20], and the project is inserted in two mesoregions, Northeast and Southeast Paraense.

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 the basis to project the baseline and future deforestation. The RR of the YBYRÁ REDD+ Project has an area of 3,526,270 ha (three million five hundred and twenty thousand, four hundred and thirty-two hectares).

The figure below (1) shows the location of the 74 properties involved in the YBYRÁ REDD+ Project in the 5 municipalities, in the Pará state.

[20] 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

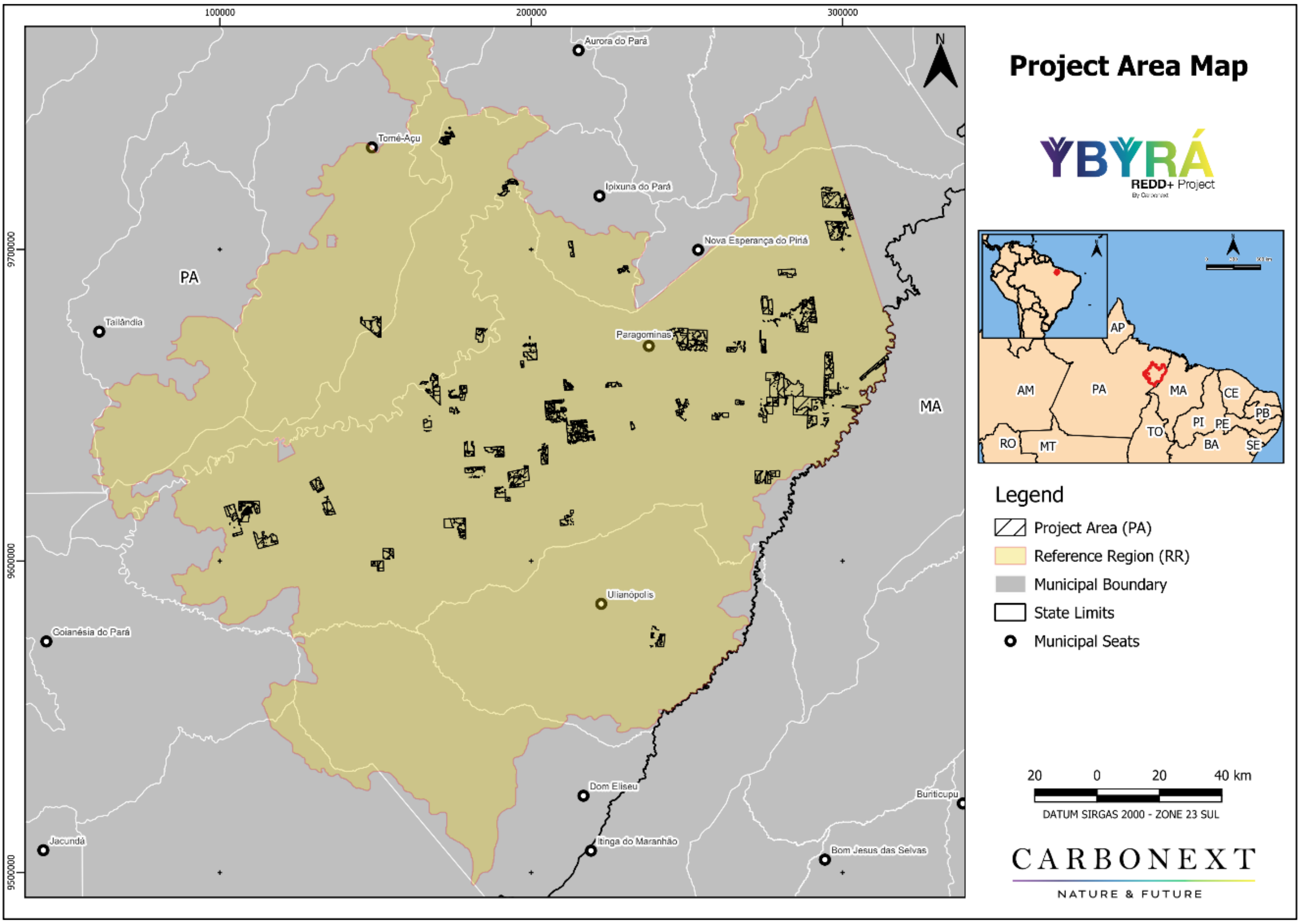


Figure 2.1 - Location of the project area in the YBYRÁ REDD+ Project.

The table 2.4 presents the geographic coordinates of the centroids of each property involved in the project.

Table 2.6 - YBYRÁ's properties that composes the project area. DATUM: SIRGAS 2000 – UTM 23S.

Property	Longitude	Latitude
ACATAUASSÚ II FARM	-46°50′2,40	-3°5′16,800″
ALAGOAS I FARM	-47°59′9,60	-3°5′42,000″
ALAGOINHA FARM	-47°58′37,2	-3°7′44,400″
ALVORADA FARM	-46°53′52,8	-3°10′1,200″
ANDIROBA FARM	-46°49′40,8	-2°33′43,200″
ANVERSA I FARM	-47°6′7,200	-3°8′56,400″
ANVERSA II FARM	-47°5′27,60	-3°9′0,000″
BADAJOZ PARTE 1-ALTEROSA FARM	-47°46′15,6	-2°31′44,400″
BEM TE VI FARM	-46°43′22,8	-3°3′57,600″

BOA ESPERANÇA FARM	-47°31′15,6	-3°14′49,200″
BOA ESPERANÇA II FARM	-47°43′12,0	-3°2′34,800″
BONANZA FARM	-47°42′10,8	-3°0′3,600″
CACHOEIRA FARM	-47°39′43,2	-3°18′14,400″
CALIFÓRNIA FARM	-47°16′19,2	-2°57′57,600″
CALIFÓRNIA II FARM	-47°1′22,80	-2°52′26,400″
CAMPO VERDE – MENOR FARM	-47°59′52,8	-3°12′50,400″
CÉU AZUL FARM	-47°54′57,6	-3°10′44,400″
CRISTAL FARM	-47°52′33,6	-3°18′10,800″
DOIS IRMÃOS FARM	-46°46′55,2	-3°10′4,800″
ESPERANÇA FARM	-48°18′57,6	-3°23′31,200″
ESTRELA DO NORTE FARM	-46°52′22,8	-3°12′32,400″
FLOR DO CAMPO FARM	-47°36′43,2	-3°9′39,600″
FLORESTA BG FARM	-48°8′9,600	-3°37′40,800″
FORMOSA FARM	-47°48′25,2	-3°17′52,800″
GLEBA 55/SANTA CLARA FARM	-46°48′36,0	-2°39′28,800″
IPÊ FARM	-46°57′39,6	-2°47′20,400″
ISRAEL FARM	-47°1′48,00	-2°58′12,000″
LOTE 35 FARM	-47°20′2,40	-3°48′57,600″
MAÇARANDUBA FARM	-48°19′26,4	-3°24′10,800″
MATÃO FARM	-47°0′25,20	-2°52′48,000″
MOLEZA FARM	-47°15′57,6	-3°11′31,200″
MUTUM FARM	-47°33′21,6	-3°13′19,200″
NASCENTE DA SERRA FARM	-46°47′31,2	-2°33′57,600″
NOSSA SENHORA DE NAZARÉ FARM	-48°9′10,80	-3°37′40,800″
PAJUSSARA III FARM	-47°9′18,00	-3°11′38,400″
PAMPULHA I FARM	-47°33′32,4	-3°15′0,000″
PAMPULHA II FARM	-47°35′2,40	-3°15′0,000″
PARAÍSO DO NORTE FARM	-47°0′50,40	-3°9′46,800″
PARAISO FARM	-47°13′4,80	-2°58′33,600″
PARAISO LEILA FARM	-47°54′57,6	-3°7′44,400″
PARAJU FARM	-47°1′1,200	-3°22′22,800″
PINGO DE OURO FARM	-47°53′38,4	-3°7′15,600″
PROSPERIDADE FARM	-47°27′21,6	-3°6′7,200″
RANCHO BG FARM	-47°25′55,2	-2°46′15,600″
RENASCER FARM	-47°38′24,0	-3°9′54,000″
RENASCER I FARM	-47°38′45,6	-3°11′49,200″
RENASCER II FARM	-47°37′30,0	-3°11′38,400″
RODA VIVA FARM	-47°52′44,4	-3°16′55,200″
SANTA BÁRBARA FARM	-47°15′39,6	-3°9′25,200″

SANTA CARMEM FARM	-47°55′12,0	-3°31′12,000″
SANTA CELIA FARM	-48°30′50,4	-3°28′4,800″
SANTA LUCIA FARM	-46°55′51,6	-2°54′28,800″
SANTA LUIZA FARM	-48°33′32,4	-3°29′38,400″
SANTA MARIA DO ACARÁ FARM	-48°9′21,60	-2°55′40,800″
SANTANA FARM	-46°47′2,40	-2°36′36,000″
SANTIAGO FARM	-47°1′48,00	-3°12′3,600″
SANTO ANTONIO FARM	-47°51′39,6	-3°21′25,200″
SÃO DIONÍSIO FARM	-48°6′46,80	-3°34′58,800″
SÃO FRANCISCO FARM	-47°35′20,4	-3°6′10,800″
SÃO MARCOS 2 FARM	-47°46′4,80	-3°25′48,000″
SÃO MATEUS FARM	-48°28′4,80	-3°32′56,400″
SÃO PIO FARM	-46°43′51,6	-3°4′40,800″
SAPUCAIA FARM	-47°6′28,80	-2°59′38,400″
SAYONARA FARM	-47°35′34,8	-3°29′42,000″
SOSSEGO FARM	-48°17′38,4	-3°26′38,400″
TANGARÁ FARM	-47°24′32,4	-3°13′26,400″
TEOLINDA I FARM	-47°50′42,0	-2°57′28,800″
TERRA BOA FARM	-46°56′31,2	-3°6′21,600″
TERRA BRUTA FARM	-46°59′42,0	-3°6′21,600″
UNIÃO FARM	-47°47′24,0	-3°24′54,000″
VAI E VEM FARM	-47°36′21,6	-3°11′38,400″
VINTE DE MAIO FARM	-47°56′31,2	-2°22′22,800″
VITÓRIA FARM	-47°44′2,40	-3°22′26,400″
ZINKAS I FARM	-47°34′55,2	-2°42′32,400″

Topography

The topography present in the RR ranges from a maximum elevation of 352 meters to a minimum 0 meters, shown in figure 2.2 below.

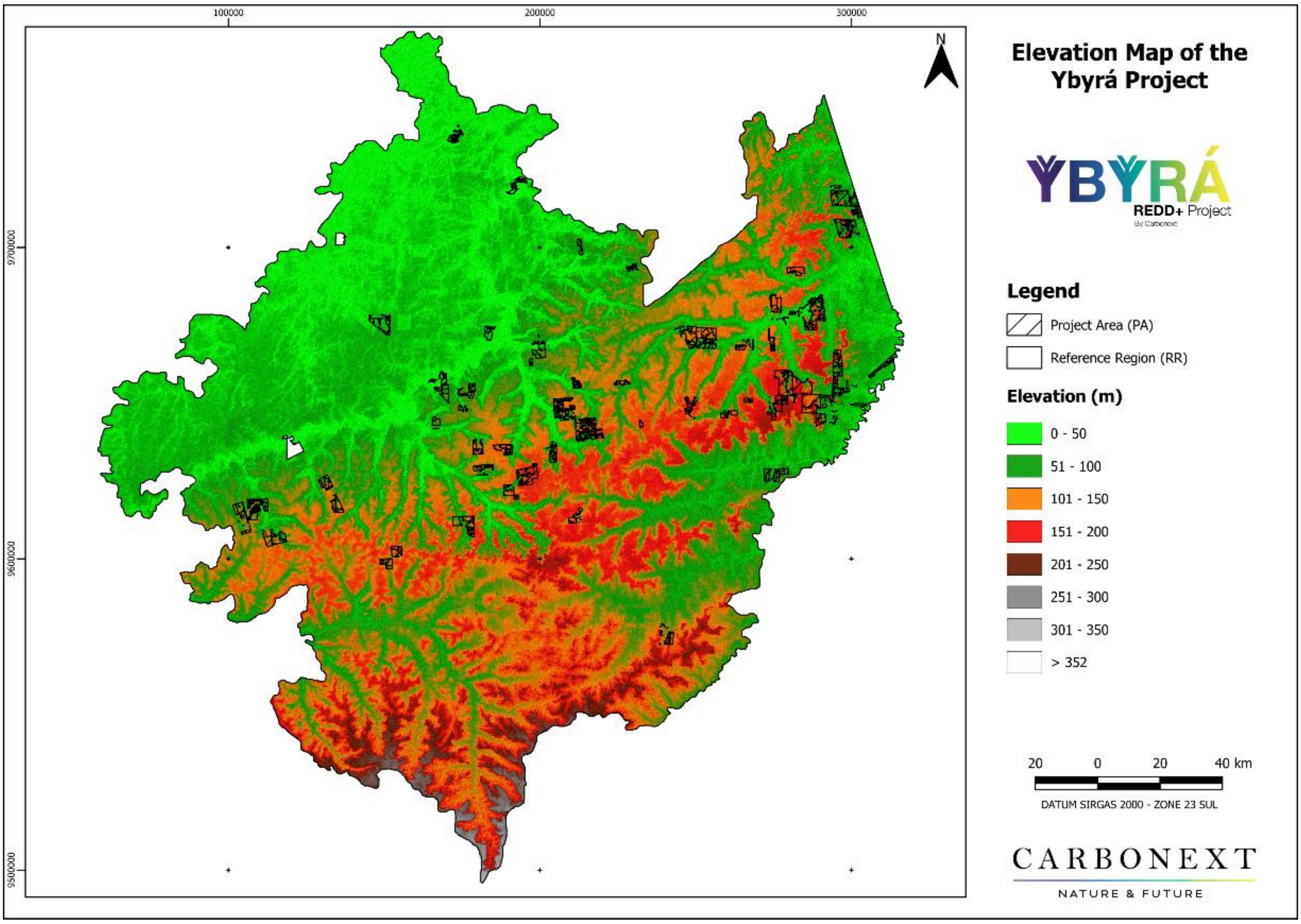


Figure 2.2 - Elevation variation in the reference region (RR) and project area (PA).

Slope

The slope is the declivity of the surface in relation to the horizontal, that is, the relationship between the difference in height between two points and the horizontal distance between these points. It is given by the angle of inclination (zenithal) of the surface of the terrain in relation to the horizontal[21]. The most part of RR area concentrates the slope between 3 to 8%. In RR area, there are six slope classes presented in the table 2.5 below, and the spatial distribution of these classes is shown in figure 2.3.

[21] Slope Definition:
http://www.dpi.inpe.br/Ambdata/declividade_gradiente.php#:~:text=A%20declividade%20%C3%A9%20a%20inclina%C3%A7%C3%A3o,terreno%20em%20rela%C3%A7%C3%A3o%20%C3%A0%20horizontal.

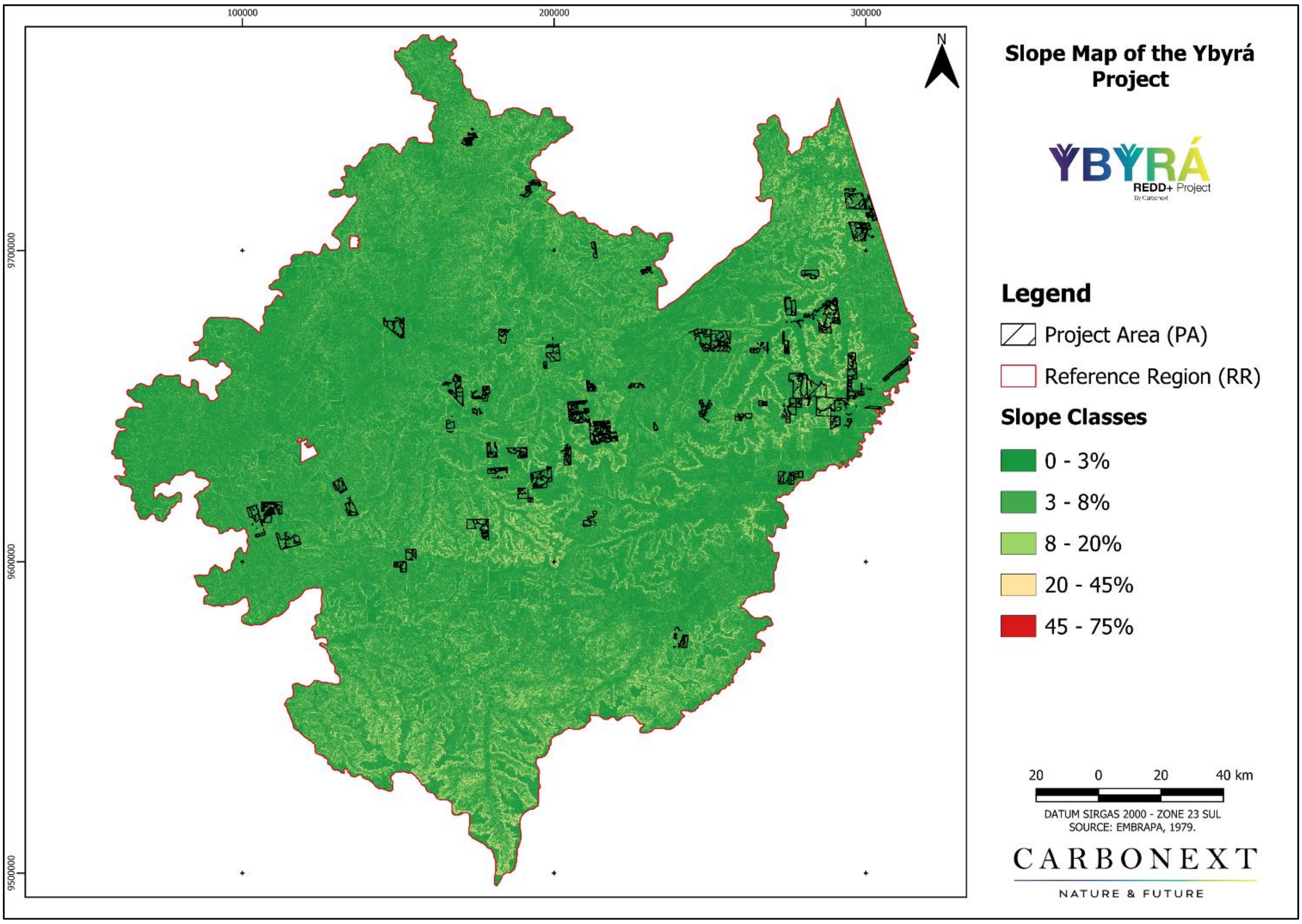


Figure 2.3 - Slope classes in reference region (RR) and project area (PA), according to Embrapa classification (1999).

Table 2.7 – Slope Classification and areas.

Class	Area (ha)	RR %
1 (0 e 3%)	751,152.00	21.30%
2 (3 e 8%)	1,661,051.00	47.11%
3 (8 e 20%)	954,917.00	27.08%
4 (20 e 45%)	154,224.00	4.37%
5 (45 e 75%)	4,910.00	0.14%
6 (75 a 2000%)	16.00	0.00%
Total	**3,526,270.00**	**100%**

Geological

The geological study of RR aims to describe the composition, structure, and geological evolution in these areas. The following information was obtained from the geological survey of the Brazilian Institute of Geography and Statistics[15]. Figure 2.4 below shows the different geomorphological classes present in the RR, the class with the highest presence is Itapecuru formation with 41.62%.

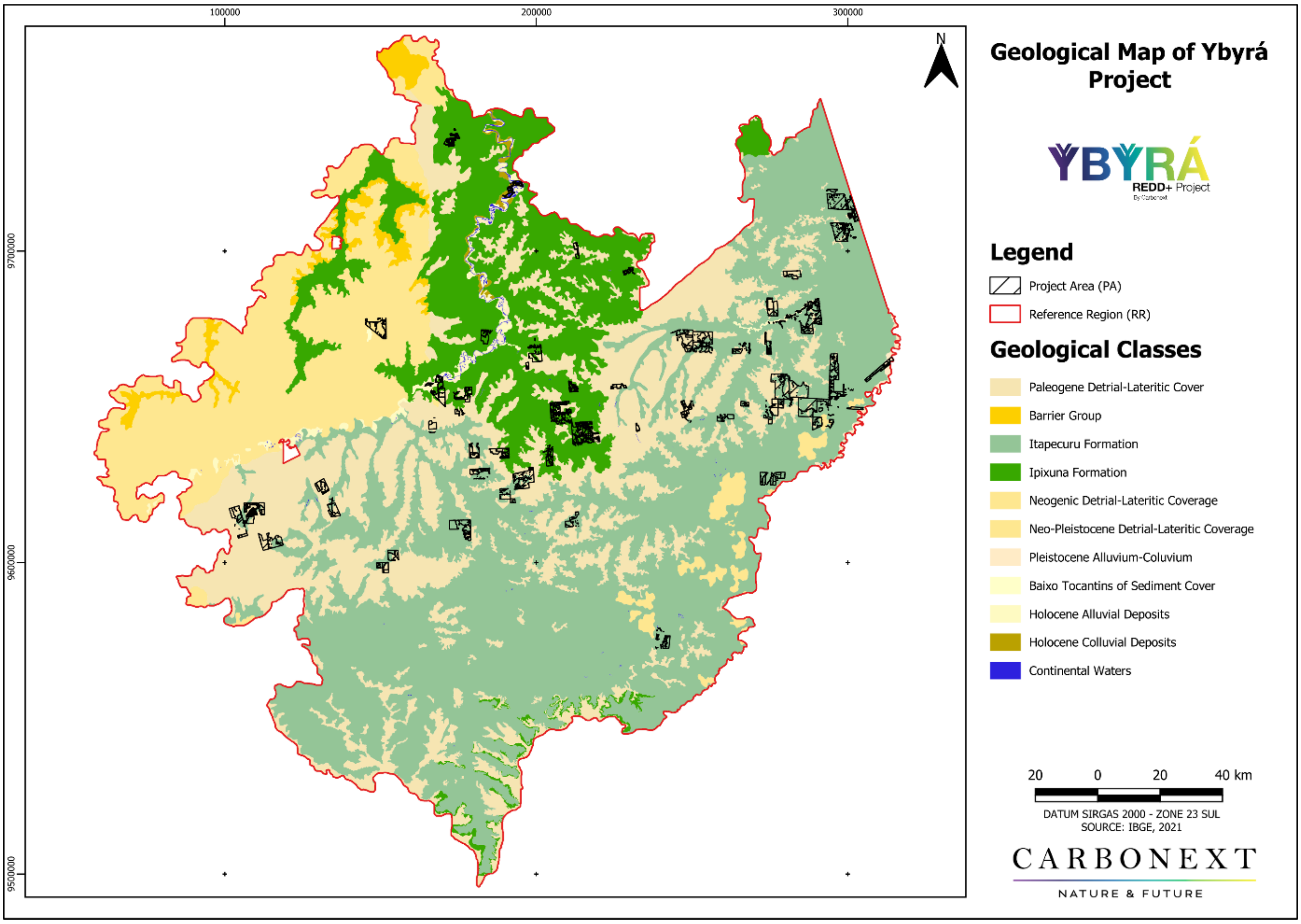


Figure 2.4 - Geological classes in reference region (RR) and project area (PA).

The geological units are grouped according to their characteristics such as age, type of rock, how they were formed, and other characteristics[22]. The geological time corresponds to all the time elapsed since the formation of the Earth[23]. The project is inserted in eleven geological units and seven geological time classes presented in the table 2.6 below, together with the area in each class. The geological class most present in the RR is the Itapecuru formation, with 41.6%.

[22] Geological Unity Definition: https://geohereditas.igc.usp.br/atuacao-inventario-em-unidades-geologicas/#:~:text=Para%20facilitar%20a%20sistematiza%C3%A7%C3%A3o%20e,rochas%20constituem%20as%20unidades%20geol%C3%B3gicas

[23] Geological Time Definition: https://www.ufrgs.br/museupaleonto/?page_id=736#:~:text=O%20Tempo%20Geol%C3%B3gico%20corresponde%20a,bilh%C3%B5es%20de%20anos%20(Ga).

Table 2.8 - Geological classes present in RR.

Geological Class	Geological time	Area (ha)	RR %
Pleistocene Colluvial Alluvial	Phanerozoic Cenozoic Neogene Pleistocene	8,468.55	0.24%
Barriers	Phanerozoic Cenozoic Neogene Miocene Langhian	57,056.26	1.62%
Neo-Pleistocene Detritus-Laterite Coverage	Phanerozoic Cenozoic Neogene Pleistocene	547,361.27	15.52%
Neogenic Detritus-Laterite Coverage	Phanerozoic Cenozoic Neogene Miocene Langhian	17,742.52	0.50%
Paleogene Detritus-Laterite Coverage	Phanerozoic Cenozoic Paleogene Oligocene	870,988.09	24.70%
Lower Tocantins Sedimentary Coverage	Phanerozoic Cenozoic Neogene Pliocene	467.59	0.01%
Mainland body of water	-	6,378.03	0.18%
Holocene Alluvial Deposits	Phanerozoic Cenozoic Neogene Holocene	28,989.82	0.82%
Holocene Colluvial Deposits	Phanerozoic Cenozoic Neogene Holocene	7,149.76	0.20%
Ipixuna formation	Mesozoic Phanerozoic Upper Cretaceous	514,194.34	14.58%
Itapecuru formation	Mesozoic Phanerozoic Lower Cretaceous Hauterivian	1,467,473.75	41.62%
Total		3,526,270.00	**100%**

Geomorphological

The geomorphology studies the origin and structure of landforms. The formation of elements of the earth's surface is identified by the nature of the rocks, the climate, and endogenous and exogenous factors[24]. The figure 2.5 below shows six geomorphological classes present in the RR according IBGE 2008 map[25].

24 Geomorphological definition: <http://www.dsr.inpe.br/DSR/areas-de-atuacao/topicos-de-pesquisa/geologia-geomorfologia#:~:text=A%20Geomorfologia%20estuda%20a%20origem,por%20fatores%20end%C3%B3genos%20e%20ex%C3%B3genos.>

25 Geomorphological Map. Source: https://geoftp.ibge.gov.br/informacoes_ambientais/geomorfologia/mapas/unidades_da_federacao/pa_geomorfologia.pdf . Access:18/03/2022

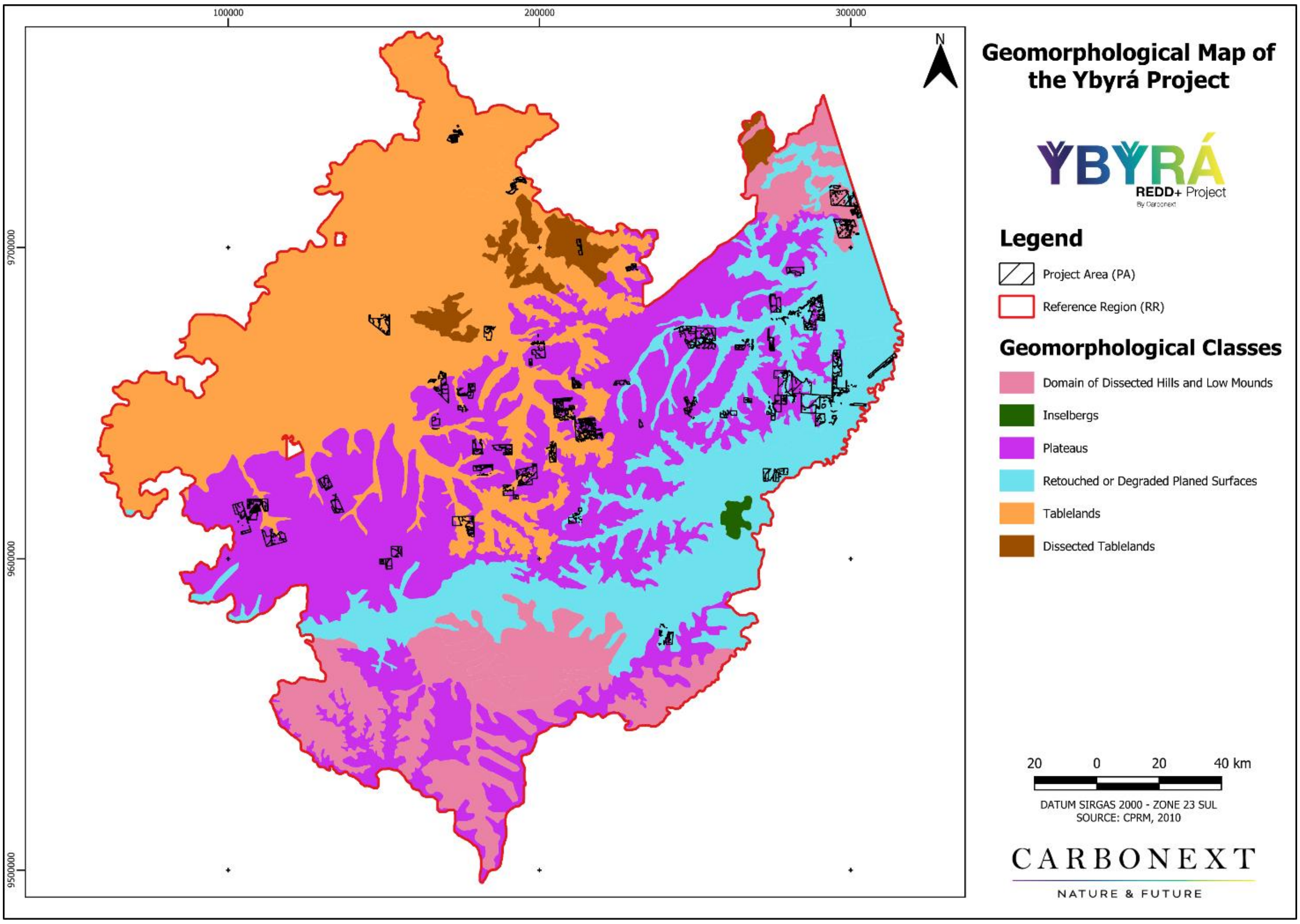


Figure 2.5 - Geomorphological units in reference region (RR) and project area (PA) of the YBYRÁ REDD+ Project

The table 2.7 presents the geomorphologic classes in the RR and their respective percentage of coverage. The major geomorphological unit present in the RR are the Plateau and Tableland classes.

Table 2.9 - Geomorphological classes present in RR of the YBYRÁ REDD+ Project.

Class	Area (ha)	RR %
Domain of Hills	431,533.52	12.24%
Inselbergs	8,837.73	0.25%
Plateaus	1,165,082.59	33.04%
Planed Surfaces	705,550.54	20.01%
Tablelands	1,135,407.65	32.20%
Dissected Tablelands	79,857.97	2.26%
Total	3,526,270.00	**100%**

Pedological

In the RR were identified eight different types of soils according IBGE (2008) pedological map[26], presented in the figure 2.6 below.

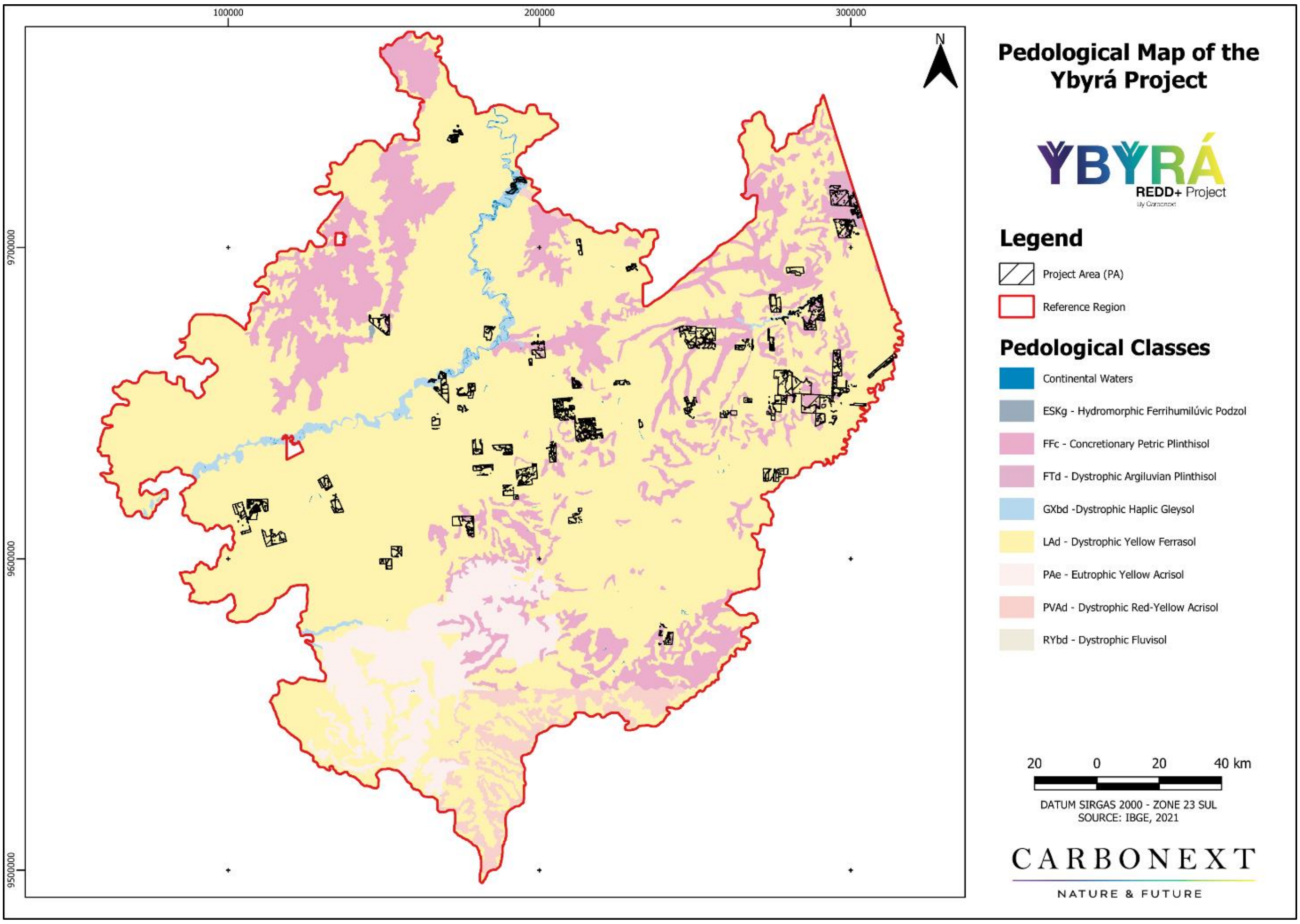


Figure 2.6 - Pedological classes in reference region (RR) and project area (PA) of the YBYRÁ REDD+ Project.

The table 2.8 below presents the pedological classes present in the RR and their respective percentage of coverage. Most of the RR has the presence of the class Dystrophic Yellow Ferrasol, with 73.29% of coverage. The lowest class present is the Hydromorphic Ferrihumilúvic Podzol with 0.02% of coverage.

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

Table 2.10 - Pedological classes present in RR.

Class	Area (ha)	RR %
ESKg – Hydromorphic Ferrihumilúvic Podzol	721.42	0.02%
FFc – Concretionary Petric Plinthisol	565,853.71	16.05%
FTd – Dystrophic Argiluvian Plinthisol	9,788.97	0.28%
GXbd – Dystrophic Haplic Gleysol	45,469.96	1.29%
LAd – Dystrophic Yellow Ferrasol	2,584,442.27	73.29%
PAe – Eutrophic Yellow Acrisol	230,723.12	6.54%
PVAd – Dystrophic Red-Yellow Acrisol	82,850.02	2.35%
RYbd – Dystrophic Fluvisol	42.50	0.00%
Continental Waterbody	6,378.01	0.18%
Total	3,526,270.00	**100%**

Hydrology

The state of Pará has seven hydrographic macro-regions[27] which are Baixo Amazonas, Tapajós, Portel-Marajó, Xingu, Atlantic Coast-Northeast, Calha Norte and Tocantins-Araguaia. All of them are locally and regionally important to the hydrography of the state and Amazon forest.

The project is inserted in the Tocantins-Araguaia hydrographic region, in the Baixo Tocantins mesoregion and Acará/Guamá microregion, as shown in the figure below (2.7).

[27] 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.

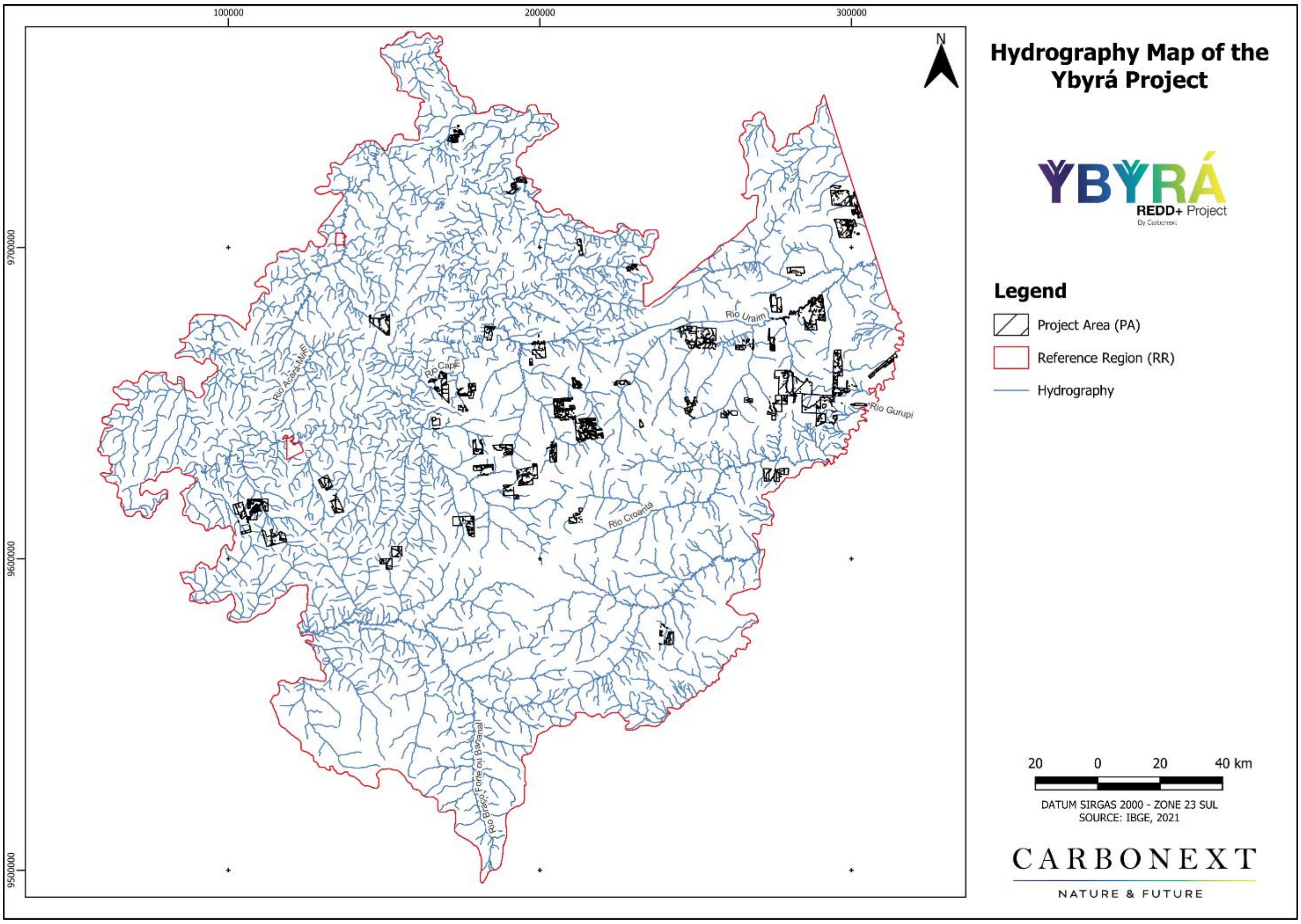


Figure 2.7 - Rivers in Reference Region (RR) and Project Area (PA) of the YBYRÁ REDD+ Project.

There are 6 main rivers in the Reference Region, presented below (table 2.9).

Table 2.11 - Main rivers present in RR.

River	Length (Km)
Capim River	440.27
Acará-Mirim River	177.77
Uruim/Uraim River	158.15
Gurupi River	56.80
Braço Forte/Bananal River	116.90
Croantá River	129.94

Climate

Most of the project area is located in a transition area between AF (Tropical humid or super humid climate) and AW (Tropical) climates (the classes are presented in the figure 2.8 below). Another part is classified as AM (humid or sub-humid tropical climate), according to the Köppen 1948 classification[28]. The zone is characterized as equatorial zone with a dry period of one to two months of the year, with average temperature above 18ºC in all months of the year.

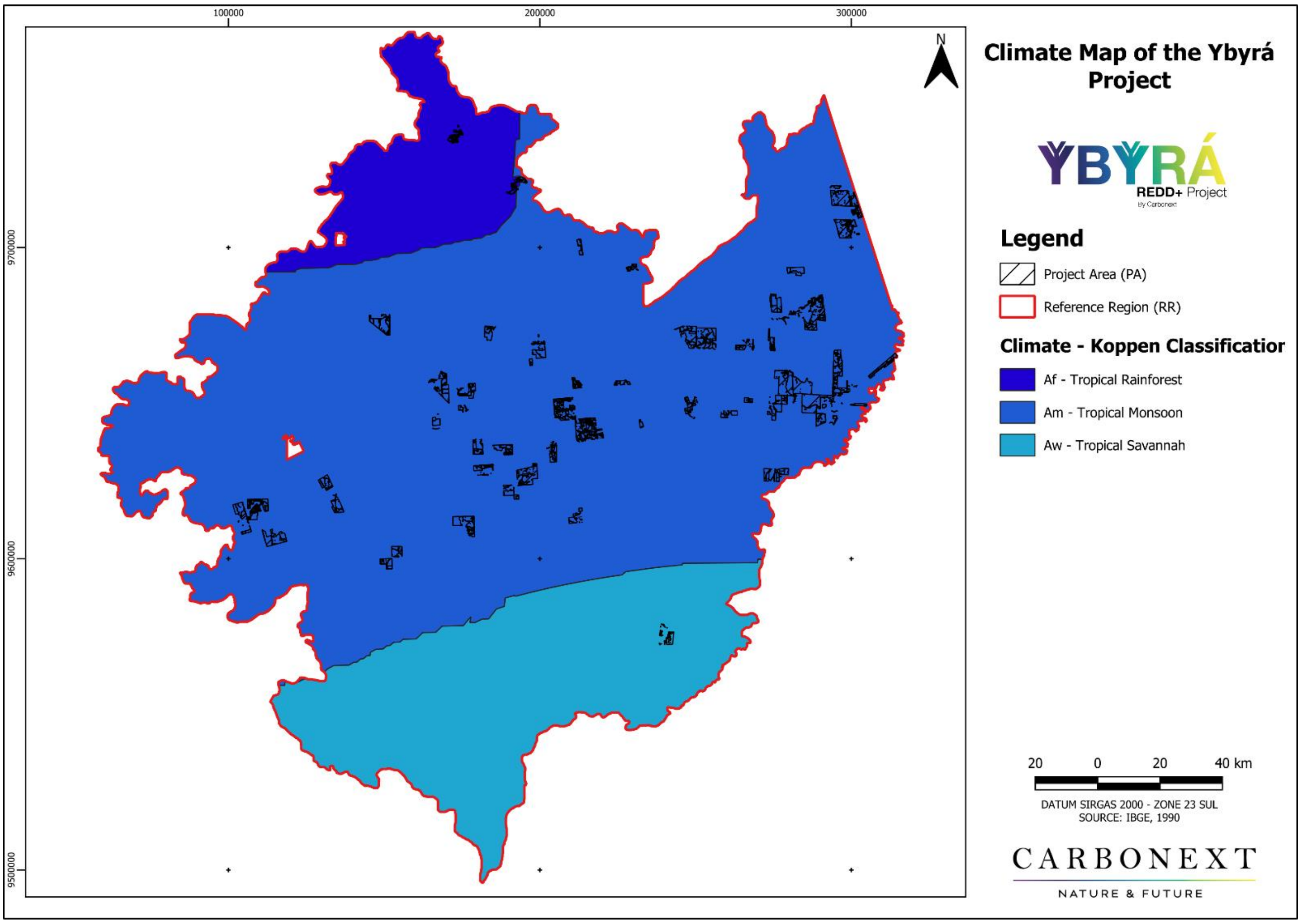


Figure 2.8 - Climate features of the Reference Region (RR) and Project Area (PA) of the YBYRÁ REDD+ Project, according to Köppen classification.

The table below (2.10) shows the area and proportion of the RR that are distributed in Af, Am and Aw Koppen Classes.

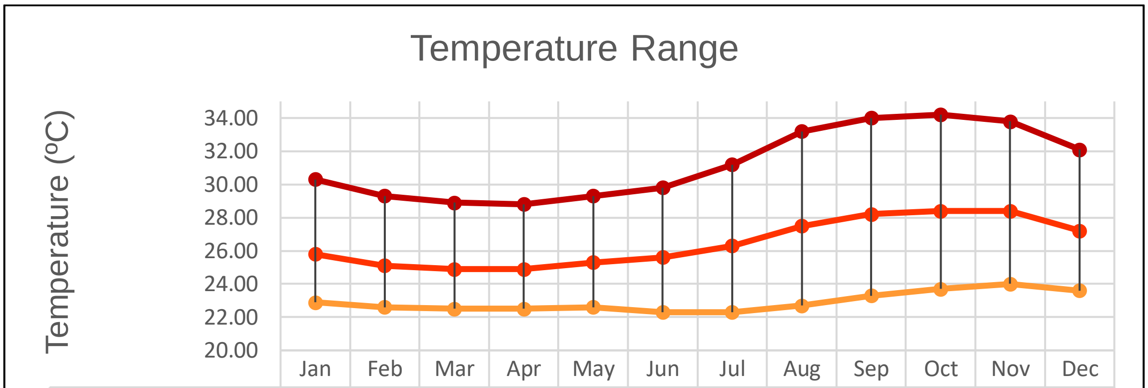
Table 2.12 - Köppen classes present in RR.

Koppen_Classes	Area (ha)	RR (%)
Af	286,005.03	8.11%
Am	2,546,645.48	72.22%
Aw	693,619.49	19.67%
Total	**3,526,270.00**	**100.00%**

Temperature

[28] Koeppen 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.

The temperature in Paragominas, the main municipality of the project, during the year, according to data of a historical series 1991-2021 from dataclimate.org shows that the warmest months are October and November, with an average temperature of 28.4ºC, and the months with the lowest temperature are March and April, with an average temperature of 24.9ºC, showing a variation of 3.4ºC throughout the year (figure 2.9)[29].



	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 2.9 – Temperature variation in Paragominas (historical series 1991-2021).

The figure 2.10 shows the spatial distribution over the RR area of the annual mean temperature variation, from WorldClim historical climate database[30]. The maximum temperature is 26.62 ºC and the minimum temperature is 25.18 ºC.

[29] Temperature -Precipitation – Rainy – Humidity - Data Source: [https://pt.climate-data.org/america-do-sul/brasil/para/paragominas-714961/.](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
[30] https://www.worldclim.org/data/worldclim21.html

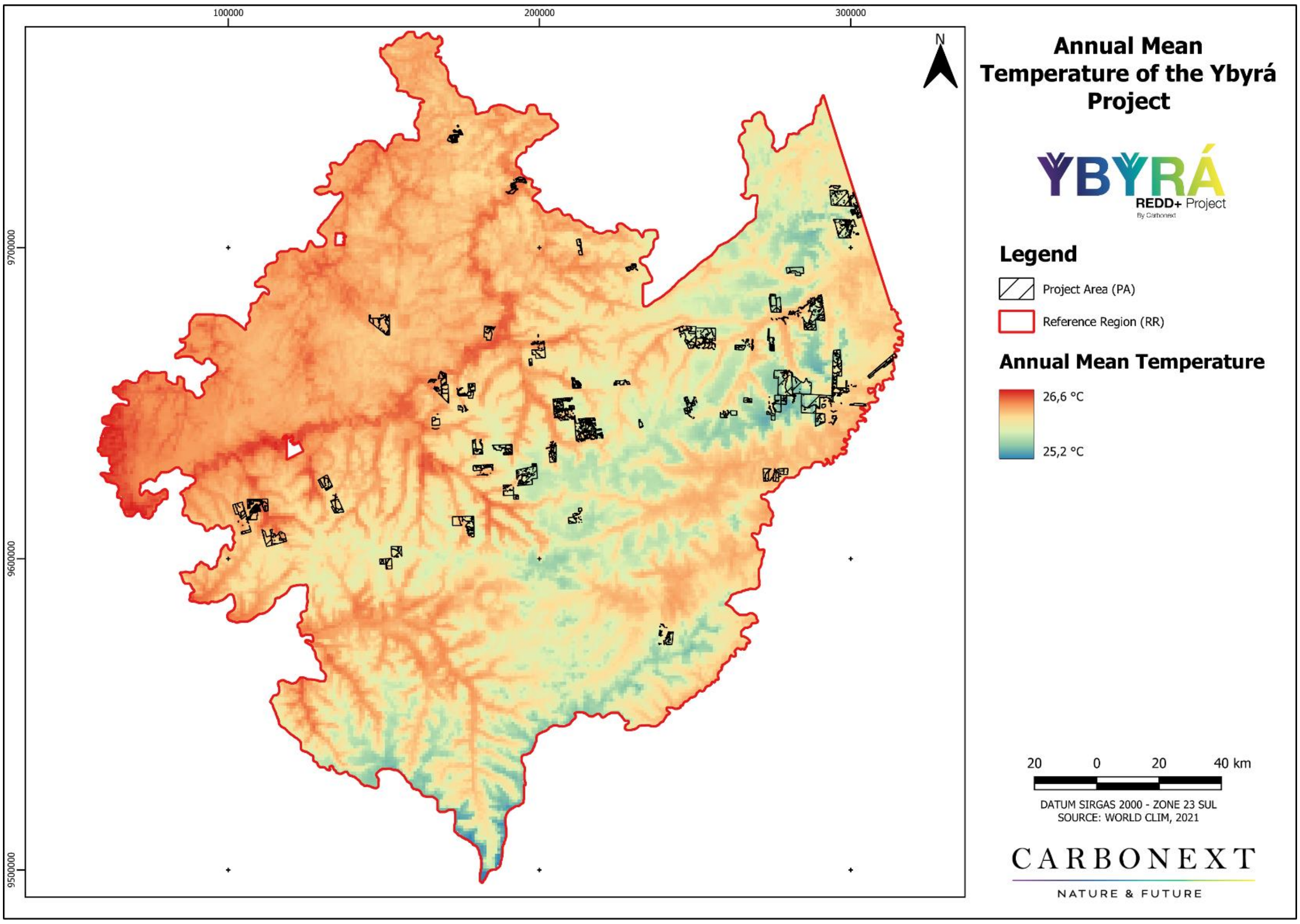


Figure 2.10 - Spatial distribution of Annual Mean Temperature in Reference Region (RR) and Project Area (PA) of the YBYRÁ REDD+ Project.

Precipitation

In Paragominas, the main municipality of the project, 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. September is the month with the least precipitation, with 16mm[31] (figure 2.11).

[31] 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

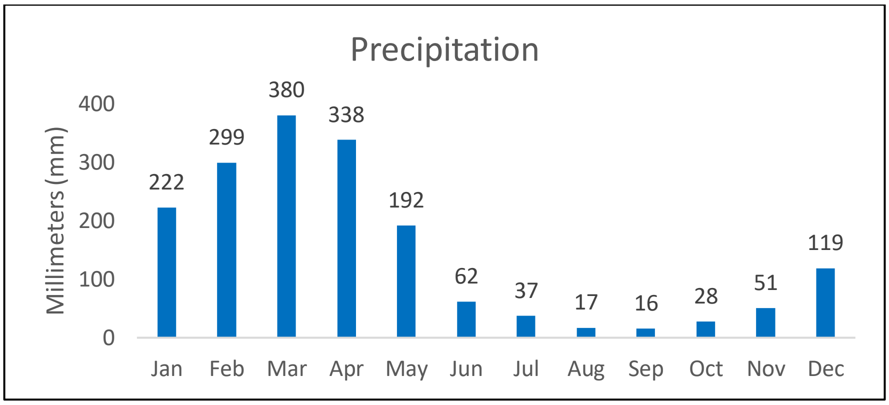


Figure 2.11 – Precipitation in Paragominas (Historical Series 1991-2021).

In the RR, the northwest region presents the highest concentration of annual precipitation volume approximately 2,323 mm, and the southeast region presents the lowest concentration of the annual precipitated volume with approximately 1,632 mm. The figure 2.12 below present the distribuition of precipitation in the RR.

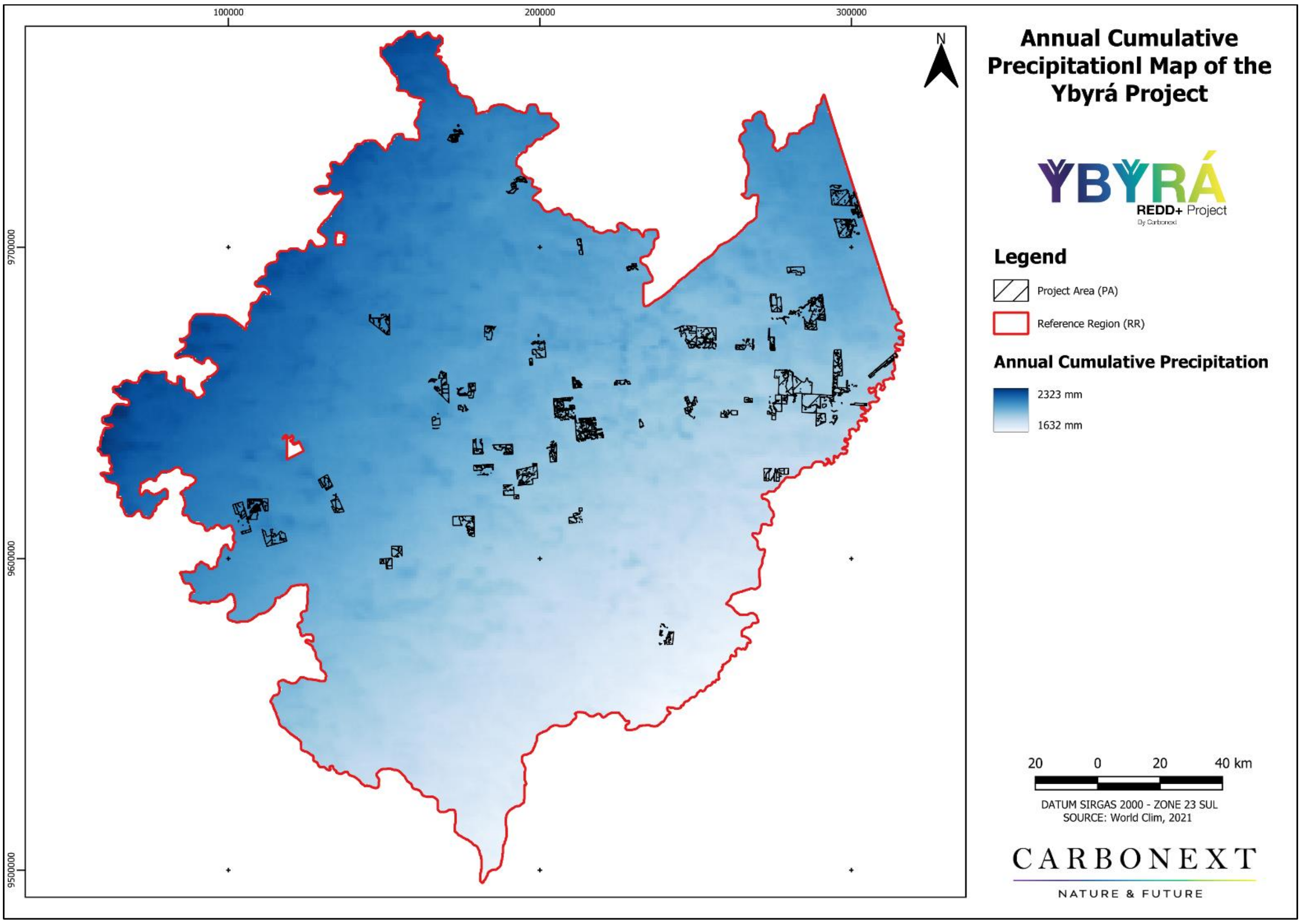


Figure 2.12 - Spatial Distribution of Average Annual Precipitation in Reference Region (RR) and Project Area (PA) of the YBYRÁ REDD+ Project.

The table below (2.11) shows the classes of Annual Precipitation in the Reference Region.

Table 2.13 - Classes of annual precipitation in the RR.

Classes of Annual Precipitation (mm)	Area (ha)	RR (%)
1 (entre 1500 e 2000)	1,944,520.00	55.14%
2 (entre 2000 a 2500)	1,581,750.00	44.86%
Total	**3,526,270.00**	**100.00%**

Vegetation

In the region of project, the forest type predominant is Dense Ombrophilous Forest, and its variations Lowlands and Submontane. The predominant characteristic on 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 the topographic and latitudinal variation[32].

The figure 2.13 presents the distribution of forest types in the PA and RR.

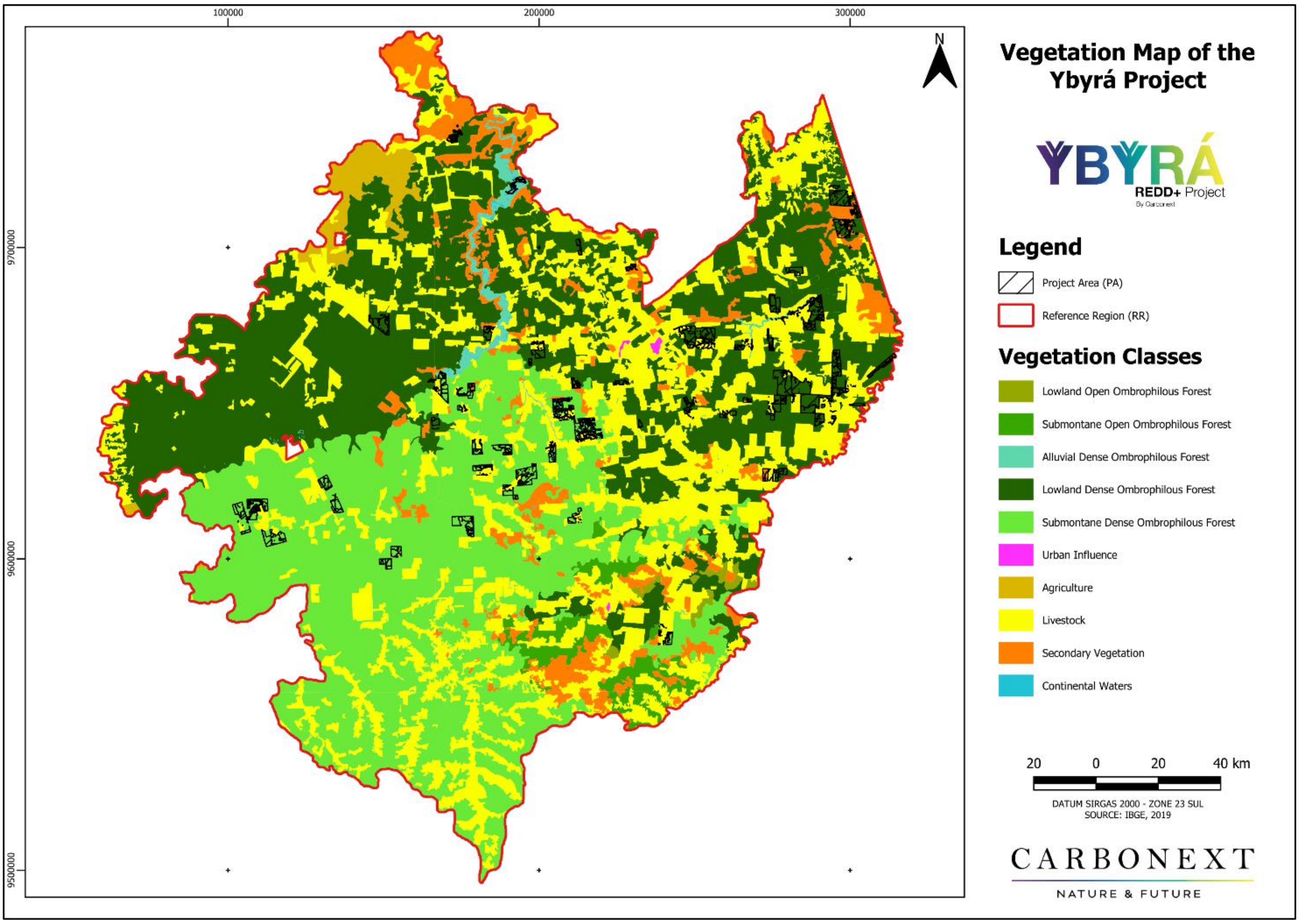


Figure 2.13 - Vegetation classes and others uses identified in Reference Region areas, from IBGE classification (2019).

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

The table below (2.12) shows the proportion of vegetation classes in the forested areas inside the RR and PA, according to IBGE data.

Table 2.14 - Proportion of phytophysiognomy classes in the PA and RR.

Forest classes	Class code	RR			PA		
		Area (ha)	**% of Total**	**% Cumulative**	**Area (ha)**	**% of Total**	**% Cumulative**
Lowland Dense Ombrophilous Forest	Db	1,134,830.00	50.8 %	50.8 %	46,521.8	60.8 %	60.8 %
Submontane Open Ombrophilous Forest	As	62,151.20	2.8 %	53.6 %	85,7	0.1 %	60.9 %
Alluvial Dense Ombrophilous Forest	Da	27,707.00	1.2 %	54.8 %	1,287.1	1.7 %	62.6 %
Lowland Open Ombrophilous Forest	Ab	12,675.00	0.6 %	55.4 %	0,0	0 %	62.6 %
Submontane Dense Ombrophilous Forest	Ds	995,484.00	44.6 %	100 %	28,586.8	37.4 %	100 %
Total		2,232,847.20	100 %		76,481.3	100 %	

In the west region of the state of Maranhão, bordering the project area, there is a Conservation Unit called Reserva Biológica do Gurupi[33], created in January 1988, by the decree nº 95.614. A Biological Reserve (REBIO) is a natural area of integral protection established by the government with the aim to preserve all living beings in that environment and the ecosystem, since direct human interference or environmental modifications are not allowed.

The Gurupi Biological Reserve, together with the Indigenous Lands: Alto Turiaçu, Awá, Caru, Rio Pindaré, Araribóia and Alto Rio Guamá (in Pará), compose the Gurupi Mosaic, which is a territory of broad socio-biodiversity that forms an important ethno-environmental corridor, whose area of influence covers approximately 46,400 km² in the state of Maranhão and eastern Pará. This territory is home to a rich flora, terrestrial and aquatic fauna, with numerous endemic and endangered species. However, this same area is one of the most threatened by the pressure of deforestation caused mainly by invaders in search of wood or illegal hunting[34].

2.1.6 Social Parameters (G1.3)

2.1.6.1. History and economic context

In the 1970s, territorial occupation in the Amazon intensified due to the large projects implemented in the region, such as highways, mining and hydroelectric plants. These incentives

[33] https://www.gov.br/icmbio/pt-br/assuntos/biodiversidade/unidade-de-conservacao/unidades-de-biomas/amazonia/lista-de-ucs/rebio-do-gurupi/arquivos/rebio_gurupi.pdf

[34] https://ispn.org.br/mosaico-gurupi-se-reune-para-fortalecer-estrategias-de-governanca-e-gestao-ambiental-e-territorial/#:~:text=O%20Mosaico%20Gurupi%20%C3%A9%20um,Maranh%C3%A3o%20e%20leste%20do%20Par%C3%A1.

occurred through public policies aimed at economic progress, such as the National Development Plan (PND) proposing to integrate the Amazon with the rest of the country's economic centers [35].

This occupation dynamics provoked a migratory flow from other regions of Brazil to the Amazon disorderly, causing agrarian, social and environmental conflicts. In southeastern Pará, one of the predominant policies was land reform with the creation of settlements as part of a strategy to facilitate colonization in the territories [36].

According to HÉBETTE, J. [37](2004) among the main consequences under the model of economic development proposed by the Brazilian government was the exploitation of natural resources in the region, impacting on the resident populations, with concentration of income, disorderly population growth, increase in poverty and hunger, and land conflicts.

Therefore, considering the historical process of the Northeast and Southeast regions of Pará is essential to define strategies that aim to improve the socioeconomic and sustainable development of the communities residing in the region. Thus, the design of project activities considers the peculiarities and social dynamics present in each community, seeking to guarantee the balance between the use of natural resources and the current productive means.

Agrarian Reform Areas and Communities

Part of the project's neighbouring populations reside in Agrarian Reform Settlements, Rural Agglomerations, Agrovillages and areas of Indigenous Reserve. The agrarian reform settlement is a set of agricultural units, installed by INCRA on a rural property. Each of these units, is destined for a family of farmer or rural worker without economic conditions to acquire a rural property, in order to implement familiar agriculture, for own sustenance. Each family benefited must develop productive activities. Until the domain title is issued, the lot belongs to INCRA. Therefore, the beneficiary cannot sell, rent, donate, lease or lend his land to third parties.

The settlements also have common areas for communitarian use and for the construction of collective structures, such as churches, community centres, agro-industries, schools, health units and sports areas. Every agrarian reform area has environmental preservation areas, such as legal reserves and permanent protection areas. Each lot in a settlement is a family unit in its respective municipality and demands benefits from all spheres of government (municipal, state and federal).

The reality demonstrates that the population, especially in the small villages and in agrarian reform areas have low income generation and poor food security. Most of the care provided to the population is done by Community Health Agents. More serious illnesses are generally treated in the cities.

[35] Santos et al. 2020.
[36] Silva Filho, 2016.
[37] J. Hébette, 2014.

Regarding education, schools from 1st to 4th grade are precarious. There are limitations in the number of high schools, teaching materials and school meals. In addition, most young people and adults cannot finish elementary school because they need to work to increase their income generation.

Considering technical assistance, it does not meet the needs of the communities. The precariousness of the local roads during the rainy season also affects the flow of production.

Economy and productive activities

There are two economic poles in the region: Paragominas and the urban area of Tomé-Açu and Quatro Bocas. These poles have easy communication with the capital, Belém, and other cities as Castanhal and Imperatriz in Maranhão.

By the region overpass three main roads: BR-010, PA-140, and PA-150, interconnecting Belém to Brasília, Tomé-Açu to the Belém, and the PA-150, respectively. These roads serve as an integration axis to the economic hub of Marabá, in the South of Pará, and the region of the Barcarena Industrial Complex and Port of Vila do Conde.

One of the municipalities, Tomé-Açu, stands out for diversification of the production of permanent crops, such as black pepper, Açai and Cocoa, which are sold locally, nationally and to other countries like Japan. The Bank of the Amazon and Embrapa have developed important works of access to credit and research in the region, adopting crop consortia and SAF (Agroforestry System) projects.

On the other hand, Paragominas and Ulianópolis have established important poles of temporary crops, especially corn, rice and soybeans. These crops have shown higher yields in relation to other localities, which leads to believe in the existence of an intensive model of agriculture in these two municipalities[38].

Ipixuna do Pará is a large producer of cassava, a reflection of the strong presence of small family-based producers. It is notorious, however, the lack of technical assistance in the municipalities, which translates into low yields in the production of corn and rice[39].

The production of soybean and palm oil in the 4 municipalities involved in the YBYRÁ REDD+ Project represented more than 33% and 19%, respectively, of all the production of the Pará State in 2021[40].

[38] https://cidades.ibge.gov.br/
[39] https://cidades.ibge.gov.br/
[40] https://cidades.ibge.gov.br/.

The production of cattle is one of the main productive activities in the region, occupying more than 75% of non-forest areas in the RR. The IBGE estimates[41] that in 2021, the 4 municipalities included in the Project Area of the project had 695,678 heads of cattle.

After extractivism, the extraction of wood, for timber and charcoal, is the most significant activity. The production of charcoal in the 4 municipalities of this project represented more than 50% of all the charcoal production in the Pará State in 2021 (IBGE).

The table 2.13 demonstrates a reflection on the socioeconomic characteristics of the municipalities within the 20km buffer around the PAs of the project. The information are official data from IBGE. The demographic increase, per capita income, and income concentration (Gini index[42]) of these populations stand out.

Table 2.15 - Socioeconomic information of the municipalities within the 20km buffer of the PAs.

TERRITORY	Ipixuna do Pará (PA)	Paragominas (PA)	Tomé-Açu (PA)	Ulianópolis (PA)
TOTAL POPULATION 1991	9,188	60,367	41,403	6,709
TOTAL POPULATION 2000	25,138	76.45	47,273	19,254
TOTAL POPULATION 2010	51,309	97,819	56,518	43,341
PER CAPITA HOME (R$) 1991	144.75	334.78	282.23	506.32
PER CAPITA HOME (R$) 2000	188.48	507.16	326.18	558.72
PER CAPITA HOME (R$) (2010)	-	-	-	-
GINI CENSUS INDEX (1991)	0.46	0.54	0.54	0.63
GINI CENSUS INDEX (2000)	0.59	0.61	0.60	0.75
GINI CENSUS INDEX (2010)	0.57	0.60	0.54	0.70

[41] https://cidades.ibge.gov.br/brasil/pa
[42] Available on: https://www.ipea.gov.br/desafios/index.php?option=com_content&id=2048:catid=28#:~:text=O%20que%20é%3F%20-%20Índice%20de%20Gini&text=O%20Índice%20de%20Gini%2C%20criado,apresentam%20de%20zero%20a%20cem)

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The index varies from 0 (minimum) to 1 point (maximum) to classify the level of each locality. The objective is to monitor development and assess possible opportunities for the locality. As a classification, they are considered: low development (<0.4), regular development (0.4:0.6), moderate development (0.6:0.8) and high development (>0.8).

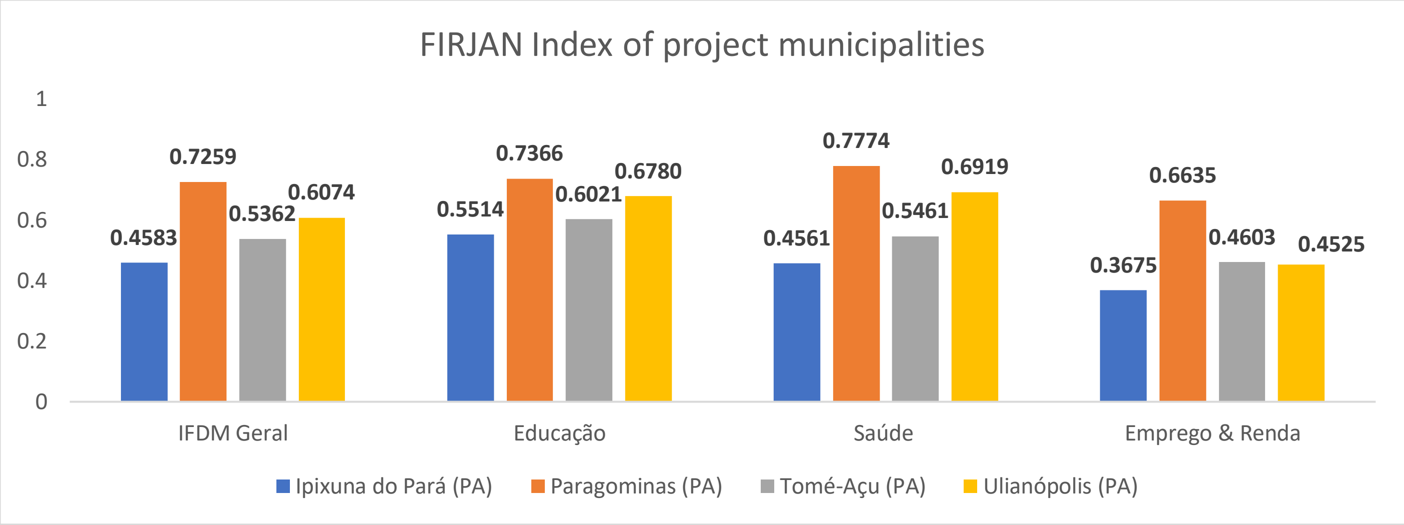


Figure 2.14 - Firjan Index information IFDM, education, health and income in Ipixuna do Pará, Paragominas, Tomé-Açu and Ulianópolis.

Table 2.16 - Ranking of the municipalities in the FIRJAN Index.

Municipalities	Ranking	
	National	State
Ipixuna do Pará (PA)	5368º	127º
Paragominas (PA)	1584º	4º
Tomé-Açu (PA)	4903º	64º
Ulianópolis (PA)	4071º	26º

According to the presented information, it is observed disproportionality[43] in the access and distribution of basic resources considering national and state level of the municipalities of the project.

The table below (2.15) presents the main characteristics of the municipalities involved in the YBYRÁ REDD+ Project, regarding household income, education, sanitation and population size, estimated by the IBGE[44].

[43] Considering the Brazilian State and the State of Pará present, respectively, 5,568 and 144 municipalities.
[44] https://cidades.ibge.gov.br/brasil/pa/

Table 2.17 - Main characteristics on the municipalities of the YBYRÁ REDD+ Project.

	Household income (IBGE, 2020)	Education (IBGE, 2010)	Sanitation (IBGE, 2010)	Population (IBGE, 2021)
Paragominas	Average salary: 2.4 times the minimum wage. 41.3% of the population earns half the minimum wage 16.4% of the population has a formal work	Enrollment rate for 6- to 14-year-olds: 95.9%	12.4% of households with adequate sanitation	115,838
Tomé-Açu	Average salary: 1.5 times the minimum wage. 44.4% of the population earns half the minimum wage 13.8% of the population has a formal work	Enrollment rate for 6- to 14-year-olds: 95.6%	2.6% of households with adequate sanitation	64,604
Ipixuna do Pará	Average salary: 2.0 times the minimum wage. 53.1% of the population earns half the minimum wage 5.9% of the population has a formal work	Enrollment rate for 6- to 14-year-olds: 74.8%	25% of households with adequate sanitation	67,170
Ulianópolis	Average salary: 1.8 times the minimum wage. 46.4% of the population earns half the minimum wage 7.7% of the population has a formal work	Enrollment rate for 6- to 14-year-olds: 82.7%	9.9% of households with adequate sanitation	62,286

2.1.6.2. Settlement projects, rural agglomerations and indigenous lands

The communities of the YBYRÁ REDD+ Project are subdivided in internal and external communities. The internal community refers to the people living in the properties with PAs, that are workers of the farms and their families. The external communities are the communities outside the PAs. Not all visited external communities will participate on project activities. The 8 external community, which are referred in this PD as the communities that will participate on the YBYRÁ project, will be further presented in item 2.1.9.

There is a distinguishment between communities identified in the 20km buffer, from the ones visited by the project and from the ones that can directly be benefited with the project activities. Another important distinguishment is regarding the types of communities, that can be classified as official settlement projects, rural agglomerations and indigenous lands.

Within the 20km buffer centred on the properties of the project area, 51 communities were identified, being 33 settlement projects and 18 rural agglomerations (figure 2.15).

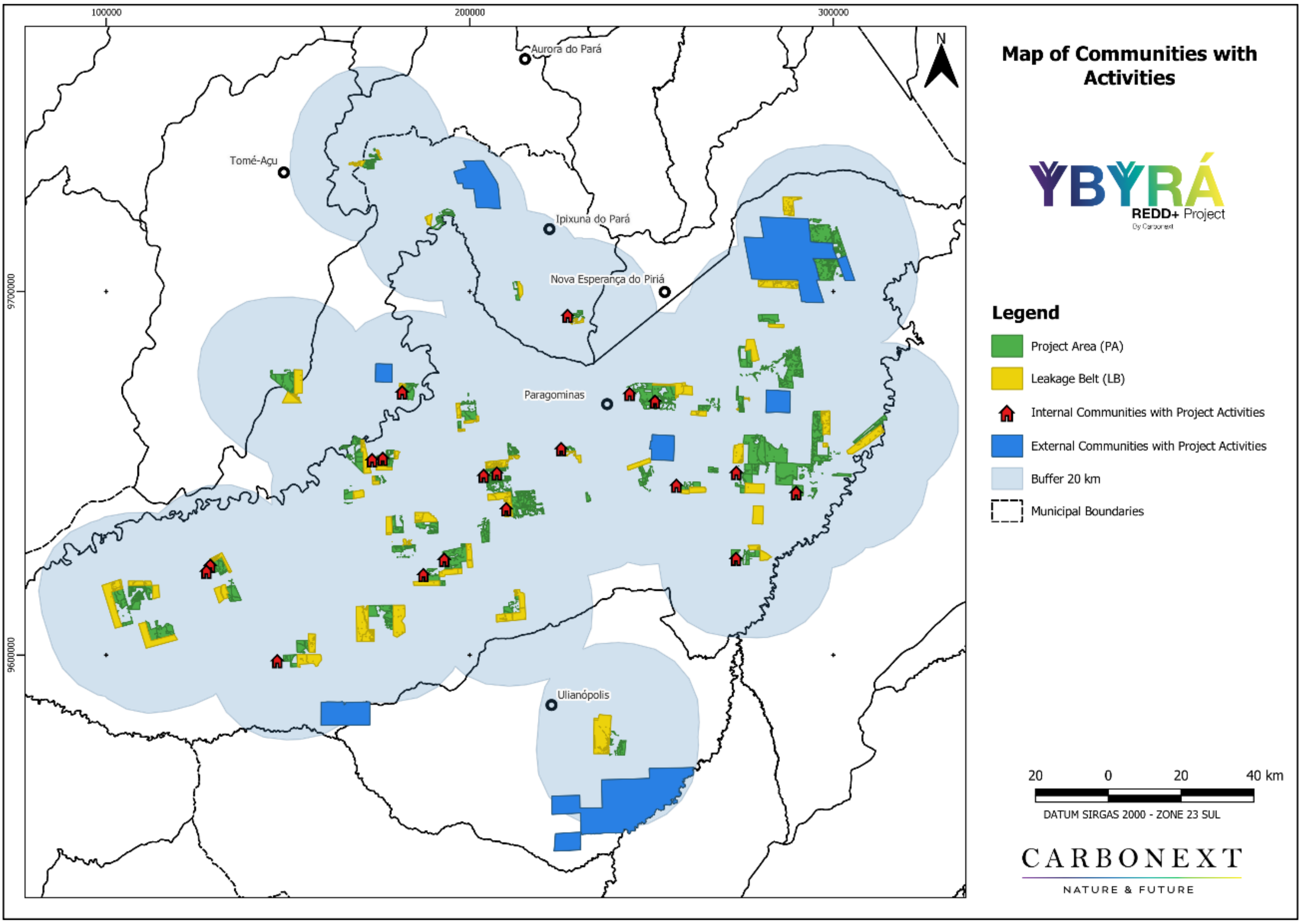


Figure 2.15 - The 20km buffer distance from the PAs of the YBYRÁ REDD+ Project.

Information on the settlement projects identified in the 20km buffer are detailed in the tables below (2.16), from the National Institute of Colonization and Agrarian Reform (INCRA)[45].

Table 2.18 - Settlements Projects in the 20km buffer of the YBYRÁ's Project Area.

Settlements Projects	**Municipality**	**Area (ha)**	**Number of families**
Anuerá	Aurora do Pará/PA	2.290,92	74
São Benedito	Aurora do Pará/PA	13.144.309	0
Esperança	Aurora do Pará/PA	48.358.916	99
Flor de Minas	Aurora do Pará/PA	26.150.162	87
Pedro Souza	Aurora do Pará/PA	11.553.269	34
Três Irmãos	Aurora do Pará/PA	34.793.256	55
Bacabal	Ipixuna do Pará/PA	23.099.184	18
Bom Jesus	Ipixuna do Pará/PA	7466	55
Candiru	Ipixuna do Pará/PA	9951	200
Diamantina II	Ipixuna do Pará/PA	2.264.883	81
Enalco	Ipixuna do Pará/PA	14316	440
João Batista	Ipixuna do Pará/PA	30.432.899	74
União I	Ipixuna do Pará/PA	135.578.325	299
Minas Pará	Ipixuna do Pará/PA	103.225.442	280
Arapuã Simeira	Nova Esperança do Piriá/PA	74452	1282
Cidapar 2ª Parte	Nova Esperança do Piriá/PA	350.815.867	467
Areia Branca	Paragominas/PA	16.230.622	16
Alta Floresta	Paragominas/PA	39.889.229	107
Camapuã	Paragominas/PA	6951.94	78
Colonia Reunidas	Paragominas/PA	4512	27
Del Rey	Paragominas/PA	8.710.837	116
Nova Vida	Paragominas/PA	39.521.785	68
Paragonorte	Paragominas/PA	320.956.712	988
Glebinha	Paragominas/PA	1.748.874	26
Luiz Inácio	Paragominas/PA	343.326.167	579
Mandacaru	Paragominas/PA	4393.11	102
Progresso	Paragominas/PA	37.330.098	96
Rio das Cruzes	Paragominas/PA	39.110.035	66
Paranoá	Paragominas/PA	16.555,41	363
Miritipitanga	Tomé-Açu/PA	4356	92
Águia	Ulianópolis/PA	84.972.462	137
Floresta Gurupi I	Ulianópolis/PA	41897	497
Surubiju	Ulianópolis/PA	4120	17

* PA in this table refers to the abbreviation of Pará State.

[45] https://antigo.incra.gov.br/media/docs/reforma-agraria/assentamentos-geral.pdf

From the total of 33 settlement projects identified, 27 were visited by the Carbonext social team, presented in item 2.1.9.

The rural agglomerations identified within the 20km buffer are presented in table 2.17. The obtained data was collected in a participatory manner during the visits of the Carbonext social team to the region, during the socioeconomic diagnosis. Thus, there are information only from the communities visited, since there are no official data available from the other agglomerations. Some rural agglomerations identified by GIS survey are not characterized as communities (verified *in loco)* (also presented in table 2.17) but are private farms and establishments.

Table 2.19 - Rural communities identified by GIS in the 20km buffer of the YBYRÁ's Project Area.

Name	Location	Area (ha)	Number of families
Agrovila paragonorte	Paragominas/PA	100	1,300
Colônia Uraim	Paragominas/PA	-	-
São João	Paragominas/PA	22	80
Balalaica	Ipixuna do Pará/PA	8,000	154
Água Branca	Tomé-Açu/PA	12,000	450
Maranhense	Tomé-Açu/PA	-	-
Quilômetro Quarenta	Tomé-Açu/PA	-	-
Vila Nova	Tomé-Açu/PA	150	450
Quilômetro Vinte Três	Tomé-Açu/PA	-	-
Maringá	Ipixuna do Pará/PA		
Cachoeira do Cravo	Tomé-Açu/PA	Are not rural agglomerations.	
Jaguaré ou Dalsan	Paragominas/PA		
João Buzi	Paragominas/PA		
Rio Capim	Paragominas/PA		
São Romualdo	Paragominas/PA		
Tarzana	Paragominas/PA		
Rainha da Selva	Tomé-Açu/PA		
Serraria Água Branca	Itinga do Maranhão/MA		

The State of Pará is one of the most ethnic diverse state in Brazil, with more than 55 ethnic groups, approximately 60 thousand indigenous people, speakers of more than 45 traditional languages from the linguistic trunks: Karib, Macro jê, Pano, Nheengatu, Tupi, Juruna, Munduruku, among others. Indigenous people occupy more than 25% (twenty-five percent) of the territory of

Pará and are distributed around 77 indigenous lands, in 52 municipalities[46]. Within 20km around the Project Area, there are five indigenous lands identified [47][48] (table 2.18).

Table 2.20 - Indigenous Lands[49] near the YBYRÁ REDD+ Project.

Indigenous Land	Area (ha) within the buffer	Localization	General Population	Groups	Language Family
Alto Rio Guamá	85.476,05	Paragominas/PA	1,727	Timbira, Tembé	Tupi-Guarani
Barreirinha	2.379,75	Paragominas/PA	86	Amanayé	Tupi-Guarani
Sarauá	186.22,8	Ipixuna do Pará/PA	184	Amanayé	Tupi-Guarani
Alto Turiaçu	39.187,72	Centro Nono do Maranhão/MA	1,500	Ka' apor	Tupi-Guarani
Awa	2.621,27	Centro Novo do Maranhão/MA	42	Guajá	Tupi-Guarani

46 Source http://ufopa.edu.br/enei2016/nossos-povos
47 Available on: https://terrasindigenas.org.br/pt-br/terras-indigenas/4154
48 Available on: https://www.gov.br/funai/pt-br/atuacao/terras-indigenas/geoprocessamento-e-mapas
49 Source https://terrasindigenas.org.br

The indigenous territory Sarauá is going through a reintegration process, where, in 2022, the land has been officially returned to the indigenous people and the invaders must leave the area within 90 days[50], however did not occur entirely yet. The situation is uncertain and conflict is called "imminent" with danger of a confrontation with the invaders pointed by the Federal Prosecution Service of Brazil. Thus, in order to discourage violent intrusions and land invasions, the Sarauá indigenous land is excluded from the project's activities, until the conflict is solved.

Even though the other indigenous lands do not have land conflicts, they were not visited by the project yet and will, therefore, not participate on project activities. The public consultation was not possible to be executed due to bureaucratic and agenda issues. However, dialogue will be made with representative institutions such as Funai, Tembé Association and other institutions, as a form of Public Consultation. In the future, their participation in the project can change.

The communities that will participate on the project activities are presented further in the PDD, on item 2.1.9, and in details on item 4.

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

The YBYRÁ REDD+ Project is composed by 74 private properties distributed in the municipalities of Paragominas, Ipixuna do Pará, Tomé-Açu and Ulianópolis. The table 2.4, presented in item 2.1.5, lists the properties and their coordinates.

The boundaries, including the PA, RR and the location of the communities identified of the YBYRÁ REDD+ Project are provided below (figure 2.16). The areas for the HCVs 1, 2 and 3 are overlapping the PA, and the area of HCV 4 is adjacent to the PA where there are permanent preservation areas (PPA). The project zone is composed by the PA, LMA boundaries and the communities that will participate on project activities (first presented in item 2.1.9.), the area in which project activities that directly affect land and associated resources will be implemented.

[50] 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

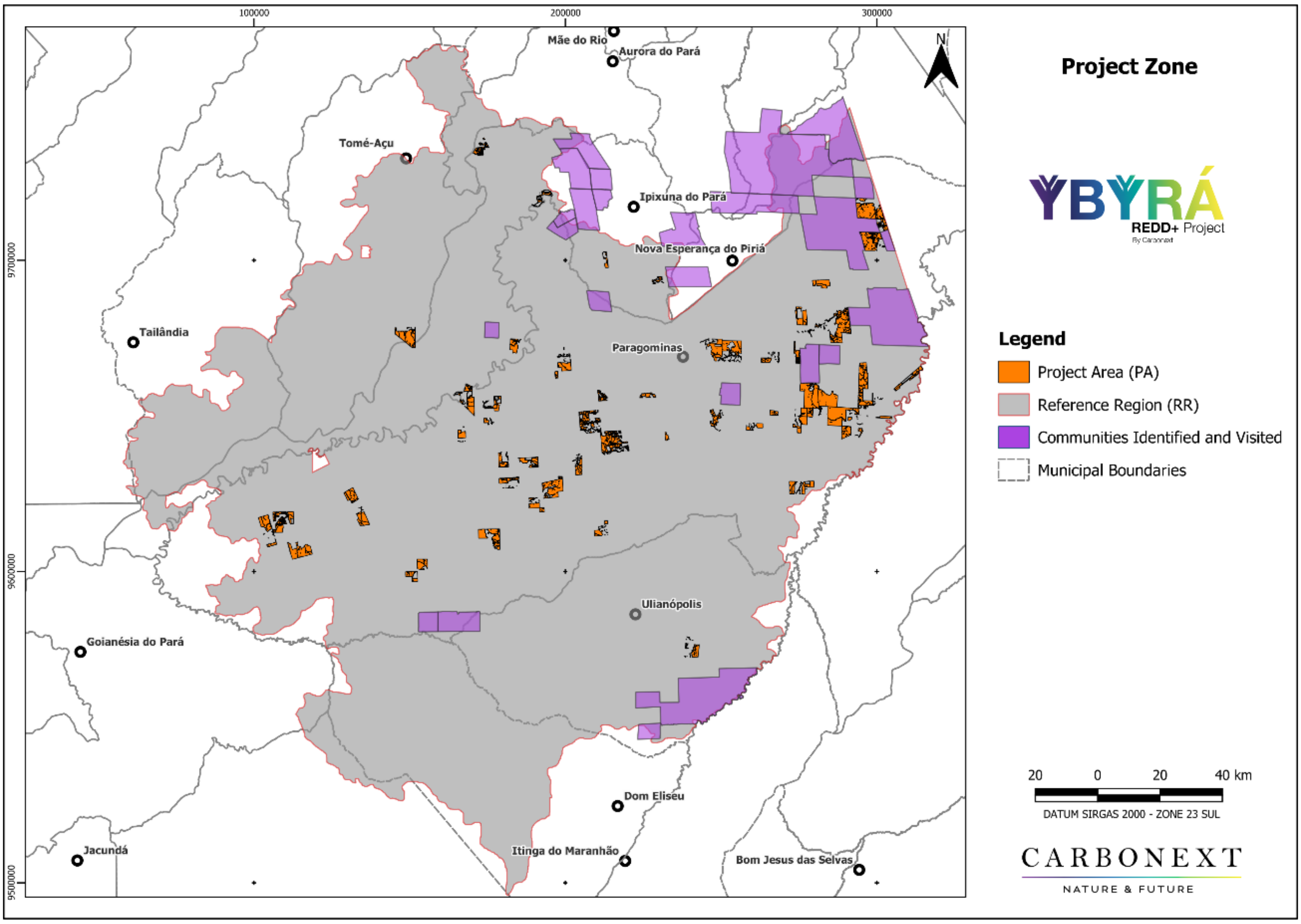


Figure 2.16 - Map of the project zone of YBYRÁ REDD+ Project.

There is no prediction until this moment of offsite climate, community and biodiversity impacts. The possible offsite impacts on climate, community and biodiversity, if present in the future, will be further diagnosed, discussed and identified along the project lifetime, so they can be monitored, avoided and mitigated, especially if they are negative.

The YBYRÁ REDD+ Project is a grouped project, so new project areas can be inserted in the project in the next monitoring periods. These areas will be inside the RR, but no specific location has been yet defined.

2.1.8 Stakeholder Identification (G1.5)

Stakeholders were identified considering direct and indirect beneficiaries of the project activities, as shown in figure 2.17.

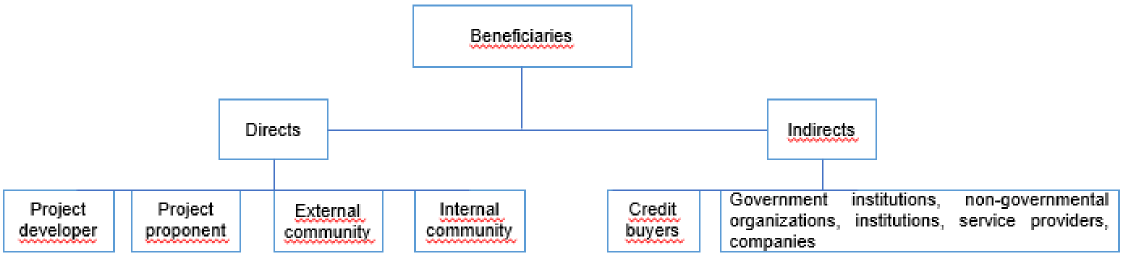


Figure 2.17: Flowchart of the types of project beneficiaries

The identification process considered the following criteria:

- Geographical location: municipalities and communities located within and adjacent the project area and in the vicinity up to 20 kilometers from the buffer of the project area.
- Project Area Dependency: Communities that use the project area and develop activities inside the PA.
- Local forest conservation institutions: private institutions, NGOs, federal/state/municipal bodies active in forest conservation and sustainable development.
- Identification of Leakage Management Areas.
- Social Movements: private institutions, NGOs, federal/state/municipal bodies working for the development of local communities.

The identification process began with community leaders and associations, government agencies and regional environmental entities, non-governmental organizations, research institutes, conservation areas, settlements, and organizations/groups with similar interests in the outcome of the project activities. Stakeholders were primarily analyzed based on their influence, along with their rights, interests, and relevance to the Project, to ensure that the YBYRÁ REDD+ Project was properly aligned with stakeholders.

The first stage of 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 found that the Project Area does not overlap with the surrounding communities, using data from the Georeferenced Information System (GIS).

After identification, the stakeholders were divided into two groups: stakeholders relevant to the Public Community Consultation and relevant to the Institutional Consultation. Considering this, the on-site visits were carried out by Carbonext's social team, to inform about the project, its activities, the potential benefits for the communities and their participation in the project, if applicable. When a community is not identified by satellite images or official databases by the GIS team and is identified only in the field, a first visit is to identify a leader or a reference point within the community, and in a second visit occurs the project presentation.

Consultations with all stakeholders should continue throughout the project lifetime to evaluate activities, make adaptations, if necessary, design new actions, mitigate impacts, and so on.

2.1.8.1 Institutional Stakeholders

The communication with institutional stakeholders was made through telephone calls and local visits, in the public departments of the municipalities of the Project. The objective was to present the project and to establish a relationship with those who can contribute to the project or those who the project activities can contribute with.

The first expedition to conduct the institutional consultation happened in September 2022, when institutions from Paragominas and Ipixuna do Pará were consulted. The second one happened in March 2023, to visit Nova Esperança do Piriá, Aurora do Pará, Tomé-Açu and Ulianópolis (figure 2.18 and 2.19).

Figure 2.18: Project presentation meeting with municipal departments of Paragominas in September 2022.

Figure 2.19 - Project presentation meeting with municipal departments of Aurora do Pará in March 2023.

2.1.8.2 Community Stakeholders/Communities Groups

The communities of the Project are mostly settlements, some administered by a federal agency, the Institute of Colonization and Agrarian Reform (INCRA), others by a state agency, the Instituto de Terras do Pará (ITERPA). The Project team visited more than 40 settlements in the region.

In the satellite survey, more than 50 communities were identified. However, in the on-site visits, it was found that many did not exist and other villages emerged (more information presented in item 2.1.9).

In the external communities, the first contact was made through visits to the communities, where local leaders were identified and communicated about the Project. The leaders or presidents of the community associations were responsible for organizing the meetings to present the Project to the people. In some communities, visits were made with the help of technicians from the city hall and local people, who indicated the route to the place.

A series of on-site interviews were conducted by the team, validating the secondary information previously collected and ensuring that all relevant stakeholders were considered. The socioeconomic diagnosis was performed on these visits. The interviews and social meetings are also important to establish contact with the communities, to understand their experience, their needs, their general characteristics, so that the project activities can be conceived in a participatory way.

Two expeditions were carried out in order to accomplish the community's consultation, the first one was in May 2022, and the second one was in October/November 2022 (figure 2.20).

Figure 2.20: YBYRÁ REDD+ Project presentation meeting held in November 2022. Minas Pará Community.

The internal community (property workers and their families) was also consulted and visited, so that the project could be explained and shown to them, with the help of banners. Their accommodations and common areas were visited to verify improvements made by the owners of the properties for their well-being (figure 2.21).

Figure 2.21: Carbonext team presenting the YBYRÁ Project to workers of the property.

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)

Considering the identified stakeholders, the project selected the most suitable ones to participate on project activities, at first moment. Other communities can be added during the project lifetime, after justification in the MRs. The stakeholders selected were separated into Community Stakeholders and Institutional Stakeholders, as described below.

2.1.9.1 Description of Institutional Stakeholders

Public institutions play a fundamental role in the socioeconomic development of communities. The municipal government, through its municipal departments, aims to take care of the demands and interests of the population, in all matters involving quality of life and well-being.

For this reason, the YBYRÁ REDD+ Project team visited and consulted the municipal secretariats of the 4 municipalities in which the Project is inserted, after identifying their presence in the field, through conversations with the communities or recognition of their local presence. The intention is to create relationships and partnerships, throughout the years of the project, so that activities of mutual interests can be developed together and achieve positive impact for the communities. The institutions visited are presented in table 2.19 below.

Although the municipalities of Aurora do Pará and Nova Esperança do Piriá have no PAs in their territories, both were visited.

Table 2.21 – Institutional stakeholders consulted by the Project

Institutional Stakeholders	Localization	Rights, Interest and Overall Relevance to the Project
Paragominas City Hall	Paragominas/PA	Public municipal management of programs for health, environment, social and economic development, and others. Ensures law enforcement.
Municipal Department of Green and Environment of Paragominas - SEMMA	Paragominas/PA	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. Specially Paragominas has implemented the program

		“município verde” to reduce and combat deforestation, violence, and child labor
Municipal Department of Education of Paragominas - SEMEC	Paragominas/PA	Guarantees the qualification of teachers and students from the public school. It’s responsible to educational policy, development projects, including urban and rural zones
Municipal Department of Agriculture of Paragominas - SEMAGRI	Paragominas/PA	Plans, coordinates, executes, supervises and controls the plans related to the municipal agricultural activities.
Municipal Department fof Social Development of Paragominas - SEMDES	Paragominas/PA	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
Department of Planning and Development of Paragominas - SEPLAN	Paragominas/PA	Responsible for strategic issues of municipal management, especially those related to economic activities, aiming to attract new investments to the city and consolidate existing projects, in addition to monitoring the projects of the city at the state level
Ipixuna do Pará City Hall	Ipixuna do Pará/PA	Public municipal management of programs for health, environment, social and economic development, and others. Ensures law enforcement.
Municipal Department of Education of Ipixuna do Pará - SEMEC	Ipixuna do Pará/PA	Develops and ensures the maintenance of early childhood education; youth and adult education; special education; elementary education; Professional education and any other related modalities constitutive of the education network in accordance with the guidelines established by the Federal Constitution, State Constitution and Organic Law of the Municipality
Municipal Department of Administration and Human Resources of Ipixuna do Pará	Ipixuna do Pará/PA	To propose and execute the budgetary fiscal policies , accounting and cost control fincanceiras of competence of the Municipality.

Municipal Department of Environment, Science and Technology of Ipixuna do Pará - SEMMA	Ipixuna do Pará/PA	Collaborate in the elaboration of the Municipal Environment Policy, offering subsidies and measures that contribute to the preservation and/or conservation of the environment, in addition to providing self-sustaining development of productive activities, proposing guidelines, standards, criteria and standards for the protection, preservation and conservation of the environment
Municipal Department of Agriculture, Agricultural and Production of Ipixuna do Pará - SEMAP	Ipixuna do Pará/PA	Promote and support sustainable productive actions; support popular initiatives in the organization for production and consumption; implement municipal research programs and promotion of agricultural production and supply and rural development of the Municipality
Municipal Department of Social Assistance of Ipixuna do Pará - SEMAS	Ipixuna do Pará/PA	Promote the integration of basic sectoral policies within the municipality in articulation with the state and national policy of attention to the family, childhood, adolescence, the elderly and the disabled person
Aurora do Pará City Hall	Aurora do Pará/PA	Public municipal management of programs for health, environment, social and economic development, and others. Ensures law enforcement.
Municipal Department of the Environment of Aurora do Pará - SEMMA	Aurora do Pará/PA	Plans, programs, coordinates and executes municipal programming with tasks focused on the defense and preservation of the environment, integrated with other government sectors
Municipal Department of Agriculture of Aurora do Pará	Aurora do Pará/PA	Creates and maintains joint programs for health, animal, plant and environmental degradation. In addition to encouraging the implementation of new technologies and methodologies in agricultural, pastoral, research and extractive activities
Municipal Department of Education of Aurora do Pará - SEMED	Aurora do Pará/PA	Organizes, manages, supervises, controls and evaluates municipal action in the field of education. In addition to implementing and implementing public policies that ensure the improvement of teaching and learning of students, teachers and servers
Municipal Department of Assistance and Social Promotion of Aurora do Pará - SEMAS	Aurora do Pará/PA	Implements the integrated social assistance system, promoting basic protection services and special social protection to citizens

Municipal Attorney General of Aurora do Pará	Aurora do Pará/PA	Perform the functions of consulting and legal and technical-legislative advice of the Executive Branch
Nova Esperança do Piriá City Hall	Nova Esperança do Piriá/PA	Public municipal management of programs for health, environment, social and economic development, and others. Ensures law enforcement.
Municipal Department of Environment and Housing os Nova Esperança do Piriá - SEMED	Nova Esperança do Piriá/PA	Responsible for the implementation of policies and planning, coordination and supervision in the area of environment, having as fundamental objectives the sustainable development and the formation of ecological awareness
Municipal Department of Agriculture, Livestock and Supply of Nova Esperança do Piriá	Nova Esperança do Piriá/PA	Responsible for the execution of planning, coordination, organization, control and promotion policies in the areas of agriculture, livestock and market supply and street free markets
Municipal Attorney General of Nova Esperança do Piriá	Nova Esperança do Piriá/PA	Perform the functions of consulting and legal and technical-legislative advice of the Executive Branch
Municipal Department of Environment of Tomé-Açu - SEMMA	Tomé-Açu/PA	Responsible for promoting the preservation of the Environment in the Municipality of Tomé-Açu, seeking to raise awareness of the need to preserve the forest and all existing vegetation, in an ecologically correct way, in addition to aiming at improving the living conditions of citizens
Municipal Department of Agriculture of Tomé-Açu - SEMAGRI	Tomé-Açu/PA	Responsible for coordinating the municipal agricultural policy, providing assistance and support to rural producers; supporting, planning, coordinating and implementing training programs for farmers and rural workers, through the Technological Center for Family Farming
Municipal Department of Environment of Ulianópolis - SEMMA	Ulianópolis/PA	Responsible for promoting sustainable development with socio-environmental responsibility, encouraging actions and programs aimed at the preservation and conservation of natural resources and quality of life, having Environmental Education as a form of behavioral change of the population about the preservation of the Environment.

Municipal Department of Agriculture of Ulianópolis/PA - SEMAGRI	Ulianópolis/PA	Responsible for formulating and implementing the municipal policy of agriculture, livestock and plant extraction in the areas of production, marketing, supply and the like; as well as promoting technical assistance, associations, rural credit, training and training of farmers
Municipal Department of Education of Ulianópolis - SEMED	Ulianópolis/PA	Responsible for planning, organizing, developing, implementing and evaluating the municipal education system, integrating it into national, state and municipal education policies and plans, with the aim of raising the quality of school performance, ensuring physical and pedagogical conditions of operation

2.1.9.2 Description of Community Stakeholders – Settlement projects

Communities play an important role in maintaining forest conservation and biodiversity. They are the agents who directly and/or indirectly experience the reality and adversities of the region. In addition, the selected communities are also the main ones impacted by the project's activities. The table below (2.20) shows the communities identified and visited by the Project team, within the 20 km buffer.

Table 2.22 - Settlement projects consulted by the Project.

Community Stakeholders	Localization
Bacabal	Ipixuna do Pará/PA
Balalaica	Ipixuna do Pará/PA
Candiru	Ipixuna do Pará/PA
União	Ipixuna do Pará/PA
Diamantina II	Ipixuna do Pará/PA
Enalco	Ipixuna do Pará/PA
Paranoá	Ipixuna do Pará/PA
João Batista	Ipixuna do Pará/PA
Minas Pará	Ipixuna do Pará/PA
Camapuã	Paragominas/PA
Nova Vida	Paragominas/PA

Colônia Reunidas	Paragominas/PA
Del Rey	Paragominas/PA
Alta Floresta	Paragominas/PA
Glebinha	Paragominas/PA
Luiz Inácio	Paragominas/PA
Mandacaru	Paragominas/PA
Paragonorte	Paragominas/PA
Agrovila Paragonorte	Paragominas/PA
Progresso	Paragominas/PA
São João Batista	Paragominas/PA
Rio das Cruzes	Paragominas/PA
Arapuã Simeira	Nova Esperança do Piriá/PA
Cidapar 2ª Parte	Nova Esperança do Piriá/PA
Águia	Ulianópolis/PA
Floresta Gurupi	Ulianópolis/PA
Vila Nova	Tomé-Açu/PA

Not all external communities that were visited will participate on project activities. However, since the YBYRÁ REDD+ Project is a grouped project, other communities can be added to the project and therefore they have already been identified. The communities that will participate on activities from the Project were selected according to relevance to the project's goals, interest by the communities to participate, absence of conflicts and presence of strong leadership in the community, so the engagement in the activities can be created effectively.

As mentioned before in item 2.1.6, there has been made a selection of 8 external communities, presented in tables 2.21 and 2.22. In the site visits, 3 communities mentioned that people make use of the forest inside the PA. Other 4 external communities do not make use of the PA, but are suitable for project participation. As strategy, the activities will be initiated by the communities that make use of forest areas of the Project and have interest in receiving the project activities.

Table 2.23 - Communities for activities of the Project - make use of Project forest.

Community	**Location**	**Overall Relevance to the Project**

Glebinha	Paragominas/PA	There are residents who make use of the Project's forest area
Alta Floresta	Paragominas/PA	There are residents who make use of the Project's forest area
Luiz Inácio (Ribeirinho)	Paragominas/PA	There are residents who make use of the Project's forest area

Table 2.24 - Communities for Project activities - do not make use of Project forest.

zone	Location	Overall Relevance to the Project
Reunidas	Paragominas/PA	Community close to the Project area and that does not use the forest
Águia	Paragominas/PA	Community clos e to the Project area and that does not use the forest
Diamantina II	Ipixuna do Pará	Community close to the Project area and that does not use the forest
Minas Pará	Ipixuna do Pará	Community close to the Project area and that does not use the forest
Floresta Gurupi I	Ulianópolis	Community with relevance to project activities

2.1.9.3 Description of Community Stakeholders in Leakage Management Areas (LMA)

The activities of the YBYRÁ REDD+ Project in the communities present in the leakage management areas aim to prevent the leakage of deforestation through sustainable practices and improve of productivity and people's income. The relevance of this community group refers to the proximity to the project areas and the Leakage Belt, in an attempt to mitigate the leakage.

The table below (2.23) shows the community group for leakage management areas activities.

Table 2.25 - Community Stakeholders in Leakage Management Areas.

Communities	Location
Águia	Paragominas/PA
Alta Floresta	Paragominas/PA
Luiz Inácio	Paragominas/PA
Diamantina II	Ipixuna do Pará/PA
Floresta Gurupi I	Ulianópolis/PA

2.1.9.4 Description of Community Stakeholders – Internal Community

The internal community is composed by the workers of the farms of the project, which have direct contact with the forest areas of the PA. This group is essential to the maintenance of the forest and participatory monitoring of eventual occurrences in the PA, since they are the first agents to observe fires or unusual occurrences in the area, for example.

The complete diagnosis of the internal community will be presented for the second monitoring period, since the visits in the first monitoring period mapped the accesses to the properties and priority monitoring places for terrestrial patrol, as well as the verification of infrastructure of the farms.

However, site visits to the farms were carried out to check infrastructure and forest areas. Based on these visits, the estimated number of people who live in the farms of the YBYRÁ Project is 250. They are mainly man, who work in the properties. The project aims to improve their well-being, through trainings on sustainable practice, inclusion on the protection of the forest areas and biodiversity, as well as improvements in their accommodations and infrastructure in the farms. More information about project activities directed to the internal communities is described in other items, such as 2.1.12 and on item 4.

In the case of the identification of new institutional and community stakeholders during the project lifetime, these will be included in the respective MR. More information on the communities that will benefit from project activities is presented further on item 4.

2.1.10 Sectoral Scope and Project Type

- Project Scope: 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 (Version 3);
- Reference of Methodology: Approved VCS Methodology for Avoided Unplanned Deforestation (VM0015) V.1.1;
- This is a grouped project (see the section 2.1.2);

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 YBYRÁ REDD+ Project's actions are designed based on the local fragilities identified through the socioeconomic diagnosis with the communities and visits *in loco*. In the region, the following vulnerabilities were observed: intense forest fragmentation; invasion of areas followed by deforestation and degradation of forests causing biodiversity loss, habitat loss and negative impacts on ecosystem services provision; lack of political articulation and institutional organization of communities; gender disparities; and food insecurity in the communities.

Considering the above-mentioned observations, the main goals of the YBYRÁ REDD+ Project, through conservation of forest areas and combating deforestation and degradation of the Amazon Forest, are:

1) **To improve the quality of life of the population that lives close to the forest areas;**
2) **To conserve biodiversity and ecosystem services; and**
3) **To promote adaptations to climate change in the region;**

The project's activities are important mechanisms for achieving the objectives for Climate, Community and Biodiversity. For this reason, the Project used the approach of the Theory of Change, proposed in Panfil and Richards (2011)[51], to design the strategic lines for the development of project activities, so long-term beneficial impacts are achieved with the presence of the Project.

The effectiveness of the project will be achieved through the monitoring of the implemented actions, measuring indicators for each activity and assessing the expected change ratio.

To describe each project activity, its objectives and expected results, the project activities proposed are presented below. All actions are aligned with the United Nations (UN) Sustainable Development Goals, which are shown in sector 2.1.12. 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.

2.1.11.1 *Infographic on the Theory of Change – YBYRÁ REDD+ Project*

[51] M. and Panfil, S.N. 2011, *Social and Biodiversity Impact Assessment (SBIA) Manual for REDD+ Projects: Part 1 – Core Guidance for Project Proponents.* Climate, Community & Biodiversity Alliance, Forest Trends, Fauna & Flora International and Rainforest Alliance. Washington, DC, 34 – 42.


YBYRÁ
REDD+ Project
Theory of Change
FRAGILITIES
Project activities
Outputs
Outcomes
Impacts
GOALS
Gender disparities; Lack of political articulation and institutional organization of communities
Socioeconomic diagnosis; Trainining in associativism/ cooperativism; Courses on digital inclusion; Feasibilty study and implementation to access water; Animal farming; diagnosis on women; Courses for women and health campaigns;
Obtain local information to design actions; number of people capacitated; Formation of association/ cooperative; Decision on best solution for water access; number of women that participated; Products made by women
Effective project activities; Community empowerment; Job opportunities; Income diversification; Implementation of wells/other solution; Water access; Food production; Female empowerment and independency on income
Political articulation with stakeholders; Increased income; Reduction on gender disparities
Improve in well-being and life quality of communities
Food insecurity in the communities; Deforestation; Forest Degradation
Training on sustainable practices for crops and agroforestry; Training in fire control and fire brigade; Satellite/terrestrial monitoring of the PA; Governance structuring
Number of people capacitated/that participated; hectare protected; Formation of fire brigade and governanace structure (association/ cooperative)
Increase in sustainable production (food and other); Conservation on natural resources; Prevent and reduce fire and invasions; Strong and effective decision-making and project management
Decrease food insecurity; Avoid deforestation and emission of GHG
Promote adaptations to climate change
Forest fragmentation
Environmental education workshops; Biodiversity monitoring; Pilot project on PPA recomposition; Creation of Ecological corridors
Number of people that participated; species monitored including endangered/ endemic; Hectate recomposed and protected
Creation of environmental awareness; Recomposition of degraded areas; Conservation of water provision; Increase biological connectivity
Reduce forest fragmentation; Conservation of water provision; Increase biological connectivity
Conserve biodiversity and ecosystem services

2.1.11.2 Project Activities and Theory of Change - Community

The project region is characterized by high rates of deforestation, forest degradation and fragmentation, combined with a significant population concentration for Amazonian standards[52] . The population is composed by family farmers who live in areas of settlements and other rural agglomerations, generally pressured by the expansion of extensive livestock, agricultural commodities and mining activities.

The historical and socioeconomic context of the region accentuates social inequality, as well as hunger, poor sanitary, health and educational conditions to these populations. The water accessibility is also scarce. The surrounding communities of the YBYRÁ REDD+ Project are heavily dependent on the economic model of government assistance and insufficient public policies.

The theory of change provides tools that allow measuring progress and achieving the goals established in the short, medium and long term, as well as the implementation of internal risk assessment procedures and preventive mitigation measures, in case unexpected adversities occur through projects lifetime. In this way, the YBYRÁ REDD+ project aims to guarantee the management and governance of its activities within the territories of the surrounding communities.

The activities that will be carried out, especially in the external communities, aim to bring benefits to them and improve their well-being, reducing deforestation and forest degradation, in order to achieve the goal: 1) **To improve the quality of life of the population that lives close to the forest areas** and 3) **To promote adaptations to climate change in the region**. Thus, the social actions were classified into three different strategic lines, as described in table 2.24 below: community empowerment, improvement of productivity and income through sustainable land use, and women protagonism.

Table 2.26 - Analysis of change with the presence of the project.

Program Area	Outputs	Outcomes	Long-term Impacts
Community empowerment	Participatory workshops and capacity training on associativism and governance, digital inclusion; diversification of income, and other themes; study to provide water access in some communities, if viable.	Capacitation on diverse fields; improve in social organization of the community and articulation with public institutions; greater social and collective sensitization in the search for improvements in its territory; increased quality	Increased quality of life of communities through better job opportunities and increase in the income; social governance well-structured in the communities; social inclusion in public programs;

[52] 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; organizadores. Belém: NAEA, 2008.

		of life of communities due to access to water, digital inclusion and income perspective.	
Sustainable land use	Capacity training on sustainable practices; production diversification; implementation of family farming projects with agroforestry and other sustainable agriculture practices.	Capacitation on sustainable practices for production; increase in productivity; increase in low-carbon farming practices; land use of unproductive areas (degraded)	Increase the quality of life of communities through food security with healthy food production and income generation; restoration of degraded and unproductive areas; increased sensitization on climate change and the importance of community participation for conservation.
Women protagonism	Meetings, workshops, trainings, informal education events, to promote women engagement, empowerment capacitation and inclusion.	Capacitation of women; diversification of income in the families; increase in women participation; strengthening of women groups and associations (if applicable).	Increase in the quality of life of women, and consequently to children and the whole community; greater number of women with access to means of social integration, equality and protagonism. through income opportunities, access to health and protagonism.

Bearing in mind that the reality of communities without the project have no expectation of social change and improvement of well-being, the YBYRÁ REDD+ project will bring significant benefits to the region, which is one of the most deforested areas in the Brazilian Amazon. The additionality of the project goes beyond the expected changes with its presence. The expected results obtained with the Project will impact not only the current generation but also the next generations of communities.

- **Community Empowerment**

Communities are of great importance for the effective performance of project activities, since they have the role of supporting the implementation and development of actions designed participatively, being the main stakeholders to be considered.

In the current scenario, the external communities do not have community engagement. Driving this situation, many of the communities live with discouragement and disbelief in social and environmental actions promised by private companies operating in the region and/ or public policies that are not carried out, according to the residents' report. Moreover, even in the communities that have associations, most of the people who have positions of importance in their associations, such as president, vice president, treasurer, among others, do not have knowledge of their functions or assistance for consultation, making associations almost inactive.

Many of the residents associated in the institutions are endowed with social intimidation, some, ashamed for not having such knowledge. And for these reasons, most community associations are not regularized and are powerless to seek improvements to their territories in front of public institutions.

In the scenario without the project, there will be no alternative events that promote social interactions and community engagement. There will be no participatory workshops where communities can learn about sustainable land management models and community models of institution formation.

Without the Project, residents who hold positions in associations will continue without technical training and without learning how to carry out their work; community associations will remain irregular and communities lacking institutional representation in front of public institutions.

Another important social factor is the accessibility to water. Some communities of the project pointed scarce sources of water for the daily life. Thus, the YBYRÁ REDD+ Project will allocate efforts to bring water to some communities, as a social empowerment action. In order to implement such project activity, a study of viability will take place, which will present if such activity is viable in the area, which is the best method, which are the most suitable communities, and so on. From this study, an implementation plan will be designed and actions will be gradually executed, so the main goal to increase well-being of people can be achieved in 30 years of project. In case of unviability, other project activities will be proposed and implemented instead.

Considering these facts, the project seeks to promote the empowerment of communities, strengthen associations and their interactions, so that communities become protagonists in their territories and can claim for their rights. The project will provide trainings and capacity building to the communities involved in the project, so they can create or structure the associations, regularize them, develop projects and articulate with any person or organization of interest. This can bring improvement to the community's health, education, economy and other social and environmental aspects.

- **Sustainable Land Use**

In the scenario without the project, communities would continue to practice activities that degrade the environment, for example, using fire as means of managing the soil. The scenario of insufficient food production would continue, maintaining food insecurity as one of the major fragilities of the region. Communities would continue to depend on practices that affect directly and negatively the biodiversity and climate regulation, such as hunting of wild species or deforestation of forest areas to grow food (as it happens in the communities present in the Leakage Management Area, for example).

Considering this, the YBYRÁ REDD+ Project will promote sustainable alternatives for agricultural practices, with theoretical and practical knowledge, and human resources, through trainings, qualification workshops in diverse themes. Through technical guidance, the project will present small producers with sustainable initiatives, showing the richness they have in the well-managed soil on their property, avoiding the use of burning to clean up the area.

The communitarians need to be capacitated in sustainable practices in the farming activities, in order to increase the productivity of crops and diversify productions. Technical assistance and support will be promoted, in partnership with other specialized organization and public programs. In long-term, agroforestry production can be implemented as an alternative to food production, income diversification and sustainable development.

- **Women protagonism**

In the scenario without the project, there is great gender disparity between women and men in decision making, education, job opportunities, access to leisure and many other social factors. Most of the girls and women are socially intimidated, in a state of social, intellectual and sexual vulnerability, with no perspective of change. The women are responsible for supporting the family, the children, and are the main agents of distribution of non-monetary income that ensures food for community groups.

Considering these characteristics, the project aims to promote punctual activities to empower the female groups through non-formal education, workshops, courses, lectures and trainings, that generate female protagonism. Thus, increase the opportunities for women to be protagonists of a place that they already occupy socially, but do not know of their importance for maintaining the means of life and are not recognized. The project also aims to create opportunities for women to generate income that directly affects their independency and well-being, and consequently the well-being of the entire community.

The project is not located within a jurisdiction covered by a jurisdictional REDD+ program.

The tables 2.25, 2.26 and 2.27 below show the activities planned and their focus on different community groups.

Table 2.27 - Project activities for external communities.

Program	Vulnerability	Activities	Community Group	Goal	Expected Results	SDG related
Community Empowerment	Lack of on-site community information	Diagnosis of communities	Communities that make use or not of the Project area and communities located in Leakage Management Areas	Strengthen human interactions and community engagement so that communities can build public social welfare goals	United and engaged community in project activity that generate social well-being.	16 PEACE, JUSTICE AND STRONG INSTITUTIONS
	Lack of community interaction activities and collective achievements	Participatory workshops with planning activities in communities				
	Difficulty in community engagement and management of associations	Training in associativism and cooperativism	Communities that make use or not of the Project area and located in Leakage Management Areas	Strengthen community institutions through information on associations and cooperative	Communities able to manage associations and cooperatives	1 NO POVERTY; 2 ZERO HUNGER; 3 GOOD HEALTH AND WELL-BEING
	Poor communities in communication and internet access; lack of training and income information	Training and courses on digital inclusion, entrepreneurship, social media	Communities that make use of the Project area and located in Leakage Management Areas including the young.	Empower communities, bring connectivity to associations and bring a new perspective of income alternatives	Improve the ability to undertake new businesses; have more access to information through technology; expand the alternative income perspective.	
	Lack of water supply for family use and agriculture activities	Feasibility study of community well or other solutions to access water	Communities that make use of the Project area and located in Leakage Management Areas	Identify the best solution to guarantee the water supply	Develop an action plan to implement the best solution.	
		Implementation of the best solution	Communities that make use of the Project area and located in Leakage Management Areas	Water supply for family use, breeding and irrigation of productive plantations	Improvement in people's quality of life in terms of well-being and increase in agriculture production	
	Insufficient infrastructure and lack of improvements in activities	Actions to improve infrastructure, safety and health at work	Internal communities	Promote the social well-being of internal communities	Satisfaction of internal communities in their workplaces without risk of accident	

Income alternative with land use	Insufficient livelihood practices	Training in agroforestry and other sustainable agriculture practices	Communities that make use or not of the Project area and communities located in Leakage Management Areas	Train the community with new techniques of sustainable crops	Producers developing plantations with more knowledge and achieving good production and good quality product	8 DECENT WORK AND ECONOMIC GROWTH 10 REDUCED INEQUALITIES 15 LIFE ON LAND
		Support community in the implementation of SAFs		Improve food quality and income with sustainable techniques crops		
		Fish farming course (suspended tanks)	Communities that make use of the Project area and communities located in Leakage Management Areas	Train communities in fish farming to produce food for consumption	Farmers trained in sustainable livelihood practices	
		Courses for raising free range chicken and laying hen		Train communities in raising free rang chicken		
	Lack of technical assistance for soil management	Articulate with institutions that provide training on silviculture, harvesting and negotiation	Communities that make use of the Project area and communities located in Leakage Management Areas	Bring soil management knowledge to communities	Farmers trained in sustainable practices in soil management	
	Lack in acquisition of basic machinery for soil management	Support partnerships between public institutional stakeholders to provide machine for soil management	Communities that make use or not of the Project area and communities located in Leakage Management Areas	Increase production	Ensure producers have access to the necessary machinery.	
	Lack of assistance to grow local crops	Cassava cultivation courses and processing with existing crops (cupuaçu, açai, cocoa)	Communities that make use of the Project area and communities located in Leakage Management Areas that have the potential to grow certain crops	Boost local production in family crops for own consumption and runoff	Increase in production and family income	
	Cultural practices of soil management with fire	Training in fire control and fire management for community residents	Communities located in Leakage Management Areas	Train communities in fire management, in their gardens, until they can change cultural practice	Prevent deforestation of forests; reduce GHG emissions from fires in the region; contribute to the preservation of biodiversity	
	Lack of sustainable soil management practices	Articulate public agents who provide training on forestry, harvesting and negotiation		Bring soil management knowledge to communities		
	Lack of practices in fire brigade	Fire brigade training with community residents	Internal communities	Train employees of the properties of project areas in firefighting	Employees of the properties of project areas trained in firefighting	
Women	Lack of detailed gender information	Participatory diagnosis of women	Women of the project communities	Collect information on women's demands in the communities' territories	Plan meaningful benefits activities for women and create an action plan based on their needs.	

	Lack of information and access to women's health	Participatory actions and lectures	Women of the project communities	Increasing the awareness of Science and Knowledge	Women with access to personal information about their health	5 GENDER EQUALITY
		Women's health campaigns		Increase access to women's health in communities	Women with access to medical care	
	Lack of female driving activities and training	Meetings to discuss gender issues; training in activities of interest; promotion of female entrepreneurship;	Women of the project communities	Insert women in different activities in the community, promote recreational activities, and non-formal education for women	Women empowerment	

Table 2.28 - Project activities for internal communities.

Program	Activities	Target Group	Goal	Expected Results	SDG Related
Forest Conservation of the Project	Fire brigade training	Internal Communities	Train employees in fire brigade	Avoid forest degradation and deforestation due to fire	13 CLIMATE ACTION
	Training in participatory monitoring of the forested Project Area		Monitor forest areas of the Project	Protect forest areas	
Social Well-Being	Participatory diagnosis of internal communities		Gather information to trace activities for improvements in employee welfare, including female gender information	Participation and satisfaction of internal communities in their workplaces	16 PEACE, JUSTICE AND STRONG INSTITUTIONS
	Infrastructure improvements		Promote the social well-being of internal communities	Satisfaction of internal communities in their workplaces	
Safety at Work	First aid training		Empower employees in first aid practices and prevent risks of accidents at work	Satisfaction of internal communities in their	

	Training on safe workplace practices		Take care of the work safety of employees of Project properties	workplaces without risk of accident	
	Course of operation of machines		Prevent risks of accidents at work		
	Course on contact and prevention with venomous animals		Prevent risks of accidents at work		
	Training on the use and importance of Personal Protective Equipment		Train employees on the importance of using Personal Protective Equipment in work activities		
Health at Work	Vaccination campaigns		Improvement and safety in the quality of work life	Participation and satisfaction of internal communities in their workplaces	
	Workshops and lectures on health, personal care and sexually transmitted infections		Promote access to personal and collective health information		

For communities located in Leakage Management Areas, all activities are proposed with the main objective of preventing leakage of deforestation into forest areas. Therefore, in addition to the activities proposed in table 2.25 for the communities located in Leakage Management Areas the Project will also carry out firefighting activities, in view of the occurrence of annual fires in these areas.

Table 2.29 - Extension of Project activities for communities located in Leakage Management Areas.

Program	Project activity and outputs	Target Group	Outcome	Expected Results/ impacts	SDG
Sustainable soil management	Fire brigade training with community residents	Communities located in Leakage Management Areas	Train communities in firefighting	Prevent deforestation of forests; reduce GHG emissions from fires in the region; contribute to the preservation of biodiversity	13 CLIMATE ACTION 15 LIFE ON LAND
	Training in fire control and fire management for community residents		Train communities in fire management		
	Lectures with sustainable soil management practices		Provide information on sustainable practices		

2.1.11.3 Project Activities and Theory of Change - Biodiversity and Climate

As detailed in sections “3. Climate” and “5. Biodiversity” of this Project Description, the Amazon is essential to life on Earth due to its climate influence and regulation capacity, together with the abundance of biodiversity species living in this biome, and the ecosystem services provided by them.

Concerning biodiversity, based on secondary data, 65 endangered species of flora and fauna were identified in the region, as presented in item 5. The region has a high rate of forest fragmentation and degradation due to the intense use of soil in recent years, compromising the connectivity of biodiversity between forest remnants. In terms of climate, many areas around water bodies lack native vegetation and are highly degraded, causing flooding, erosion in water courses and reduction of water provision.

In order to bring benefits to the Climate and to the Biodiversity, the YBYRÁ REDD+ Project will implement activities, starting with the reinforcement of monitoring of forest areas, avoiding deforestation. Deforestation is directly associated with habitat loss and consequent biodiversity loss, as well as with GHG emissions to the atmosphere which increases effects of climate changes.

Associated with the social activities, the actions will promote: development of environmental awareness and sustainable practices, conservation of species of fauna and flora, protection of endangered species, foment of strategies to recompose small degraded areas to maintain and enhance the provision of ecological services in priority Permanent Protected Areas, and promote the connectivity between forest fragments with the creation of ecological corridors, bringing direct benefits to local biodiversity and climate effects. Thus, the biodiversity and climate project activities are related to the 3 main goals of the project. The table below (2.28) presents such activities, their description and goals.

Table 30 - Climate and Biodiversity project activities.

Program	Project activity and outputs	Target Group	Outcome	Expected Results/impacts	SDG
Protection and monitoring of the project area	Structuring the governance of the project and implementation of operational procedures;	Forest areas of the PA	Formation of a solid governance system to manage the project for 30 years, decreasing the risks of discontinuity and increasing effectiveness of project activities	Prevent deforestation of forests; reduce GHG emissions from in the region; contribute to the protection of biodiversity	16 PEACE, JUSTICE AND STRONG INSTITUTIONS
	Terrestrial monitoring of the PA periodically;		Reduce invasions, deforestation, degradation and hunt in the PA	Prevent deforestation of forests; reduce GHG emissions from in the region; contribute to the protection of biodiversity	6 CLEAN WATER AND SANITATION
	Satellite monitoring system implementation;				
Environmental education	Workshops and campaigns on diverse topics, bringing knowledge on conservation and protection of endangered species, biodiversity, hunting, waste and pollution, sustainable practices, natural environment, ecosystem services, and many others.	External and internal communities and communities located in Leakage Management Areas	Creation of environmental awareness, conservation of the biodiversity and ecosystem services, sustainable practices and habit change (even in small scale).	Prevent deforestation of forests; reduce GHG emissions from fires in the region; contribute to the protection of biodiversity	

Fire brigade training	Fire brigade training with community residents	Communities located in Leakage Management Areas ; internal and external communities near Pas.	Train communities in firefighting	Prevent deforestation of forests; reduce GHG emissions from fires in the region; contribute to the preservation of biodiversity	13 CLIMATE ACTION 15 LIFE ON LAND
Biodiversity Monitoring	Periodically monitoring of fauna and flora species through inventories and generation of reports and data on the local biodiversity; Production of scientific information on the local biodiversity	Fauna and Flora species in the PA	Promote the assessment of the activities' impacts on the biodiversity present in the project area.	Protection and conservation of biodiversity; prevention on habitat loss.	
Recomposition of PPAs	Landscape analysis and evaluation of priority areas for PPA recomposition and creation of ecological corridor	Permanent Protected Areas (PPA) adjacent to the PA	Provide information to implement PPA recomposition with impact	Foment strategies to recompose degraded areas of Permanent Protected Areas (PPA); protect ecosystem services.	
	Implement prototype/pilot projects and replicate them in more areas during project's lifetime; in partnership with public and local institutions	Permanent Protected Areas (PPA) adjacent to the PA	Implement PPA recomposition with impact and restore degraded areas; provide scientific information on effective PPA recomposition methods	Improve ecosystem services; regulation of climate; protection of biodiversity and habitat;	
Ecological corridor	Landscape analysis and evaluation of priority areas for PPA recomposition and ecological corridors	Permanent Protected Areas (PPA) adjacent to the PA, that connect forest fragments of the PA	Provide information to implement ecological corridors with impact	Protection and conservation of biodiversity and habitat; protect ecosystem services.	
	Implementation of prototype/pilot projects of ecological corridor and replication in more areas during project's lifetime; in partnership with public and local institutions*	Permanent Protected Areas (PPA) adjacent to the PA, that connect forest fragments of the PA	Connect forest fragments between the properties of the YBYRÁ Project, enabling the creation of ecological corridors and genetic variations within biodiversity	Protection and conservation of biodiversity and habitat;	

*The activity plan will be defined and presented with more details for the next monitoring period, as this action is dependent on accreditation and the first monitoring period is dedicated to the design of project activities. More information on item 5 of the PD.

Some activities have been implemented since the start date of the project, such as the socioeconomic diagnosis, workshops for governance of the project with the proponents, validation of project area workshop, a fire brigade training with selected workers of the farms, and others, further presented.

It is important to mention that all the activities have 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 Communities, Climate and Biodiversity. For example, the conservation of endangered species can only be effective together with environmental education activities to respect the ecological corridors, manage of hunting and fishing, implementation of sustainable practices, and so on. The preservation of these species influences also in the ecosystem services, that directly affect the population and can bring benefits to climate regulation as well. Thus, the goals of the YBYRÁ REDD+ Project are all interconnected.

Protection and monitoring of the project area

In the without project scenario, the common practice of the region is characterized by private properties with forest areas invaded by landgrabbers, to explore natural resources and the land. The result is intense deforestation and degradation of areas, to implement other economic attractive activities, especially the pasture for cattle farming. This situation happens because it is not usual to implement monitoring systems and protection of the properties, since these actions are expensive and are rarely effective when practice individually.

Considering this scenario, the monitoring plan, in combination with the other project activities, is designed to reduce deforestation and avoid emissions of GHG, bringing benefits to the population and to the biodiversity as well. The monitoring plan is designed to begin the activities implementation now, expecting to achieve the main goals in the 30-year project lifetime. Thus, activities are planned to enforce projects governance and management, since this is a unique and complex project that unites 74 rural properties. In parallel with the governance structuring, the monitoring of the area starts with the construction of monitoring plan, identification of main drivers, implementation of remote monitoring and local monitoring, through terrestrial security. Once these actions are stablished and periodically assessed, the project will assist in the achievement of the 3 goals of the project.

Environmental education

As mentioned before, the actual scenario in the region is characterized by many social vulnerabilities and invasion of forest areas. Both conditions are associated, among others, with precarious conditions and no investments in education, and lack of information. As people are the agents of deforestation, they are also the main agents of transformation, capable to build critical sense, if they are given the opportunity to evolve it. Thus, the courses and trainings on conservation of species, provision of ecosystem services by living beings and the forest, pollution, climate change, and many other topics related to the environment, are essential to the possibility to change habits and build environmental awareness to conserve the forest and allow their own sustainable development.

Fire brigade training

Historically, the region of the project suffers from fire events, as it is used to "clean" areas. It is often uncontrolled and poorly managed, being one of the main drivers of degradation and deforestation, emitting GHG to the atmosphere. Considering this, the project intends to prevent forest fires and reduce damage in case of events, by training yearly the internal communities and also external communities involved in the YBYRÁ REDD+ Project, forming a brigade and allowing rapidly response. The participants of the training receive certificates, knowing how to respond safely, in case of fires in the PA and forest areas adjacent.

Biodiversity Monitoring

The secondary data collection on biodiversity (item 5.1) shows the great abundancy of species in the Amazon and in the region of the project. However, this great diversity is not monitored, making it impossible to promote effective conservation actions and evaluate its impacts on the fauna and flora. Additionally, the effects of human impact in general, prevenient of, for example, deforestation, are not entirely known, besides that is negative.

Therefore, the YBYRÁ REDD+ Project will monitor the biodiversity periodically through the project lifetime, enabling the assessment of the project actions, the production of scientific information and the addressing of effective conservation activities to protect the biodiversity of the region.

Recomposition of PPAs and creation of Ecological corridors

The current landscape of the project region is fragmented and some Permanent Preservation Areas (PPAs) are degraded by the intense exploration of the land. In the without project scenario, this panorama would continue or would increase, with no efforts to address these matters. However, the YBYRÁ REDD+ Project proposes to step in and face this complex issue through the 30-year project lifetime.

Considering the expensive solutions of the market, the project will implement prototypes in small areas to recompose PPAs, aiming to test different methods and promote new solutions that are more economically viable and can be replicated. In addition, this activity will prioritize areas that connect forest of the PAs, so biological connectivity can be promoted, and thus, enhanced in the project region. Thus, creation of ecological corridors, together with the recomposition of PPAs will be implemented as project activities, aiming to conserve biodiversity species and ecosystem services, consequently, promote adaptations to climate change in the region and improve the quality of life of the population that lives close to the forest areas;

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”[53].

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. 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. In total, there are 17 SDGs integrated and directed to balance the development between social, economic and environmental sustainability.

All the actions designed by the YBYRÁ REDD+ Project are aligned with the Sustainable Development Goals (SDGs), at the same time aligned with Brazilian's actions and national policy towards sustainable development. As seen in sector 2.1.11, the project aims to contribute to 11 SDGs, as listed below (table 2.29).

Table 2.31 - The SDG’s goals related to the project activities of the YBYRÁ REDD+ Project.

SDG	Goals

[53] 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.

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.
SDG 2 - End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.	2.3) Increase agricultural productivity and income of small family food producers, aiming at both self-consumption production and their socioeconomic development; 2.4) Support the formation of sustainable food production systems, through technical assistance and rural extension, among others, aiming to implement resilient agricultural practices that increase production and productivity and, at the same time, help to protect, recover and conserve services ecosystems;
SDG 3 - Ensure healthy lives and promote well-being for all at all ages.	3.5) Strengthen the prevention and treatment of problems arising from substance use, including substance abuse and harmful use of alcohol; 3.7) Support access to sexual and reproductive health information and services;
SDG 5 - Achieve gender equality and empower all women and girls.	5.1) End all forms of discrimination against all women and girls everywhere; 5.5) Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life;
SDG 6 - Ensure availability and sustainable management of water and sanitation for all.	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; 6.6) By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes;

	6.b) Support and strengthen the participation of local communities to improve water management;
SDG 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. 	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;
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;
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;
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;

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; 15.5) 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.
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.

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 of this PDD and, after, on the following monitoring reports.

2.1.13 Implementation Schedule (G1.9)

During the life of the project, from development to implementation, some important dates and milestones occur, such as signing of the contract between the parties involved responsible for the development and implementation of the Project, visits to the properties, consultations with community and institutional stakeholders, socioeconomic diagnosis of the communities, start and end dates of the GHG accounting period, monitoring and verification program, etc. The table below presents the milestones, that can suffer alteration along the project development (table 2.30). Precise dates will be established and disclosed to the stakeholders.

Table 2.32 - Milestones of of the YBYRÁ REDD+ Project.

Date	Milestone(s) in the project's development and implementation
31st January of 2022	Signature of 93% of contracts to implement REDD+ Project between proponents – **Definition of START DATE and begin of GHG accounting period for the YBYRÁ REDD+ Project**
5th of April of 2022	First technical meeting with proponents
3rd to 8th April of 2022	First visit to the properties and presentation of the project to the internal community
25th April to 5th May of 2022	First visits in communities for socioeconomical diagnosis
5th of August of 2022	Roads and firebreak maintenance in Santa Bárbara farm
13th of September of 2022	Institutional Stakeholders Consultation – Paragominas and Ipixuna do Pará
15th September of 2022	Second technical meeting – Development of the YBYRÁ REDD+ Project
24th October to 04th November 2022	Second visits in communities for socioeconomical diagnosis

October of 2022	Second visit to the properties and presentation of the project to the internal community
19th of October of 2022	Implementation of MonitoraCarbon™ in all 74 farms (remote sensing monitoring - Carbonext system)
25th of November of 2022	Governance workshop with the landowners/proponents
05th to 8th December 2022	Confirmation of maps and PA with individual meetings with the proponents
1rst to 07th of March of 2023	Institutional Stakeholders Consultation – Tomé-Açu, Aurora do Pará, Ulianópolis and Nova Esperança do Piriá
1rst to 3rd March of 2023	Monitoring and forest integrity workshop with the landowners/proponents
10th to 14th April of 2023	Workshop with land owners to validate monitoring plan
April-May of 2023	Landscape fragmentation analyses.
08 and 09 of May of 2023	Forest fire brigade training with 20 employees
30th June of 2023	Official formation of the Cooperative COOPERCARBON
13th July of 2023	Purchase of motorcycle to the terrestrial monitoring
18th July of 2023	First terrestrial monitoring by official monitor
24th July of 2023	Last day of the MR01 period
25th July of 2023	Begin of second monitoring period - MR02
30th January of 2052	End of GHG accounting period

The next site visit is scheduled for August of 2023, and the local visit of the VVB for Validation is scheduled to happen in October of 2023. The firsts results of the first monitoring period will be presented after de validation and verification process to the land owners and proponents. Further articulations with the communities and local stakeholders can take place at these visits as well.

2.1.14 Project Start Date

According to the VCS Program Definitions V4.2[54]: "*The start date of an AFOLU project or jurisdictional REDD+ program is the date on which activities that led to the generation of GHG emission reductions or removals are implemented*". Considering this definition, the start date of

[54] https://verra.org/wp-content/uploads/2022/12/vcs-program-definitions-v4.3-final.pdf. Accessed in 24/03/2023.

the YBYRÁ REDD+ Project is the **31st January of 2022**, because on this day, the farmers group reached 94.3% of the project area formalized in the legal contract to develop the REDD+ Project, with a total of 72,089.20 hectare of forest area.

The context in the region of the project is of massive deforestation to implement pasture and strong fire events. The record of the constant incidence of fire in the region can be verified in the evidences of the Non-Permance Risk Analysis. Considering this, several landowners of the region begun to act on the protection of their properties, however, in individual initiatives, that were not effective to contain deforestation.

In this context of individual actions, from September to November of 2021, fourteen landowners, representing more than 80 private properties, got together to formalize and sign a collective term, in which they committed to develop strategies of monitoring and maintaining the forest remnants of the farms collectively. United, the properties owners could optimize actions and produce greater impacts towards forest protection. This culminated in the interest in the development of a REDD+ project, that enabled the creation of the YBYRÁ REDD+ Project.

In addition to the signing of the collective term by 100% of the properties involved in the project, the YBYRÁ REDD+ Project is considered to be born on the 31st January of 2022, with the signing of the contract between the landowner of the Santa Carmem Farm and Carbonext to develop a REDD+ Project. The signing of this contract meant that 92% of the properties were officially committed with development of the YBYRÁ REDD+ Project. This represents 94.3% of the current project area, with a total of 72,089.20 hectare.

The flowchart below shows the start date marking the begin of the actions of the YBYRÁ REDD+ Project (2.22).

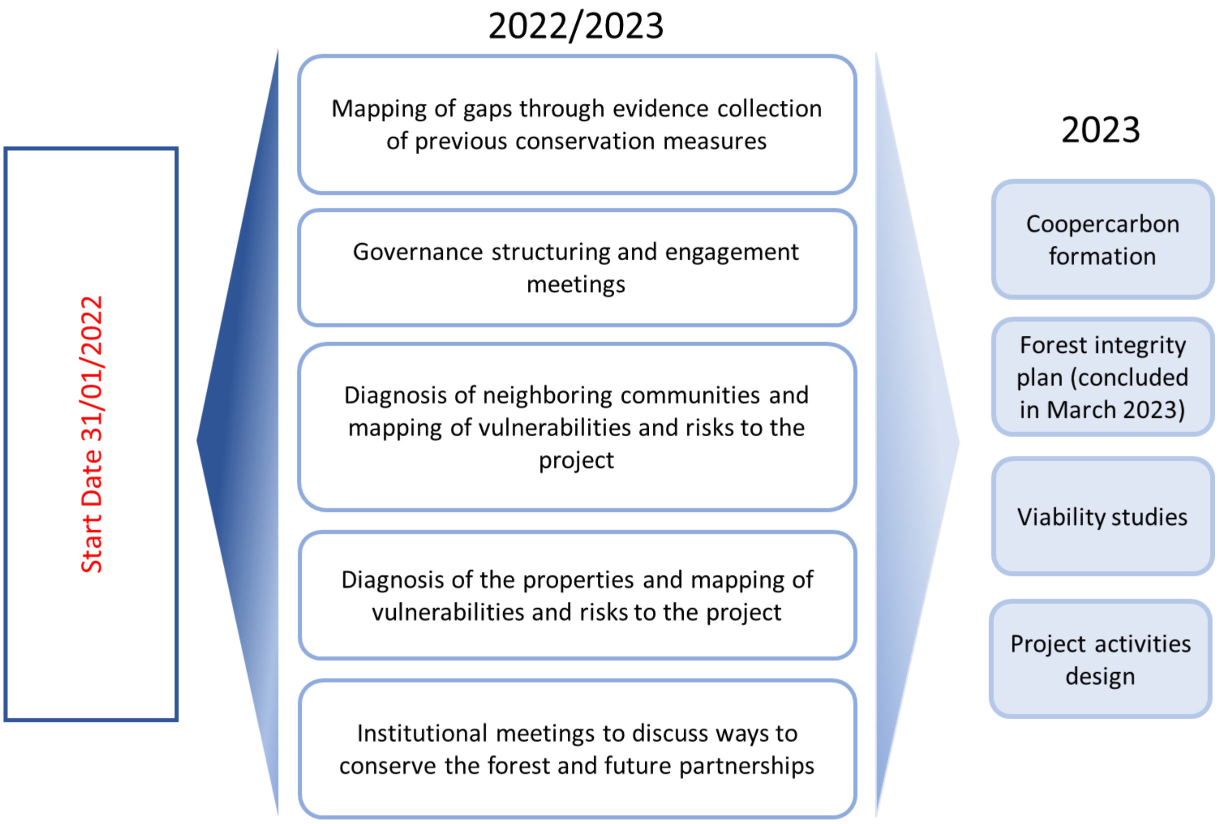


Figure 2.22 - Flowchart of actions since the Start Date.

The evidence collection was carried out in order to map all the actions of conservation in the properties before the Start Date and to identify the fragilities and points of improvement. These evidence will be provided to the VVB. Some individual initiatives towards forest conservation were mapped, such as access control to the properties, tractor purchasing (used to road and firebreak maintenance), employees hiring (for surveillance), fire brigade trainings, firebreak and road maintenance, monitoring and surveillance, regularization of areas affected by fire, watchtowers and sentry-box implementation and others[55]. However, it was only after the signing of the contracts that the landowners took measures together and started to develop the governance of the project and the monitoring plan, in order to guarantee the effectiveness of project activities implementation.

2.1.15 Benefits Assessment and Crediting Period (G1.9)

- Start date: 31/01/2022;
- End date: 30/01/2052.

[55] Evidence available in “Conservation_Mapping”

- Crediting period: 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/climate/biodiversity benefits assessment periods of the YBYRÁ REDD+ Project. Since the start date of the project, the activities to conserve the forest areas and the biodiversity are being implemented. The actions also aimed to bring benefit to climate regulation and the internal community in the project area and are in compliance with the CCB Standard together with the VCS Standard. The community benefits are also prevenient from the ecosystems services as consequence of reduction/avoidance of deforestation.

2.1.17 Estimated GHG Emission Reductions or Removals

In the 30 years of the YBYRÁ REDD+ Project it is estimated that the net GHG emission reductions protecting the project area against deforestation is of 12,044,741.50 tCO_2e (table 2.31).

Table 2.33 - Estimated GHG emission reductions year by year by the YBYRÁ REDD+ Project.

Year	Estimated net GHG emission reductions (tCO2e)
2022	298,368.41
2023	405,520.86
2024	454,273.38
2025	491,702.85
2026	546,242.75
2027	595,612.86
2028	487,813.75
2029	429,815.91
2030	484,404.11
2031	469,550.73
2032	477,559.37
2033	431,002.46

2034	382,423.45
2035	448,024.93
2036	477,993.11
2037	358,291.87
2038	393,471.18
2039	364,448.37
2040	392,741.46
2041	374,262.05
2042	411,163.91
2043	365,696.25
2044	250,737.47
2045	312,003.87
2046	299,016.18
2047	274,101.09
2048	356,762.71
2049	338,260.58
2050	378,004.47
2051	222,427.91
2052	73,043.21
Total estimated ERs	**12,044,741.50**
Total number of crediting years	30.00
Average annual ERs	401,491.38

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 (table2.32) 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 2.34 - Risks of the YBYRÁ 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 YBYRÁ 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, sanitation, trainings and workshops about sustainable practices, agroforestry and other professionalizing courses, mitigation actions regarding local climate events, monitoring and studies about the local fauna and flora, and many other that are still being defined according to the information gathered in the socioeconomic diagnosis to understand the local vulnerabilities and how the project can support the local institutions to bring benefits. All these measures aim to build environmental awareness, sustainable practices and changes 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 YBYRÁ REDD+ aims to decrease and avoid deforestation and, as consequence, GHG emissions. The reduction of GHG emission benefit life on Earth through the regulation of climate effects and ecosystem services' functions. To generate more climate benefits, a constant and effective monitoring of the project area will be maintained during the project lifetime. The evaluation and foment of strategies to recompose some of the Permanent Preservation Areas (APPs) of the properties involved in the project will also benefit the climate regulation and protection of fresh waters that are important in the region to the fauna, flora and to the communities. In addition, 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 are indirectly related to the climate.

- Community

For activities and benefits with communities, based on the socioeconomic diagnosis carried out, it was possible to identify the main vulnerabilities and, based on this, outline initiatives that aim to generate benefits that last beyond the duration of the project.

In order to increase family income, it is proposed to strengthen the good practices and cultivation of present family agriculture. For this, initially there will be a strengthening of the social organization to have tools and knowledge about financial, administrative, inputs and territory management. After that, courses and trainings on sustainable practices will be promoted, to increase productivity and assess the already cultivated products. Then, it will be assed the technical and economic viability for the potential implementation of agroforestry systems (SAFs), with institutional partnerships in order to provide training on rural technical assistance to producers.

In this sense, with the strengthening of vocations, training will be carried out to provide better access to the market, seeking to ensure fair marketing. This stage will be through courses for formation of the sale price, good practices in services and products, brand and product positioning and communication and customer service. All these actions aim to propose a diversity and increase in income, without seasonal dependence, which consequently contributes to the increase in the consumption power of the families benefiting from the project.

Regarding access to water, it means contributing to quality human consumption and availability for agricultural activities in the area. For this, a technical and financial feasibility study will be carried out, identifying if it is possible to implement this activity in the area, and if so, the best alternatives for implementation. Afterwards, a plan for the implementation of water supply for some communities will be developed, as well as strategies and steps to be followed along the 30-year project lifetime. The evaluation plan for the control and surveillance of water quality through analyzes carried out on an annual basis based on Ordinance GM/MS No. 888, of 4 May 2021 following recommendations and parameters according to environmental conditions.

For digital inclusion, the implementation of broadband internet technology via satellite is suggested, guaranteeing access in remote areas and rural areas. To this end, a Digital Inclusion and Innovation Program will be implemented in partnership with government entities at schools. The purpose is to reduce digital illiteracy through the acquisition of computers and training to access, use, produce and distribute acquired information and knowledge. This activity aims at the following benefits: Introduce skills with digital technologies, generate access and interest, corroborate job and income opportunities.

Regarding gender, there are two work fronts: I) Women's Health and; II) Female empowerment, aiming to work with women in different stages of human development (pre-adolescence and adulthood). The first is aimed at proposing actions through lectures and workshops on sex education in schools, aiming to prevent unwanted pregnancies and sexually transmitted infections (STIs) and diseases that most affect women. In this way, develop actions in government partnership that seek to meet needs in this regard. Finally, the expected benefits are greater awareness of disease prevention and treatment, better healthy habits and practices, and improved well-being.

In relation to women's empowerment, it means carrying out actions that strengthen their active participation, autonomy and equal conditions for job opportunities and access to basic needs. This action takes place through participatory methodologies in the field that list the main desires on the part of women. After that, training and qualifications are carried out in activities that aim to generate greater well-being, satisfaction with life and seek to promote an increase in income. The desirable benefit is to provide greater autonomy, appreciation of work and strengthening of the local women's network.

Finally, there is the Relationship Channel, which is a tool to provide transparency, security and record the demands of the community. For the development of intervention actions, communication represents a fundamental basis for agile project management. Therefore, the channel has e-mails, telephone contacts and communication applications. All records are addressed and forwarded according to purpose. With that, the benefit of this action is to establish contact throughout the process and predict or solve possible problems to propose solutions.

- 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, significant 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, ecological corridors to promote connectivity between forest fragments in the PA will be implemented in the areas chosen to develop strategies to protect and recompose PPAs, after landscape and fragmentation analysis. 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 and in item 4 and 5.

2.1.20 Financial Sustainability (G1.12)

Funding for project activities is secured 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 YBYRÁ 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[56].

This grouped project was developed with the purpose to reduce net GHG emissions by decreasing 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 and all the eligibility criteria for grouped project presented in the methodology are secured).

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

The project considers the international[57] and national[58] definition accepted of 'forest", which includes mature forests, secondary forests, and degraded forests, and includes typologies 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.

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 74 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

[57] According to the Decision 11/CP.7 of Marrakesh Accord, the following definition of forests is adopted (UNFCCC, 2002) 57: (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. https://unfccc.int/files/meetings/workshops/other_meetings/application/pdf/11cp7.pdf (page 5 of PDF).

[58] The Brazilian Forestal Service considers as "forest" the typologies of woody vegetation that are closer to the definition of "forests" of the Food and Agriculture Organization of the United Nations (FAO). These corresponds to the classification system of the Instituto Brasileiro de Geografia e Estatística (IBGE). https://snif.florestal.gov.br/pt-br/florestas-e-recursos-florestais/167-definicao-de-floresta#:~:text=%22Floresta%20%2D%20%C3%A1rea%20medindo%20mais%20de,sob%20uso%20agr%C3%ADcola%20ou%20urbano.%22

rates) were assessed across the grouped project geographic area and respective Reference Region.

The project proponents have 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 74 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)

Data from the Deforestation Alert System (SAD), from the Amazon Institute for Man and Environment (Imazon), revealed that Pará remains the state that most deforests among the nine that make up the Amazon region. From August 2021 to July 2022, 3,858 km² of forests in Pará were cut down, which represents 36% of the total area devastated in the Amazon (10,781 km²)[59].

According to data provided by the IMAZON[60], deforestation in the Amazon occurs more often in private properties (figure 2.23), as it is the case of the 74 rural properties involved in the YBYRÁ REDD+ project. One of the things that facilitates the most the invasions of private area and illegal activity in the Amazonian region is the lack of enforcement by local agents[61].

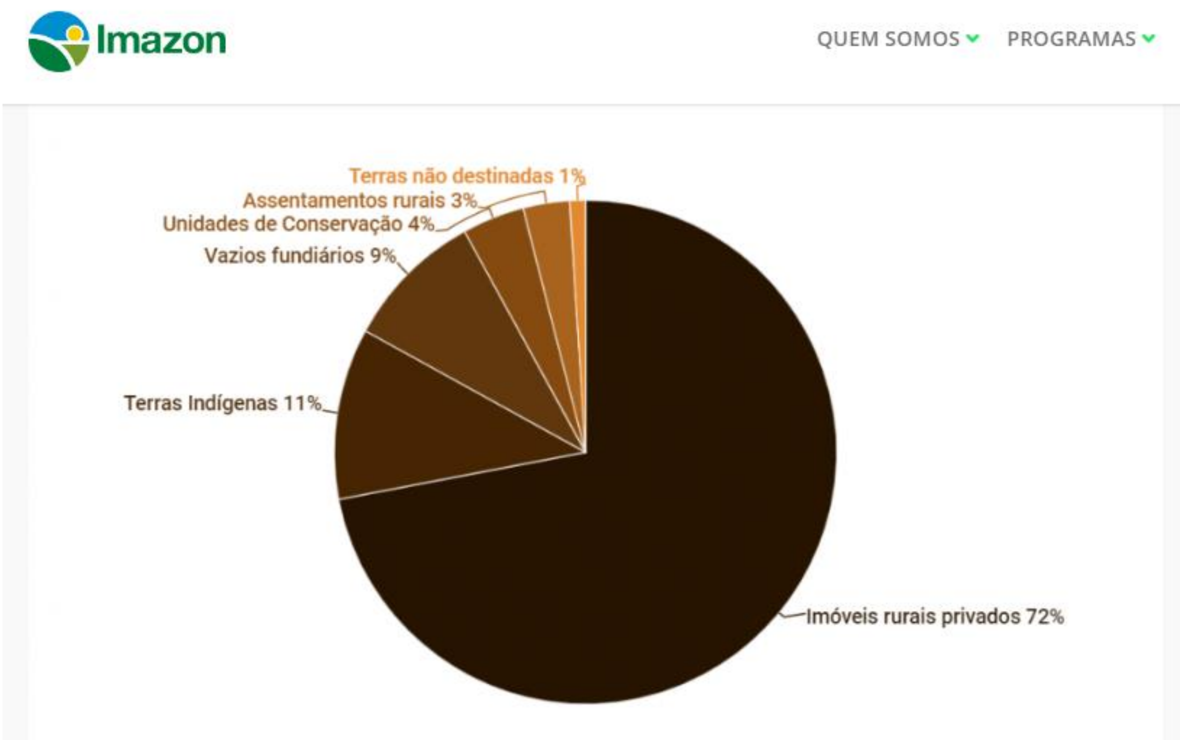


Figure 2.23 - Figure representing the most deforested areas in the Amazon. Source: https://imazon.org.br/imprensa/quase-40-da-extracao-de-madeira-na-amazonia-nao-e-autorizada-mostra-pesquisa-inedita/. Free translation, from darker colour to lighter: Private rural properties; Indigenous lands; Areas with no governance regulated; Conservation Units; Rural communities; Non-destinated areas.

[59] Desmatamento no Pará chega a quase 4 mil km² nos últimos 12 meses, maior derrubada entre os estados da Amazônia - Imazon
[60] https://imazon.org.br/imprensa/quase-40-da-extracao-de-madeira-na-amazonia-nao-e-autorizada-mostra-pesquisa-inedita/
[61] https://www12.senado.leg.br/noticias/materias/2021/10/01/especialistas-pedem-mais-fiscalizacao-e-alertam-para-desmatamento-e-queimadas-na-amazonia; https://www.scielo.br/j/rap/a/LjyN7XcZM9JNPQVv6Br7M9P/?lang=pt.

After invading properties, the main post-deforestation land uses in the region of the project are three anthropic activities: timber exploration, pasture for cattle raising and agriculture of grains, legally and illegally. Invasions of non-productive lands are common practice, usually followed by the timber extraction, and implementation of pasture for cattle production or agriculture, that are economically attractive. First, the areas are invaded and the trees are cut down. The wood is then sold illegally. After that, the pasture is implemented to produce cattle, the main land use activity of the RR of the YBYRÁ REDD+ Project.

From 2018 to 2021[62], Paragominas went from 276,131 to 367,490 heads of cattle (33% growth). Ipixuna do Pará presented an increase of 46% in the same period, while in Tomé-Açu the growth was of 27% and in Ulianópolis of 47%. In the year of 2021 the 4 municipalities produced 52% of all charcoal from timber[63] in the state of Pará. The production of roundwood and firewood (2021) corresponded to 547.938 m³ of timber removed in the 5 municipalities[64].

Although the pasture is by far the main land use scenario, the expansion of soybean agriculture is spreading fast. The production of soybean in Pará has grown exponentially: from 2009 to 2021 it increased 981%[65] and its price increased almost 350% (May/2015 to March/2022[66]). The area of its cultivation increased[67] from 71,410 ha (2009) to 753,781 ha (2021), a 955% increase. However, there is first the implementation of pasture, even if of bad quality, then the culture of grains.

All these numbers mean increasing pressure to convert forest areas into pasture and/or cultivation areas. In the map below (figure 2.24) and in table 2.33, it can be seen the distribution and percentage of the different classes of land use in the RR and the deforestation pressure in PA, according to the classification of the Mapbiomas[68].

Table 2.35 - Detail of land use and vegetation of 2021 in RR. Source: Mapbiomas.

Land Use Classes	Area (ha)	% of RR area
Forest	2,182,356	61.88

[62]IBGE.https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/18/16459?localidade1=150345&localidade2=150800&tipo=grafi co&indicador=16533https://cidades.ibge.gov.br/brasil/ac/bujari/pesquisa/18/16459?tipo=grafico&indicador=16533
[63] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/16/12705. Accessed in 11/04/2022.
[64] IBGE Cidades, 2020. Available on:https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/16/12705. Accessed in 11/04/2022.
[64] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/tome-acu/pesquisa/16/1270. Accessed in 11/04/2022.
[64] IBGE Cidades, 2020. Available on:https://cidades.ibge.gov.br/brasil/pa/ipixuna-do-para/pesquisa/16/12705. Accessed in 11/04/2022.
[65] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?tipo=grafico&indicador=10370. Accessed in 11/04/2022.
[66] https://sisdep.conab.gov.br/precosiagroweb/
[67] https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?ano=2009
[68] https://mapbiomas.org/

Savanna Formation	788.63	0.02
Non-Forest Natural Formation	11,520.57	0.32
Pasture	1,006,689	28,54
Agriculture	89,728.78	2.54
Soybean	196,669.7	5.57
Forest Plantation	16,795.46	0.47
Urban Area	2,780.08	0.07
Mining	7,556.86	0.21
Water	11,384.88	0.32
Total	3,526,270.00	100

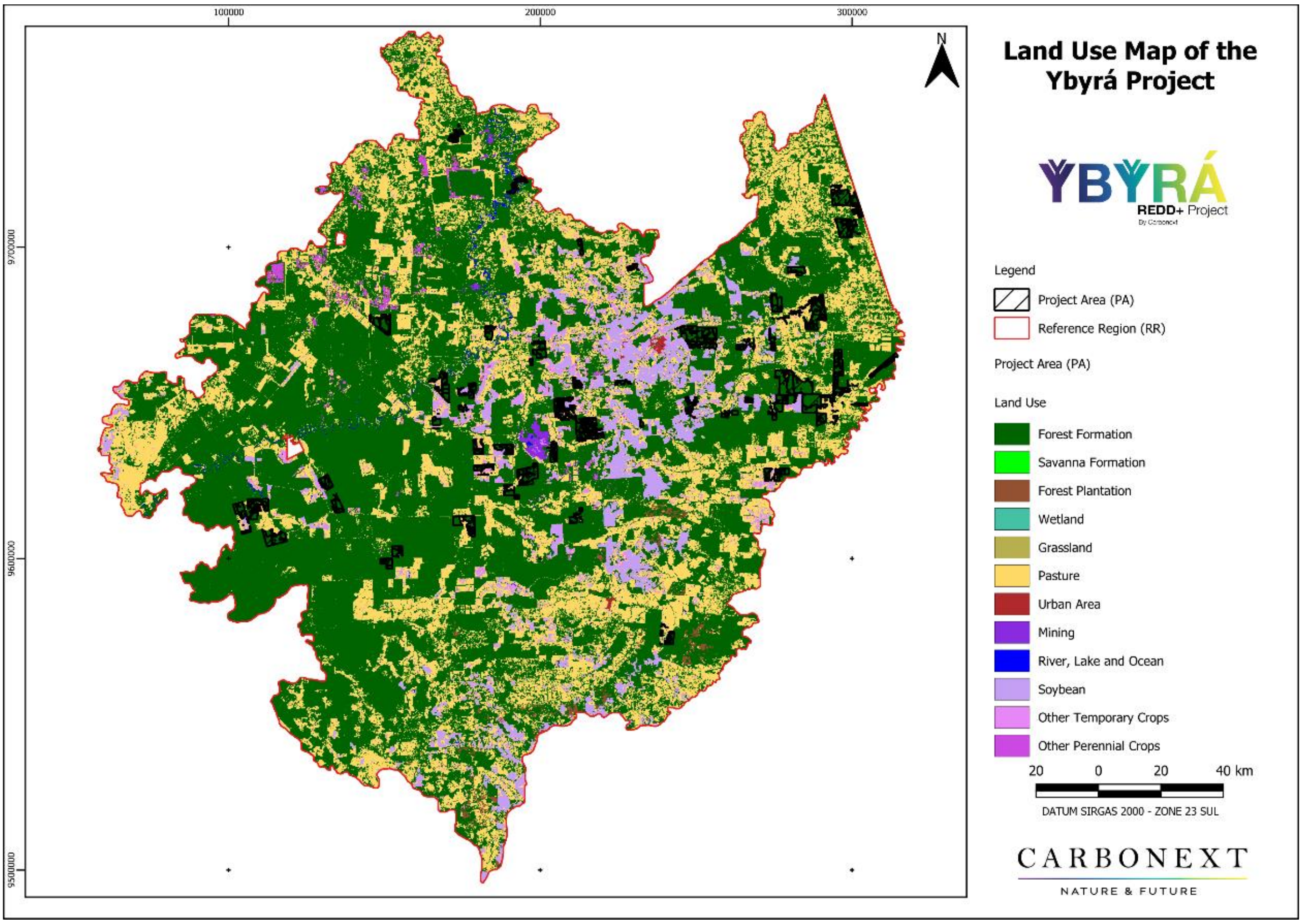


Figure 2.24 - Land Use map of the RR of the Ybyrá REDD+ Project.

Forest fires are also common in the region, used to clean the soil by burning the vegetation. Together with other degradation agents, the region would become more fragmented and would increase habitat and biodiversity loss, as well as would prejudice sources of water and other ecosystem services, without the implementation of project activities to minimize fire effects and prevent events in the PAs, without monitoring and surveillance.

Considering this context of illegal deforestation in the state, the baseline scenario is: forest within the project area is expected to be converted to non-forest land, primarily pasture to cattle production, because the region faces a high deforestation pressure, considering that other activities are economically more attractive than forest areas. In order to identify the land use scenarios without the project and projects additionality, the VCS approved tool VT0001 – Tool for the Demonstration and Assessment of Additionality in VCS, was applied. The baseline scenario identified is further discussed in Section 3.1.4, where it is presented the analysis of deforestation, vector agents and underline causes.

Despite some of the landowners already held a patrol system with employees patrolling the property, separate and individual initiatives are not enough to prevent encroachments and illegal deforestation in the long term. Through the income from the YBYRÁ REDD+ project, ground monitoring activities will be improved and intensified. The project is also remotely monitored by Carbonext's MonitoraCarbon System, which analyses satellite images frequently and issues fire and deforestation alerts, facilitating early detection of deforestation patterns and rapid action of landowners and local enforcement, thus reducing invasions and deforestation for implementation of other activities in the land.

The present project has not been implemented to generate GHG emissions for the purpose of their subsequent reduction, removal or destruction.

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 pasture implementation for cattle raising, after the exploration of timber to "clean" the area. After a bad quality pasture, other agricultural activities can be implemented. 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 illegal logging[69].

Historically, the state of Pará has its resources explored and forests deforested. Data from PRODES shows that from 2004 to 2014 there has been a substantial decline in deforestation in

[69] https://amazoniareal.com.br/amazonia-em-chamas-retirada-de-madeira-contribui-para-o-desmatamento/ ; https://imazon.org.br/imprensa/quase-40-da-extracao-de-madeira-na-amazonia-nao-e-autorizada-mostra-pesquisa-inedita/ ; https://infoamazonia.org/2021/09/21/maior-parte-madeira-consumida-ilegal-desmatamento-amazonia/; https://www.wwf.org.br/natureza_brasileira/areas_prioritarias/amazonia1/ameacas_riscos_amazonia/desmatamento_na_amazonia/extracao_de_madeira_na_amazonia/.

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 such as logging, cattle raising and soybean production, but also with the lack of law enforcement by authorities.

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[70]. Such economical and productive growth led to the formation of large population centres, such as Paragominas city and its surroundings.

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[71]; EMBRAPA[72]). According Freitas Júnior & Barros[73], 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.

The livestock in the state achieved 23,921,005 heads in 2021[74] (Figure 2.25). From 2018 to 2021[75], Paragominas went from 276,131 to 367,490 heads of cattle (33% growth). Ipixuna do Pará presented an increase of 46% in the same period, in Tomé-Açu the growth was of 27%, and in Ulianópolis it was 47%.

[70] Available on: http://repositorio.ipea.gov.br/bitstream/11058/9000/1/A%20Economia%20do%20Sudeste.pdf
[71] https://www.scielo.br/j/neco/a/jVyJbvTGbZKcvYg5NhzTFLk/?lang=pt&format=pdf
[72] 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
[73] Freitas Júnior, A. M.; Bastos, P. H. B. 2021. A expansão da pecuária para a Amazônia Legal. Available on: DOI: http://dx.doi.org/10.1590/0103-6351/5064.
[74] IBGE
[75] IBGE
https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/18/16459?localidade1=150345&localidade2=150800&tipo=grafi
co&indicador=16533https://cidades.ibge.gov.br/brasil/ac/bujari/pesquisa/18/16459?tipo=grafico&indicador=16533

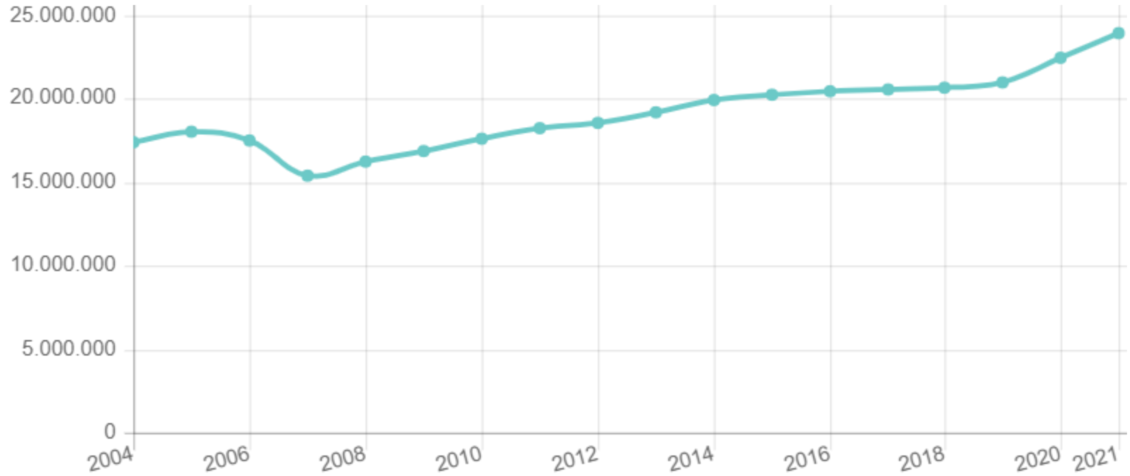


Figure 2.25 - Herd from 2009 to 2021 in the Pará state, in heads of cattle. Source: IBGE, 2023. Available on https://cidades.ibge.gov.br/brasil/pa/pesquisa/18/16459?tipo=grafico&indicador=16533. Accessed in 13/01/2023.

Considering the timber market, the state of Pará is also historically known for intense exploration. According to the IBGE[76], the production of wood log is elevated, producing in average 205,895.4 m^3 per year. The production of charcoal was responsible for 74,113 tons in 2021, which represents a 347% increase compared to 2018 (16,576 tons). The production of firewood had an increase from 2018 to 2021 of 5.55%, producing 1,483,173 m^3 in 2018 and 1,565,557 m^3 in 2021. The roundwood production also increased, from 3,247,263 tons in 2018 to 3,870,374 tons in 2021, with a price increase of 26% in this period[77]. Even though the timber exploration maintains a relatively stable production, it's been growing in the last years (Figure 2.26).

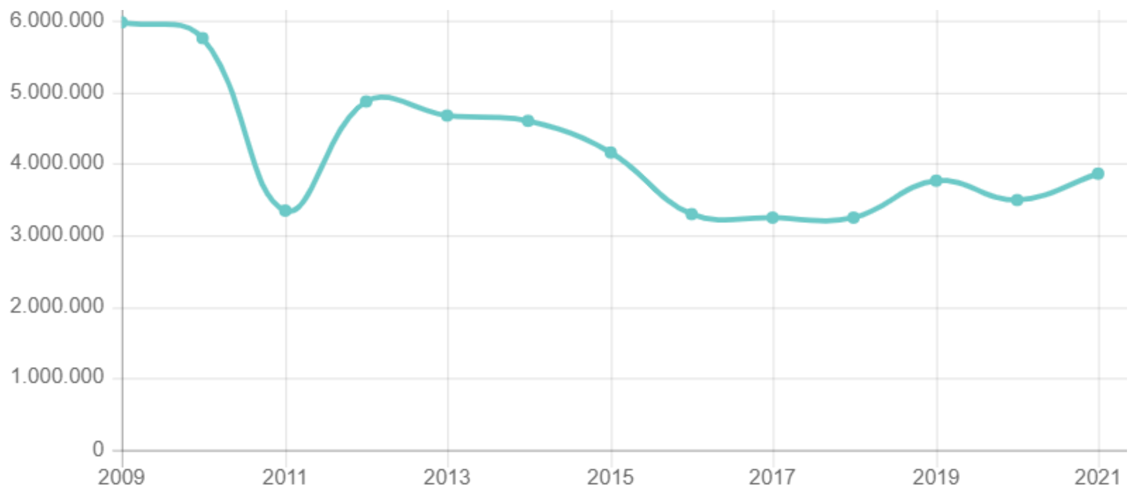


Figure 2.26 - Timber production from 2009 to 2021 in the Pará state, in tons. Source: IBGE, 2023. Available on https://cidades.ibge.gov.br/brasil/pa/pesquisa/16/12705?indicador=12804&ano=2018. Accessed in 06/04/2022.

[76]https://cidades.ibge.gov.br/brasil/pa/pesquisa/16/12705?tipo=grafico&indicador=12804
[77] https://cidades.ibge.gov.br/brasil/pa/pesquisa/16/12705?indicador=12804&ano=2021

As mentioned before, the soybean agriculture is not the most common practice in the project region, thus it is not the baseline scenario of the YBYRÁ REDD+ Project. However, it's increase in the economy is also nowadays a significant pressure for deforestation in the area. The soybean production increased 981%[78] from 2009 to 2021 (Figure 2.27). The area of its cultivation increased[79] from 71,410 ha (2009) to 753,781 ha (2021), a 955% increase. The soy cultivation represents 50.13% of all agriculture-products exported from Pará[80]. 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[81]. In addition, the value of this commodity has abruptly increased: In the period of one year from May 2020 to March 2022, there price of soybean increased almost 350%[82]. It has a great potential to grow in the region of Paragominas, Ipixuna do Pará, Ulianópolis and Tomé-Açú in the next few years if it follows the growth trend of this crop in the state of Pará.

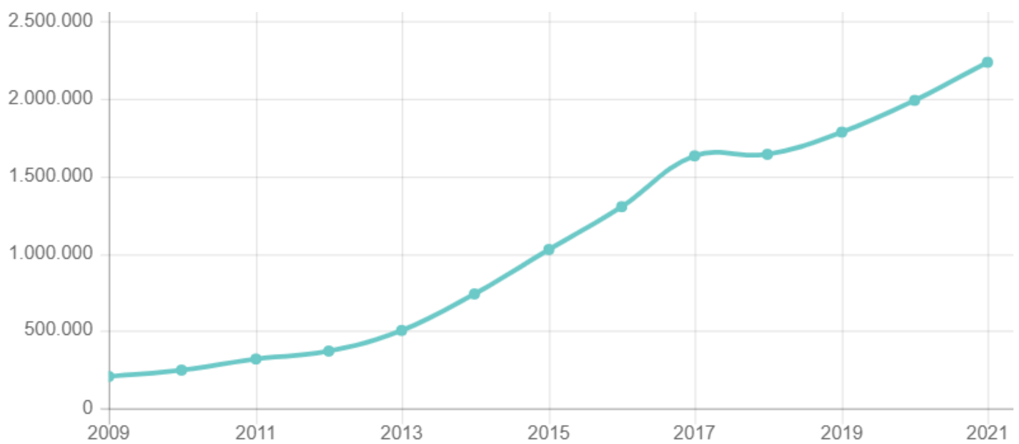


Figure 2.27 - Soybean production from 2009 to 2021 in the Pará state, in tons. Source: IBGE, 2023. Available on https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?tipo=grafico&indicador=10368. Accessed in 13/01/2023.

2.2.3 Community and Biodiversity Additionality (G2.2)

In the absence of the YBYRÁ REDD+ project, the without-project scenario (more details in sections 2.2.1 Land Use Scenarios without the project, 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 the impacts of the

[78] IBGE Cidades, 2020. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?tipo=grafico&indicador=10370. Accessed in 11/04/2022.
[79] https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193?ano=2009
[80] Pará está entre os 10 maiores exportadores de grãos do País | Agência Pará (agenciapara.com.br)
[81] Pará está entre os 10 maiores exportadores de grãos do País | Agência Pará (agenciapara.com.br)
[82] https://sisdep.conab.gov.br/precosiagroweb/

deforestation of great areas of native forest. Most important, the situation of the area would be considered critical to be protected, since invasions are common practice in the region, the activities predicted by the project would not happen and would not bring monitoring of the forest areas nor any additional benefits for the communities, climate and biodiversity.

According to the Theory of Change, the YBYRÁ REDD+ Project has 3 main goals: 1) foment the development of strategies to recovery some areas of degraded Permanent Preservation Areas (APPs) and creation of ecological corridors, which will promote connectivity between species in the region and maintenance of ecosystem services, such as mitigation of erosion and increased water quality and supply; 2) strengthening governance and administrative and financial management of community associations; 3) promotion of sustainable practices of family agriculture in the communities, aiming at generating work, source of food and income. 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.

In the absence of the YBYRÁ REDD+ project, the project activities designed based on the 3 main goals (mentioned above) would not be implement. It would mean 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[83]. The properties would be invaded, and then converted into pasture for cattle raising areas, after the removal of tons of timber by illegal logging of the forested area. The permanence of the without-project currently scenario means the continue financing on unsustainable agriculture and livestock production, that is already the scenario in the city of Paragominas[84], rather than investments in the sustainable development.

Regarding existing laws, regulations, and governance arrangements, the occupation history of the Pará lands resulted in land tenure conflicts and invasions of private and public lands, with non-compliance to the laws. Invasions followed by implementation of illegal activities, such as unauthorized deforestation, is widespread in the region. One example is the invasion of the Sarauá Indigenous land and the illegal timber exploration and hunting. About invasions in private properties, as one example, there is the process of repossession of the land, secured by the private property rights, but the process can be slow and costly[85].

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

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

[84] 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.

[85]https://www.scielo.br/j/resr/a/fd5CWmqcKBfxf7SGPnTtsrs/?lang=pt

attempts are very high. 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. However, this 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 land cover and phytophysiognomy brings habitat and biodiversity loss, soil erosion, pollution, nutrients loss, change in the local climate and rainfall regime, increase in fires, and many other negative impacts[86]. The GHG emissions would also consequently increase, contributing to climate change.

Regarding the communities, considering historical aspects of land use and occupation (mentioned in section 2.1.6) and their impact on socioeconomic development, it is observed that the trend based on the reported historical data is in an increase in GDP per capita, caused by the expansion of economic activities (agricultural and livestock). However, considering the last 20 years (1991-2000) there has been an increase in the concentration of income in the municipalities where the project operates, characterizing greater inequality of access to resources for the local population. Therefore, it is clear that although illegal activities can bring income to the region it does not solve any social problem, in the opposite, it may deeper social inequalities.

In view of this, based on State Decree No. 5615 of October 29th, 2002[87], which provides for the policy of economic and tax incentives for companies that contribute to the socioeconomic development of the State in its regions. According to the Operational Secretariat of the Incentive Policy Commission[88] (SECOP-PA), in the Capim River region, from 2010 to 2023, 17 companies in the agricultural, forestry and mining segment are encouraged, representing an amount of accumulated revenue in the order of 11.47 billion reais, generating 8,078 direct jobs. However, according to the community diagnosis in loco, this do not reflect on actual jobs on the rural communities, distanced from the cities' centers. Therefore, the desirable social return for rural communities in the region's municipalities is incipient in relation to growing economic progress.

[86] 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.

[87] https://www.semas.pa.gov.br/legislacao/files/pdf/326.pdf

[88]https://app.powerbi.com/view?r=eyJrIjoiYzA0ZjY0ZjctZTFhYy00NWY4LTkyYzktZWM1OTRkNGU0OGJhIiwidCI6ImRkYmY2NzZjLTA3NTAtNGQ0ZC04YzQ5LTI2MDg5ZTc3Y2U0ZiJ9

This reality is reinforced by Law Nº 1.070/2021 referring to the Multiannual Plan (2022-2025)[89] of the city of Paragominas, for example, which seeks to establish goals and guidelines of the public administration in order to plan actions that result in the application of public resources efficiently in the goods and services for the local population. However, in the public consultation carried out by the municipality from June 21st to August 13th, 2021 it was found that: I) With 29.9%, the biggest problem in the municipality is unemployment II) With 51.7% the desirable priority for population is in actions that promote socioeconomic development III) With 47.2% the desire to develop local agriculture is to diversify and support food production in the municipality to strengthen local supply and IV) With 64.8%, the solution for the generation of employment and local income is to attract new investments and projects that contribute to the socioeconomic development of the population.

Therefore, when considering the socioeconomic reality of the rural communities where the project operates based on primary and secondary data, it is observed that the REDD+ YBIRÁ project acts in a proactive and additional way for the socioeconomic development of these populations that live in remote areas. Thus, contributing to a positive change in the areas of employment and income, health, communication, access to water and other work fronts that can reach different generations.

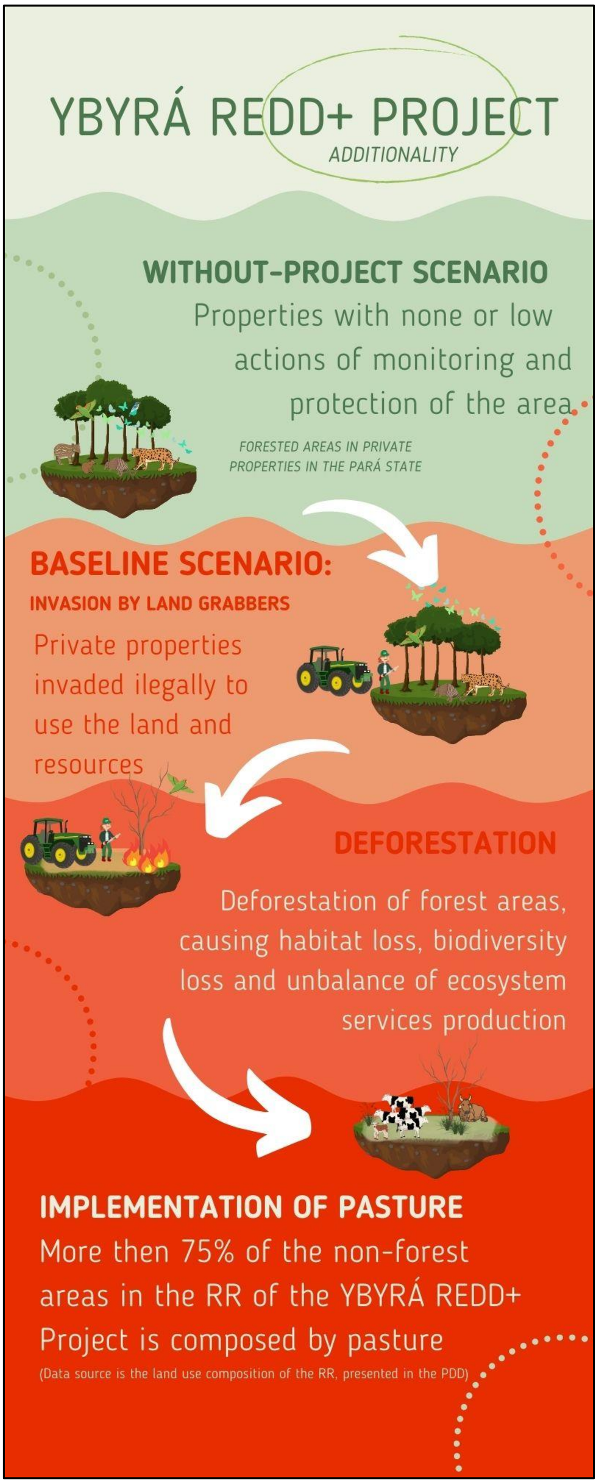
The development of a REDD+ project in the area brings many benefits, that would not be implemented with the absence of the project. Not only deforestation will be avoided, preventing GHG projected emissions, but also the community and biodiversity will benefit from the activities of the project designed based on the needs of the region, fauna and flora characterization. The implementation of the project brings carbon credits, that will be sold and allow support on sustainability, conservation, and actions that are dependent on the carbon accreditation. In summary follows some of the beneficial impacts predicted with the implementation of the YBYRÁ REDD+ Project, some in partnership with local institutions and social programs:

- Protection and conservation of 76,481.34 ha of forest;
- Avoidance of 38,259.07 ha of deforestation in 30 years in the Project Area;
- Avoidance of 12,044,741.50 tCO2e 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, specially, women.
- Recomposition of Permanent Preserved Areas (APPs in Portuguese);

[89] https://paragominas.pa.gov.br/wp-content/uploads/2021/11/CAPA-PPA_merged.pdf

- Creation of ecological corridors to promote connectivity between forest fragments;
- Support sustainable agricultural activities for rural producers;
- Strengthening and training for social organizations;
- Strengthen women's empowerment as well as their health;
- Support access to quality drinking water;
- Support access to communication through digital inclusion actions.

The infographic below (figures 2.28 a and b) illustrates the YBYRÁ Project Additionality on the communities, biodiversity and climate in the region.


YBYRÁ REDD+ PROJECT
ADDITIONALITY
WITHOUT-PROJECT SCENARIO
Properties with none or low actions of monitoring and protection of the area
FORESTED AREAS IN PRIVATE PROPERTIES IN THE PARÁ STATE
BASELINE SCENARIO:
INVASION BY LAND GRABBERS
Private properties invaded ilegally to use the land and resources
DEFORESTATION
Deforestation of forest areas, causing habitat loss, biodiversity loss and unbalance of ecosystem services production
IMPLEMENTATION OF PASTURE
More then 75% of the non-forest areas in the RR of the YBYRÁ REDD+ Project is composed by pasture
(Data source is the land use composition of the RR, presented in the PDD)

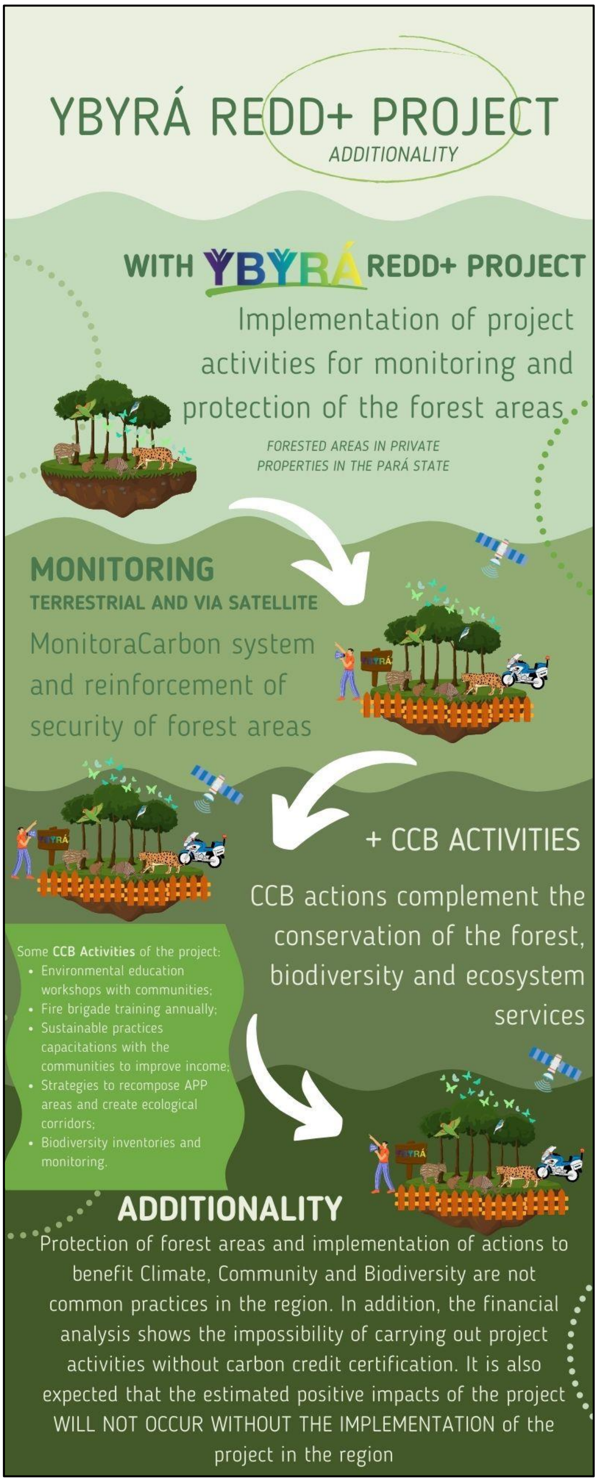


Figure 2.28 - Infographic a) representing the without- project scenario, and b) showing the additionality of the project.

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 YBYRÁ REDD+ project will be available on the VERRA website[90], 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 printed to the communities, through visits and meetings that we occurred to the stakeholders. Folders with the information of the Project and the results of every year after the monitoring will be distributed, in Portuguese.

The meetings with the communities are previously scheduled, either by local leadership and/or with residents who mobilizes to bring together the residents of the communities. Regarding municipal public institutions, meetings are also previously scheduled according to the agendas of each municipality, which received the Project team.

In all meetings, materials with information about the YBYRÁ REDD+ Project are distributed, as well as the Project's Relationship Channel, with telephone contacts, e-mails and internet communication applications (figure 29 a, b and c). This is done to ensure that all can have access to the information and ask any questions that may arise.

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

Figure 2.29 a, b and c- Community and Institutional Stakeholder Access to Project Documents

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. Any person interested in the YBYRÁ REDD+ Project and it´s documents can also contact Carbonext[91] and the technical team by the email: redd.ybyra@carbonext.com.br .

2.3.2 Dissemination of Summary Project Documents (G3.1)

Documents referring to the Project are translated into Portuguese to ensure that all local people can understand the objectives and activities of the project to be developed in the Project Area. This document is composed of informative booklets, a summary of the Project, which contains a map with the location of the project areas. Documents are shared with all stakeholders through consultative workshops, training sessions, events and on-site visits in print format in Portuguese and orally as well.

In addition, a poster in Portuguese was made to be presented during the site visit for a better understanding of the project (figures 2.30 and 2.31).

Figure 2.30 - Carbonext social team in a meeting with local community Mandacaru about the YBYRÁ REDD+ Project. Photo taken by Carbonext Team, in the field visit in May of 2022.

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

Figure 2.31: Carbonext social team in a meeting with local community Alta Floresta about the YBYRÁ REDD+ Project. Photo taken by Carbonext Team, in the field visit in October of 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 on the VCS and CCB standards platforms, as it is usually done (public available at VERRA website[92]).

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 YBYRÁ 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

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

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.

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 YBYRÁ Project. On these visits also happens the participative socioeconomic diagnosis, caried out by Carbonext with help of questionnaires.

In 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 fragilities (figure 2.32). Some properties involved in the project were also visited.

Figure 2.32: Carbonext's social team meeting with the local population about the YBYRÁ REDD+ Project in the Paragonorte community. Photo taken by Carbonext Team in May 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.

The first presentation of the development of the YBYRÁ REDD+ Project to the city halls and public secretariats happened in the second week of September of 2022 (figure 2.33 a and b).

Figure 2.33 - a) and b) Presentation of the YBYRÁ Project was televisioneted by the local journal. Source: https://www.youtube.com/watch?v=wGiMAtMLzA0

Other visits to the communities took place in October and November 2022, by 3 technical teams to visit the project properties and 2 more social teams to visit the communities.

Also, in March 2023, Project meetings were held with public institutions in the municipalities (Figure 2.34).

Figure 2.34: Carbonext development team in an institutional visit in Ulianópolis city hall. Photo taken by Carbonext Team, in the field visit in March of 2022

More onsite visits will happen periodically and continually during the project lifetime. 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 and surroundings, 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)

In order to carry out community consultations, social organizations and associations are informed in advance, in order to inform about the project development in the region and their benefits to be generated. In addition, the site visit show transparency in relation to the costs that are responsibility of the project proponent and the developer, so the community does not present any financial disbursements for the development of the project. Therefore, when explaining the possible social benefits that the project aims to contribute, the constructive and participatory process for the planning and implementation of the structuring actions arising from the REDD+ YBYRÁ Project is clarified. It is also important to mention that the project is developed in private properties, thus the participation of the external communities is limited.

The application of the socioeconomic diagnosis is an effective way to understand the reality and the relationship of the community in the territory. In view of this, it was identified that for the initial performance of the project of the 8 communities, 3 of them depend on the PA area (Glebinha, Alta Floresta and Luiz Inácio) and 5 do not depend on the PA area (Reunidas, Águia Rio Bonito, Diamantina II, Minas Pará and Floresta Gurupi I).

Regarding the communities that depend on the PA, the activities will conserve land use practices without infringing their traditional way and dependence on inputs for their food security. Therefore, regardless of the type of population present in the territory that will be benefited, throughout the process, all interventions that will affect directly the lives of community members will be consulted in a free and participatory manner to guarantee security and transparency throughout the project.

When considering the Project's 20 km buffer, intersections of this delimitation with adjacent Indigenous Lands with rural properties were identified. Especially the Terra Indígena Alto Rio Guamá in the region of Paragominas, the Terra Indígena Alto Turi-Açu adjacent to the municipality of Ulianópolis, as well as the Terra Indígena Barreirinha in the region of the Municipality of Tomé-Açu. For these communities, the community consultation is being planned to be carried out, after the occurrence of conflicts in the region cease, due to records of conflicts because of illegal extraction of wood and invasion of land[93].

However, for legal compliance, the institution representing the indigenous peoples, FUNAI, and other institutions such as social organizations present in the territory and associations, will be contacted to be informed about the development of the project.

For dealings with government entities, the communication channels used are via email and direct messages through Whatsapp, as well as reinforced by other means. In the case of the association, a contact is made seeking to verify the common agenda, respecting the community calendar about its activities, beliefs and rites to mobilize a general assembly that has representativeness and active participation of the community in the meetings. In order to produce evidence, photographic reports, attendance lists, authorization for the use of images and satisfaction assess are registered.

Finally, the benefits proposed as an intervention were identified together with the community through socioeconomic diagnosis, construction of the theory of change and situational assessment. These benefits are clearly presented to the stakeholders that will participate on project activities.

Regarding the risks of the project, only 2 presented in the item 2.1.18 of this document represent impacts on community and other stakeholders, and these are: 1) Discontinuity of the project activities on climate, community and biodiversity, bringing negative impacts; and 2) Poor results on climate, community, or biodiversity aspects, differing from what was expected previously as a result from project activities. Both are communicated together with the benefits.

[93] https://www.gov.br/funai/pt-br/assuntos/noticias/2023/governo-federal-inicia-retirada-pacifica-de-ocupantes-ilegais-da-terra-indigena-alto-rio-guama. https://www.mpf.mp.br/pa/sala-de-imprensa/noticias-pa/em-audiencia-publica-indios-e-colonos-reivindicam-solucao-para-a-terra-indigena-alto-rio-guama

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 and institutional stakeholders through the communication channels established (message apps, email address - comunidades@carbonext.com.br ; and telephone number (91) 3118-2040), preferably in-person on the visits and meetings.

On the meetings, the project is presented, as well the necessity of verification process and onsite visits of the international VVB, and any doubts are clarified. 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. A meeting with the local institutions, city hall and municipal secretariats is also scheduled to inform about the validation and verification date, with possible visit from international VVB, if they wished.

The proponents will assist in the schedule and articulation with the stakeholders, to guarantee the necessary visits demanded by the VVBs.

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.

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 in person the communities about an eventual audit visit or other event. The owners 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 external and internal 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)

The meetings and onsite visits, together with the questionnaires applied with the local communities were very important so the characteristics and vulnerabilities can be identified by the Carbonext team, making a socioeconomic diagnosis on each community. This valuable information assists in the development of the project activities with the partners to be effective and directly improve the quality of life and well-being of the local population, aligned with the schedule of the actions and capacity of implementation.

The activities are developed by the technical and social team of Carbonext, considering the results and observations obtained in the meetings and the socioeconomic diagnosis. The communities are directly consulted about any activity and their participation is fundamental to implement an effective action that can benefit them. The actions are implemented considering the suggestions and necessities pointed. All the comments direct the design of the activities and affect it completely, so the Carbonext team develop, adapt and alter them according to the necessities and feedbacks.

The implementation of the project activities, especially regarding the communities of the project, will be in collaboration with the Proponents (Carbonext and the Land owner) and the partners such as the local institutions, city halls and secretariats. The project intends to support social programs made by these partners, in order to achieve improve in well-being of the local population near the project area.

As an example of the influence of the communities in the project activities design, the socioeconomic diagnosis identified the gender disparities in the communities, thus designed activities directed to women and girls to empower them and train to diversification of income as financial independency.

The consultations with stakeholders took place in different periods, according to their agenda, reaching the groups that are most influenced by the project for this first moment: Community Stakeholders and Institutional Stakeholders. The result of the consultations is presented in item 2.1.9 Stakeholder Descriptions.

2.3.7.1 Community Stakeholder Consultation

The preliminary consultations with the communities took place in a previously scheduled manner, in a place, date and time agreed between the community leaders and the residents, with the presence of men and women (figure 2.35 a, b, c and d).

Figure 2.35 a, b, c and d- Community Stakeholder Consultation with Carbonext technical and social team.

In the meetings, the Project was presented, with delivery of informative material on the Project and relationship channels. A survey of information for the socioeconomic diagnosis, through a questionnaire applied collectively, with questions directed to habitual life, common activity, perceptions, community characteristics, High Conservation Value areas, among other questions. The residents felt comfortable with the team and in answering the questions, made with active listening, respect and transparency with the communities. The questionnaires allow to identify needs and fragilities, which are important information used to design the project activities.

Most communities within the 20km buffer have been consulted, and are Settlement Projects (PA). The buffer also includes rural settlements and Indigenous Lands. The rural agglomerations are included in the GIS survey, but a large part is not community or villages with residents, are farms, establishments.

Indigenous Lands were not consulted and the consultation process is not done as in other communities. Consultations in Indigenous Lands go through a process of prior contact with the body responsible for the territories, the National Foundation of Indigenous Peoples (FUNAI), which requests authorization to enter the territories. The YBYRÁ REDD+ Project aims to conserve forest, bringing benefits to indigenous community groups, even if indirectly. Over the time of the Project, there will be effective communication with FUNAI, for risk management that may arise.

Other consultations are planned to take place, mainly with the communities that will participate on activities of the Project, to deepen the socioeconomic diagnosis and raise specific local and gender information. This contact with the community facilitates the development of an action and its implementation, with engagement.

2.3.7.2 Institutional Stakeholder Consultation

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 comunidades@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.

In September of 2022, the first meeting with the institutional stakeholders took place in Paragominas and in Ipixuna do Pará, with the city halls and secretariats. The institutional consultation on Aurora do Pará, Nova Esperança do Piriá, Ulianópolis and Tomé-Açu took place in March of 2023 (figure 2.36 a, b, c and d).

Figure 2.36 - Consultation of institucional stakeholders: a) Paragomas; b) Ipixuna do Pará; c) Tomé-Açu; and d) Ulianópolis.

The objective of these meeting was to present the YBYRÁ Project and also begin the articulation on partnerships to support local programs with the communities regarding diverse themes.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

The project is constructing an ongoing communication and consultation channel between the project proponents, communities and other stakeholders. The communication happens through the project team in the field and also in the office, by email and telephone. A procedure to inform monthly the stakeholders is being developed and implemented, in order to inform constantly the steps of the project to them. The constant communication is important to guarantee the best flow of communication, effectiveness of the project activities, engagement, trust and receipt of feedbacks, suggestions and complaints.

The input obtained from feedbacks, suggestions and complaints by stakeholders will be evaluated by the development team of the project and mitigation measures will be taken to address such notes. The stakeholders will be informed of any adaptation through the monthly communication managed by the project.

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.

All the participants and the local people interviewed must sign an attendance list for the meetings and participation in some project activity, if applicable. 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 (the VCS Standard recommends that the summary of the project presents information till the item 2.1.7 as the PD). The same summary in Portuguese will be available in the VERRA website.

Material with short explanation of REDD+ projects and the main goals of the YBYRÁ REDD+ is delivered at all meetings with the stakeholders. The Project's Relationship Channel is available in this material, containing different forms of contact, to facilitate the relationship with the Project and the local conditions of the communities. The Relationship Channel has e-mails, telephone contacts and communication apps (as Whatsapp). The figure below shows the material with the relationship channels of the YBYRÁ REDD+ Project.

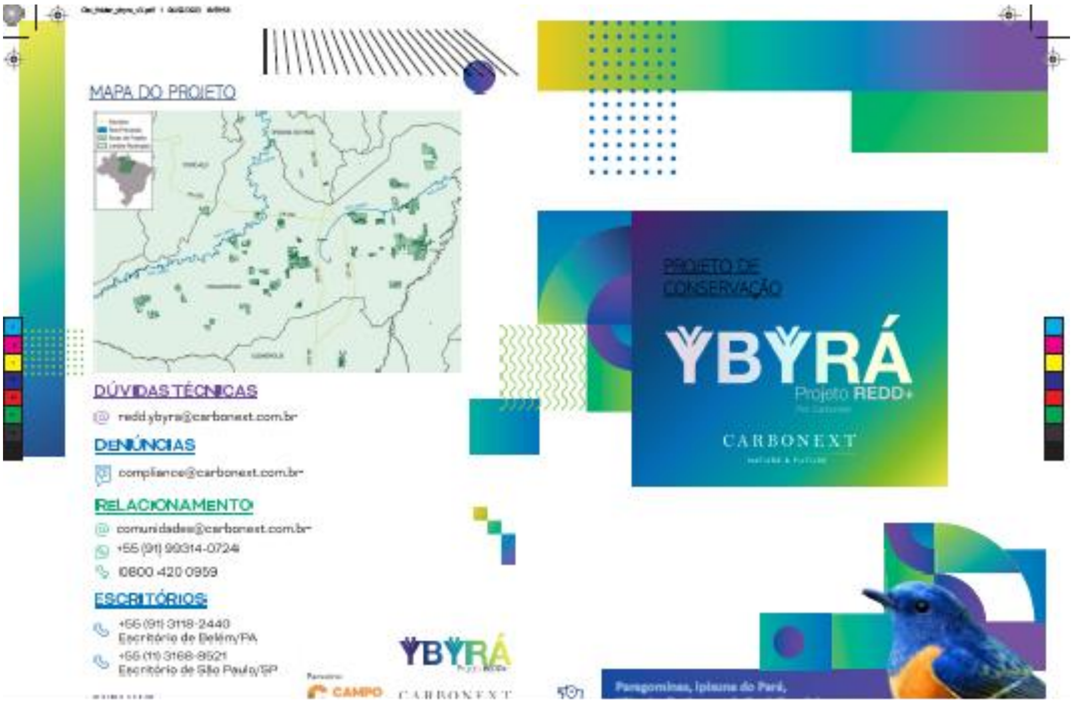


Figure 2.37: YBYRÁ REDD+ Project Relationship Channel

For communities, the Relationship Channel has specific contacts for technical questions about the Project, complaints, suggestions and feedbacks. In addition, the language addressed during the information provided by the Project team to the communities is accessible, so the people can understand about the YBYRÁ REDD+ Project and its goals (figure 2.38 a and b).

Figure 2.38: Relationship Channel of the YBYRÁ REDD+ Project delivered, Nova Esperança do Piriá.

The contact number for the local communities is through the number: + 55 (91) 3118-2040. The email address exclusive to communities is: comunidades@carbonext.com.br.

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

The YBYRÁ REDD+ Project is composed only by private properties. Thus, the public consultations with the community and stakeholders aim to ensure local adherence and a full understanding of the conservation project. Their participation in the decision-making is through the socioeconomic diagnosis, in order to identify the main fragilities of the region, the design of project activities and which communities are suitable for implementation of project activities, since not all of the communities inside the 20km buffer can be benefited.

The community members are informed of the date of local visits in advance to organize a participatory meeting, where information for the socioeconomical diagnostic is gathered. The community is invited to comment on the project and its activities, and is stimulated to make propositions if any critical point is identified (Figure 2.39).

Figure 2.39 - Community Luiz Inácio on the public consultation and meeting about the YBYRÁ REDD+ Project.

The permanence of the Project in the communities is according to their acceptance. Each has an important role in the development of activities, face-to-face meetings, decision-making to implement effective activities. All this is done with respect for local cultures, collective participation and universal respect of people, regardless of gender, age, etc.

Institutional stakeholders also play an important role in decision making for activities carried out by the Project. They are the ones who know the political, the environmental and social demands present in the region of the Project. The public organizations also have events, programs and technical assistance for the region, that can be expanded to the communities involved in the project, since the REDD+ projects and the public institutions have in common the will to benefit the society.

Over the time of the Project, to implement activity in the communities, stakeholders will be consulted according to the activity and its performance, both community and institutions. For example, sustainable land use activity, which involves family farming, also involves the agriculture department of the municipality that the community is inserted. Thus, both are consulted. And so on, according to the axis of action of the activities and their respective audiences.

The consultations are made to reach men and women of all ages of the communities involved in the project and other parts interested. The proportion of women in the meetings was in average of 41% compared with men participation, with more feminine participation in some communities than in others (table 2.34 and 2.35).

Table 2.36 - Number of community members who participated in the first community consultation and proportion of women.

External Community	Date of visit	Total	Women	Men	Proportion of women (%)
Balalaica	27th of April of 2022	28	14	14	50%
Vila Nova	29th of April and 14th of September of 2022	31	24	7	77%
Luiz Inácio	04th of May and 26th of October of 2022	40	13	27	33%
Enalco	04th of May of 2022	34	14	20	41%
Del Rey	04th of May of 2022	11	7	4	64%
Mandacaru	07th of May of 2022	18	5	13	28%
Diamantina II	07th of May and 03th of November of 2022	13	7	6	54%
Progresso	07th of May of 2022	1	0	1	0%
União	11th of May of 2022	16	5	11	31%
Paranoá	11th of May of 2022	26	5	21	19%
João Batista	11th of May of 2022	13	0	13	30%
Floresta Gurupi I	12th of May of 2022	50	17	33	34%
Águia	14th of May of 2022	34	12	22	35%
Rio das Cruzes	14th of May of 2022	10	0	10	0%
Paragonorte	17th of May of 2022	13	9	4	69%
Agrovila Paragonorte	17th of May of 2022	3	2	1	67%
São João Batista	20th of May of 2022	40	28	12	70%
Colônia Reunidas	20th of May of 2022	14	7	7	50%
Glebinha	26th of October of 2022	14	4	10	29%
Nova Vida	27th of October of 2022	18	12	6	67%

Camapuã	28th of October of 2022	9	5	4	56%
Alta Floresta	28th of October of 2022	5	2	3	40%
Arapuã Simeira	29th of October of 2022	16	5	11	31%
Cidapar 2ª Parte	29th of October of 2022	6	1	5	17%
Bacabal	01th of November of 2022	1	0	1	0%
Candiru	05th of November of 2022	4	1	3	25%
Minas Pará	06th of November of 2022	24	2	22	8%

Table 2.37 - Number of members of municipal public institutions who participated in the first institutional consultation and proportion of women.

Municipal Government	Date of visit	Total	Women	Men	Proportion of women (%)
Ipixuna do Pará	13/09/2022	13	2	11	15%
Paragominas	13/09/2022	6	1	5	17%
Nova Esperança do Piriá	03/03/2023	9	2	7	22%
Tomé-Açu	06/03/2023	9	5	4	56%
Ulianópolis	06/03/2023	8	3	5	38%
Aurora do Pará	07/03/2023	9	3	6	33%
Total		**54**	**16**	**38**	**Average: 30%**

Local associations, culture- and gender-sensitivity groups identified in the project are/will be consulted as well, separately if desired by the groups. In addition, the project has a relationship channel, with contacts available for communication for all communities. The identity of the sender will be preserved, if necessary.

Periodic meetings will be held during the life of the project, in a place of easy access within the respective communities, as well as with public institutions and other stakeholders.

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 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.

The COOPERCARBON have an internal code of compliance and ethics, that will be presented to the VVB, if requested. This code is in compliance with the Carbonexts' policy. This guarantees the noninvolvement of the members in any form of discrimination and crime, under penalty of Brazilian laws and internal measures. All the members of the internal community must also comply with the Code of Ethics and Organizational Conduct, that will be implemented, if not yet implemented, in all farms till the end of 2024.

2.3.12 Feedback and Grievance Redress Procedure (G3.8)

Carbonext considers communities participation and feedbacks very important to characterize local needs as better as possible within project possibilities and boundaries. The project's feedback and grievance redress procedure must be present during the project lifetime. All stakeholders and communities were informed of the project email account (comunidades@carbonext.com.br), 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. The grievances will be redressed through mitigation measures and new activities can be proposed according to the demands. The communities are also invited to personally contact the field workers and monitors whenever they have something to report.

Carbonext has a procedure for feedback and grievance redress ("PO-S5-Canal para Sugestões e Reparação de Queixas") which guides and establishes the processes related to the implementation and execution of the formal communication system for REDD+ Projects. The procedure establishes how and through where suggestions and complaints reported by local actors (communities, civil police, public bodies, associations) should be received, providing the respective resolutions.

Carbonext provides four channels for suggestions and complaints, the mobile number and WhatsApp application (91) 99314-0724, telephone (91) 3118-2040, 0800-4200959 and the e-mail addresses: comunidades@carbonext.com.br , in addition to the e-mail of the project in question: redd.ybyra@carbonext.com.br. In the case of projects where there are local employees, the community is the proponent or the Carbonext team is in the field, feedback can also be received in person. The project's social team is responsible for formally registering the suggestion or complaint, the response time is up to 10 working days.

The figure bellow (2.40) illustrates the process on resolution attempt, mediation and arbitration or courts. In this period, the Carbonext team will develop an attempt to evaluate, mediate the conflict and solve it in the best way possible for all the parties involved.

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 2024, for the second monitoring report.

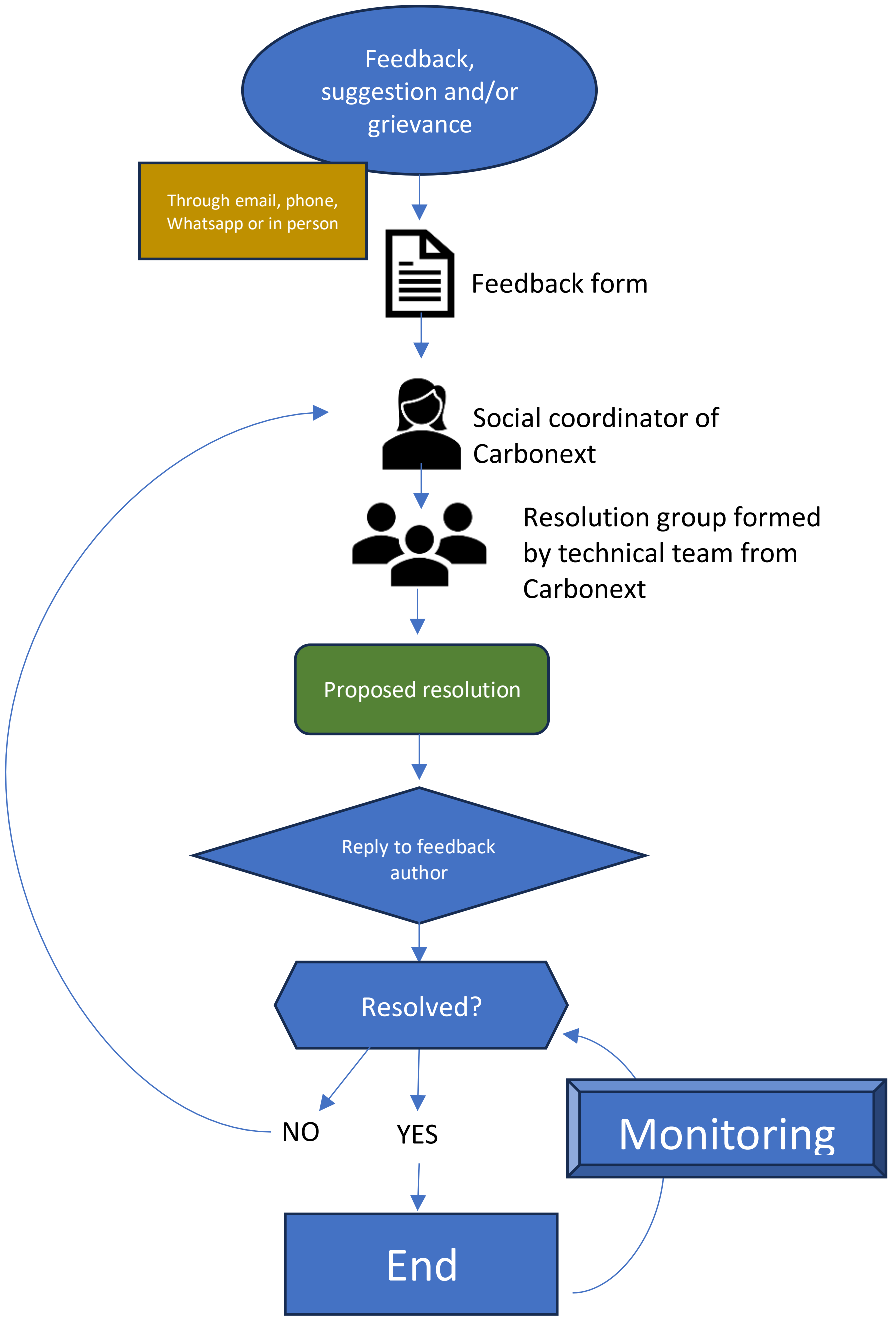


Figure 2.40: Feedback and grievance redress procedure.

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 queries and suggestions 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, 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 whole procedure to redress suggestions, feedbacks and grievances will be reported in the MR documents, thus being publicly available and accessible for all stakeholders in the VERRA website.

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 the end of 2024.

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. The onsite visit on the properties also identified some points that need to be reinforced. A relevant set of trainings and courses are being planned and developed with partners 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 YBYRÁ REDD+ Project will be trained in 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 8th and 9th of May of 2023, for 20 employees of the farms involved in the project (figures 2.41 a, b, c and d). This activity was prioritized because of the begin of the dry season, which is the season with more fire events. Further fire brigade trainings will occur once in the year for employees and also to community members closed to the project area, so the project area can be protected and GHG emissions can be prevented.

Figure 41 a,b, c and d- Fire brigade training with the distribution of certificate.

The Carbonext is planning to establish a partnership with the SENAR (National Service in Rural Learning[94]), 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 better 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 and other people can participate in the following years.

[94] Available on: https://sistemafaepa.com.br/senar/o-senar/

In order to guarantee that acquired abilities will not be lost, the trainings are planned to happen periodically, once a year, so the contents can be revisited by the participants.

2.3.15 Community Employment Opportunities (G3.10)

The activities of the project are being developed and designed according to the communities' characteristics and the socioeconomic diagnosis made by Carbonext social team. The actions intent to capacitate the internal and the 8 external communities, that will be further presented in item 4, with the objective to improve their production and qualification in the themes of the trainings and courses that will be offered. The activities will also support social programs from the municipal secretariats and other local institutions.

In case of direct generation of job opportunities offered by the YBYRÁ REDD+ Project, these will be offered without any discrimination of gender, age, religion, marital status or ethnicity. The selection will be made through divulgation of the position in the communities involved in the project. The choice of candidates will happen according to the people that better qualify 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, according to Brazilian laws.

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 of 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 29th, 2016);
- NR 5 - Internal Commission for Accident Prevention. (Last updated: SIT Ordinance No. 247 of July 12th, 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)

In order to identify and assess substantial risks to worker safety that could arise due to project implementation, the project activities proposed have been evaluated considering the participation of the workers and the objectives of the actions.

One of the main risks identified in the project area is fire outbreaks, that are common in the in the region, considering the municipalities of Ipixuna do Pará, Paragominas, Tome Açú and Ulianópolis. In view of this, the project provides fire brigade training for the internal communities, because the farm workers are the first to combat the fire if it spreads near their accommodation and farm infrastructure. This project activity can represent a risk to the participants.

In addition, it was identified the risk on handling and operation of equipment and machinery, considering the trainings and capacitation that can be developed with the workers of the farms. In order to minimize this risk, all necessary training in health and safety will be given by professionals specialized in the area, in accordance with the Brazilian Regulatory Norms (NR). First aid trainings will be given, as well as first aid kits will be made available in the properties. Personal protective equipment are mandatory to prevent accidents and will be obligatory.

The main Brazilian Regulatory Norms related to the project, which regulate and guide the mandatory procedures related to occupational safety and health in Brazil, are as follows:

• NR4 - Services Specialized in Occupational Health and Safety;

• NR5 - Internal Commission for Accident Prevention;

• NR6 - Personal Protective Equipment – PPE;

• NR20 - Occupational Health and Safety with Flammables and Combustibles

• NR23 - Fire Protection, and

• NR31 - Safety and Health at Work in Agriculture, Livestock, Forestry, Forestry and Aquaculture

Other possible risks have been identified and are presented in the table below, together with the mitigation measures that will be implemented by the project (table 2.36). During the project lifetime, if new risks are identified for workers due to project activities, they will be presented in the following MR and mitigation measures will be presented and implemented to prevent and mitigate accidents and other occurrences.

Table 2.38 - 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 once a year. Personal Protective Equipment and First-Aid Kits will be made available, as well as trainings on safety and first aids will be provided to the internal community. An Operational 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.
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 responsible worker(s) for the monitoring and protection of the PA will be trained with the best conduct to avoid conflicts, 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 qualified professional.

Activity	Risks	Measures to minimize the risk

2.4 Management Capacity

2.4.1 Project Governance Structures (G4.1)

Carbonext is responsible for the development of the activities for the Project Description, considering 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 2.42):

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.

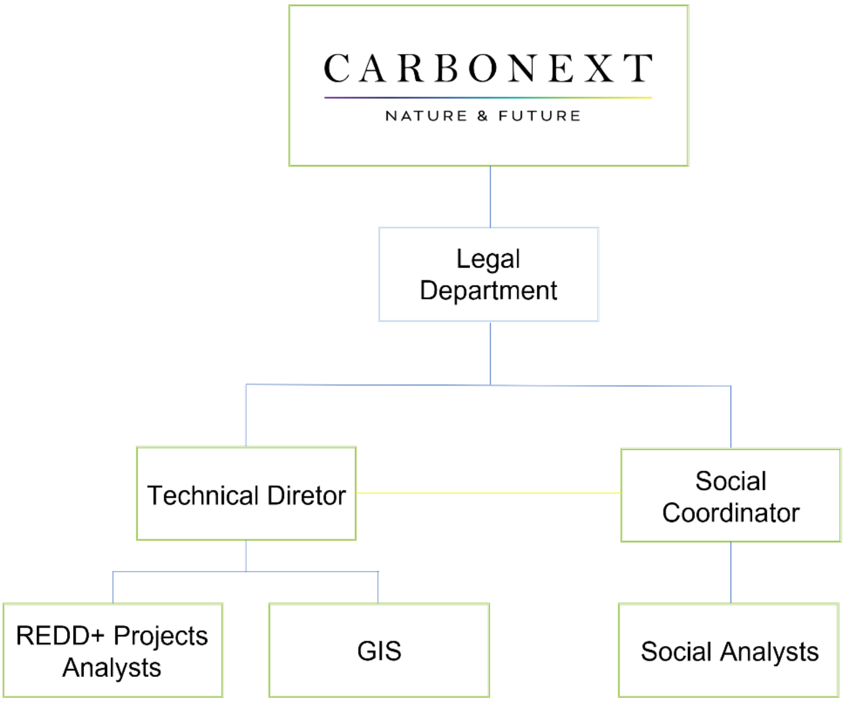


Figure 2.42 - Carbonext internal Governance Structure in Project Management.

After the project is developed by Carbonext, the Project Activities Governance is also coordinated by Carbonext together with the project proponents presented in item 2.1.3, and other partners, if applicable. For the YBYRÁ REDD+ Project, the partner CAMPO VERDE is assisting in the logistics and support of project activities.

The project proponents 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 forest, habitat and 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, through the socioeconomic diagnosis as the participatory process to build the actions according to the communities' characteristics and fragilities.

In addition, the YBYRÁ REDD+ Project aim to stablish partnerships with the local and public institutions, to assist in the implementation of programs that the secretariats area already implementing, for example, thus facilitating the access of important actions to the communities.

The Governance and Management of the YBYRÁ REDD+ Project can be seen in the chart below (Figure 2.42).

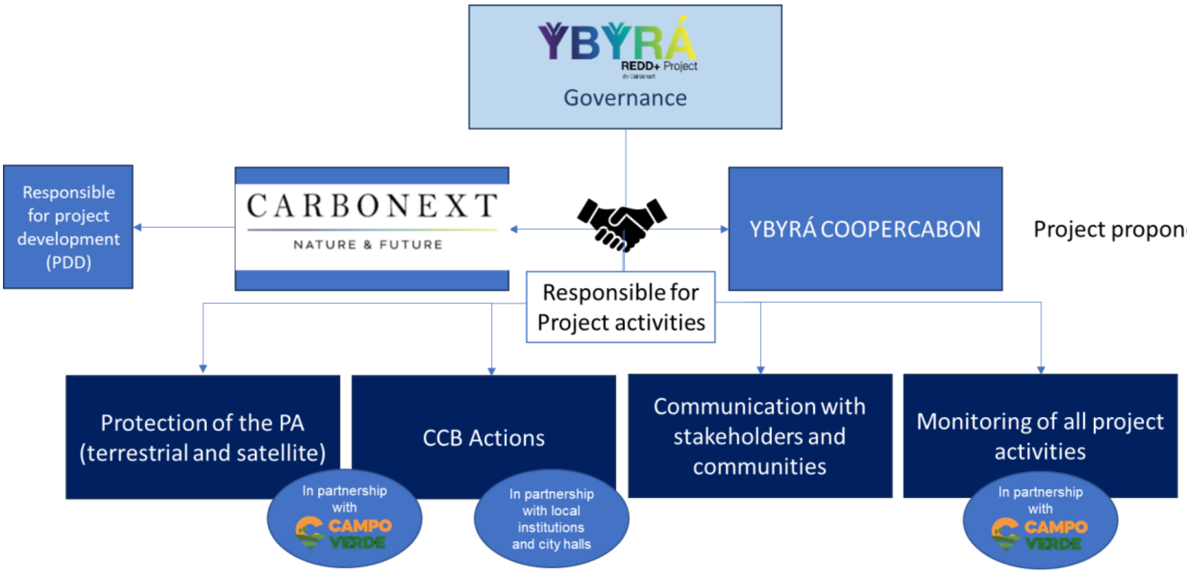


Figure 2.43 - Governance of the YBYRÁ REDD+ Project.

Since the YBYRÁ 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. The properties owners must affiliate in the cooperative.

Regarding the actions proposed by the project, the Carbonext and the proponents will manage and execute them supporting social programs according to the activities and the planning/schedule. The design 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., in partnership with the local institutions, city halls and secretariats. This means, professionals in each area for workshops and proposed activities. The specialists will be presented in each MR which the activities will be held.

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. The diverse composition of the team is differential for the development of quality project, implementation of effective actions and globalized vision.

The following technical skills are presented in the Carbonext's development team of the YBYRÁ REDD+ Project, as seen in the item 2.4.3 below:

- Specialist in Biomass calculation;
- Specialist in rural processes and documents in the Pará state;
- Specialist in development of REDD+ Projects in Brazilian Amazon;
- GIS specialists;
- Social engagement specialists;
- Educators;

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 carried out by a specialized team that has previous experience with other REDD projects. The biodiversity assessments and fauna/flora inventories will be caried out by a hired company, specialized in this area with the support from Carbonext's specialists, 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.

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.

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 1,637,874 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 YBYRÁ 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+ project manager
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	GIS manager
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	Inácio Gonçalves de Souza
Position	REDD+ Analyst
Education	Forest Engineer from the University of Viçosa (UFV) and Master's in Soil and Plant Nutrition at the same institution.

Resume summary	Experience with agroecology, agroforestry systems and sustainable land use. Worked as rural extensionist, when had experience with smallholder farmers and rural communities. Worked in the Soil Physics Laboratory and Microbial Ecology Laboratory, conducting research on soil health, and as an environmental consultant working with reforestation, recovery of degraded areas, agroforestry systems and others.
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Name	Isabella Romitelli
Position	REDD+ Analyst
Education	Graduated in Biological Sciences from Paulista State University (UNESP), with majors in Marine Biology and Coastal Management. Master's and PhD in Ecology from the Institute of Biosciences at the University of São Paulo (USP).
Resume summary	Experience with carbon stock modeling in tropical forests for WWF Brazil, WWF US and EcoHealth Institute. Experience as flora coordinator with environmental licensing studies and restoration projects at Tetra Mais Environmental Consulting. Experience with forest inventories and biomass calculation during masters and doctoral projects.
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Name	Carlos Aranha
Position	REDD+ Analyst
Education	Graduated in Forest Engineering from the Universidade Federal Rural da Amazônia (UFRA), with specialization in geoprocessing.
Resume summary	Forest Engineer responsible for coordinating the forest management project of the forest concession of Saracá Taquera Flona, general coordinator of certification of the company Golf florestal. Analyst of Rural Environmental Cadastre (CAR) for the Secretariat of Environment of the State of Pará (SEMAS).

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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	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	Diego Pires Latorre
Position	GIS Analyst
Education	Bachelor in Geography from University of São Paulo (USP) and Postgraduate in Geoprocessing by SENAC
Resume summary	Experience in GIS, in the creation of territorial boundaries, hydrological mapping, data post-processing and research in the diagnosis of watersheds. Currently working with the development of REDD+ projects.

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Name	Alex da Silva Sousa
Position	GIS Analyst
Education	PhD Candidate (Physical Geography), Master Degree (Physical Geography), Bachelor (Geography) at University of São Paulo (USP)
Resume summary	Professional with more than 10 years of experience in Geotechnology. Model development in GIS for various purposes, with solid knowledge in remote sensing, geoprocessing and socio-environmental issues.
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Name	Rodrigo Caracciolo Martins
Position	GIS Analyst
Education	Bachelor in Geography from University of São Paulo (USP) and Master from Wilhelm-Leibniz University of Hannover, Germany.
Resume summary	Experience in GIS, focused on LULCC scenario modelling, hidrological mapping, risk management, nature-based solutions and participatory mapping. Further, I have developed research of cultural ecosystem services, developing environmental indicators and analysing public participation opinions. Also experienced in project management.
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Name	Eduardo Nicolau Demetrio Neto
Position	Social Analyst REDD+

Education	Degree in Forestry Engineering from Amazonia Federal Rural University
Resume summary	Forest Engineer (UFRA) with experience in the development of socioeconomic projects, social diagnosis and impact assessment on the Carajás Railroad (EFC) in the states of Pará and Maranhão and the Nacala Logistic Corridor (CLN) in Mozambique. In addition to having worked for the State of Pará in the development of production chains in the Amazon, building relationships with the community and government. Acting in strategic consultancy in mining, energy and agriculture projects.
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Name	Bruna Vaz Dias
Position	MRV Analyst
Education	Bacharelor in Forestry Engineering from UFLA.
Resume summary	Experience with planning and analysis of forest sector indicators.
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Name	Rafael Ruas Martins
Position	MRV Manager
Education	Bachelor in Biological Science; MBA in Database Administration; GIS Professional, Spatial Analyst and Spatial Data Processing ESRI certified; CTT+ certified.
Resume summary	Eighteen years of experience in developing GIS routines, processes and solutions for conservation projects, land use and land cover management, forest management and forest integrity monitoring.
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Name	Danilo Carneiro Valente

Position	GIS Analyst
Education	Bacharelor in Geography and Master student in Geography (University of Campinas – UNICAMP)
Resume summary	Experience with Geographic Information Systems (GIS) and Remote Sensing. Land use and land cover mapping and geospatial analysis.
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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 and monitoring, 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. The hired team must have experience in biodiversity inventories and monitoring in the Amazon. These activities will take place after the first verification report, so the contracted company has not yet been defined and the activity will be hired after the sale of carbon credits. The data collected on the biodiversity surveys 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 are being established with municipal secretariats, local institutions, and city halls, according to the identification of relevant social programs and the necessity of specialized professionals and services. The fire brigade training will be caried out by Nativa Florestal, specialized in safety and security trainings. The activities of environmental education will be caried out by specialized educators with the support of Carbonext, as members of the team have skills to act on environmental education activities. The health monitoring activities, technical workshops and other activities are examples of actions that will need to be carried out by specialized workers and personal, in partnership with the public institutions. The articulation with the SENAR, as an example, can bring specialized and local educators to promote courses and trainings with the communities.

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 as definitive partner. However, if during the monitoring work, the need to contract the services of independent professionals or institutions to carry out the activities 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, according to activities planning and schedule developed by the project proponents.

Partnerships with the city halls and secretariats (specially of education, health, agriculture and environment) will be established to implement some of the project activities. The first meeting was held in September of 2022 and in March of 2023, as presented in previous items of this PDD (2.1.).

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 approximately 1,637,874 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 and audit by independent audit bodies to certify reliable processes in the company. The frequent financial assessments in the company are also important 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[95] 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

[95] Evidence presented to the auditors

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.

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 department (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, Environmental entities (such as IBAMA), 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 legal situations for the termination of the intended partnership, as predicted in the signed contract.

For all the project activities, the legal Department of Carbonext assesses documentation and legal status in the justice system for all suppliers and services hired, including for transport, facilitators and so on. 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[96].

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 and take the proper measures within the laws and regulations of Brazil.

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

Anti-corruption policy, 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, with rights 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 (2.37).

Table 2.39 - The properties involved in the YBYRÁ 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 ACATAUASSÚ II	PARAGOMINAS	5,202.06	3,541.22	IVANDILSON DA COSTA MELO	951.005.924.482-6
FAZENDA ALAGOAS I	PARAGOMINAS	1,483.75	562.54	LOURIVAL DELPUPO	999.962.545.600-2
FAZENDA ALAGOINHA	PARAGOMINAS	1,492.12	1,141.30	CARLOS JESUS DELPUPO	051.055.032.328-0
FAZENDA ALVORADA	PARAGOMINAS	9,318.43	3,880.37	IVANDILSON DA COSTA MELO	051.055.007.447-6
FAZENDA ANDIROBA	PARAGOMINAS	4,131.02	3,046.83	ADERVAL JOSÉ DALMASO	055.018.022.276-6
FAZENDA ANVERSA I	PARAGOMINAS	362.77	177.23	RODRIGO ANVERSA	950.149.190.918-0
FAZENDA ANVERSA II	PARAGOMINAS	362.08	157.10	DANIEL ANVERSA	00.035.218.855-7
FAZENDA BADAJOZ PARTE 1- ALTEROSA	IPIXUNA DO PARÁ	1,747.29	505.63	AGROPECUÁRIA ANVERSA LTDA	
FAZENDA BEM TE VI	PARAGOMINAS	1,082.40	541.86	ADERVAL JOSÉ DALMASO	951.021.649.759-8
FAZENDA BOA ESPERANÇA	PARAGOMINAS	1,098.39	181.03	OSMAR SCARAMUSSA	950.190.000.787-8
FAZENDA BOA ESPERANÇA	PARAGOMINAS	388.09	273.27	BAIARDO HENRIQUES GOMES	950.181.823.023-2
FAZENDA BONANZA	PARAGOMINAS	2,876.31	1,064.78	BAIARDO HENRIQUES GOMES	999.938.320.170-5
FAZENDA CACHOEIRA	PARAGOMINAS	1,494.31	216.45	DEBORA DE FREITAS FERNANDES	950.203.752.568-3
FAZENDA CALIFÓRNIA	PARAGOMINAS	3,534.57	915.91	SEBASTIÃO MOREIRA	051.055.267.295-8
FAZENDA CALIFÓRNIA	PARAGOMINAS	1,138.84	613.08	JOSE LUIZ BAU	951.102.438.863-5
FAZENDA CAMPO VERDE - MENOR	PARAGOMINAS	1,162.50	1,868.82	EDENIS MARIS CUZZUOL RUY	051.055.308.757-9
FAZENDA CÉU AZUL	PARAGOMINAS	768.07	546.74	GILVETE MARASCHIN TASCA	950.173.622.354-8
FAZENDA CRISTAL	PARAGOMINAS	484.84	387.55	VANDA SCARAMUSSA	999.962.251.011-1
FAZENDA DOIS IRMÃOS	PARAGOMINAS	508.80	287.24	IVANDILSON DA COSTA MELO	951.013.119.300-0
FAZENDA ESPERANÇA	PARAGOMINAS	1,124.50	1,060.47	EDILEUZA SOUZA DA SILVA	999.946.606.375-4
FAZENDA ESTRELA DO NORTE	PARAGOMINAS	2,101.36	1,192.94	IVANDILSON DA COSTA MELO	999.954.056.286-5

FAZENDA FLOR DO CAMPO	PARAGOMINAS	**895.63**	372.81	JOÃO ALVES SANTIAGO	951.102.462.209-3
FAZENDA FLORESTA BG	PARAGOMINAS	**630.15**	337.81	BAIARDO HENRIQUES GOMES	951.129.492.299-4
FAZENDA FORMOSA	PARAGOMINAS	**2,051.07**	938.06	OSMAR SCARAMUSSA	
FAZENDA GLEBA 55/SANTA CLARA	PARAGOMINAS	**3,980.98**	2,755.19	URIEL ZOPPÉ BRANDÃO	
FAZENDA IPÊ	PARAGOMINAS	**1,419.93**	1,092.63	EDENIS MARIS CUZZUOL RUY	999.911.087.319-0
FAZENDA ISRAEL	PARAGOMINAS	**1,327.64**	618.80	CINTHIA KARLA LOBATO TERRA	
FAZENDA LOTE 35	ULIANÓPOLIS	**4,600.96**	809.54	JADIRMARCOS DEPRÁ	051.055.714.763-0
FAZENDA MAÇARANDUBA	PARAGOMINAS	**329.49**	154.84	MARCUS VINÍCIUS CYPRIANO SCARAMUSSA	951.129.075.914-2
FAZENDA MATÃO	PARAGOMINAS	**632.20**	620.48	JOSÉ LUIZ BAÚ	951.102.438.863-5
FAZENDA MOLEZA	PARAGOMINAS	**857.89**	350.18	GILBERTO MARASCHIN	950.181.890.405-5
FAZENDA MUTUM	PARAGOMINAS	**1,497.04**	1,029.46	BETO DA FONSECA RIBEIRO	951.129.545.627-0
FAZENDA NASCENTE DA SERRA	PARAGOMINAS	**969.89**	608.56	VIRGÍNIA DALMASO	951.021.443.441-6
FAZENDA NOSSA SENHORA DE NAZARÉ	PARAGOMINAS	**637.29**	310.19	DANIEL ANVERSA	951.021.970.328-8
FAZENDA PAJUSSARA III	PARAGOMINAS	**932.31**	459.57	OSMAR SCARAMUSSA	051.055.007.064-0
FAZENDA PAMPULHA I	PARAGOMINAS	**1,454.04**	906.35	PRISCILA FERNANDES	951.145.789.119-6
FAZENDA PAMPULHA II	PARAGOMINAS	**1,455.40**	1,081.90	DEBORA FERNANDES	951.145.789.364-4
FAZENDA PARAISO	PARAGOMINAS	**4,213.26**	1,646.43	SEBASTIÃO MOREIRA JÚNIOR	051.055.294.616-0
FAZENDA PARAÍSO DO NORTE	PARAGOMINAS	**2,637.71**	2,124.47	ADERVAL JOSÉ DALMASO	951.145.849.790-4
FAZENDA PARAISO_LEILA	PARAGOMINAS	**1,065.98**	459.29	LEILA PIACENTINI MARASCHIN	950.181.874.884-3
FAZENDA PARAJU	PARAGOMINAS	**3,237.30**	1,453.55	JOÃO BOSCO GABRIEL	051.055.251.933-5
FAZENDA PINGO DE OURO	PARAGOMINAS	**1,036.83**	359.03	JARL AGROPECUÁRIA	
FAZENDA PROSPERIDADE	PARAGOMINAS	**874.43**	428.52	RENATO ANVERSA	951.021.055.190-6
FAZENDA RANCHO BG	IPIXUNA DO PARÁ	**663.35**	278.61	BAIARDO GOMES	051.055.012.459-7
FAZENDA RENASCER	PARAGOMINAS	**1,310.26**	765.03	MARCUS SCARAMUSSA	950.165.450.340-2
FAZENDA RENASCER I	PARAGOMINAS	**944.99**	430.18	ANA CAROLINA SCARAMUSSA	951.013.936.073-8
FAZENDA RENASCER II	PARAGOMINAS	**797.23**	260.05	OSMAR SCARAMUSSA	950.190.000.574-3

FAZENDA RODA VIVA	PARAGOMINAS	**1,009.17**	363.07	ÂNGELA MARIA GUIMARÃES	051.055.032.328-0
FAZENDA SANTA BÁRBARA	PARAGOMINAS	**1,191.34**	912.95	VALDECIR ZUFFO	051.055.006.963-4
FAZENDA SANTA CARMEM	PARAGOMINAS	**4,508.19**	533.61	JOSÉ VITÓRIO	051.055.025.585-3
FAZENDA SANTA CELIA	PARAGOMINAS	**4,312.15**	199.32	GUALTEMAR LOUREIRO	051.055.269.778-0
FAZENDA SANTA LUCIA	PARAGOMINAS	**8,151.81**	2,317.36	NEUSA LOBATO NOGUEIRA	812.021.016.454-0
FAZENDA SANTA LUIZA	PARAGOMINAS	**3,184.75**	404.61	GUALTEMAR LOUREIRO	950.017.371.530-2
FAZENDA SANTA MARIA DO ACARÁ	TOMÉ-AÇULOT	**3.,25.85**	524.18	URIEL ZOPPÉ OUTROS	050.024.283.738-2
FAZENDA SANTANA	PARAGOMINAS	**1,080.92**	2,024.86	NILZA DO DE SOUZA	951.021.443.441-6
FAZENDA SANTIAGO	PARAGOMINAS	**736.10**	2,235.30	TIAGO CAMPOS DALMASO	951.048.988.499-3
FAZENDA SANTO ANTONIO	PARAGOMINAS	**2,108.22**	4,196.57	OSMAR SCARAMUSSA	051.055.027.413-0
FAZENDA SÃO DIONÍSIO	PARAGOMINAS	**2,162.55**	1,618.09	JADIRMARCOS DEPRA	815.055.074.497-0
FAZENDA SÃO FRANCISCO	PARAGOMINAS	**1,210.37**	2,305.04	ANVERSA PARTICIPACOES LTDA	951.102.869.783-7
FAZENDA SÃO MARCOS 2	PARAGOMINAS	**362.68**	510.28	JADIRMARCOS DEPRA	051.055.020.621-6
FAZENDA SÃO MATEUS	PARAGOMINAS	**3,037.88**	347.08	ODETTI GARUZZI LOUREIRO	051.055.013.218-2
FAZENDA SÃO PIO	PARAGOMINAS	**868.86**	773.19	TIAGO CAMPOS DALMASO	951.021.441.457-1
FAZENDA SAPUCAIA	PARAGOMINAS	**2,017.88**	546.85	AXM ADMINISTRAÇÃO LTDA	051.055.269.093-0
FAZENDA SAYONARA	PARAGOMINAS	**1,367.41**	551.43	ADNAN DEMACHKI	051.055.252.115-1
FAZENDA SOSSEGO	PARAGOMINAS	**2,495.91**	1,206.58	OSMAR SCARAMUSSA	000.035.644.005-6
FAZENDA TANGARÁ	PARAGOMINAS	**399.12**	184.18	RENATO ANVERSA	999.997.775.711-8
FAZENDA TEOLINDA I	IPIXUNA DO PARÁ	**1,332.41**	911.46	VICTOR LOREIRO	951.102.251.283-5
FAZENDA TERRA BOA	PARAGOMINAS	**4,302.52**	2,730.33	AXM ADMINISTRAÇÃO LTDA	951.099.839.175-0
FAZENDA TERRRA BRUTA	PARAGOMINAS	**4,750.28**	3,641.72	AXM ADMINISTRAÇÃO LTDA	051.055.263.168-2
FAZENDA UNIÃO	PARAGOMINAS	**1,103,33**	627.51	OSMAR SCARAMUSSA	999.997.526.711-3
FAZENDA VAI E VEM	PARAGOMINAS	**727.28**	156.79	PRISCILA FERNANDES	951.145.826.847-6
FAZENDA VINTE DE MAIO	IPIXUNA	**2,055.14**	747.54	AGROPECUÁRIA ANVERSA LTDA	

FAZENDA VITÓRIA	PARAGOMINAS	**3,673.25**	2,710.64	OSMAR SCARAMUSSA	051.055.019.410-2
FAZENDA ZINKAS ISAN	IPIXUNA DO PARÁ	**585.23**	283.99	ZINKAS MADEIREIRA LTDA	951.137.491.640-5

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.

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.

In this first monitoring period, 34 communities were visited to participate in the public consultation, meetings about the YBYRÁ REDD+ Project and also to participate in the socioeconomic diagnosis. Among them, communities inside and outside the 20km buffer. The tables below (2. 38 and 2.39) show the communities and the number of people who attended the meetings. There were some children in the meeting place, but they were not counted. The visits were scheduled in advance with the residents of the communities. All participants in the meeting were interested in learning about the Project.

Table 2.40 - Number of people present on the public consultation about the YBYRÁ REDD+ Project - Communities within the 20 km buffer

Communities	Total	Women	Men	Visit date
Del Rey	11	7	4	04th May 2022
Luiz Inácio (Paragonorte)	5	1	4	04th May 2022
Luiz Inácio (Cajueiro)	22	7	15	04th May 2022
Enalco	13	1	12	04th May 2022
Mandacaru	18	5	13	07th May 2022
Diamantina II	13	7	6	07th May 2022
Progresso	1	0	1	07th May 2022
João Batista	14	1	13	11th May 2022
União I (Comunidade 13)	16	5	11	11th May 2022
Floresta Gurupi (União)	24	9	15	12th May 2022

Floresta Gurupi (Bom Jesus)	26	9	17	12th May 2022
Rio das Cruzes	10	0	10	14th May 2022
Águia Rio Bonito	34	11	23	14th May 2022
Paragonorte (Caip)	13	9	4	17th May 2022
Reunidas	14	7	7	20th May 2022
São João Batista	40	28	12	20th May 2022
Glebinha	14	4	10	26th October 2022
Luiz Inácio (Ribeirinho)	10	3	7	26th October 2022
Nova Vida	18	12	6	27th October 2022
Camapuã	9	5	4	28th October 2022
Alta Floresta	5	2	3	28th October 2022
Arapuã Simeira	16	2	14	29th October 2022
Cidapr 2ª Parte	6	1	5	29th October 2022
Maranhense	18	15	3	29th October 2022
Candiru	4	1	3	05th November 2022
Minas Pará	24	2	22	06th November 2022
Bacabal	1	0	1	01th November 2022
TOTAL	**399**	**154**	**245**	**Years 2022 and 2023**

Table 2.41 - Number of people present on the public consultation about the YBYRÁ REDD+ Project - Communities outside the buffer.

Communities	Total	Visit date
Nova União	13	04th May 2022
Canaã	12	05th May 2022
Barcelona	16	06th May 2022
Imperassu	12	06th May 2022
Timborana Jacamizinho	22	06th May 2022
Bola Preta	18	10th May 2022
Jabuti	1	10th May 2022
Vila de Fátima	18	04th November 2022

The protection of the project area and actions to monitor it do not interfere on the external communities and so, the project will cause no encroachment, no allocation and no compensation.

2.5.4 Property Rights Protection (G5.3)

Project activities will not cause the involuntary removal or relocation of property rights holders from their lands or territories, nor force rights holders to relocate activities important to their culture or livelihoods if practiced in the Project Area. On the contrary, the project activities will help protect the community's lands and culture by providing courses, activities, and a better understanding of the importance of the forest for its conservation.
The Project Area does not overlap with any community areas or other lands. Furthermore, no activities beyond that, according to the landowner and the public consultation, it seems that monitoring and preservation are the only activities carried out in the project area, since no use of the area was indicated by the local population.

In this first monitoring period, external and internal communities within a 20 km buffer of the project area were visited to participate in the public consultation, meetings about the YBYRÁ REDD+ Project, and to participate in the socio-economic diagnosis.

In addition, the socio-economic diagnosis obtained from interviews with community members indicated that the project area is not used by the communities for any activity. Thus, the protection of the project area and the monitoring actions do not interfere with external communities and therefore the project will not lead to the 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, cattle ranching, soybean production and conflicts as consequence of land disputes, which are common in the region.

To prevent such activities, the project will strengthen the local monitoring system 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. Furthermore, 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 take rapid action. Another tool utilized in the terrestrial monitoring is the app QuickCapture, which allows taking pictures of the place and mark the exact location. The points marked by the monitoring in the YBYRÁ REDD+ Project are directed sent to the Carbonexts' office, so the monitoring can be accompanied by the proponents as well.

The project has a Forest and Property Integrity Plan, which establishes control and surveillance mechanisms, and determines which monitoring activities will be carried out during the project lifetime.

2.5.6 Ongoing Disputes (G5.5)

The existence or not of land conflicts in the project area is formally ascertained through Due Diligence Legal. In DD, the legal department collects the certificates of judicial, jurisdictional and administrative bodies, ascertaining the existence or not of judicial and/ or administrative proceedings, as well as administrative procedures that have as their object the right of possession or ownership over the property area.

If, eventually, there is any conflict that does not appear in such certificates, the existence of the project will not interfere with the result of them, because our partnership agreement creates a mandatory relationship with the owner of the property, that is, the rights to possession and ownership remain with the owner, so there is no intervention of the project in the chain of facts or rights that may eventually be discussed in land conflicts.

All actions and activities are design considering the characteristics and needs of the local population and project communities to improve the well-being and quality of life of them and other stakeholders involved in the project. Any conflicts (ongoing or past/historic) are taken into account in the development of the project and activities.

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 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);

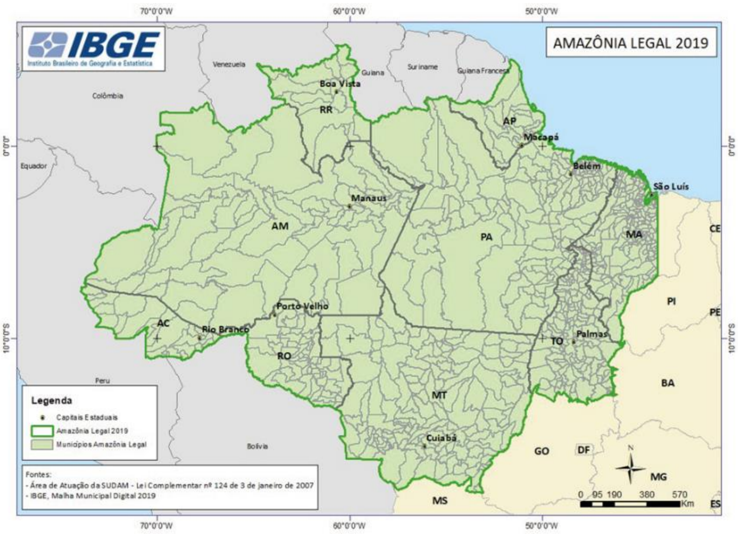
Regarding the Forest Code, the following definitions of the Brazilian Forest Code stand out as being relevant:

"Article 41 - The Federal Executive Power is authorized to institute, without prejudice to the compliance with the environmental legislation, a support and incentive program for environmental conservation, as well as for the adoption of technologies and good practices that reconcile agricultural, livestock, and forest productivity, with a reduction in environmental impacts, as a way of promoting ecologically sustainable development, always observing the criteria of progressiveness, comprising the following categories and lines of action.

*§ 4º - The maintenance activities of the Permanent Preservation Areas, Legal Reserves and Restricted Use Areas are **eligible** for any payments or incentives for environmental services, constituting **additionality** for the purposes of national and international markets for certified reductions in greenhouse gas emissions"*

"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 1 - 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.

Table 2.42 - The proportion of Legal Reserve area in each property of the project[97].

PROPERTY	PROPERTY AREA (HA)	LEGAL RESERVE (RL) DECLARED IN CAR* (HA)	% RL X PROPERTY
FAZENDA ACATAUASSÚ II	5,202.06	4,680.20	89.97%
FAZENDA ALAGOAS I	1.493,61	978.35	65.50%
FAZENDA ALAGOINHA	1.492,11	1,242.33	83.26%
FAZENDA ALVORADA	9,319.72	4,716.28	50.60%
FAZENDA ANDIROBA	4,131.02	3,535.99	85.50%
FAZENDA ANVERSA I	362.77	362.36	99.89%
FAZENDA ANVERSA II	362.08	361.82	99.93%
FAZENDA BADAJOZ PARTE 1- ALTEROSA	1,747.29	1,155.17	66.1%
FAZENDA BEM TE VI	1,082.40	797.99	73.72%
FAZENDA BOA ESPERANÇA	1,098.39	585.19	53.28%
FAZENDA BOA ESPERANÇA	388.09	388.09	100.00%
FAZENDA BONANZA	2,876.31	1,612.39	56.06%
FAZENDA CACHOEIRA	1,494.31	1,068.38	71.50%
FAZENDA CALIFÓRNIA	3,534.57	2,398.42	67.86%
FAZENDA CALIFÓRNIA	1,138.84	1,135.34	99.69%
FAZENDA CAMPO VERDE – MENOR	1,162.50	653.89	56.25%
FAZENDA CÉU AZUL	768.07	393.85	51.20%
FAZENDA CRISTAL	484.84	484.84	100.00%
FAZENDA DOIS IRMÃOS	508.80	321.69	63.23%
FAZENDA ESPERANÇA	1,124.50	1,116.13	99.26%
FAZENDA ESTRELA DO NORTE	2,101.36	1,280.63	60.94%
FAZENDA FLOR DO CAMPO	895.63	459.34	51.29%
FAZENDA FLORESTA BG	629.83	629.42	99.93%
FAZENDA FORMOSA	2,051.07	1,252.76	61.00%
FAZENDA GLEBA 55/SANTA CLARA	3,984.45	3,189.83	80.00%
FAZENDA IPÊ	2,412.98	1,689.01	70.00%
FAZENDA ISRAEL	1,327.64	957.90	72.15%
FAZENDA LOTE 35	4,600.96	2.333.49	50.72%
FAZENDA MAÇARANDUBA	331.45	319.73	96.45%

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

FAZENDA MATÃO	632.20	631.77	99.93%
FAZENDA MOLEZA	857.89	481.68	56.15%
FAZENDA MUTUM	1,497.04	1,197.92	80.02%
FAZENDA NASCENTE DA SERRA	969.89	658.52	67.80%
FAZENDA NOSSA SENHORA DE NAZARÉ	636.92	636.92	100.00%
FAZENDA PAJUSSARA III	932.31	560.27	60.09%
FAZENDA PAMPULHA I	1,352.98	1,079.17	79.7%
FAZENDA PAMPULHA II	1,454.04	1,299.48	89.20%
FAZENDA PARAISO	4,213.26	2,999.12	71.18%
FAZENDA PARAÍSO DO NORTE	2,637.71	1,911.15	72.45%
FAZENDA PARAISO_LEILA	1,065.98	570.68	53.54%
FAZENDA PARAJU	3,237.30	2,419.45	74.74%
FAZENDA PINGO DE OURO	1,036.83	935.10	90.20%
FAZENDA PROSPERIDADE	874.43	552.83	63.22%
FAZENDA RANCHO BG	662.57	365.10	55.10%
FAZENDA RENASCER	1,310.26	991.33	75.66%
FAZENDA RENASCER I	944.99	570.03	60.32%
FAZENDA RENASCER II	797.23	465.22	58.35%
FAZENDA RODA VIVA	1,009.17	501.60	49.70%
FAZENDA SANTA BÁRBARA	1,191.37	625.58	52.50%
FAZENDA SANTA CARMEM	4,508.19	3,127.49	69.37%
FAZENDA SANTA CELIA	4,304.05	3328,71	77,34%
FAZENDA SANTA LUCIA	8,151.81	4964,68	60,90%
FAZENDA SANTA LUIZA	3,178.22	1767,26	55,61%
FAZENDA SANTA MARIA DO ACARÁ	3,024.11	2418,81	79,90%
FAZENDA SANTANA	1,082.72	764,84	70,60%
FAZENDA SANTIAGO	736.10	650,58	88,38%
FAZENDA SANTO ANTONIO	2,108.22	1072,98	50,90%
FAZENDA SÃO DIONÍSIO	2,162.55	1843,85	85,26%
FAZENDA SÃO FRANCISCO	1,210.37	619.35	51.17%
FAZENDA SÃO MARCOS 2	362.68	361.72	99.74%
FAZENDA SÃO MATEUS	3,037.88	2,753.45	90.64%
FAZENDA SÃO PIO	869.79	595.200	68.43%
FAZENDA SAPUCAIA	2,017.88	1,060.91	52.58%
FAZENDA SAYONARA	1,367.41	798.57	58.40%
FAZENDA SOSSEGO	2.495,91	2,489.99	99.76%
FAZENDA TANGARÁ	399.12	247.07	61.90%
FAZENDA TEOLINDA I	1,332.41	1,059.23	79.40%

FAZENDA TERRA BOA	4,302.52	2,614.98	60.78%
FAZENDA TERRRA BRUTA	4,750.28	3,810.03	80.21%
FAZENDA UNIÃO	1,103.33	729.69	66.14%
FAZENDA VAI E VEM	727.28	412.65	56.74%
FAZENDA VINTE DE MAIO	2,055.14	1,027.57	50.00%
FAZENDA VITÓRIA	3,673.25	3,449.41	93.91%
FAZENDA ZINKAS I	585.23	468.30	80.02%

- 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 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.

Regarding the Cancun Safeguards, they were established to implement actions for REDD+ projects, to ensure that these initiatives adequately address sensitive issues such as the rights of indigenous peoples and traditional communities, social participation, preservation of natural ecosystems, the permanence of REDD+ results achieved and the risk of shifting pressure from deforestation and forest degradation to other areas.

The seven Cancun Safeguards state that REDD+ initiatives must promote and support:

1. Actions that are complementary to or consistent with the objectives of national forest programs and other relevant international conventions and agreements.

2. Transparent and effective national forest governance structures, with a view to national sovereignty and national legislation.

3. Respect for the knowledge and rights of indigenous peoples and members of local communities, taking into account relevant international obligations, national laws and the United Nations Declaration on the Rights of Indigenous People.

4. Full and effective participation of stakeholders, in particular indigenous peoples and local communities.

5. Actions consistent with the conservation of natural forests and biological diversity, ensuring that the actions referred to in paragraph 70 of Decision 1/CP 16 are not used for the conversion of natural forests, but rather to encourage the protection and conservation of natural forests and their services ecosystems, as well as to contribute to other social and environmental benefits.

6. Actions to avoid the risks of reversal of REDD+ results.

7. Actions to reduce the displacement of carbon emissions to other areas.

Despite being international guidelines, Brazil follows the UNFCCC requirements for the recognition of its results in reducing deforestation, submitting in 2015 to the UN, the 1st Summary of Safeguards, and, in 2018, the 2nd Summary of Safeguards[98], with information on how the Cancún safeguards were addressed and respected by Brazil during the implementation of actions to reduce emissions from deforestation in the Amazon biome (from 2006). These two summaries also address how the Amazon Fund has been supporting and contributing to the observance of these safeguards.

In relation to the YBYRÁ REDD+ Project, although the project is a private project, being developed in private properties, the project intends to base its actions and project design taking into account the Cancún safeguards, since the project also intends to promote benefits to the communities near the project area. Thus, the project brings transparency in the project activities and complies with the national laws and regulations; respects the rights of the local communities; considers the participation of the local communities in the socioeconomic diagnostic of the area, essential to the design of project activities; encourages the protection of the forest and associated biodiversity, bringing also social, environmental and climate benefits; has plans to avoid and reduce the risk

[98] Available on: http://redd.mma.gov.br/pt/salvaguardas/sumario-sobre-salvaguardas.

of reversal of REDD+ results (that is further presented in this PD); and also has action to reduce the displacement of carbon emissions to other areas (that is further presented in this PD).

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 YBYRÁ 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 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 YBYRÁ REDD+ Project are presented in item 2.1.3.. It is important to emphasize that the CooperCarbon is the legal representative of the owners of the 74 (seventy-four) private properties encompassed in the project ("Properties"), facilitating governance and the implementation of the Project activities effectively. The ownership of the Properties (as per the Brazilian Civil Code applicable dispositions) guarantees the necessary rights to control and operate Project activities. CARBONEXT TECNOLOGIA EM SOLUÇÕES AMBIENTAIS LTDA. is the proponent, together with the cooperative and it is also the technical responsible for the Project development, activities, monitoring, etc., with the support of the company CAMPO VERDE AGÊNCIA DE NEGÓCIOS IMOBILIÁRIOS E SERVIÇOS AMBIENTAIS LTDA. The Civil Partnership Agreement was established (agreed and signed) by the proponents in a way which both ownership and possession rights remain with the current owners of the Properties. It is also contractually stipulated among the parties (i) legal right to control and operate the Project activities; and (ii) rights over the carbon credits to the proponents listed in section 2.1.3. Furthermore, as stated in section 2.5.1 above, if the owners wish to sell the Properties, CARBONEXT TECNOLOGIA EM SOLUÇÕES AMBIENTAIS LTDA. has the prerogative to exercise its right of first refusal. 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

The YBYRÁ REDD+ Project aims to conserve forest ecosystems through the prevention of unplanned deforestation through monitoring activities and improvement of environmental awareness of local people. The common practice of the region is invasion of properties followed by deforestation, burning (emitting CO_2, N_2O and CH_4) and cattle implementation. The wood sale gains cover the initial costs of cattle implementation.

The Project aims to avoid a net baseline release of 12,044,741.50 tCO_2 at the end of its 30-year period, bringing benefits to the regulation of the climate effects. Besides, the project will bring benefits to the local forest ecosystems fomenting the development of strategies to protect preserved areas and regenerate degraded areas. One of the main achievements of this project is to connect forest remnants, by ecological. The ecological corridors will increase the protection of water bodies, reducing forest fragmentation, and bringing benefits to the biodiversity, climate regulation and communities as well.

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 present the applicability conditions and how the project meets them.

Table 3.1. Applicability conditions

Applicability conditions	Project meet description
VCS-VM0015_V1.1 (AUD)	
Baseline activities may include planned or unplanned logging for timber, fuel-wood collection, charcoal production, agricultural and grazing activities if the category is unplanned deforestation according to the most recent VCS AFOLU requirements	The baseline activities include planned authorized logging for some properties (not most of them).
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 falls into category D, as it predominantly involves protection of forest with controlled logging only in the minority of properties (sustainable forest management), and the baseline consists of unplanned deforestation in old-growth forests with logging (performing clear cut). For this type of project activity, the carbon balance is represented as shown in the Figure 3.1.
The project area can include different types of forest, 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 Project Area meets the internationally accepted definition of forest, which may include mature forests, secondary forests, and degraded forests (the Decision 11/CP.7 of the Marrakesh Accord adopts as "forests" (UNFCCC, 2002[99]): (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

[99] Available on: https://unfccc.int/cop7/documents/accords_draft.pdf

Applicability conditions	Project meet description
	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 because of human intervention such as harvesting or natural causes, but which are expected to revert to forest). The Brazilian Forest Service has considered as "forest" the types of woody vegetation that are closest to the definition of forests by the United Nations Organization for Agriculture and Food (FAO): "Area measuring more than 0.5 ha, with trees greater than 5 meters in height and crown cover greater than 10%, or trees capable of achieving these parameters *in situ*. This does not include land that is predominantly under agriculture or urban use." (Available on: *Avaliação Global dos Recursos Florestais (FRA)*).
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 2012 to 2021 to identify the forest areas according to forest definition.
The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) if 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: • Plinthosol Concretionary Petric • Dystrophic Yellow Latosol • Hydromorphic Ferrihumilúvic Spodosol and • Haplic Gleissolo Dystrophic Tb

Applicability conditions	Project meet description
VT0001_AFOLU_V3.0	
AFOLU activities the same or like the proposed project activity on the land within the proposed project boundary performed with or without being registered as the VCS AFOLU project shall not lead to violation of any applicable law even if the law is not enforced	The project activity does not lead to violation of any applicable law, even if the law is not enforced.
The use of this tool to determine additionality requires the baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario. Project proponent(s) proposing new baseline methodologies shall ensure consistency between the determination of a baseline scenario and the determination of additionality of a project activity.	There is a baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario.

Table 3.2 - Scope of the VM0015 methodology v1.1 (Table 1 of the VM0015 v1.1)

			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.

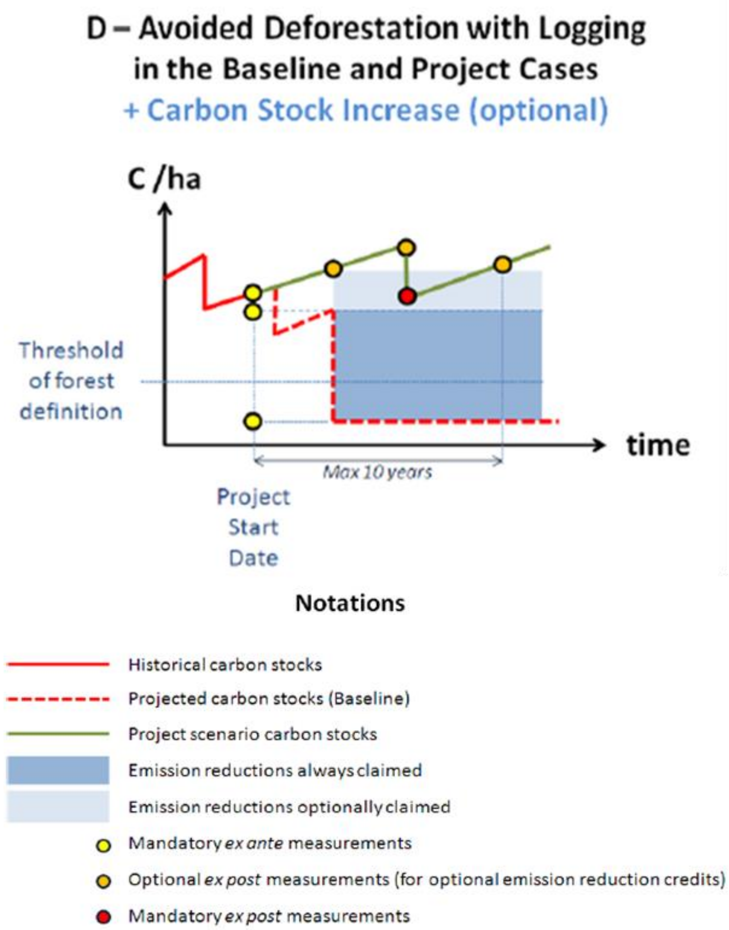


Figure 3.1.Carbon balance in project category D of VM0015 v1.1 methodology.

In this context, it is demonstrated that the VM0015 v1.1 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 PD also mentions the use of AFOLU "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

3.1.3.1 Temporal Boundary – Historical Period of Reference

The temporal boundary utilized as historical reference period for the baseline scenario analysis and the baseline emission calculations is from January 2012 to December 2021.

3.1.3.2 Spatial Boundaries – PROJECT AREA

The project area, according to VM0015, is an area covered only by forest for at least 10 years (as proven via evidence at audit) before the Project Start Date, considering as historical period: January 2012 to December 2021.

As a result, it was obtained an area of 76,481.34 hectares of Project Area, distributed in 74 private properties, presented on topic 2.1.5. 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. The spatial boundaries of the YBYRÁ REDD+ Project, as the RR and PA, are presented in the Figure 3.2. Since the project is composed by 74 properties, detailed maps have been created and are available as Annex 1. The coordinates of the 960 vertex points of the PAs are also available for the audit.

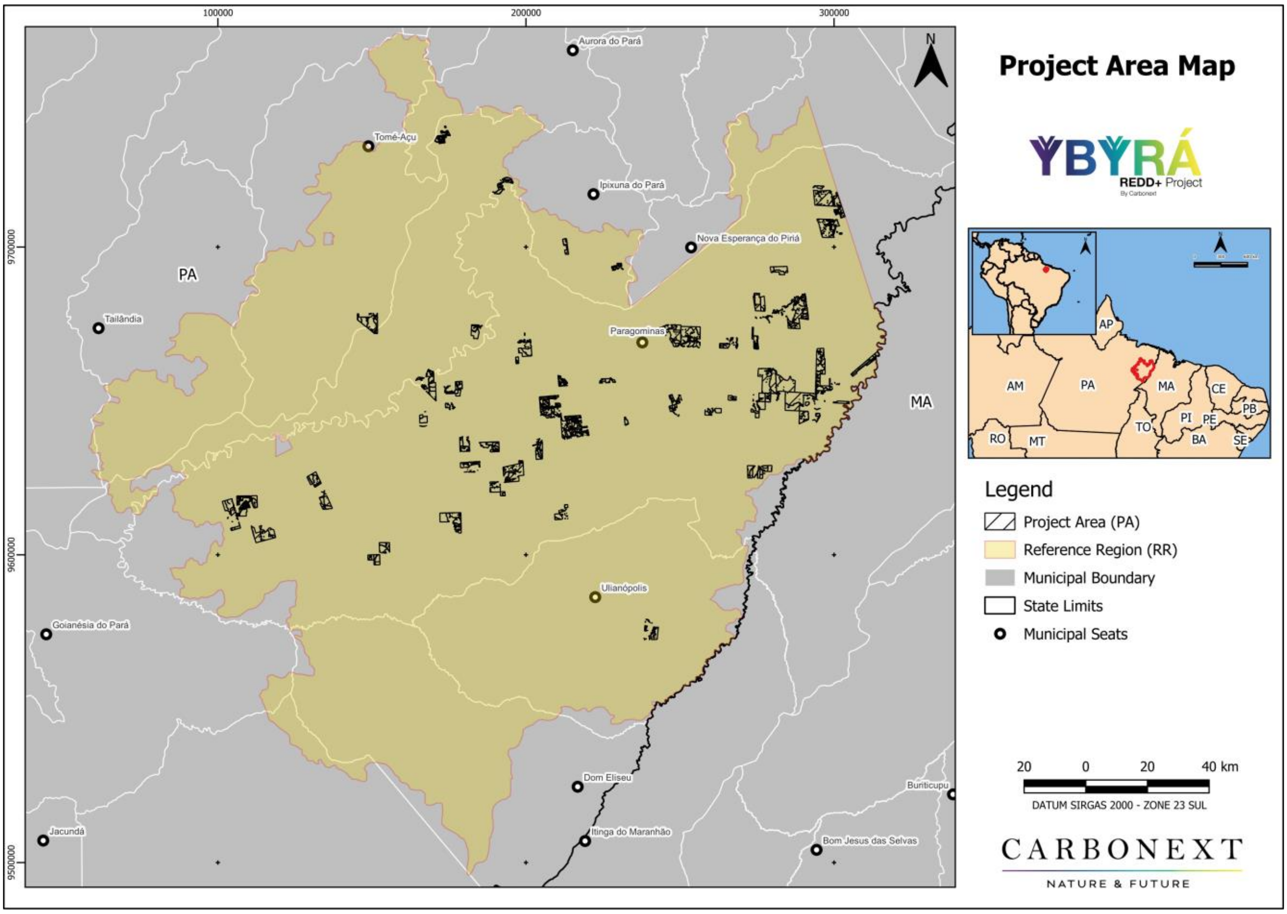


Figure 3.2.Map of the Project Area and Reference Region of the YBYRÁ REDD+ Project.

3.1.3.3 Spatial Boundaries – REFERENCE REGION

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

- Accessibility to 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 communities: Proximity to communities defined as villages and rural agglomerations that can become places that enhance the occurrence of deforestation.

The Figure 3.3 shows the limits of the Project Area, the Reference Region, and the Leakage Belt.

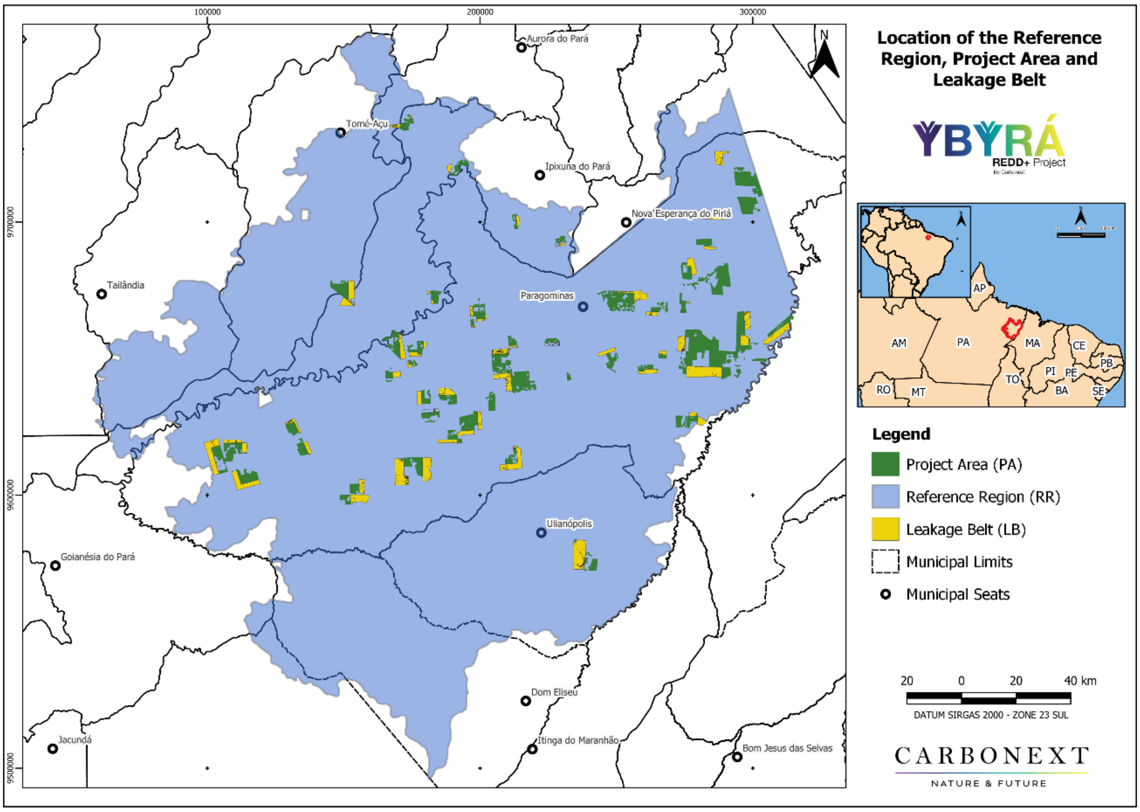


Figure 3.3.Location of the Reference Region, Project Area and Leakage Belt.

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 conservation units) were excluded from the Reference Region, as these are public areas with different agrarian and legal attributes compared to a private property, thus their characteristics is not representative of the local deforestation for the YBYRÁ REDD+ Project. However, the rural and agrarian settlements were maintained since the deforestation pattern is like the project region and corresponds to the reality of land use cover. The Indigenous Land Sarauá/Amanayé was also maintained in the RR since this area is uncharacterized as protected area and Indigenous land, since land grabbers invaded the land and expelled the indigenous people since 2002 and exploit the resources and deforest[100], as happens in the reference region of the project.

[100] Information available on: https://g1.globo.com/pa/para/noticia/2022/02/25/justica-da-90-dias-para-nao-indigenas-deixarem-terra-saraua-pa-no-para.ghtml; https://g1.globo.com/pa/para/noticia/2021/10/26/criminosos-ambientais-impedem-que-indigenas-usem-o-proprio-territorio-no-pa.ghtml; https://cimi.org.br/pub/relatorio/Relatorio-violencia-contra-povos-indigenas_2014-Cimi.pdf

The main criteria used in defining the Reference Region are:

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 VM0015 methodology, version 1.1.

As a result, it was obtained a Reference Region of 3,526,270 hectares, which includes the Project Area of 76,481.34 hectare. VM0015 suggests that when the Project Area is under 100,000 hectares, 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, according to the topics presented below:

Similarity analysis between Reference Region and Project Area

Agents and drivers

In the absence of the present REDD project, it is assumed that the properties would undergo deforestation at the same intensity, carried out by the same agents and motivated by the same drivers, as 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 and degradation, since there are reports of fires near of Project Areas, as mentioned by Barlow et al. (2012)[101] in a study in the Paragominas municipality. The fire events are considered as threatens the long-term permanence of carbon stocks in undisturbed primary forests, logged forests, and forest regeneration and reforestation projects. More information on the drivers are detailed in the sector 3.1.4 and 3.2.1.

[101] Barlow et al. 2012. The critical importance of considering fire in REDD+ programs. Biological Conservation v. 154, pp.1-8.

Infrastructure Drivers

The Reference Region has the same deforestation drivers of the Project Area. In the historical period, no significant infrastructure changes were observed. All considered infrastructures were already consolidated before the historical period. Therefore, there is not formalized information on infrastructure changes that will be improved or implementation of new infrastructure for the next 30 years.

Land occupation

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 Figure 3.4 shows the land-use within the Reference Region, illustrating the main legally recognized Conservation Areas. The following categories were included: Federal and State Conservation Areas (“Unidades de Conservação (UC)” in Portuguese), Indigenous Territories recognized by FUNAI, legally approved settlement projects, and private land certified by INCRA. The only Conservation Area (“Unidades de Conservação (UC)”) near the PA is the “Reserva Biológica do Gurupi” at southeast of the RR. In relation to Indigenous territories were identifies the follows territories: Sarauá Indigenous Land (Amanayé ethnicity); Alto Rio Guamá (Tembé ethnicity), Barreirinha (Amanayé ethnicity), Alto Turiaçu (Ka'apor ethnicity) and Awa (Guajá ethnicity) indigenous lands. The Sarauá Indigenous Land (Amanayé ethnicity) was maintained in reference region due to the history of conflict and the pressure of deforestation in the project area adjacent to the unit, as previously described in Spatial boundaries – Reference Region.

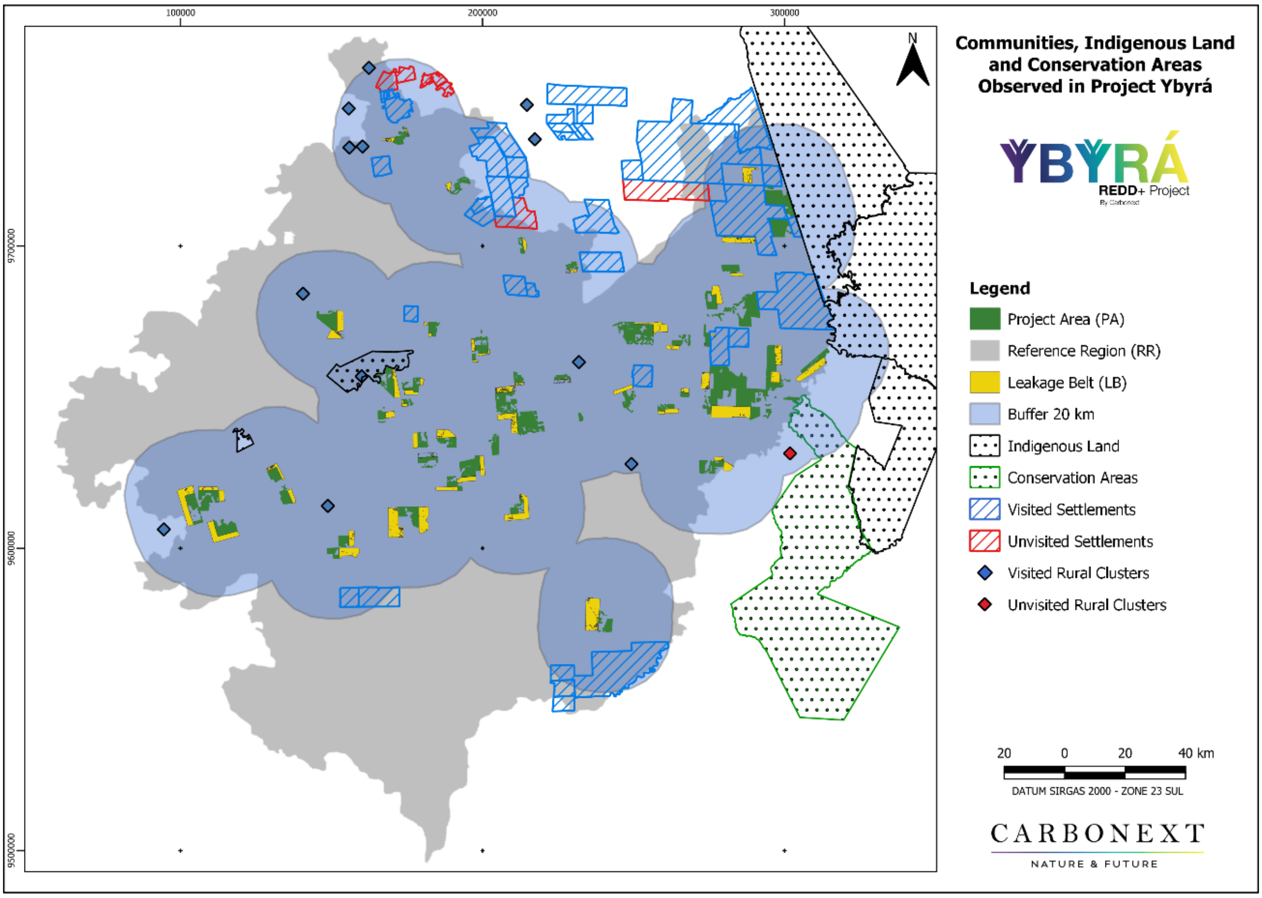


Figure 3.4.Communities, Indigenous Land and Protected Areas observed in the Reference Region (RR) and Project Area (PA).

Forest classes

The dominant forest classes in the Reference Region are Lowland Dense Ombrophilous Forest (Db) according to IBGE, covering 50.8 % of the RR. The Figure 3.5 below shows the spatial representation of these vegetation types in the Project Area and Reference Region and the Table 3.3 shows the proportion of each forest classes.

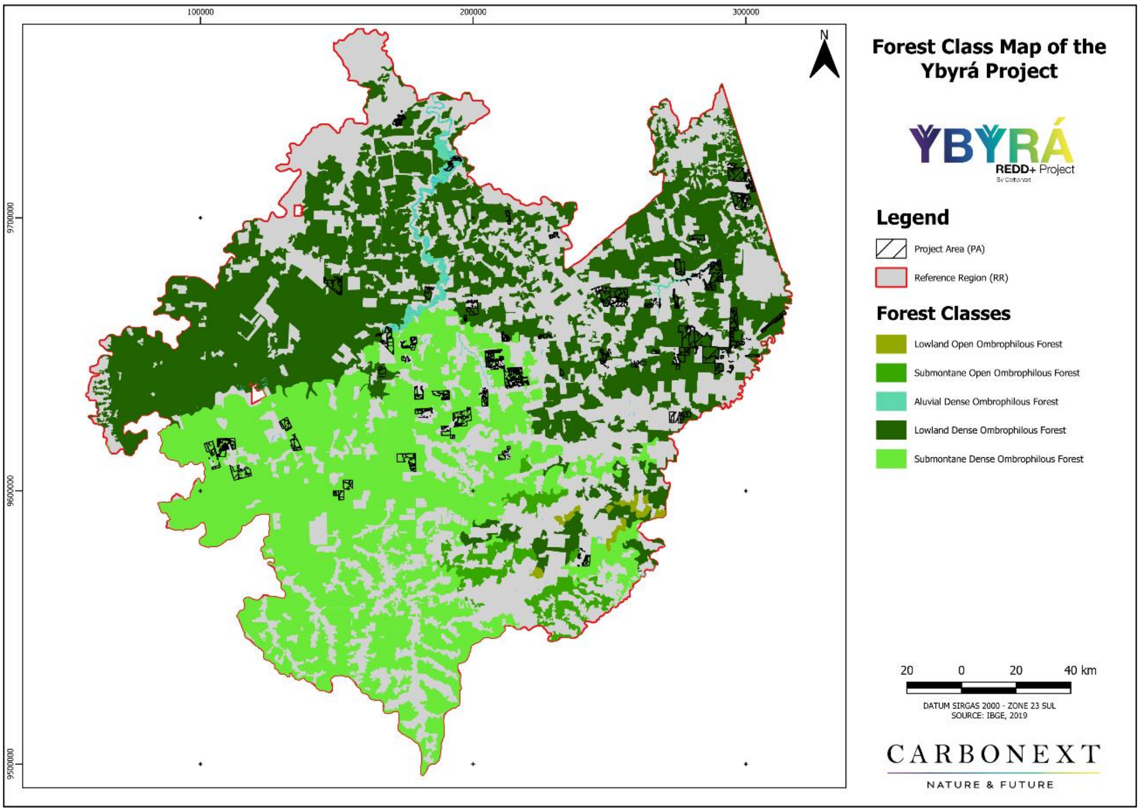


Figure 3.5. Identification of forest typologies in the Reference Region and Project Area.

Table 3.3 - Forest classes in the Reference Region (RR) and Project Area (PA).

Forest classes	Class code	RR			PA		
		Area (ha)	% of Total	% Cumulative	Area (ha)	% of Total	% Cumulative
Lowland Dense Ombrophilous Forest	Db	1,134,830.00	50.8 %	50.8 %	46,521.8	60.8 %	60.8 %
Submontane Open Ombrophilous Forest	As	62,151.20	2.8 %	53.6 %	85,7	0.1 %	60.9 %
Alluvial Dense Ombrophilous Forest	Da	27,707.00	1.2 %	54.8 %	1,287.1	1.7 %	62.6 %
Lowland Open Ombrophilous Forest	Ab	12,675.00	0.6 %	55.4 %	0,0	0 %	62.6 %
Submontane Dense Ombrophilous Forest	Ds	995,484.00	44.6 %	100 %	28,586.8	37.4 %	100 %
Total		2,232,847.20	100 %		76,481.3	100 %	

Conclusion on the similarity of forest types: 100% of the PA has forest classes that are in 99% of the RR, namely Dense Ombrophilous Forest classified in 3 subtypes: Lowlands, Submontane and Alluvial. 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 S02W046, S02W047, S02W048, S02W049, S02W050, S03W046, S03W047, S03W048, S03W049, S03W050, S04W046, S04W047, S04W048, S04W049, S04W050, S05W046, S05W047, S05W048, S05W049, S05W050, S09W051, S09W052, S10W051 and S10W052; in HGT format, provided by Earthdata - NASA. The Figure 3.6 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 3.7 and 3.8).

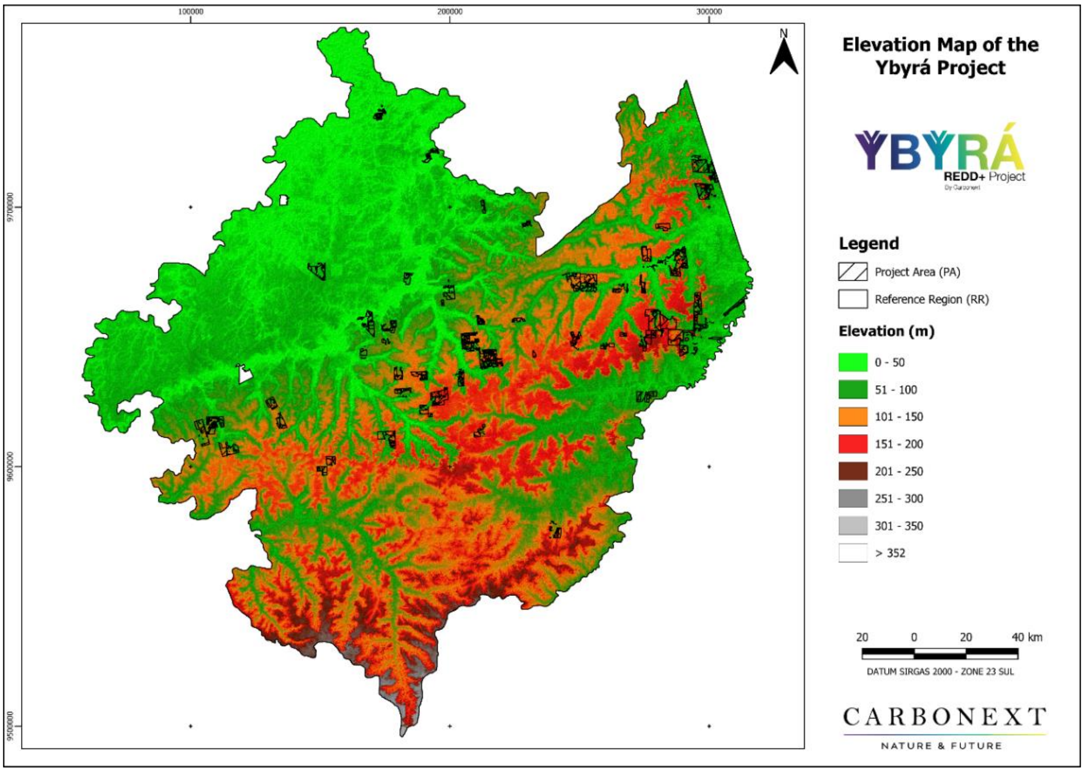


Figure 3.6. Elevation of the Reference Region and Project Area.

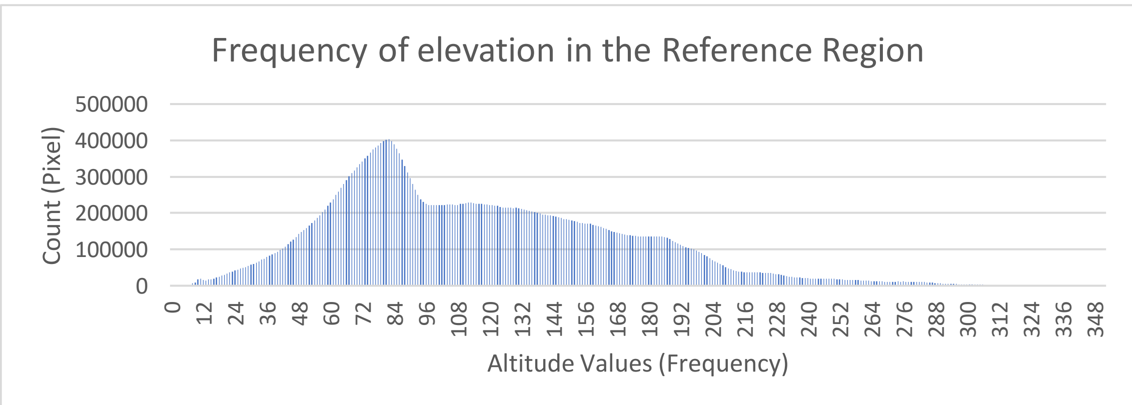


Figure 3.7.Frequency of elevation in the Reference Region.

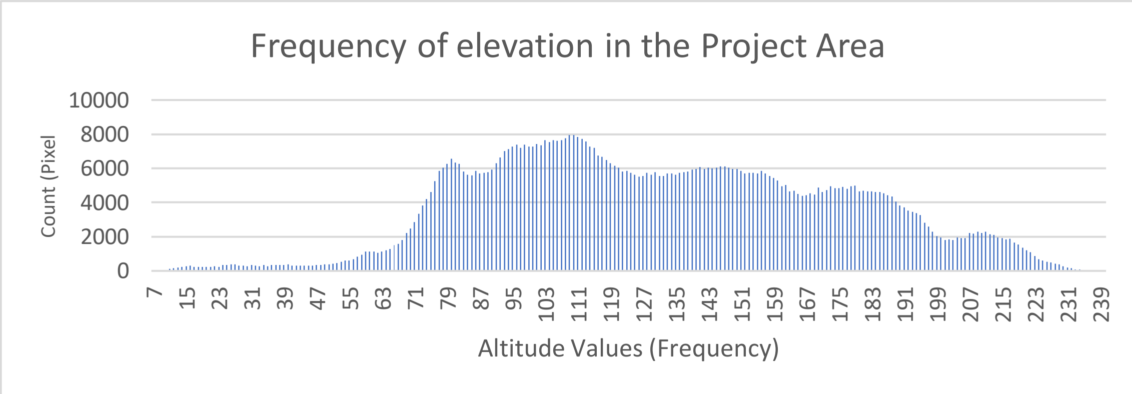


Figure 3.8.Frequency of elevation in the Project Area.

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Conclusion on the similarity: 66% of the Project Area has an altitude ranging between 0 and 150.0 meters and 33% has an altitude of 150.0 to 300.0 meters. While more than 74% of the Reference Region is located at altitudes between 0 and 150.0 meters and 25% is between 150.0 and 300 meters of altitude. Thus, the assessment of similarity of reduction is greater than 90% and meets the requirements of the methodology. In this analysis, the 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 analyze slope within the Project Area and the Reference Region, in compliance with methodology criteria, which require 90% between both areas, a mosaic of digital elevation models was prepared using scenes S02W046, S02W047, S02W048, S02W049, S02W050, S03W046, S03W047, S03W048, S03W049, S03W050, S04W046, S04W047, S04W048, S04W049, S04W050, S05W046, S05W047, S05W048, S05W049, S05W050, S09W051, S09W052, S10W051 and S10W052; in HGT format, provided by Earthdata - NASA, in which each pixel represents the average slope of the land.

The Figure 3.9 shows the similarity of the slope classes in the Reference Region and Project Area; and in the Table 3.4, 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 most prevalent class was Slightly-undulating (3-8% slope), which covers 47.1% of RR and 44.8% of PA."

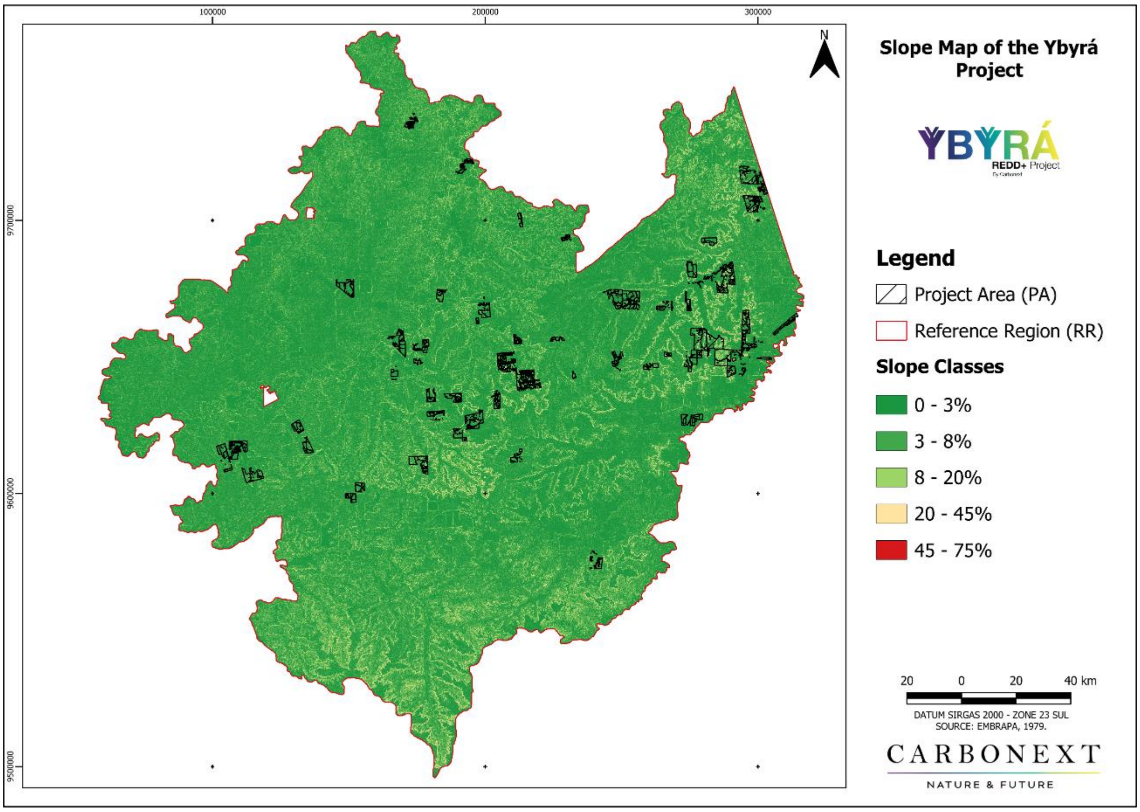

Figure 3.9.Landscape slope analysis in the Reference Region and Project Area.

Table 3.4 - Slope Similarity in the Project Area and Reference Region.

N	Slope classes	Reference Region (RR)		Project Area (PA)		Difference in % coverage in RR and PA
		Area (ha)	**Area (%)**	**Area (ha)**	**Area (%)**	
1	Flat (0-3%)	751,152.00	21.30%	12,920.57	16.89%	4.41%
2	Slightly Undulating (3-8%)	1,661,051.00	47.11%	35,242.71	46.08%	1.03%
3	Undulating (8-20%)	954,917.00	27.08%	21,947.31	28.70%	1.62%
4	Hilly (20-45%)	154,224.00	4.37%	6,088.90	7.96%	7.59%
5	Mountainous (45-75%)	4,910.00	0.14%	281.07	0.37%	0.23%
6	Steep (>75%)	16.00	0.00%	0.76	0.00%	0%
	Total	3,526,270.00	**100%**	76,481.33	**100%**	**-**

Conclusion regarding slope class: the same three slope classes cover 90% of both the Project Area and the Reference Region, specifically: Flat, Slightly Undulating and Undulating class. The difference of coverage percentage of the slope classes between RR and PA areas does not exceed 5 %, with the Flat 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, it was used a study by[102] WorldClim. The Figure 3.10 shows a map of the Annual Mean Precipitation of the Project Area and Region of Reference.

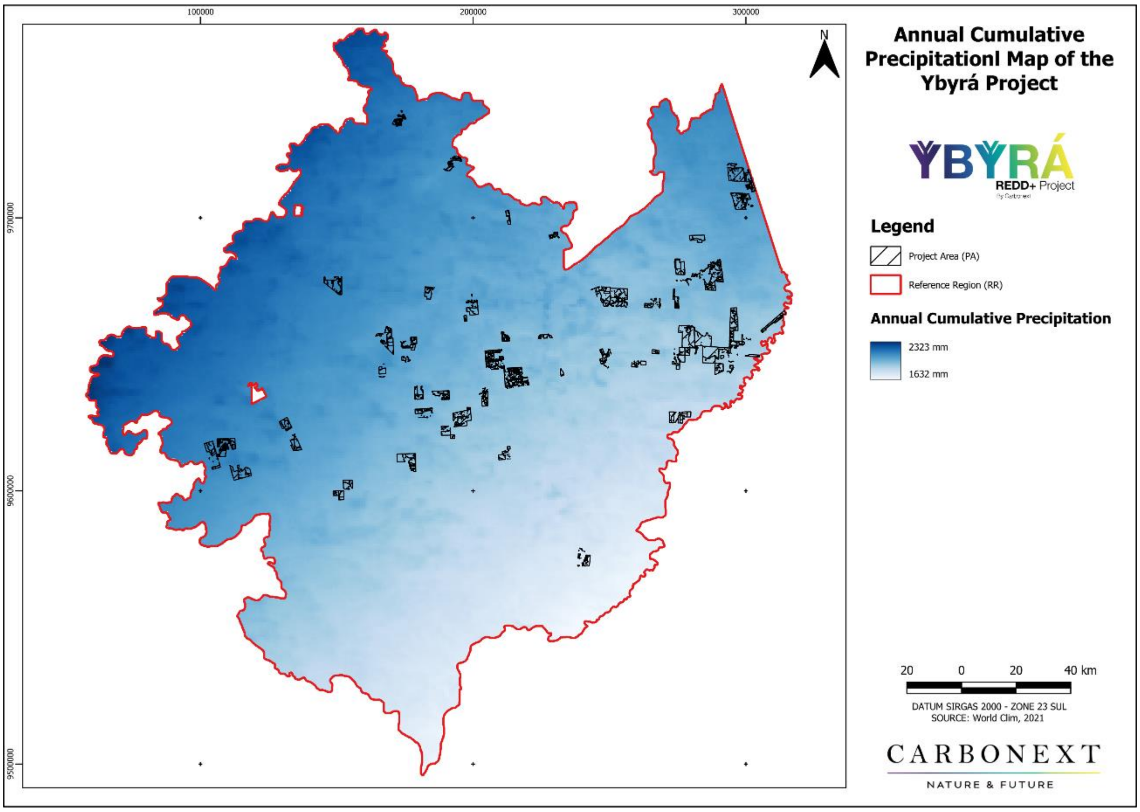

Figure 3.10. Rainfall analysis in the Reference Region and Project Area.

Table 3.5 - Annual Mean Precipitation.

Precipitation (1970-2000 average prec. *in mm*)*			
Class (mm)	**RR**		**PA**

[102] FICK, Stephen E.; HIJMANS, Robert J. WorldClim 2: new 1-km spatial resolution climate surfaces for global land areas. International journal of climatology, v. 37, n. 12, p. 4302-4315, 2017.

	Area (ha)	% of Total	Area (ha)	% of Total
From 1500 to 2000	1,944,520.00	55.14%	52,326.87	68.42%
From 2000 to 2500	1,581,750.00	44.86%	24,154.46	31.58%
Total	3,526,270.00	100.00%	76,481.33	100.00%

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 3.5), varying in the mean and maximum value of rainfall.

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 (more than 90 %); Elevation (more than 90%) and; Slope (more than 90%).

3.1.3.4 Spatial Boundaries – LEAKAGE BELT

The Leakage Belt are land areas surrounding to the project area in which baseline activities could be displaced due to the project activities implemented in the project area. Total area of leakage belt is 57,686.78 hectares and is located adjacent to the Project Areas. The boundary of the Leakage Belt (Figure 3.11) 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.

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.

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 deforested area in the reference region 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[103] were used to demonstrate the profitability of the main products of deforestation in the region: cattle.

[103][1] https://www.cepea.esalq.usp.br/br/indicador/boi-gordo.aspx[2] https://www.cnabrasil.org.br/sevicos/custos-producao (accessed in 10/02/2022);[3] PORTARIA Nº 169, de 18 DE MARÇO DE 2022 : portaria nº 169, 18 de março de 2022 – DOU 169, - DOU - Imprensa Nacional (in.gov.br) (accessed in 10/02/2023); [4] PIS: 0%: https://www.campograndenews.com.br/artigos/produtor-rural-pessoa-juridica-x-pis/pasep-e-cofins; [5] COFINS: 0%:

Based on the 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:

List the main land-uses that deforestation agents ae 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.

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 were considered as the main and final product of deforestation in this assessment. Living cattle are 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$ R$ 18,993.33/ton[104]. Nevertheless, there is a great variety of fees and taxes [105] that must be discounted from the sale price. The discount on the total selling price has been reduced, resulting in a total of R$ [R$ 15,375.10]/ton return on the 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 BR-010 and PA-256 highway. However, it also considered sales points outside the reference region, considering that there are other slaughterhouses closer to our project area, located along secondary roads, where transportation costs would be lower and, consequently, more profitable for the deforestation agent to sell the cattle.

https://www.campograndenews.com.br/artigos/produtor-rural-pessoa-juridica-x-pis/pasep-e-cofins; [6] ICMS: 4,0%: https://online.sefaz.am.gov.br/silt/Normas/ ; [7] INSS/FUNRURAL: 2,05%: https://www.agrolink.com.br/colunistas/funrural--o-imposto-que-o-produtor-rural-nao-pode-esquecer-_448507.html ; [8] IRPJ: 25%: http://www.planalto.gov.br/ccivil_03/leis/l8541.htm; [9] CSLL: 9%: https://www.gov.br/receitafederal/pt-br/assuntos/orientacao-tributaria/tributos/CSLL; [10] Boas Práticas de Manejo; [11] Indicadores IBGE Estatística da Produção Pecuária; [12] Pesquisa da Pecuária Municipal

[104] Cotação do Boi: Preço da Arroba do Boi Hoje (melhorcambio.com) (accessed in 10/02/2023)
[105] 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
INSS/FUNRURAL: 2,05%: https://www.agrolink.com.br/colunistas/

$PCxi =$ 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$ R$ 12,147.33/ton [106] to obtain the net margin is necessary to discount the IRPJ and CSLL[107] from the difference between the sales price and production cost resulting in R$ 1,196.31/ton. The transportation cost is the net margin multiplied by 40% (percent accounted for in the "sharecropper's agreement" for paying the landowner), which results in R$ 960.30/ ton for transportation.

$TCv =$ Average transport cost per kilometer 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$ 5.23/km and R$ 412.40 to load and unload the truck according to National Terrestrial Transportation Agency (Agência Nacional de Transportes Terrestres, ANTT) freight chart. Considering the sales cost, production cost, and transportation, the maximum distance that would still be profitable for the implementation of livestock would be 183.3 km.

The methodology for calculating the cost of road transportation for livestock in the region considered the distance that would be covered from the forest areas adjacent to the project area through the established accesses (highways and local roads) to the nearest sales points. The figure below represents the data of roads and reference region.

[106] https://www.cnabrasil.org.br/sevicos/custos-producao (accessed in 10/03/20223)
[107] 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)).

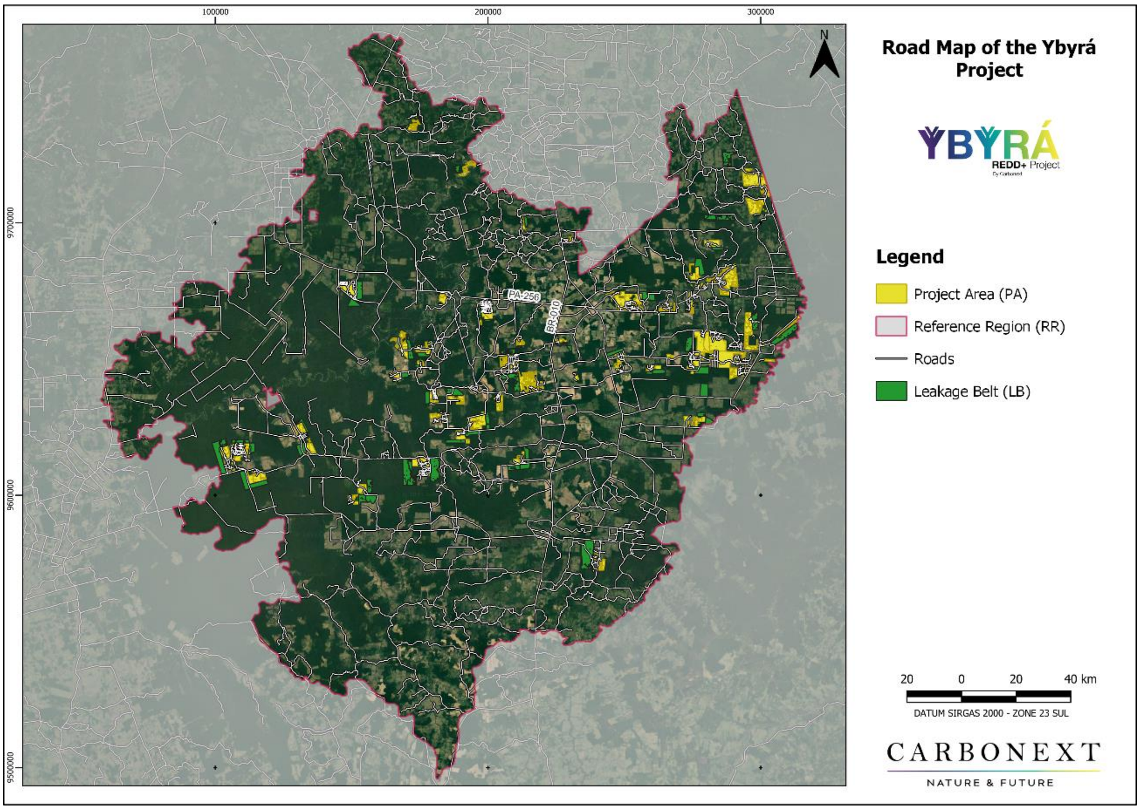

Figure 3.11. Roads in the reference region.

Therefore, a resulting surface was generated representing the profitability potential of livestock encompassing the reference region and sales points along secondary roads near the project areas. The two main highways providing access to the sales points are BR 010 and PA 256. The map below shows the locations of the most profitable areas for leakage to occur, taking into account the transportation cost.

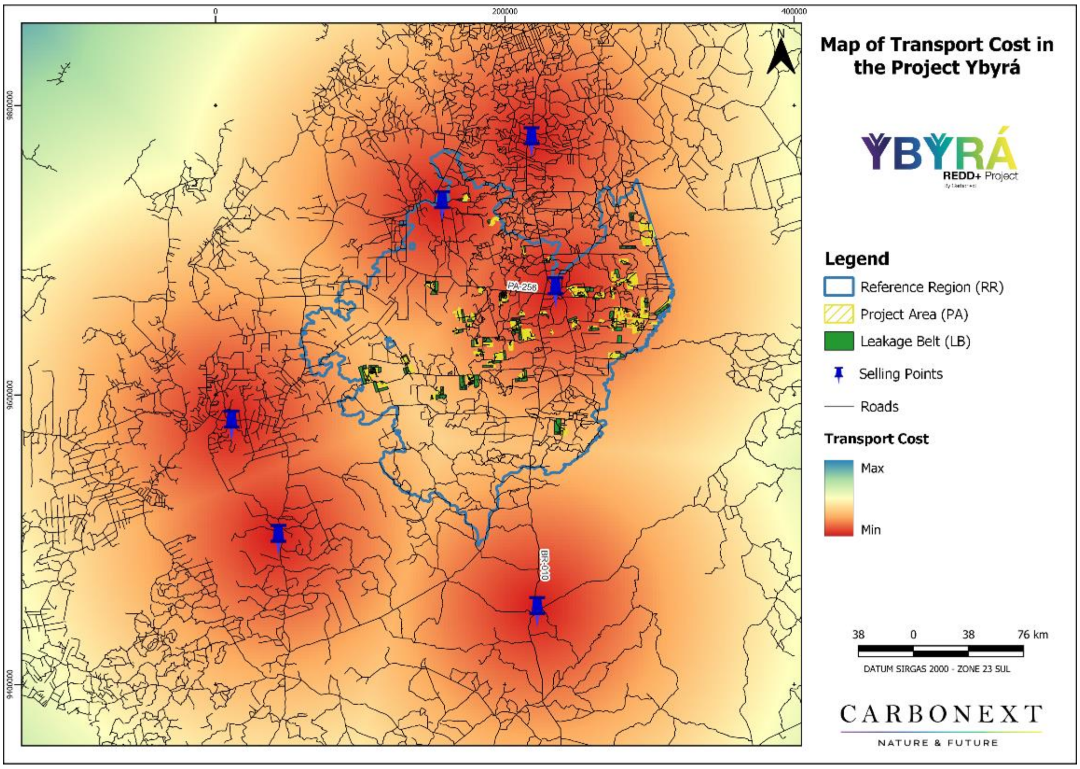

Figure 3.12. Surface costs (R$) for road transportation to the nearest selling points.

Thus, the area of the leakage belt was defined, comprising an area of 81,217.32ha. The figure below illustrates its location.

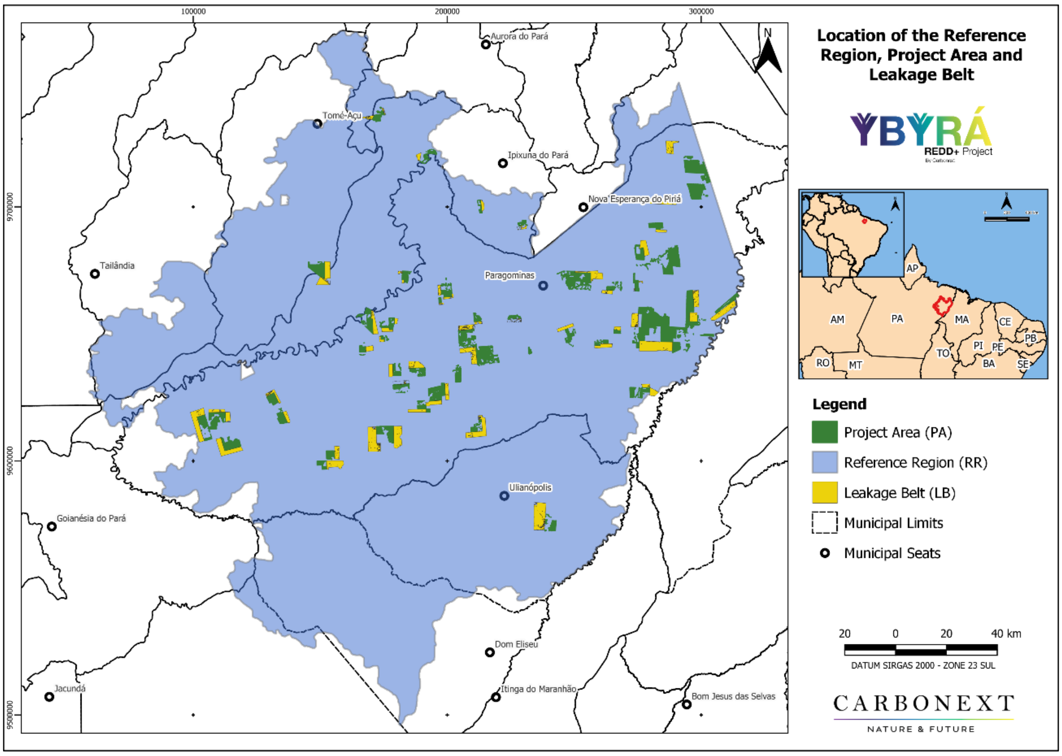

Figure 3.13 Location of the Leakage Belt adjacent to PA.

3.1.3.5 Spatial Boundaries – LEAKAGE MANAGEMENT AREAS

The Leakage Management Areas (LMA) are non-forest areas located outside the project boundary. In these areas, aiming to implement activities that will reduce the risk of activity displacement deforestation leakage. The boundary of Leakage Management Areas was defined using the common projection and GIS software formats used in the project.

The delimitation of the Leakage Management Areas considered the distances to reach the Project Area and the Leakage Belt. Besides, areas with communities that have a direct relationship with the project area were identified considering agricultural practices and sources of income to plan activities that are directly related to reducing deforestation.

The following spatial criteria were used for delimitation:

- Non-forest classes present on Start Date;
- Areas near to communities where socio-environmental actions were planned to mitigate and reduce the pressure of deforestation in the Project Area;
- High potential for land-use changes in these areas, considering their proximity to roads and other deforested areas. In the table below, the deforestation data in the LMA areas is presented, where it is possible to observe that in all cases, the deforested areas are greater than the forested areas, revealing that these areas do not meet the required amount of legal reserve set by Brazilian legislation for the Amazon.

Table 3.6 -Settlements present in the Leakage Management Areas (LMA).

List of Settlements present in the Leakage Management Areas (LMA)		
Settlements	**Total Forest Area present in 2022 (ha)**	**Accumulated Deforestation (ha)**
ÁGUIA RIO BONITO	972.39	7,421.21
ALTA FLORESTA	735.45	3,244.34
DIAMANTINA II	621.12	1,618.24
FLORESTA GURUPI I	6,931.43	32,401.27
LUIZ INÁCIO	8,197.58	26,093.73

The total area delimited for the LMA is 53,624.8 ha, corresponding to 70.11 % in relation to the area of the PA. According to the criteria cited above, the Leakage Management Areas were allocated in the communities: Águia Rio Bonito, Alta Floresta, Diamantina II, Floresta Gurupi I and Luiz Inácio (Figure 3.14).

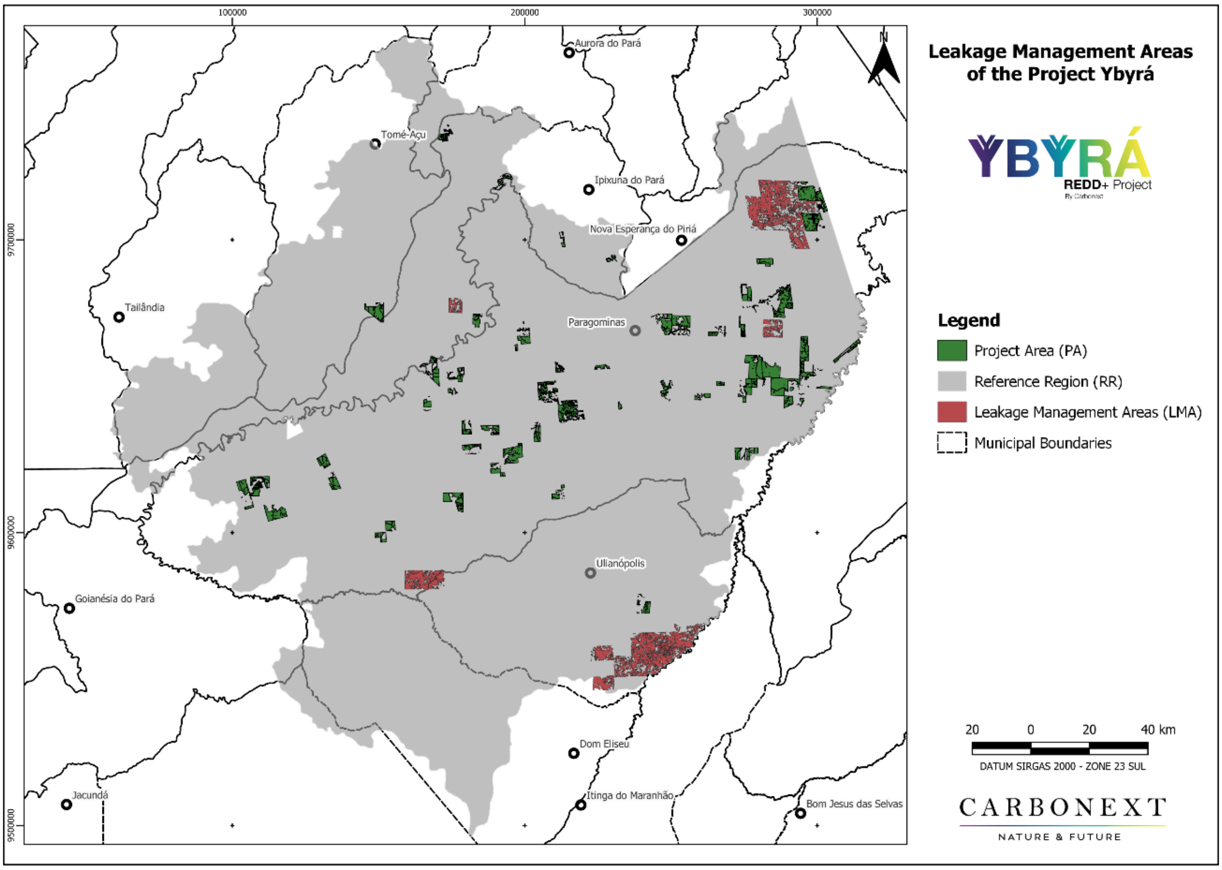

Figure 3.14.Location of the Leakage Management Areas.

The current livelihoods of the communities located in the Leakage Management Area (LMA) can contribute to the forest degradation because of fire use as an agricultural practice. Moreover, in a study[108] carried out in the region of Paragominas, it was identified strong relation between forest fires with places of social vulnerability. Project activities for Communities located in the Leakage Management Areas were planned to reduce the risk of deforestation leakage. And it goes through different axes, which involve training, capacity building, technical guidance on sustainable land use practices.

The topic 2.1.11 present the Activity Plan and the topic 4.4.1. presents the Monitoring plan of the activities in Communities located in Leakage Management Area.

Sources of GHG of the project

The table 3.7 presents the sources of the GHG included or excluded within the boundary of the proposed AUD project activity.

[108] Barlow et al. 2012. The critical importance of considering fire in REDD+ programs. Biological Conservation v. 154, pp.1-8

Table 3.7 - 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	No	Considered insignificant according to VCS Program Update of May 24th, 2010
		Other	-	Not applicable.
	Livestock Emissions	CO_2	No	Not a significant source
		CH_4	No	It accounts less than 5% of the total GHG generated (Rivera, J. E., & Chará, J. (2021)[109])
		N_2O	No	It accounts less than 5% of the total GHG generated (Rivera, J. E., & Chará, J. (2021))
		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.
		N_2O	No	It accounts less than 5% of the total GHG generated
		Other	-	Not applicable.
	Livestock Emissions	CO_2	No	Not a significant source
		CH_4	No	It accounts less than 5% of the total GHG generated (Rivera, J. E., & Chará, J. (2021))
		N_2O	No	It accounts less than 5% of the total GHG generated (Rivera, J. E., & Chará, J. (2021))
		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. Only CH4 emissions have been included as biomass burning source. 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 Table 3.8 indicates the carbon pools to be included and excluded in the YBYRÁ REDD+ Project. Carbon pools were selected in a conservative manner. Conservative numbers and approaches were adopted to obtain 0% uncertainty in this component. The following carbon

[109] Available on PDF.

pools were hence included and excluded in quantifications, in compliance with VM0015 Methodology, as shown in the table below:

Table 3.8 - 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	Included as it is mandatory in the VM0015 Methodology.
	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	Included	Included as recommended in the VM0015 Methodology.
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

As the region faces a high deforestation pressure, the project falls within the category AFOLU – REDD – Avoiding unplanned deforestation (AUD). The baseline scenario identified (Section 3.1.5) is forest loss caused by deforestation to implement pasture, for cattle ranching.

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 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 since 77% of the forest conversion is to pasture in the historical period, as fully described in section 3.1.5 below. As the main deforestation agent in the region, this activity is expected to increase in the project region. Considering the data from Paragominas, Ulianópolis, Ipixuna do Pará and Tomé-Açu, from 2011 to 2021, the total heads of cattle increased 18.35%, going from 653,490 heads to 773,437, according to IBGE[110] data. Therefore, the implementation of YBYRÁ REDD+ project can help to contain the deforestation pressure, which is caused in the region by the invasion of properties, followed by extraction of timber, expansion of cattle farming (pasture) and agricultural areas.

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

3.1.4.1.1 Collection of appropriate data sources

To classify land use and land cover classes were used Mapbiomas[111] database. Besides, a mosaic of images was used to map the classes Forest, Disturbed Vegetation (Deforestation), Hydrography, and Non-forest Vegetation. The images cover the historical reference period (2012 to 2021) and correspond to the following orbits/points of Landsat satellite: 223/61, 223/62, 223/63, 222/62 and 222/63 (Table 3.9).

Mapbiomas uses LANDSAT class satellite images (30 meters of spatial resolution and 16-day revisit rate) in a mosaic combination that seeks to minimize the problem of cloud cover and ensure interoperability criteria. The minimum area mapped by Mapbiomas is 30 meters pixel. Total of 50 mosaic images, composed of five scenes (orbits: 223 and 222 / points: 61, 62 and 63), were adopted to map the land use classes of interest in the reference region within the historical period.

[110] https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/18/16459?localidade1=150095&localidade2=150800&ano=2021&tipo=grafico&indicador=16533. See the excel: Memorial de Cálculo – Gado.
[111] MAPBIOMAS, 2022. Accessed: Dec. 10, 2022. [Online]. Available: https://brasil.mapbiomas.org/colecoes-mapbiomas-1?cama_set_language=pt-BR

The **Error! Reference source not found.**.9 shows the data used for the historical LU/LC change analyses.

Table 3.9 - 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	(year)	Path / Latitude	Row / Longitude
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	223	61
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	223	62
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	223	63
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	222	62
Satellite	Landsat 7 ETM+	30 X 30 m	0.43 - 2.35 µm	170 x 183	2012	222	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	223	61
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	223	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	223	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	222	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2013	222	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	223	61
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	223	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	223	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	222	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2014	222	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	223	61
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	223	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	223	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	222	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2015	222	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	223	61
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	223	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	223	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	222	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2016	222	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	223	61
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	223	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	223	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	222	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2017	222	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	223	61
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	223	62

Vector (Satellite or Airplane)	Sensor	Resolution		Coverage	Acquisition date	Scene or Point identifier	
		Spatial	Spectral	km	(year)	Path / Latitude	Row / Longitude
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	223	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	222	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2018	222	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	223	61
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	223	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	223	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	222	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2019	222	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	223	61
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	223	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	223	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	222	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2020	222	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	223	61
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	223	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	223	63
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	222	62
Satellite	Landsat 8 OLI	30 X 30 m	0.43 - 2.29 µm	170 x 183	2021	222	63

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

For the land use and land cover of this project, a reclassification was made based on the raster provided by Mapbiomas with deforestation classified year by year. The land use and cover classes used (**Error! Reference source not found.**.10), the description of each class and the existing area before the Project start year are shown below.

Table 10 - Land use and cover classes of the YBYRÁ REDD+ Project.

Mapbiomas ID	Project ID	Project land use description
3	1	Forest Formation
4	2	Savanna Formation
9	4	Forestry
11	2	Flooded Field and Swampy Area
12	2	Natural Grassland
15	4	Pasture
24	5	Urbanized Area

Mapbiomas ID	Project ID	Project land use description
30	6	Mining
33	3	River, Lake and Ocean
39	4	Soy
41	4	Other Crops Temporary
48	4	Other Perennial Crops

The classification criteria for the project were the same as those already defined by Mapbiomas:

- **Forest Land**: areas of remaining forest. This class includes all areas classified as forest since 2012 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. As Mapbiomas definition, clear-cuts deforestation process it is the complete removal of the forest cover and areas are converted in other anthropic uses (agricultural, pasture, etc).
- **Others natural formations**: areas of natural formation, which, when vegetated, have a different physiognomy from the Forest (Savannah, Shrublands, Natural Grassland, etc.).
- **Hydrography:** water bodies of any kind.
- **Mining:** mining areas.
- **Urbanized Area:** urbanized areas

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 3.11 (Table 6 of VM0015).

Table 3.11 - 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]			
ID_{cl}	Name			LG	FW	CP	Description (including criteria for unambiguous boundary definition)

1	Forest Land	decreasing	RR; LK; PA	yes	no	no	Determined as the same criteria in Mapbiomas program. Forest Land is remaining forest. The physiognomies are determined by IBGE classification. In project area were observed 5 physiognomies for calculations of biomass: Submontane Dense Ombrophylous, Submontane Open Ombrophylous, Alluvial Dense Ombrophylous, Lowland Open Ombrophylous and Lowland Dense Ombrophylous.
2	Non-Forest Land	increasing	RR; LM	yes	no	no	Determined as the same criteria in Mabbiomas program. These areas are clear-cuts deforestation areas occupied by agriculture and pasture use. This class is considered as the areas of deforestation.
3	Others natural formations	constant	RR; LM	no	no	no	Determined as the same criteria in Mapbiomas program. Others natural formations are natural vegetation areas different of forest formation as grassland, shrublands, etc.
4	Hydrography/ Bodies of water (Magua)	constant	RR; LM	no	no	no	Determined as the same criteria in Mapbiomas program. Any water bodies are classified in this class.
5	Urbanized Area	constant	RR	no	no	no	Determined as the same criteria in Mapbiomas program. Any water bodies are classified in this class.
6	Mining	constant	RR	no	no	no	Determined as the same criteria in Mapbiomas program. Any water bodies are classified in this class.

Source: Remote Sensing data from Mapbiomas: 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 3.12 and Table 3.13).

Table 3.12 - Potential land-use and land-cover change matrix in project area and leakage belt (Table 7.a of VM0015) in the Project Case and Baseline Scenario.

Project Case Scenario					
ID_{cl}			Initial LU/LC class (2022)		Total (ha)
			Forest	Non-Forest	
			I1	I2	
Final LU/LC class (2052)	F1	Forest	76,481.33	0	76,481.33
	F2	Non-Forest	0	0	0
Total (ha)			76,481.33	0	76,481.33

Baseline Scenario					
ID_{cl}			Initial LU/LC class (2022)		Total (ha)
			Forest	Non-Forest	
			I1	I2	
Final LU/LC class (2052)	F1	Forest	38,222.26	-	38,222.26
	F2	Non-Forest	-	38,259.07	38,259.07
Total (ha)			38,222.26	38,259.07	76,481.33

In the project area, over 30 years, it is projected that of the total of 76,481.33 hectare, 38,259.07 ha will be deforested, leaving 38,222.26 ha of forest area at the end of the period, according to projections.

Table 3.13 - Potential land-use and land-cover change matrix (Table 7.a of VM0015) in the Project case and Baseline Scenario.

Leakage Belt – Project Case					
			Initial LU/LC class (2022)		Total (ha)
			Forest	Non-Forest	
		ID_{cl}	I1	I2	
Final LU/LC class (2052)	F1	Forest	59,123.40	0	59,123.40
	F2	Non-Forest	0	0	0
Total (ha)			59,123.40	0	59,123.40

Leakage Belt – Baseline Scenario					
			Initial LU/LC class (2022)		Total (ha)
			Forest	Non-Forest	
		ID_{cl}	I1	I2	
Final LU/LC class (2051)	F1	Forest	31,573.95	0	31,573.95
	F2	Non-Forest		27,549.45	27,549.45
Total (ha)			31,573.95	27,549.45	59,123.40

In the leakage belt, it is projected that of the total of 59,123.40 hectares, 27,549.45 ha will be deforested, leaving 31,573.95 ha of forest area at the end of the period, according to projections.

Table 3.14 - 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 baseline case**			**Name**	**Trend in Carbon stock**	**Presence in**	**Activity in the project case**		
				LG	**FW**	**CP**				**LG**	**FW**	**CP**

I1/F1	*Forest*	Constant	RR, LK, PA	yes	no	no	*Forest*	Constant	RR, LK, PA	yes	no	no
I1/F2	*Forest*	Decreasing	RR, LK, PA	yes	no	no	*Forest*	Decreasing	RR, LK, PA	yes	no	no
I2/F1	Non-Forest	Increasing	RR	yes	no	no	Non-Forest	Increasing	RR	yes	no	no
I2/F2	Non-Forest	Constant	RR	yes	no	no	Non-Forest	Constant	RR	yes	no	no

3.1.4.1.4 Analysis of historical land-use and land-cover change

Deforestation mapping data provided by Mapbiomas[112] were used to analyse the history of land use changes. The main methodological steps conducted by Mapbiomas to map deforestation in the Brazilian Amazon are as follows:

Pre-processing: Landsat mosaics were generated based on specific time periods to optimize spectral contrast and help discriminate land cover and use classes. A cloud and shadow removal script that takes advantage of the Google Earth Engine (GEE) quality assessment (QA) bandwidth and median reducer was used to improve data integrity and remove pixels affected by artifacts or cloud contamination.

In Collection 7, new Landsat surface reflectance images from the USGS (Collection 2, Tier 1) were used in the classification. For each area of analysis, a specific temporal mosaic of Landsat images was constructed based on selection criteria that allowed an annual analysis and provided sufficient spectral contrast to better distinguish land cover and land use classes.

The cross-cutting themes (Pasture, Agriculture, Forest Planting, Urban Area, Coastal Area and Mining) processed the Landsat mosaics by individual scene, using a tool developed to evaluate the images individually and improve the quality of the mosaic. In the Amazon biome, each Landsat image was classified using the Random Forest algorithm and the results were reclassified to create the annual land cover and land use map.

Classification: The Mapbiomas classification scheme is hierarchical, with six Level. Each level has subclasses representing different land cover and land use categories. Random Forest and deep learning algorithms like U-Net are used for classification, with specific parameters and training samples defined for each biome and cross-cutting theme.

At level 1, there are six main classes: Forest, Non-Forest Formation, Agriculture, Unvegetated Area, Water, and Unobserved. At level 2, there are 16 classes that also combine classes from LULC. The Forest class at level 1 is divided into four subclasses: Forest Formation, Savanna Formation, Mangrove, and Sandbank Shrub Vegetation. The Non-Forest Formation is divided into

[112] MAPBIOMAS, 2022. Accessed: Dec. 10, 2022. [Online]. Available: https://brasil.mapbiomas.org/colecoes-mapbiomas-1?cama_set_language=pt-BR

wetlands, grassland formations, salt flats, rocky outcrops, other non-forest formations, and the new Sand Bench Herbaceous Vegetation class. The agriculture class is subdivided into Pasture, Agriculture, Forest Planting and Mosaic of Uses. The Non-Vegetable Area is divided into Beach, Dunes and Sand Patches, Urban Area, Mining and Other Non-Vegetable Areas. The Water class is divided into River, Lake and Ocean and Aquaculture. Farming classes go up to levels 3 and 4, with subdivisions into temporary crops and perennial crops. Temporary crops are divided into soybeans, sugar cane, rice, cotton and other temporary crops. Meanwhile, the Perennial Crop is detailed in the Coffee, Citrus, and Other Perennial Crop classes.

Post-processing:

Filters are applied to the classified maps to reduce noise and improve accuracy. These filters include gap fill to replace no-data values, spatial filter to remove isolated pixels, temporal filter to correct non-permitted transitions, frequency filter to filter out classes with low occurrence frequency, incident filter to stabilize noisy pixel trajectories, and integration of maps from different biomes and cross-cutting themes.

Map accuracy check:

Two validation approaches were adopted: comparative analysis with reference maps of specific biomes/regions and determined years, and precision analysis based on statistical techniques using independent sample points with visual interpretation throughout Brazil and throughout the series temporal.

For the analysis of spatial agreement with reference maps, each biome and cross-sectional theme carried out the analyses according to the availability of reference maps. The validation with independent points involved the visual interpretation of Landsat data, MODIS-NDVI time series and high-resolution Google Earth images (when available) for each MapBiomas class.

MapBiomas used a combination of comparative analysis with reference maps and precision analysis with independent points to validate its coverage and land use mapping product in Brazil. The results demonstrated satisfactory and stable overall accuracy over time.

From these maps, LULC maps were adapted for use in the baseline scenario. The maps below are detail of LULC historical data used in this project, according to methodology definitions:

1) Forest Cover Benchmark Map

The Forest cover during the historical period is presented in the Figure 3.15 (year 2012) and Figure 3.16 (year 2021).

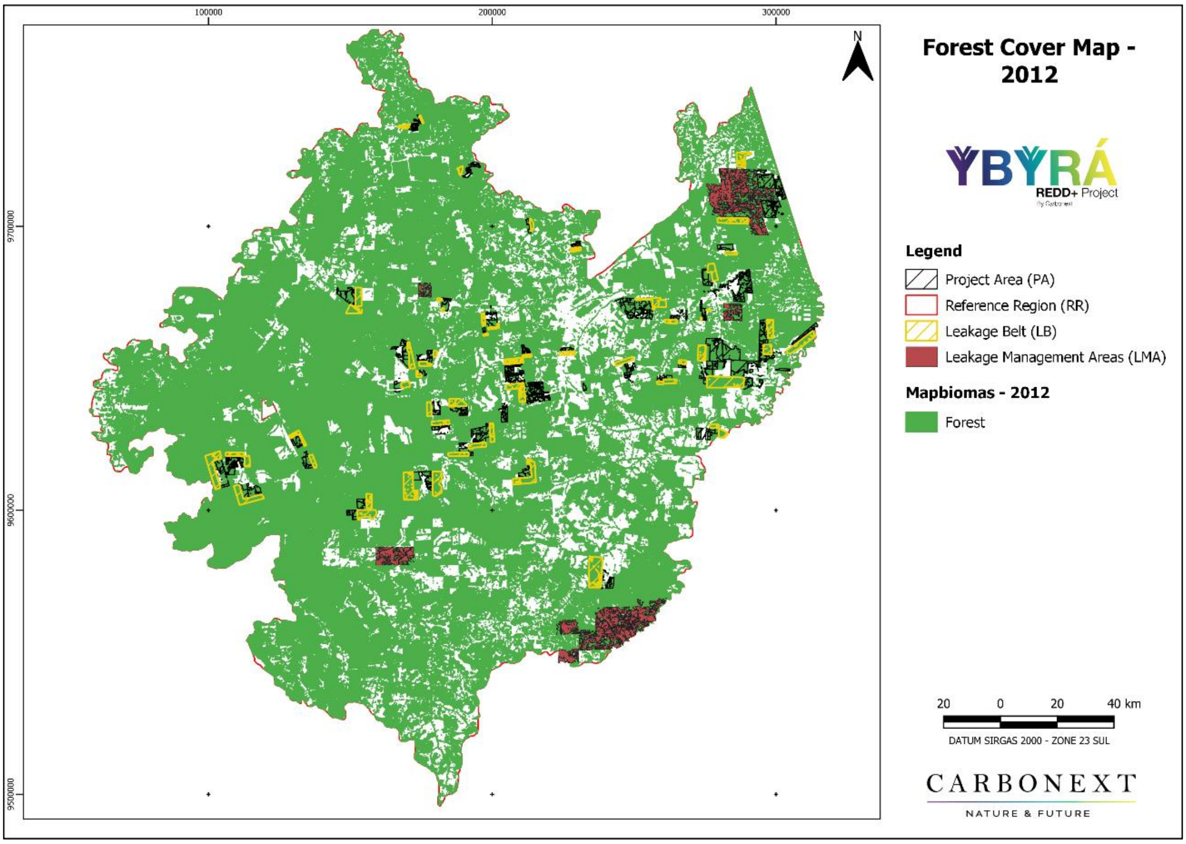

Figure 3.15.Forest Cover Benchmark Map to 2012, highlighting areas of forest (green areas) and no-forest (white areas inside RR).

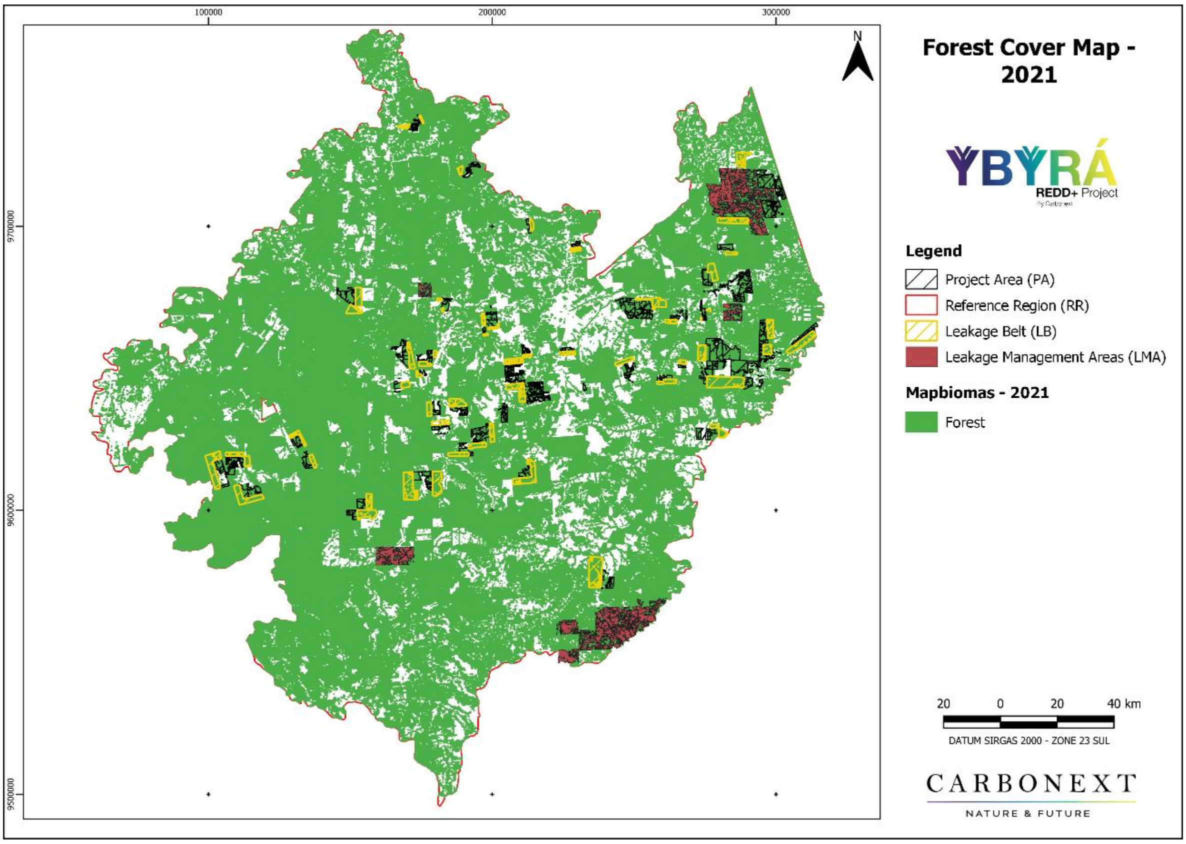

Figure 3.16. Forest Cover Benchmark Map to 2021, highlighting areas forest (green areas) and no-forest (white areas inside RR).

2) Land-Use and Land-Cover Map

The Figure 3.17 shows the classes of use land and land cover, according defined in reclass of Mapbiomas data. The forest class was separated in 5 forest types according IBGE vegetation classification: Submontane Dense Ombrophylous; Submontane Open Ombrophylous; Alluvial Dense Ombrophylous; Lowland Open Ombrophylous and Lowland Dense Ombrophylous. Other natural formations are also shown, areas of deforestation and continental waters, as well.

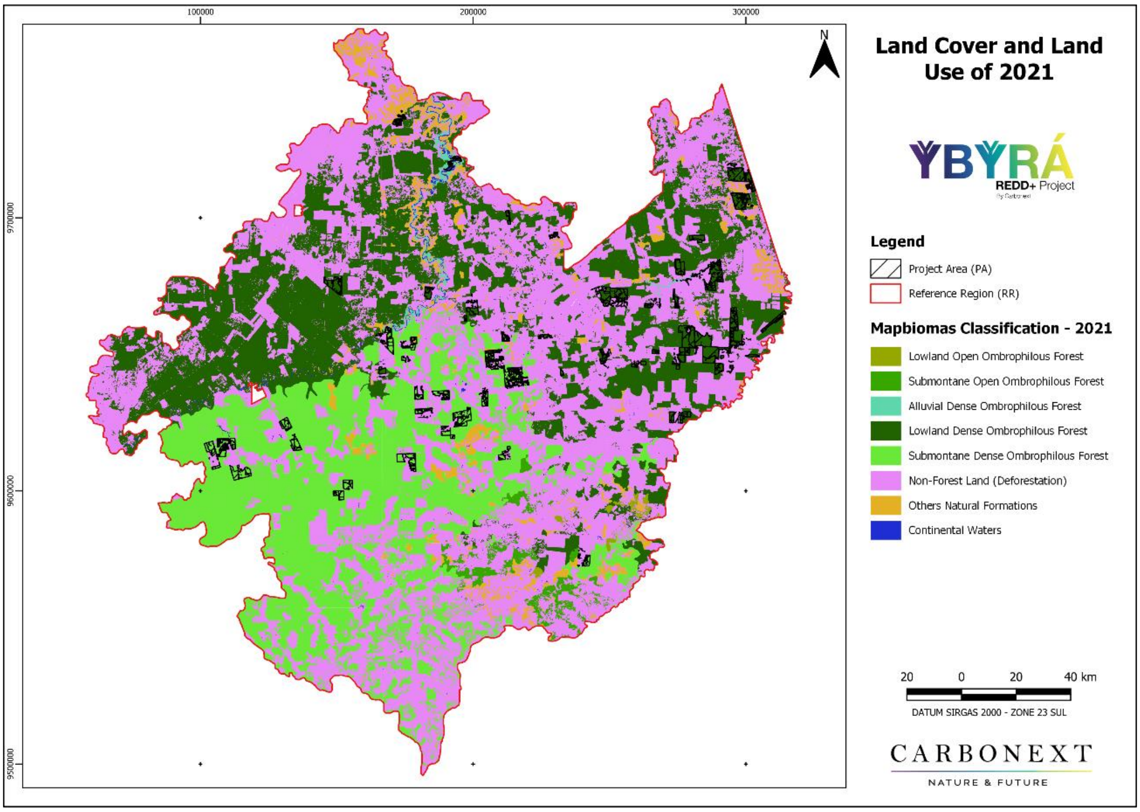

Figure 3.17. Land cover and land use of 2021 (last year of historical period analysis).

3) Deforestation Map

The Figure 3.18 presents the deforestation areas, separated by year from its detection.

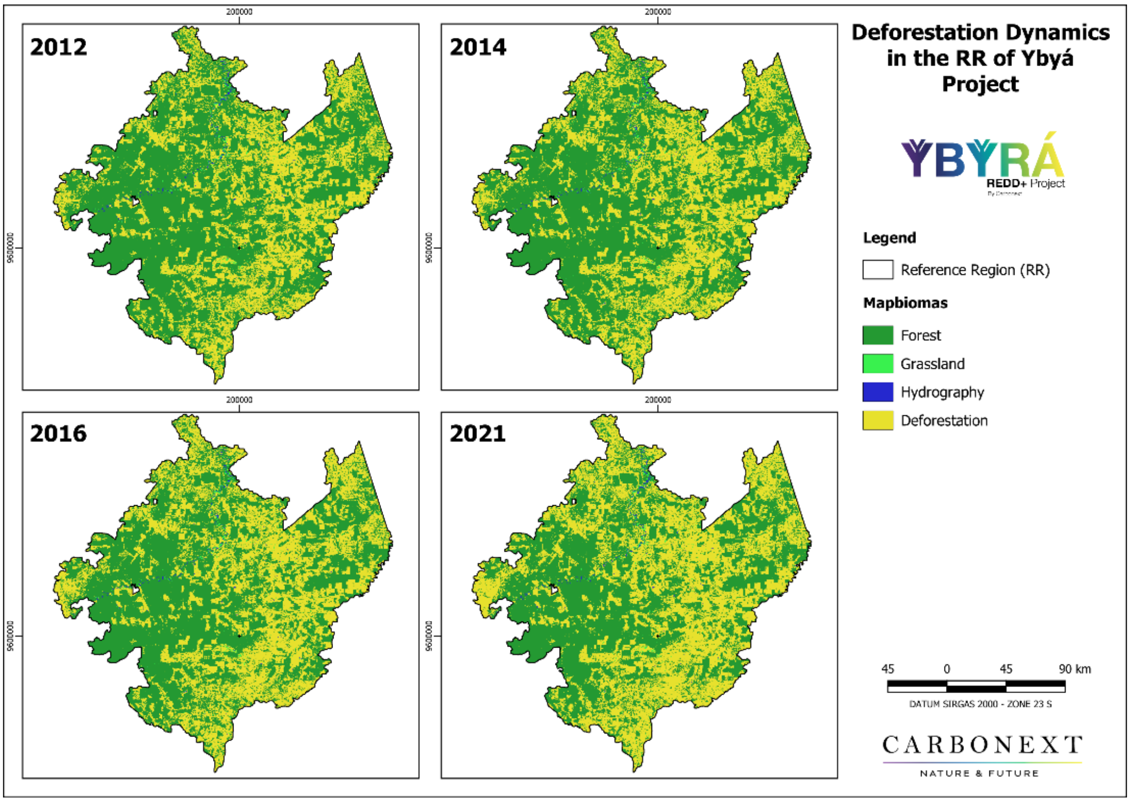

Figure 3.18.Deforestation accumulated in the RR in the historical period.

4) Land-Use and Land-Cover Change Map

It was maintained the deforestation separated by detection year and it was included the other uses and cover classes previously defined, like forest, other natural formations and continental waters (Figure 3.19).

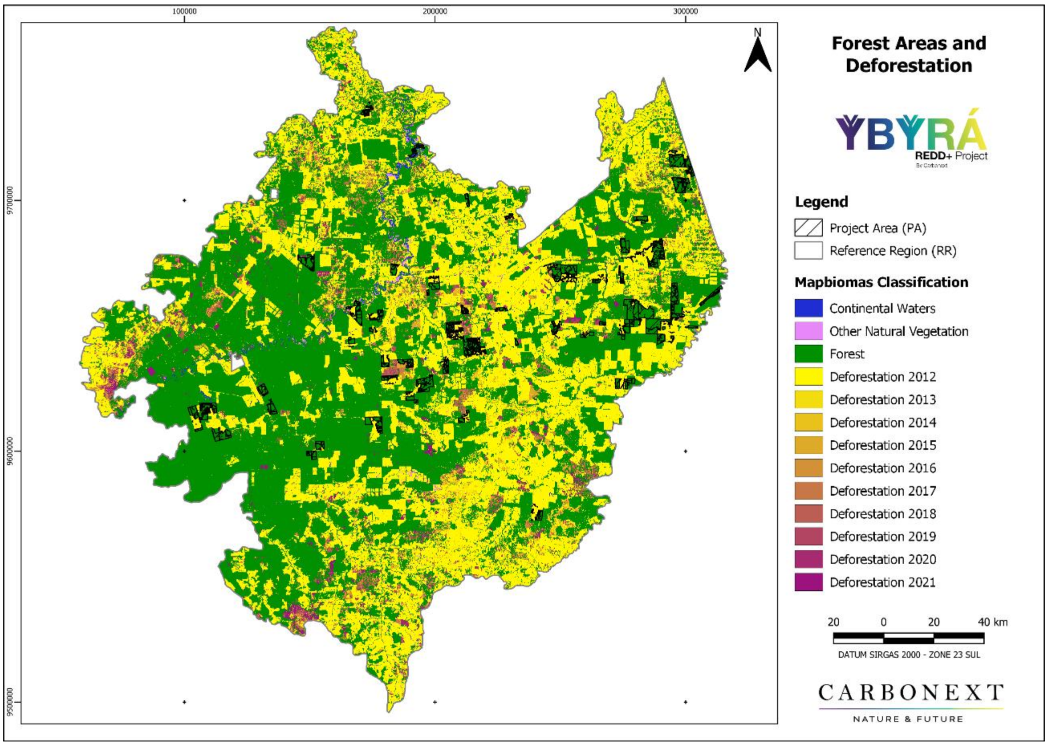

Figure 3.19.Forest areas and deforestation in the RR during the historical period.

5) Land-Use and Land-Cover Change Matrix

The table bellow presents the matrix of the land-use and the land-cover for the project.

Table 3.15 - Land-use and land cover chance matrix of historical period.

Historic LULC Matrix					
			Initial LU/LC class (2012)		Total (ha)
			Forest	Pasture	
		ID_{cl}	I1	I2	
Final LU/LC class (2021)	F1	Forest	1,838,916.90	0	1,838,916.90
	F2	Pasture	407,945.25	1,253,281.59	1,661,226.84
Total (ha)			2,246,862.15	1,253,281.59	3,500,143.74

STEP 3: ANALYSIS OF AGENTS, DRIVERS AND UNDERLYING CAUSES OF DEFORESTATION AND THEIR LIKELY FUTURE DEVELOPMENT

3.1.4.2 Identification of agents of deforestation

The following information is provided for the identified agent of deforestation:

- Name of the main agent: Cattle Ranchers

  Description of the main features of the main agent of deforestation: Cattle ranching (pasture) is usually financed by initial capital obtained in wood logging. The pasture implementation is possible after the clear-cutting forests which occurs following the timber extraction. 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. 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 (Figure 3.20). According to the last land use map by Mapbiomas[113], the states with the largest pasture area are Pará (21.5 million hectare), Mato Grosso (21 million) and Minas Gerais (19.3 million).

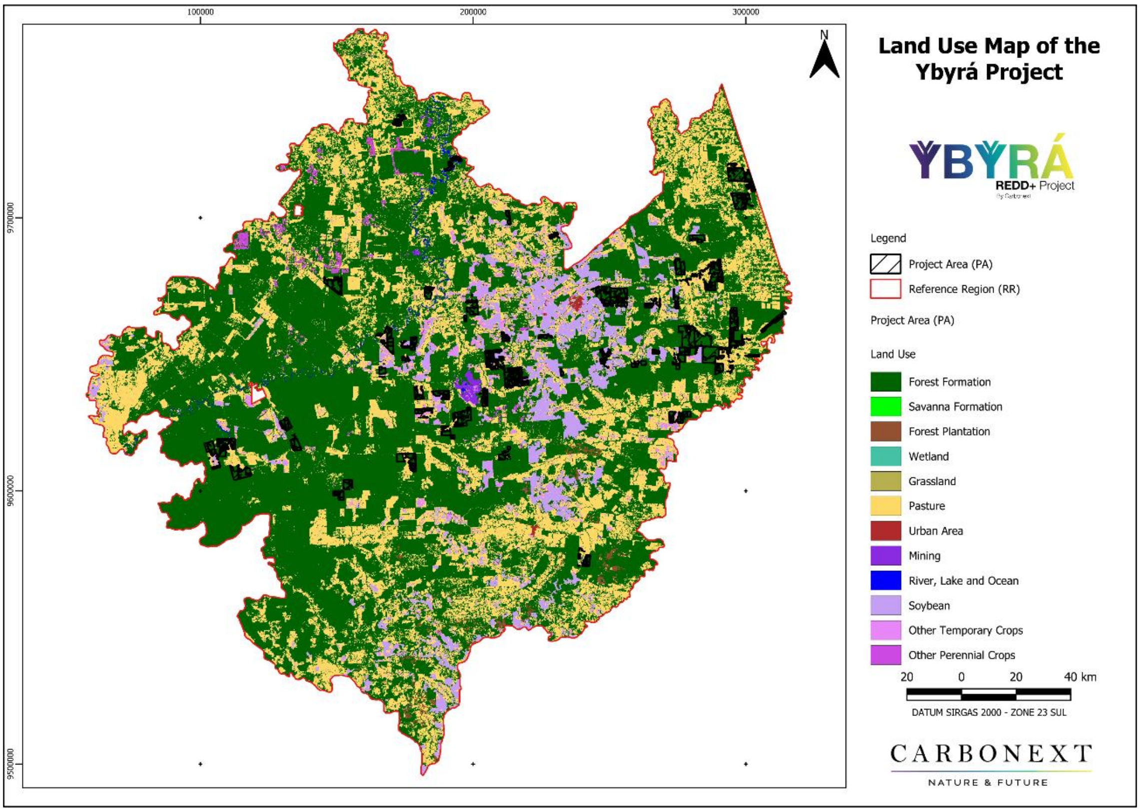

Figure 3.20.Land use and land cover in the RR, from the classes of Mapbiomas project.

113 MAPBIOMAS https://mapbiomas.org/estatisticas

3.1.4.2.1. Identification of deforestation drivers

In this step, the land-use decisions drivers are analysed to identify the immediate causes of deforestation. For this analysis, two sets of driver variables are distinguished:

1) Driver variables explaining the quantity (hectares) of deforestation:
Cattle prices:

According to CEPEA (2022)[114], the price of cattle increased 257% over the 2012 to 2022 period. Young (1998) as cited in Rivero et al. (2009)[115], 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.[116] 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. The main factors are: Livestock tradition; Safe and fast return; Good liquidity; Market for livestock products and Socio-economic potential. If the cattle price increases, the profits obtained with pasture for cattle ranching tends to increase as well, instead of maintaining standing forests. The Figure 3.21 (CEPEA, 2022) clearly shows the increasing trend of cattle prices over the years.

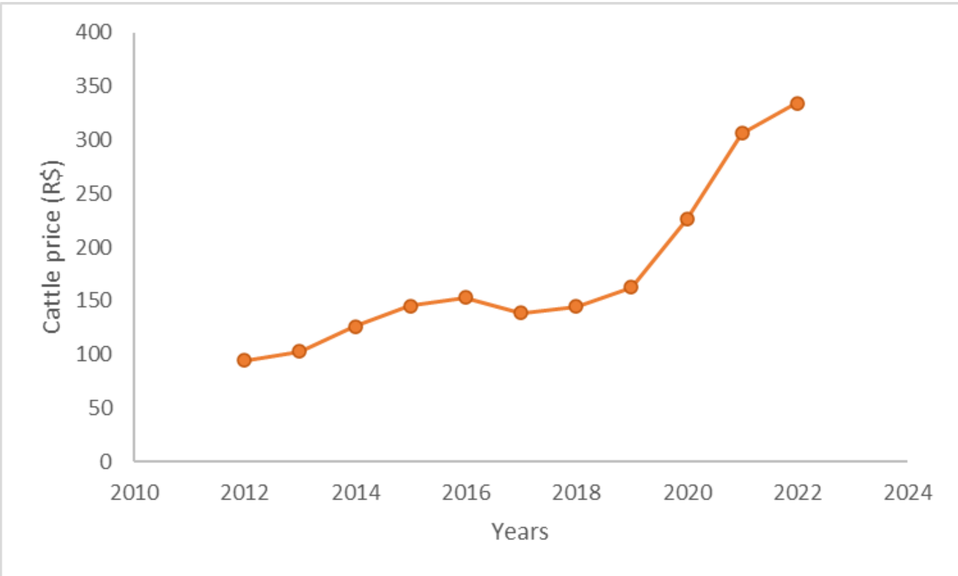

Figure 3.21 - Cattle price in Brazil l (CEPEA, 2022).

[114] Source (accessed: 16/03/22): CEPEA, https://www.cepea.esalq.usp.br/br/consultas-ao-banco-de-dados-do-site.aspx.
[115] Young, C. Public policies and deforestation in the Brazilian Amazon. *Planejamento e Políticas Públicas,* IPEA, n. 18, 1998. In: Rivero et al. **Pecuária e desmatamento: uma análise das principais causas diretas do desmatamento na Amazônia.** https://doi.org/10.1590/S0103-63512009000100003. Available on: https://www.scielo.br/j/neco/a/jZHjd9B8ZghY7tG9G7qchTk/
[116] VEIGA et al. (accessed: 15/06/22 https://ainfo.cnptia.embrapa.br/digital/bitstream/item/84029/1/9-4.pdf).

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 the Cattle-price driver. According to Imazon[117], there is a tendency to increase the cattle in the Amazon region for the future due to several factors including control of “foot and mouth disease”.

2) Driver variables explaining the location of deforestation (“predisposing factors”)

a) 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[118]). 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, the PA-256 and BR 010 highway are the main access between the municipalities, and the Capim River is an important navigable river in the region.

The Mongabay article[119] mentioned that constructions of roads - legal and illegal constructions i-are an important deforestation driver. The article mentions that the 2,234 km paving of the Transamazon Highway promotes the deforestation of 561,000 hectares. In terms of impact on biodiversity, water, carbon storage and integrity of protected areas, BR-163, BR-230 and BR-319 would cause the most significant damage to the environment, according to the study. The paving of 496 km of BR-163 would generate 400 million tons of carbon dioxide emissions by 2030. Considering the common practice of constructions irregular roads, it is unpredictable to know the number of new illegal construction in the future, but certainly the roads increasing is tendency in many municipalities of the Amazon.

The monitoring and surveillance in the PA of the YBYRÁ REDD+ Project will protect the forest area thus preventing the construction of illegal roads in the properties.

b) Proximity to forest edges:

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,

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[117] https://imazon.org.br/pecuaria-na-amazonia-tendencias-e-implicacoes-para-a-conservacao-ambiental/#:~:text=A%20pecu%C3%A1ria%20mais%20produtiva%20dessa,%C3%A9%20a%20aus%C3%AAncia%20de%20geadas.

[118] Source (accessed 16/03/21): Imazon, https://imazongeo.org.br/

[119] https://brasil.mongabay.com/2022/10/rede-de-estradas-espalha-arterias-de-destruicao-por-41-da-amazonia-brasileira/

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[120]; ROSA et al. 2013). According to ROSA et al. (2013)[121], deforestation is spreadable, such that local deforestation rates increase over time if adjacent locations are deforested, influencing in the increase of deforestation. The monitoring and surveillance in the PA of the YBYRÁ REDD+ Project will protect the forest area thus preventing the construction of illegal roads in the properties.

3.1.4.2.2 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:

1) Land-use policies and their enforcement; and
2) Poverty and wealth.

Land-use policies and their enforcement

Land-use policies and their enforcement: As previously mentioned in this PD, despite 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. 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 (IPAM, 2011). Analysis of land use, based on Mapbiomas data, indicates that the cumulative deforestation in the reference region from 2012 to 2021 was to 407,945.25 hectare.

The problem of lack of command-and-control measures to contain deforestation in the Amazon Biome is a widespread issue, which has been getting continuously worse, 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

[120] Laurance, W.F. Changing Drivers of Deforestation and New Opportunities for Conservation. 2009. https://doi.org/10.1111/j.1523-1739.2009.01332.x. Available on: https://conbio.onlinelibrary.wiley.com/doi/abs/10.1111/j.1523-1739.2009.01332.x.
[121] Rosa, IDM et al. Predictive Modelling of Contagious Deforestation in the Brazilian Amazon. 2013. https://doi.org/10.1371/journal.pone.0077231. Available on: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0077231.

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[122] created alert tool that monitors inspection data with the issuance of suppression authorization, the latest data show that more than 99% of deforestation has at least one irregularity index associated.

The lack of law enforcement, consequence of the lack of personnel and infrastructure, schemes of corruption and violence established by illegal agents, in addition to the vast dimensions of land in the region and its low demographic density, has no direct influence on cattle prices, but it does have direct influence on the expansion of illegal deforestation and construction of roads, since the surveillance of the legal authorities is insufficient and has been shown to be ineffective.

The project, although it can propose improvements, cannot interfere in public security policies. Given so, the project can act to supply the lack of action from legal authorities in the project area. The Project Area Monitoring will be enhanced with securities trained, maintenance of their equipment and means of transport, reinforcement and maintenance of the fences, remote monitoring by satellite images, incentive community engagement, and others. This allows the project proponents to identify any illegal trespassing and deforestation and take rapid action.

Since the start date, the area is being protected by many actions, cited below:

a. Reinforcement of surveillance and security of the project area, to inhibit illegal agents.
b. Remote sensing monitoring using the Carbonext system MonitoraCarbon™ (more details on item 3.3.3.1.1) which detects probable changes in land cover with a maximum frequency of 7 days, triggering alerts for monitoring teams to check and take necessary actions to contain the deforesting agent.
c. Implementation of terrestrial patrols carried out continuously by trained personnel, using appropriate vehicles, to inhibit illegal agents and to allow rapid detection of illegal activities.
d. Development of environmental education and sustainable practices activities to be implemented during the project lifetime, creating "Environmental awareness" within the population.

Poverty and wealth

The poverty and the need to find a source of income is an important underlying cause of deforestation. In 2021, the North region of Brazil had the highest proportions of poor people (44.9%) in their population[123]. In this scenario, the illegal exploration and wood commercialization

[122] https://plataforma.alerta.mapbiomas.org/monitor-da-fiscalizacao.
[123] Nível de pobreza no Brasil bate recorde, segundo IBGE – DMT – Democracia e Mundo do Trabalho em Debate (dmtemdebate.com.br)

can be an attractive alternative. Also, the price of cattle has increased significantly in the last decade (more details on topic 3.1.4.2.2), which can also encourage illegal deforestation to sell wood products and turn the forest into pasture.

Poverty and wealth bring a vulnerability situation, inducing the necessity to find other income sources, such as illegal exploration of the forest products and wood. Thus, the higher the poverty and vulnerability situation, the biggest is the necessity to reach for other income sources.

The economic crisis is more intense in the Northeast (-12.5%) and North (-9.8%)[124] of Brazil. Almost 63 million people living in poverty in Brazil in 2022[125]. Aiming to mitigate this underlying cause, the project is implementing different actions with the surrounding communities, with the objective to encourage the communities to get empowered to claim for their legal rights and with activities aiming important points of vulnerability identified on the socioeconomic diagnosis. Some of them cited below (more details on topic 4.1.1):

- Trainings on multiple topics (sustainable practices, fire brigade, capacity, implementation of agroforestry systems and professionalizing courses);
- Association regularization and sociativism;
- Environmental education activities;
- Trainings, events and lectures directed exclusively to women;
- Workshops on motivation of the rural work, and others.

3.1.4.2.3. Analysis of chain of events leading to deforestation

As presented in the items above, the analysis of chain of events leading to deforestation shows that the main agent group, key drivers and underlying causes of deforestation are closely related. The poverty and wealth disparities in the north of Brazil, especially in the Amazon region, influence directly in the demand for better life, thus promoting cattle raising an interesting and attractive activity, rather than gaining nothing with the forest preservation. In this sense, the forest dependency increases as far as the vulnerable population distances from the urban centers increases.

As consequence, the access to forests and proximity to forest edges increases leading directly to deforestation by the cattle ranchers and land grabbers, interested, as presented before, in exploring the forest to transform into economic earnings and power in the region. The weakened

[124] Nível de pobreza no Brasil bate recorde, segundo IBGE – DMT – Democracia e Mundo do Trabalho em Debate (dmtemdebate.com.br)
[125] Mapa da nova pobreza: Estudo revela que 29,6% dos brasileiros têm renda familiar inferior a R$ 497 mensais | Portal FGV

policies and enforcement of the law facilitates this process of deforestation, chiefly pressed by power and money in the region.

3.1.4.2.4. 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.

The deforestation data observed during the historical period supports the analyses of the chain of events leading to deforestation. When observing the deforestation pattern, the trend is to increase. According to the methodology, when the data is conclusive and the trend is increasing, one should proceed to step 4 for selecting the baseline approach, which, for this project, was "a". (Step 4.1.1 of the VM0015 methodology: Selection of Baseline Approach).
more details in the item 3.2.1.1 Projection of the quantity of future deforestation.

3.1.4.2.5. 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 Mapbiomas[126] database and the details are presented in item 3.2.1.

In the absence of the REDD project, it is assumed that the properties would certainly undergo the same deforestation intensity as other neighbouring lands, specially under pressure of invasions and illegal logging, for example, as the situation of the indigenous land Amanayé/Sarauá. There is more information about the conflict in the area, in sector 2.5.6.

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.

[126] https://mapbiomas.org/

Fossil fuel emissions were not accounted for in the Project Area (baseline case) or for the Project Activity because they are assumed to be 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 YBYRÁ REDD+ Project are presented in table 42, 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 statement: "The project activity does not lead to violation of any applicable law, even if the law is not enforced." 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 into one scenario. The components of Scenario 1 can be described under the following categories:

Sustainable Forest Management Plans (SFMPs).

Considering all the 74 properties of the project, only 12 have been considered to practice SFMPs, because of forestry carried out in the past or have documentation/authorization for the present and future. No other farms have documents that show intention to implement SFM in their areas. With the implementation of the project, no SFM will take place in PAs, as described in signed contract by the proponents. Financial resources from forest management activities maintain the management of rural properties. According to the analyses, SFMP income is less attractive than livestock production. In addition, 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, that can take up to almost 8 months to obtain. Considering that sustainable forest management actions take place in the dryer 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 authorization 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 labour and machinery for the execution in time.

To calculate the estimation of forestry activity in the 30- year-lifetime of the project, the 12 properties with authorization and that have already managed their areas and have evidence of this activity have been considered by conservatisms, since it is not sure that these properties will continue the exploration in these areas. The list of the properties is presented in table 3.16.

Table 3.16 - Properties of the YBYRÁ project with sustainable forestry management.

ID	Property	Forestry management year	Cutting cycle (years)	Year of projection of forestry until 2051
1	Maçaranduba farm	2022	35	-
2	Zinkas I farm	2022	25	2047
3	São Pio farm	2021	25	2046
4	Paraíso farm	2019	Considered 30	2049
5	Bem-te-vi farm	2021	25	2046

6	Vinte de maio farm	2010	Considered 35	2045
7	Teolinda I farm	2022	Considered 25	2047
8	Estrela do Norte farm	2022	Considered 25	2047
9	Sossego farm	2008/2012/2016	Considered 35	2043/2047/2051
10	Santa Carmen farm	2021	Considered 30	2051
11	Santa Célia farm	2018/2019/2021	25	2043/2044/2046
12	Santa Maria do Acará farm	2020	Considered 30	2050

In Brazil, the Sustainable Forestry Management must follow the federal normative n° 5, of the 11th of December of 2006[127]. These normative states that the cutting cycles must respect determined volume of extraction of wood. The table 3.17 presents the cutting cycles and respective allowed volume for exploration.

Table 3.17 - Maximum timber volume allowed in each cutting cycle according to IBAMA (federal normative n° 5).

Cutting cycle (years)	Maximum Timber Volume (m^3)
35	30
30	25.71
25	21.43

Each farm must specify their own cutting cycle in each SFMP or POA document. For the farms that did not specify the cutting cycle, the projection of SFM in the properties considered the most conservative approach, considering the highest value of volume that could be extracted in the 30-year life of the YBYRÁ REDD+ Project. In addition, to be conservative as well, the 12

[127] www.ibama.gov.br/sophia/cnia/legislacao/MMA/IN0005-111206.PDF. Available in PDF.

farms have been considered that will execute their full cutting cycle planned for the next years, with maximum volume, even though it is not known if this will become true in the future.

All the analysis can be verified in the document: "Additionality & NPRR – YBYRÁ" that will be available for the audit consultation, that contains all specific information about activity costs, maintenance expenses, total expenses, activity revenue and annual profit which are detailed in the financial analysis spreadsheet[128].

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: Considering the 74 properties involved in the YBYRÁ REDD+ Project, 62 properties have no economic activity in the project area, generating no income, with a 100% loss rate, and display negative profit ratios and IRRs. In the analysis, it was considered costs with maintenance of private roads between some property's complexes, infrastructure of the farms and at least 1 fixed employee for the properties with infrastructure, by conservatisms.

The scenario 1 also considers the common practice of the region, which is invasion of private lands and deforestation for implementation of other land-use activities since the rural properties are under invasion and deforestation pressure. The profit of these illegal activities following the invasions is not related in any way to the property's owner, since it is considered illegal invasion by third parties.

Scenario 1: Continuation of pre-project land-uses was included in accordance with VT001 tool requirements.

ii) SCENARIO 2: Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project:

The same categories of activity as mentioned under Scenario 1 were considered, however, the costs for REDD+ monitoring, CBB actions and other projects activities' implementation were added to create scenario 2, as project activities. Therefore, the elements of Scenario 2 were defined as follows:

Sustainable Forest Management Plans (SFMPs): as presented in scenario 1 above.

No activity: as presented in scenario 1 above.

REDD implementation with CCB shares, and monitoring costs: Costs with farm employees training and expenses with surveillance and security, terrestrial monitoring, implementation of actions to benefit community, biodiversity and climate regulation, and other project activities

[128] Calculations available in spreadsheet: Additionality & NPRR – YBYRÁ.

were added in to the 30-year cashflow. More details can be assessed in the Additionality Analysis Document.

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.

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.

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"*** and ***"ii"***, described above.

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

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 11th, 2006, establishes the technical procedures for the preparation, presentation, execution, and technical evaluation of sustainable forest management plans.

To carry out sustainable forest management, the landowners have the forest management plan and authorization documents provided by the state of Pará, 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 existing sustainable forest management plans of the properties involved in the YBYRÁ REDD+ Project are available for the auditors.

The unplanned invasion of private lands and implementation of other land use activities in the properties by external agents is illegal, not in compliance with all mandatory applicable legal and regulatory requirements, as it results from systematic lack of enforcement of applicable laws and regulations. However, it is important to emphasize that this situation does not concern with the proponents and landowners, as it was previously explained in item 2 of this PDD that illegal invasions of private areas is common practice of the Amazonian region.

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[129]. 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[130].

The common practice for private properties in the region is to be invaded by third parties, due to lack of efficient monitoring, security, law enforcement and control. Thus, encouraging invaders and land grabbers to perform 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 implementation of pasture to 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 invaded the Oriente Farm (in the region of Paragominas). Currently is the property under ownership repossession and land tenure conflict. The community Oriente is in the project region but was excluded from project activities due to this conflict.

Outcome of the Sub-step 1b: It has been demonstrated that scenarios "***i***" and "***ii***" are plausible alternative land use scenarios to this VCS AFOLU project activity. The implementation of YBYRÁ REDD+ Project brings project activities to monitor the area, per satellite, by land with the hiring of specialized third-party company to monitor the properties with motorized cars/motorcycles with established frequency (as mentioned in section 2.1.11 and 2.1.13, and will be described in section 3.3.3). The project activities also aim to reduce invasions and deforestation bringing trainings, environmental education activities and income enhancement opportunities through the work with the communities surrounding the forest areas near the project. Thus, the proposed VCS AFOLU project activities are not common practice in the region of deforestation of forest area, being additional.

Sub-step 1c. Selection of the baseline scenario:

Outcome of sub-step 1c: 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 (more details are presented in section 2.2 and 3.1.4 of this PDD).

[129] Available on: http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/rates
[130] Available on: 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/

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 Carbon credits is economically or financially less attractive than at least one of the other land use scenarios". The investment analysis was applied.

Sub-Step 2a. Determine appropriate analysis method:
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 carbon credits is far less economically attractive than the baseline scenario. Evidence of all the estimated data in each scenario is available to the auditors. The Internal 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 and 2 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.

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: 2.43%), and with project activities implemented without VCU revenues (Scenario 2 – IRR: 1.73%).

SCENARIO 1

For this scenario, it was considered the annual permissible exploitation yield of each of the 12 properties with SFM and its projection until the end date of the project (in 2051), based on the documents presented by the landowners. The estimation can be consulted in the document "Additionality & NPRR – YBYRÁ", available for the audit. The table 3.18 shows the maintenance costs involved on the pre-project scenario, the IRR and the NPV values over the 30-year project lifetime. The whole analysis is available at document "Additionality & NPRR – YBYRÁ**"** for auditors, together with all specific information and references on activity costs, maintenance expenses, total expenses, activity revenue and annual profit[131]. All information used to prepare this financial analysis was provided by the owners of the farms and will be available to auditors.

Table 3.18 - Financial Scenario 1.

SCENARIO 1 - Pre-Project	
Total costs (R$)	88,794,445.87
Total revenue (R$)	148,094,522.98
Total profit (R$)	59,300,077.11
Net Present Value - NPV (R$)	10,679,675.78
IRR (%)	2.51%

SCENARIO 2

For this scenario, it was considered the same information considered for the scenario 1 above. In addition, for costs, it was considered: the 1) implementation and maintenance of specialized security company for surveillance and security of the project areas and expenses to maintain terrestrial and satellite monitoring that include fuel, communication system, technical repairs, and maintenance; 2) annual fire brigade training; 3) project activities implementations and CCB actions.

Considering all these costs mentioned above, the calculated IRR and NPV for the scenario 2 over the 30-year project lifetime is present in the Table 3.19. The projection is available at document "**Additionality & NPRR - YBYRA"** available for auditors, with all specific information

[131] Calculations available in spreadsheet: " *Additionality $ NPRR – YBYRÁ"*

about activity costs, maintenance expenses, total expenses, activity revenue and annual profit[132].

All information used to prepare this financial analysis was provided by the owner of the farm and will be available to auditors.

Table 3.19 - Financial Scenario 2.

SCENARIO 2 - With Project	
Total costs (R$)	100,966,742.65
Total revenue (R$)	148,094,522.98
Total profit (R$)	47,127,780.33
Net Present Value - NPV (R$)	6,790,107.49
IRR (%)	1.84%

Comparatively, scenario 2 has lower IRR values than scenario 1, showing that the costs to implement and carry the project activities is much higher than without the project, in scenario 1, and the revenues would decrease substantially, hence the scenario 2 is less financially attractive. It is important to emphasize that for conservatisms and practical reasons, the revenues of SFM activity in the 12 farms of the project was distributed to the other farms, that however have no activities in the properties, gaining no revenues. For these farms, it is even more financially unattractive to implement actions of the proposed AFOLU project.

In conclusion, it is impracticable to maintain and sustain the monitoring, security, and integrity of the forest areas inside the project areas without the carbon credits investments, thus being financially unattractive to implement project activities to protect and monitor the forested areas. The profitability of cattle ranching linked to the sale of illegally harvested timber drives to land invasions since it is a profitable option for external agents, and consequently causes illegal deforestation. Then in a scenario with the sale of carbon credits, there is a reduction of financial risk for the landowner, which consequently encourages the continuation of project actions such as monitoring the area, internal training, and socioenvironmental and biodiversity activities.

Sub-step 2d: Sensitivity analysis

The sensitivity analysis was included, to evaluate whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The complete analysis can be consulted in the document" Additionality & NPRR – YBYRA", available for the VVB. The rational is: 1) to see how much the value of the wood obtained in the forestry must increase to became financially more attractive than VCUs issuance with the implementation of the project, and 2) how much the cost in the production must decrease to became financially more attractive.

[132] Calculations available in spreadsheet: " ***Additionality & NPRR*** **– YBYRA"**

According to the sensitivity analysis, the price of the wood that is obtained by the SFM must increase in 126%, in other words, more than double so the project activities without the VCS credits can be considered financially attractive. Nevertheless, considering the values obtained by official data from SEMAS and SISFLORA[133], from 2010 to 2016 the price of wood in Paragominas did not vary significantly. In fact, the value of the round wood in Paragominas, Tomé-Açu and Ipixuna do Pará only decreased (IBGE) (Figure 3.21).

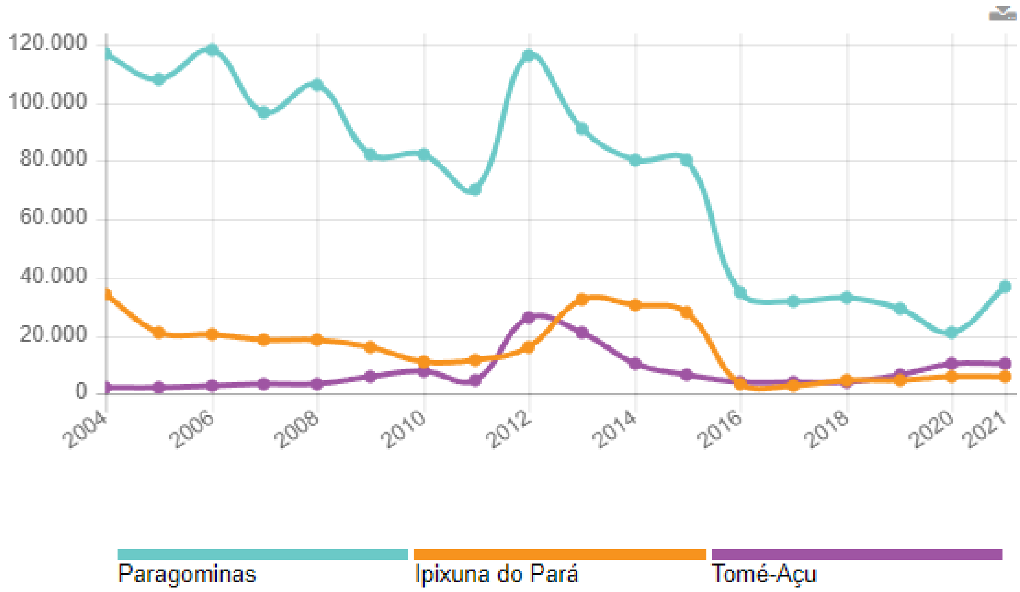


Figure 3.21. Variation of the value of production of round wood in the 3 municipalities of the project, showing reduction in price value. Source: Graphic generated by IBGE[134].

As per the costs, to the project activities to be financially attractive to its implementation without the VCS credits, the costs of production must reduce in 31% without interference in the volume produced.

In conclusion, the proposed VCS AFOLU project, without the financial benefits from the VCS, is unlikely to be financially attractive to the proponents, thus it would not be implemented without the credits.

STEP 3. Barriers analyses

Barrier analysis is performed as an extension of investment analysis, considering barriers of prevailing practice.

Sub-step 3a. *Identify barriers that would prevent the implementation of the type of proposed project activity*

[133] http://monitoramento.semas.pa.gov.br/sisflora/relatorios.html
[134] https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/16/12705?tipo=grafico&localidade1=150345&localida

For the YBYRÁ REDD+ Project, there are barriers that would prevent the implementation of the type of proposed project activities from being carried out if the project activity was not registered as a VCS AFOLU project.

According to Tool of Additionality, these barriers, for the YBYRÁ REDD+ Project, are:

a) Investment barriers;
b) Barriers due to social conditions and land-use practices:

Sub-step 3a. item I) The argumentation and evidence to demonstrate the existence and significance of the 5 barriers presented above is presented below.

a) Investment barriers:

Investment barriers exist in terms of Scenarios 1 and 2, as there are very few options for conservation of forest on private properties, above and beyond legal requirements, generating no financial returns. This can be evidenced by the number of Particular Reserves of the Natural Patrimony (in Portuguese: "Reserva Particular do Patrimônio Natural – RPPN") in the Pará state, in comparison to the protected areas such as Indigenous Land, federal and state-owned Conservation Units ("Unidades de Conservação – UCs), as shown in the table below. Considering these areas, the RRPNs represents 4.20%. If all the territory of the Pará state was considered, this proportion would be even insignificant.

Table 3.20 - Proportion of private areas protected in the region.

Conservation Units - federal (km2):	195,285.20		
Conservation Units - state-owned (km2):	204,732.10	RPPNs in Pará (km2):	283.78
Indigenous Lands (km2):	275,541.6		
Total:	**675,558.90**	**Total:**	**283.78**
Proportion:		**4.20%**	

However, regarding Cattle farming, having illegal levels of deforestation generally does not prevent this land-use scenario from obtaining funding. There are numerous funding resources and credit lines for cattle raising activities in Brazil[135]. Moreover, the implementation of cattle raising activities can be funded by initial capital obtained with timber sales after deforestation, and subsequently benefit from speculation of the value of deforested land.

b) Barriers due to social conditions and land-use practices:

This barrier hinders any compliant alternative land-use scenarios, due to widespread illegal practices, which lead to unfair competition from a great portion of regional producers and insecurity related to land tenure (trespassing by squatters). On the other hand, this factor favours cattle raising and pastureland which, as previously described, often depends on illegal practices to be financially viable. In addition to the higher economic attractiveness of land use scenarios dependent on deforestation, the additionality of the YBYRÁ REDD+ Project is reinforced by the surrounding land use and deforestation patterns, as well as by some of the regulatory aspects of the Brazilian Forest Code, as Barriers due to social conditions and land-use practices. In general terms, the Project Area suffers an ascending deforestation threat, which is evident when observing the proportion of preserved Legal Reserve areas inside the Reference Region, far under the 80% stablished by the forest code.

According to the Mapbiomas Annual Deforestation Report (2022)[136], 44% of the deforested area in the Amazon Biome is allocated inside private areas. From that data, the report examines the evidence of illegality related to each deforestation alert detected and its correspondent area, regarding the existence of authorization for suppression and overlaps with areas protected by the law, such as Legal Reserves and Permanent Preservation Areas (APP, in Portuguese). As Legal Reserves and APPs are legally not subject to deforestation, these overlaps are strong signs of irregularity.

It is obtained that there are 303,600 ha of illegally suppressed areas in overlap with Legal Reserves, which is equivalent to 70% of the total deforested area inside private land holds in the biome. The graphic below demonstrates the ascending deforestation tendency in overlap with Legal Reserves in the Amazon Biome.

[135] Sources: https://www.bcb.gov.br/estabilidadefinanceira/creditorural; https://www.bndes.gov.br/wps/portal/site/home/onde-atuamos/agropecuaria
[136] RAD2021_Completo_FINAL_Rev1.pdf

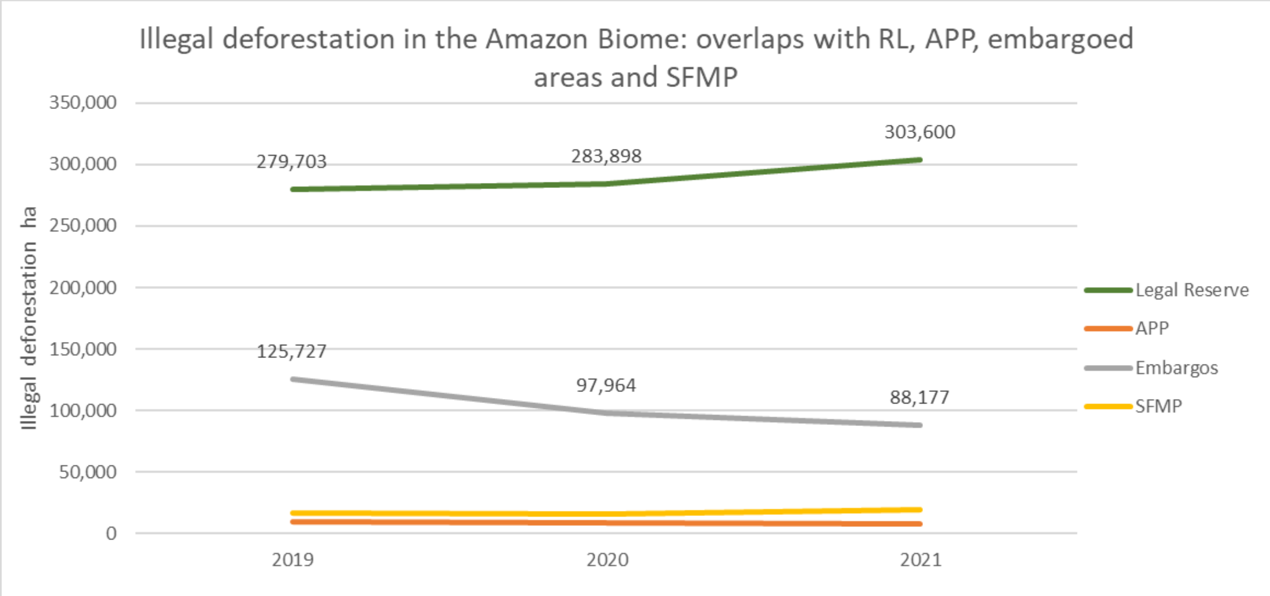


Figure 3.22 - Illegal deforestation in overlap with Legal Reserves, Permanent Preservation Areas, embargoed areas and areas subjected to SFMP in the Amazon Biome.

From the graphic it is also possible to note the overlaps with Permanent Preservation Areas (APP), alongside the rivers. For the APPs, the report uses self-declared data from SICAR, which is known to be underestimated. Even so, in 2021 there were at least 10,337 ha of deforested area inside APPs, or 2% of the total deforestation in private land holds in the biome.

As for the protected areas, overlaps with embargoed and SFMP activity areas were also analyzed. By law, it is not reasonable to issue authorizations of deforestation for land holds with embargoed areas until a definitive environmental regularization. In the case of areas subjected to SFMP activities, as those areas are licensed for forest exploration, clear cuts are forbidden at least until the management cycle is completed. These conditions indicate that overlaps in both the situations described are also a strong sign of irregularity. Either way, data from the report reveals that in 2021, 20% of the deforested area in the Amazon Biome was in overlap with embargoed areas and 5% in overlap with areas subjected to SFMP activities.

Regarding the described barriers and the general condition of non-enforcement of the law and the forest code in the region, a cultural incentive for deforestation becomes clear, apart from the economic incentives already described.

It is also important to reinforce that as non-compliance with the law in respect to the Legal Reserves disseminated in the region, it is additional to protect them, as the Forest Code itself stablishes in its Article 41[137], chapter 4:

"The maintenance activities of Permanent Preservation Areas, Legal Reserves and of restricted use are eligible for any payments or incentives for environmental services, configuring additionality for the purposes of national and international markets for certified greenhouse gas emission reductions." (Law No. 12.651/2012).

Sub-step 3b. *Show that the identified barriers would not prevent the implementation of at least one of the alternative land use scenarios (except the proposed project activity).*

As put into context above, the baseline scenario, i. e., invasion of forest areas, deforestation and implementation of pasture to cattle farming, would not be hindered or prevented by any of the barriers identified in Sub-step 3a. Thus, the baseline scenario is confirmed as the most plausible alternative land-use scenario, in the absence of the project activity.

The presented barriers associated, as low funding, the non-enforcement and non-compliance with the forest code in the region of the project, reinforce the higher attractiveness of the baseline land use scenario to the detriment of forest integrity preservation activities, such as the purposed by this project, justifying its additionality and the need for economic incentive for conservation.

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 region of Paragominas, Ipixuna do Pará, Tomé-Açú and Ulianópolis, no privative conservation reserves (in Portuguese: RESERVAS PARTICULARES DO PATRIMÔNIO

[137] http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm

NATURAL – "RPPN") were found in a ray of 70 km of the RR[138]. In this buffer, it was found just some areas defined as Private Natural Heritage Reserves (PNHR)[139], which are private domain conservation units. Considering AFOLU projects, there are only 4 AFOLU private projects registered in VERRA. The total area protected by these projects represents 4.30% of the total area of the 4 municipalities (Table 3.21), thus being insignificant and are not considered as common practice (Table 3.22).

Table 3.21 - Area (km2) of the 4 municipalities of the YBYRÁ REDD+ Project.

Municipalities	Paragominas	Ulianópolis	Ipixuna do Pará	Tomé Açu	TOTAL
Area (km^2)	19,342.57	5,088.47	5,215.56	5,145.36	**34,791.96**

Table 3.22 - Area (km2) of the AFOLU projects registered in the region.

Projects in the region	Carbono Verde AR Project	Floresta Verde REDD+ Project	Cikel	Maísa	TOTAL
Project ID	1969	1953	832	1329	-
Project type	ARR	REDD	REDD	REDD	-
Area (km^2)	391.5	545.28	274.39	287.52	**1,498.69**

In this context, it can be concluded that is not common practice in the region to conserve forested areas and to carry conservation projects of great magnitude as the one proposed by the YBYRÁ REDD+ Project, thus the project implementation is additional.

Also, the practice of legal logging is an activity that **is not common in the region** as occurs in the SFM in the 12 farms presented previously in this item**.** A study published by Imazon[140], reports that about 70% of the timber exploited in Pará from August 2017 to July 2018 was illegal, corresponding to 38,000 hectare. This study emphasizes the unauthorized logging was concentrated mainly in private areas or under dispute (76%), followed by Indigenous Lands (12%), Settlements (8%) and Conservation Units (UCs) (5%).

Therefore, considering the Amazonian context, the common practice in the region is land invasion for the illegal logging, pasture implementation and illegal use of land rights, as mentioned in the topic 2.1.6 Social Parameters.

Thus, the history of invasion in the RR, and the percentage of preserved forest areas demonstrate that the YBYRÁ REDD+ Project is additional, because it is not common practice to implement conservation projects in the region, as well as invest in security,

[138] Available on: https://sistemas.icmbio.gov.br/simrppn/publico/rppn/PA/
[139] Available on: 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.
[140] Available on: https://imazon.org.br/imprensa/imazon-avalia-exploracao-madeireira-ilegal-paraense/

surveillance, and monitoring activities in vast forested areas to avoid deforestation and land invasion by external agents.

In accordance with the financial analysis, as well as the analysis of common practices in the region, *Step 4* concludes that similar activities cannot be observed in the Amazonian region, considering the area of the 4 municipalities where the project is located, and there are essential distinctions between the proposed VCS AFOLU Project activity and other activities. The YBYRÁ REDD+ project proves not to be the baseline scenario and hence, **it is additional**.

3.1.6. Methodology Deviations

Not applicable, as there are no methodological deviations in the preparation of the PD.

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 3.1.4.

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 approach “a” has been chosen to project future deforestation, which involves estimation of deforestation from historical average.

To define approach “a”, the deforestation history in the RR was analysed (Figure 3.23).

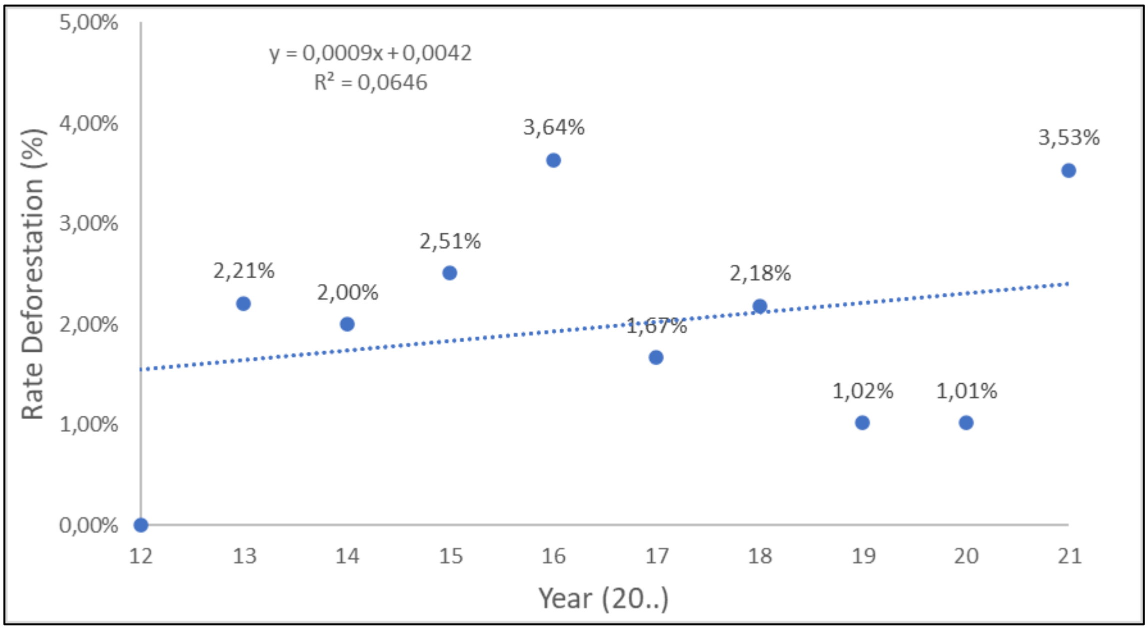


Figure 3.23. Analysis of the deforestation history in the RR for the historical period (2012-2021).

In the figure 3.23, it can be observed that the historical deforestation rate can be described by the equation y = 0.0009x + 0.0042 (with determination coefficient of $R^2 = 0.0646$). According to the GIS analysis the deforestation rate obtained with Mapbiomas data, historical period data from 2012 to 2021 indicates, increment, but the trend is not statistically significant, given that the $p > 0.05$ is not significant, therefore adopted the historical average approach ‘a”.

The Figure 3.24 presents the steps of the process for defining the approach:

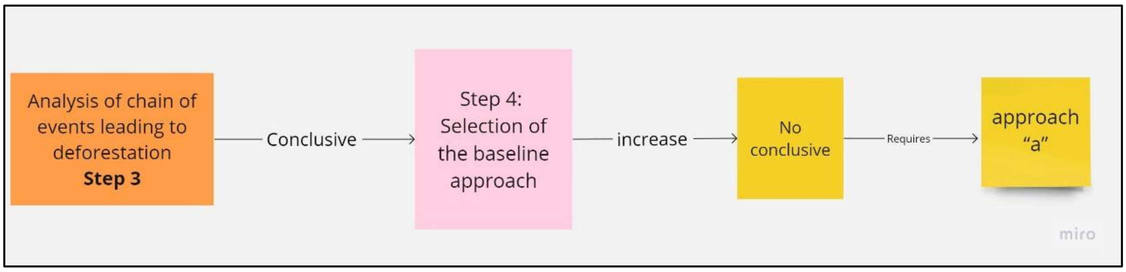


Figure 3.24.Steps of the baseline approach.

According to the methodology, when the historical deforestation rates do not reveal any trend that could explain this increment, approach “a” should be adopted. Therefore, the historical average rate was used: 2.20%. The years 2012 to 2016 were used for model calibration and the last year of the historical period for validation (Figure 3.25). From this historical average rate, the deforestation for the next 30 years was projected, from the project start date. It is important to mention that this equation was generated based on the analysis of the entire historical period, from 2012 to 2021.

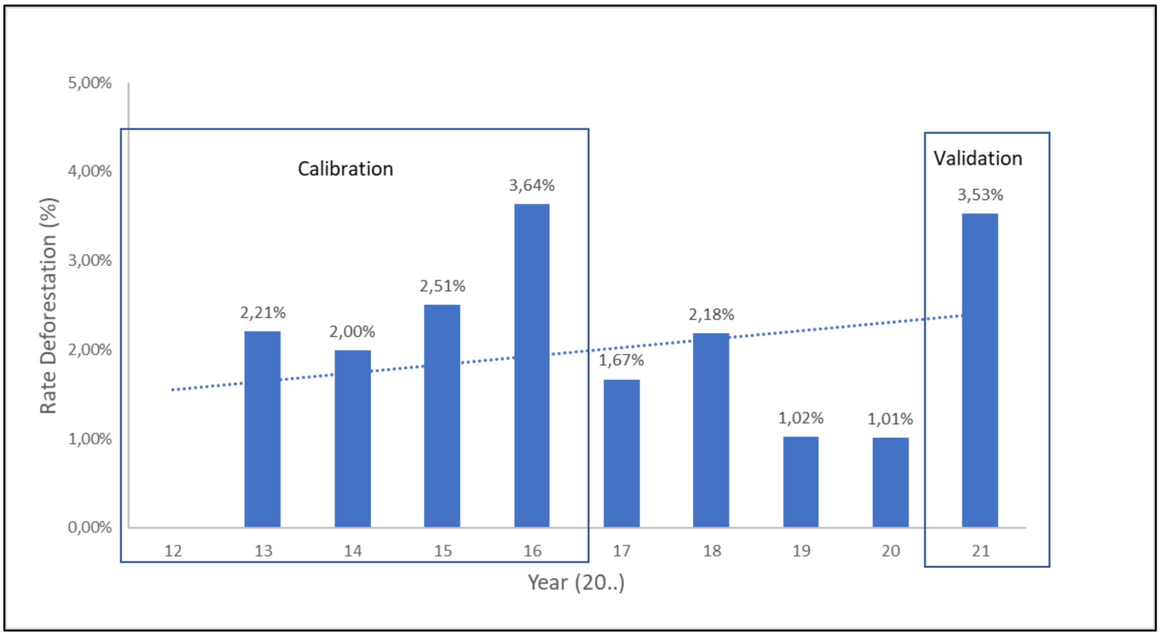


Figure 3.25. Calibration and validation period for future deforestation projection analysis.

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:

1) Preparation of factor maps.
2) Preparation of risk maps for deforestation.
3) Selection of the most accurate deforestation risk map; and
4) Mapping of the locations of future deforestation.

The Table 3.23 shows the list of variables, maps and factor maps.

Table 3.23 - List of variables, maps and factor maps (Table 10 of VM0015).

Factor Map		**Source**	**Variable represented**		**Meaning of the categories or pixel value**		**Other Maps and Variables used to create factor map**		**Algorithm or Equation used**	**Comments**
ID	***File Name***		**Unit**	**Description**	**Range**	**Meaning**	**ID**	**File name**		
1	dist_desmat_1	Mapbiomas (2012 - 2021)	meters	Distance to existing deforestation	1, 3 e 4	Values close to 4 are closer to the deforestation	1A	desmatamento_driver.tiff	ArcGis (Esri)	N/A.

2	dist_estradas_1	IBGE (2021)	meters	Distance to main roads	0 – 14,701	Values close to 0 are closer to main roads	2 A	estradas_driver.tiff	Euclidean Distance - ArcGis (Esri)	N/A.
3	dist_hidro_1	IBGE (2021)	meters	Distance to waterways	0 – 7,102	Values close to 0 are closer to waterways	3 A	hidrografia_driver.tiff	Euclidean Distance - ArcGis (Esri)	N/A.
4	slope	SRTM	degrees	Values in degrees	0-90º	Variation of Slope in the terrain	4 A	slope_driver.tiff	Euclidean Distance - ArcGis (Esri)	N/A
5	elevation	SRTM	meters	Distance to elevation	0-347	Variation of elevation in the terrain	5 A	elevation_driver.tiff	Euclidean Distance - ArcGis (Esri)	N/A
6	dist_communities	IBGE (2021)	meters	Distance to communities	0 – 32,767	Values close to 0 are closer to communities	6 A	communities_driver.tiff	Euclidean Distance - ArcGis (Esri)	N/A.

3.2.1.2.1 Definition of the Model

Future deforestation location projection was found through Dinamica-EGO software version 7.2.0. The selection for Dinamica-EGO was made the following reasons: a) it is a model available in the scientific publications of [141]Rodrigues et al. (2007) and Yanai et al. (2012); 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 were: (i) To organize maps on land use and land cover, and maps with deforestation explanatory factors; (ii) To model calibration by determining the weight of evidence and analyzing correlations between variables; (iii) To assess of model accuracy; (iv) To develop deforestation baseline scenarios. Dinamica-EGO used spatial data with 30 x 30 m pixel size, GeoTIFF format.

To develop deforestation baseline scenarios, it was considered: distance from deforestation; distance from roads; distance from rivers; distance from communities; elevation and slope to

[141] YANAI, AM; FEARNSIDE, PM; GRAÇA, PMLA; NOGUEIRA, EM Desmatamento evitado na Amazônia brasileira: simulando o efeito da Reserva de Desenvolvimento Sustentável do Juma. Ecologia e Manejo Florestal, v. 282, p. 78-91, 2012

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 six 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.

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 2012 and 2016).

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.

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 to test the independence assumption. Methods employed are the Chi^2, Cramer, the Contingency, the Entropy, and the Uncertainty Joint Information [59]. 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, all if 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 methodology, "The Prediction Map with the best fit is the map that best reproduced actual deforestation in the confirmation period. The best fit must be assessed using appropriate statistical techniques". Dinamica-EGO include in the software package appropriate assessment techniques, which can be used under this methodology. "Preference should be given to techniques that assess the accuracy of the prediction at the polygon level, such as the predicted quantity of total deforestation within the project area as compared to the observed one." Thus, in the YBYRÁ REDD Project case, the exponential decay function was used to calculate the similarity between real and projected scenarios, which is a method indicated in the Dinamica Ego software, software recommended by the methodology[142].

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. As mentioned before in item 3.1.3, the historical reference period for the baseline scenario analysis and the baseline emission calculations is from 2012 to 2021.

The accumulated baseline deforestation projected to occur within the Reference Region was 731,797 hectares over the 30-year project lifetime (Table 3.24), corresponding to an estimated average annual rate of deforestation is 24,393.23 hectare for the Reference Region.

Table 3.24 - Annual areas of baseline deforestation in the reference region (As= Submontane Open Ombrophylous; Da = Alluvial Dense Ombrophylous; Db= Lowland Dense Ombrophylous; Ds= Submontane Dense Ombrophylous) (Table 9.a of VM0015).

Year	Project year	Total - RR					
		FC 1 As	FC 2 Da	FC 3 Db	FC 4 Ds	annual $ABSLRR_t$ ha	cummulative ABSLRR ha
2022	0	670	791	16,075	9,874	27,410	27,410
2023	1	647	928	18,489	9,747	29,813	57,223
2024	2	724	926	18,699	10,062	30,411	87,633
2025	3	436	808	18,175	10,146	29,566	117,199
2026	4	514	463	18,079	10,445	29,500	146,699
2027	5	516	483	17,416	10,662	29,076	175,775
2028	6	542	707	18,144	9,158	28,551	204,327
2029	7	415	559	18,072	9,357	28,402	232,728

[142] Example of application is presented in the following article: [A hybrid analytical-heuristic method for calibrating land-use change models - ScienceDirect]

Year	Project year	Total - RR					
		FC 1 As	FC 2 Da	FC 3 Db	FC 4 Ds	annual $ABSLRR_t$ ha	cummulative ABSLRR ha
2030	8	286	293	16,535	10,200	27,313	260,042
2031	9	545	219	16,432	9,397	26,593	286,635
2032	10	463	313	16,343	9,389	26,509	313,144
2033	11	433	303	16,807	8,403	25,946	339,090
2034	12	527	385	15,258	9,392	25,563	364,652
2035	13	494	405	15,604	8,971	25,474	390,126
2036	14	402	327	15,389	8,660	24,778	414,904
2037	15	207	574	13,972	8,965	23,717	438,622
2038	16	430	349	14,182	8,545	23,506	462,128
2039	17	246	179	13,494	9,248	23,167	485,295
2040	18	500	332	13,207	9,091	23,130	508,425
2041	19	382	190	13,954	8,084	22,609	531,033
2042	20	338	214	13,170	8,314	22,036	553,069
2043	21	296	260	13,037	7,740	21,333	574,403
2044	22	472	224	12,551	7,963	21,210	595,612
2045	23	156	164	12,552	8,421	21,293	616,905
2046	24	352	218	11,945	7,381	19,896	636,802
2047	25	381	168	11,290	7,754	19,594	656,396

Year	Project year	Total - RR					
		FC 1 As	FC 2 Da	FC 3 Db	FC 4 Ds	annual $ABSLRR_t$ ha	cummulative ABSLRR ha
2048	26	317	176	11,411	7,698	19,603	675,998
2049	27	376	163	10,270	7,718	18,527	694,525
2050	28	412	39	10,503	7,523	18,477	713,002
2051	29	203	140	10,663	6,948	17,954	730,956
2052	30	21	9	812	0	841	731,797
TOTAL		**12,703**	**11,308**	**442.528**	**2265,257**	**731,797**	**731,797**

The accumulated baseline deforestation projected to occur within the Project Area over the 30-year project lifetime was estimated at 38,259.07 hectare (Table 3.25). The estimated average annual rate of deforestation is 1,275.30 hectare for the Project Area.

Table 3.25 - Annual areas of baseline deforestation in the project area (As= Submontane Open Ombrophylous; Da = Alluvial Dense Ombrophylous; Db= Lowland Dense Ombrophylous; Ds= Submontane Dense Ombrophylous) (Table 9.b of VM0015).

Year	Project year	Total - PA					
		$ABSLPA_{F1}$ FC 1 As ha	$ABSLPA_{F2}$ FC 2 Da ha	$ABSLPA_{F3}$ FC 3 Db ha	$ABSLPA_{F4}$ FC 4 Ds ha	annual $ABSLPA_t$ ha	cummulative ABSLPA ha
2022	0	0.00	11.23	1,037.42	393.25	1,441.91	1,441.91
2023	1	8.83	85.43	882.37	522.22	1,498.85	2,940.75
2024	2	11.25	76.03	1,125.67	450.30	1,663.25	4,604.00
2025	3	0.00	131.53	1,277.25	390.01	1,798.78	6,402.79
2026	4	0.19	20.94	1,426.03	477.09	1,924.24	8,327.03
2027	5	0.00	50.78	1,355.23	628.15	2,034.16	10,361.19
2028	6	0.00	114.66	958.82	528.71	1,602.20	11,963.39
2029	7	0.00	34.03	1,032.44	280.62	1,347.09	13,310.47

Year	Project year	Total - PA					
		ABSLPA$_{F1}$ FC 1 As ha	ABSLPA$_{F2}$ FC 2 Da ha	ABSLPA$_{F3}$ FC 3 Db ha	ABSLPA$_{F4}$ FC 4 Ds ha	annual ABSLPA$_t$ ha	cummulative ABSLPA ha
2030	8	0.00	40.79	1,182.76	316.10	1,539.65	14,850.12
2031	9	0.00	7.39	1,039.05	396.67	1,443.12	16,293.24
2032	10	0.00	15.52	932.72	481.66	1,429.90	17,723.14
2033	11	0.00	37.69	878.00	365.84	1,281.53	19,004.68
2034	12	0.00	54.23	918.36	165.76	1,138.36	20,143.03
2035	13	0.00	33.65	805.05	516.61	1,355.31	21,498.34
2036	14	41.50	32.87	1,070.20	392.19	1,536.75	23,035.09
2037	15	0.00	49.97	711.32	312.45	1,073.75	24,108.84
2038	16	0.00	4.59	754.98	438.99	1,198.56	25,307.40
2039	17	0.00	0.00	664.52	427.42	1,091.94	26,399.33
2040	18	0.00	14.31	856.74	352.15	1,223.20	27,622.53
2041	19	0.00	20.00	878.11	287.48	1,185.59	28,808.12
2042	20	0.00	10.07	812.19	420.14	1,242.39	30,050.52
2043	21	0.00	43.24	616.20	506.79	1,166.22	31,216.74
2044	22	0.00	16.62	527.71	197.07	741.40	31,958.14
2045	23	0.00	16.34	682.63	250.01	948.99	32,907.13
2046	24	0.00	24.34	504.34	425.65	954.33	33,861.46
2047	25	0.73	9.43	378.82	336.06	725.03	34,586.49
2048	26	0.00	8.04	784.69	186.29	979.02	35,565.51
2049	27	0.00	27.51	419.37	442.99	889.88	36,455.38
2050	28	0.00	0.00	577.68	480.06	1,057.74	37,513.12
2051	29	0.00	8.71	327.90	345.45	682.07	38,195.19
2052	30	0.00	2.40	35.90	25.59	63.88	38,259.07
TOTAL		**62.5**	**1,002.33**	**25,454.45**	**11,739.79**	**38,259.07**	

The accumulated baseline deforestation projected to occur within the Leakage Belt over the 30-year project lifetime was estimated at 27,549.45 hectare (table 3.25). The estimated average annual rate of deforestation is 918.32 hectare for the Leakage Belt Area.

Table 3.26 - Annual areas of baseline deforestation in the leakage belt (As= Submontane Open Ombrophylous; Da = Alluvial Dense Ombrophylous; Db= Lowland Dense Ombrophylous; Ds= Submontane Dense Ombrophylous) (Table 9.c of VM0015).

Year	Project year	Total - LK					
		FC 1 As	FC 2 Da	FC 3 Db	FC 4 Ds	annual $ABSLLK_t$	cummulative ABSLLK
		ha	ha	ha	ha	ha	ha
2022	0	44.00	0.14	418.92	504.46	967.52	967.52
2023	1	110.64	0.00	529.91	430.64	1,071.19	2,038.71
2024	2	78.99	9.07	627.79	231.45	947.30	2,986.01
2025	3	151.08	0.00	693.38	437.45	1,281.91	4,267.92
2026	4	80.12	2.02	602.18	365.17	1,049.49	5,317.42
2027	5	192.39	3.76	366.90	324.88	887.93	6,205.34
2028	6	29.29	7.98	504.20	543.02	1,084.49	7,289.84
2029	7	38.57	0.00	472.19	340.40	851.17	8,141.00
2030	8	19.63	9.08	512.51	544.67	1,085.89	9,226.89
2031	9	109.12	0.00	610.54	772.65	1,492.32	10,719.21
2032	10	48.84	0.00	462.09	378.31	889.23	11,608.44
2033	11	33.25	0.00	489.79	463.63	986.66	12,595.10
2034	12	44.07	1.99	395.49	491.52	933.07	13,528.17
2035	13	92.95	0.00	584.09	360.31	1,037.35	14,565.52
2036	14	38.50	0.00	559.25	265.56	863.31	15,428.82
2037	15	148.93	0.00	450.17	380.80	979.90	16,408.73
2038	16	96.86	0.00	505.02	326.37	928.26	17,336.98
2039	17	20.28	0.00	486.26	377.54	884.08	18,221.07
2040	18	83.04	2.06	244.03	401.15	730.28	18,951.35
2041	19	47.25	0.00	329.55	565.90	942.70	19,894.05
2042	20	107.20	2.14	386.61	473.77	969.72	20,863.77
2043	21	0.00	0.00	362.96	379.79	742.76	21,606.53
2044	22	84.07	23.10	374.18	361.69	843.03	22,449.56
2045	23	11.95	0.00	439.53	186.65	638.13	23,087.69
2046	24	132.53	0.00	384.50	432.32	949.35	24,037.04
2047	25	67.78	0.00	343.64	202.79	614.22	24,651.26
2048	26	93.68	2.25	255.34	398.46	749.73	25,400.99
2049	27	73.22	0.00	256.86	325.95	656.03	26,057.02
2050	28	34.73	0.00	225.51	458.02	718.26	26,775.28
2051	29	16.16	4.02	305.02	369.64	694.83	27,470.12
2052	30	0.64	0.94	29.73	48.03	79.34	27,549.45
TOTAL		**2,129.8**	**68.5**	**13,208.1**	**12,143.0**	**27,549.45**	

3.2.1.2.4 Location of future deforestation: Conclusion

The deforestation location in the Reference Region was strongly influenced by forest accessibility which contributes to the expansion and clearing of new areas in the entire region, mainly as extensions from the PA-256 and BR-010, those cross all RR area and it is the closest highways to PA area. Distance from previously deforested areas (i.e., proximity to forest edges) has also been an important deforestation driver: regions near old deforestation and communities 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 labour, which directly affects deforestation. The Figure 3.25 shows the projection of deforestation up to 2051 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 2051.

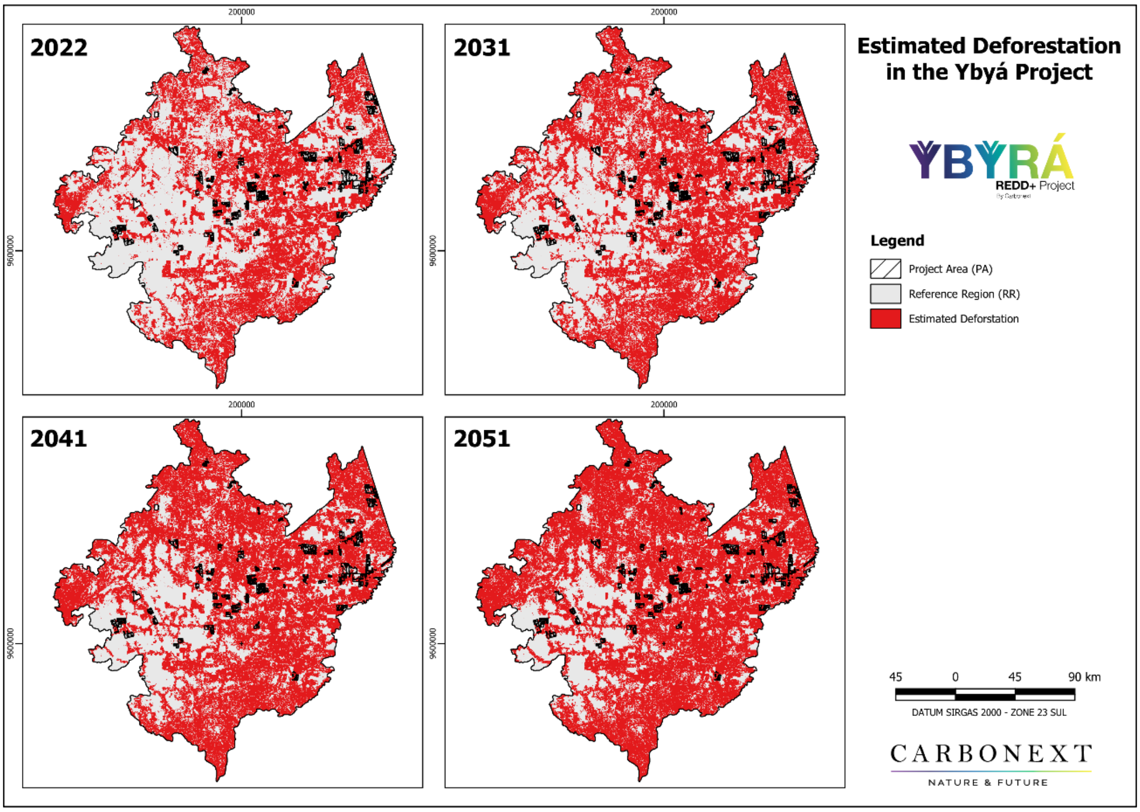


Figure 3.26. Mapping of cumulative annual deforestation projected up to 2051, covering the Reference Region and Project Area.

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 (hectares 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.

Calculation of baseline activity data per forest class

(Step 5.1) According to IBGE classification, the Project Area consists of: 60.8% Lowland Dense Ombrophilous Forest (Db); 37.4% Submontane Dense Ombrophilous Forest (Ds); 1.7% Alluvial Dense Ombrophilous Forest (Da) and; 0.1% Submontane Open Ombrophilous Forest (As). The data processing procedure in this step was the same as performed and explained in previous steps.

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

Table 3.27 - 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)

Area deforested per forest class icl within the project area							
Year	ID_{icl} >	FC1	FC2	FC3	FC4	Total baseline deforestation in the project area	
	Name >	As	Da	Db	Ds	annual ABSLPAt	cummulative ABSLPA
	Project year *t*	ha	ha	ha	ha	ha	ha
2022	0	0.00	11.23	1,037.42	393.25	1,441.91	1,441.91
2023	1	8.83	85.43	882.37	522.22	1,498.85	2,940.75
2024	2	11.25	76.03	1,125.67	450.30	1,663.25	4,604.00
2025	3	-	131.53	1,277.25	390.01	1,798.78	6,402.79
2026	4	0.19	20.94	1,426.03	477.09	1,924.24	8,327.03
2027	5	-	50.78	1,355.23	628.15	2,034.16	10,361.19
2028	6	-	114.66	958.82	528.71	1,602.20	11,963.39
2029	7	-	34.03	1,032.44	280.62	1,347.09	13,310.47
2030	8	-	40.79	1,182.76	316.10	1,539.65	14,850.12
2031	9	0.00	7.39	1,039.05	396.67	1,443.12	16,293.24
2032	10	-	15.52	932.72	481.66	1,429.90	17,723.14
2033	11	-	37.69	878.00	365.84	1,281.53	19,004.68
2034	12	0.00	54.23	918.36	165.76	1,138.36	20,143.03
2035	13	-	33.65	805.05	516.61	1,355.31	21,498.34
2036	14	41.50	32.87	1,070.20	392.19	1,536.75	23,035.09
2037	15	-	49.97	711.32	312.45	1,073.75	24,108.84
2038	16	-	4.59	754.98	438.99	1,198.56	25,307.40
2039	17	-	-	664.52	427.42	1,091.94	26,399.33
2040	18	-	14.31	856.74	352.15	1,223.20	27,622.53
2041	19	-	20.00	878.11	287.48	1,185.59	28,808.12
2042	20	-	10.07	812.19	420.14	1,242.39	30,050.52
2043	21	-	43.24	616.20	506.79	1,166.22	31,216.74
2044	22	-	16.62	527.71	197.07	741.40	31,958.14
2045	23	-	16.34	682.63	250.01	948.99	32,907.13
2046	24	-	24.34	504.34	425.65	954.33	33,861.46
2047	25	0.73	9.43	378.82	336.06	725.03	34,586.49
2048	26	-	8.04	784.69	186.29	979.02	35,565.51
2049	27	-	27.51	419.37	442.99	889.88	36,455.38
2050	28	-	-	577.68	480.06	1,057.74	37,513.12
2051	29	-	8.71	327.90	345.45	682.07	38,195.19
2052	30	-	2.40	35.90	25.59	63.88	38,259.07

Area deforested per forest class icl within the project area							
Year	ID$_{icl}$ >	FC1	FC2	FC3	FC4	Total baseline deforestation in the project area	
	Name >	As	Da	Db	Ds	annual ABSLPAt	cummulative ABSLPA
	Project year *t*	ha	ha	ha	ha	ha	ha
TOTAL		62.50	1,002.33	25,454.45	11,739.79	38,259.07	

According to IBGE classification, the Leakage Belt shows the same Forest Types. The Table 3.28 shows the annual estimates of deforestation within the Leakage Belt.

Table 3.28 - 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	ID$_{icl}$ >	FC1	FC2	FC3	FC4	Total baseline deforestation in the leake belt area	
	Name >	As	Da	Db	Ds	annual ABSLLKt	cummulative ABSLLK
	Project year *t*	ha	ha	ha	ha	ha	ha
2022	0	44.00	0.14	418.92	504.46	967.52	967.52
2023	1	110.64	-	529.91	430.64	1,071.19	2,038.71
2024	2	78.99	9.07	627.79	231.45	947.30	2,986.01
2025	3	151.08	-	693.38	437.45	1,281.91	4,267.92
2026	4	80.12	2.02	602.18	365.17	1,049.49	5,317.42
2027	5	192.39	3.76	366.90	324.88	887.93	6,205.34
2028	6	29.29	7.98	504.20	543.02	1,084.49	7,289.84
2029	7	38.57	-	472.19	340.40	851.17	8,141.00
2030	8	19.63	9.08	512.51	544.67	1,085.89	9,226.89
2031	9	109.12	0.00	610.54	772.65	1,492.32	10,719.21
2032	10	48.84	-	462.09	378.31	889.23	11,608.44
2033	11	33.25	-	489.79	463.63	986.66	12,595.10

Year	IDicl >	FC1	FC2	FC3	FC4	Total baseline deforestation in the leake belt area	
	Name >	As	Da	Db	Ds	annual ABSLLKt	cummulative ABSLLK
	Project year *t*	ha	ha	ha	ha	ha	ha
2034	12	44.07	1.99	395.49	491.52	933.07	13,528.17
2035	13	92.95	-	584.09	360.31	1,037.35	14,565.52
2036	14	38.50	-	559.25	265.56	863.31	15,428.82
2037	15	148.93	-	450.17	380.80	979.90	16,408.73
2038	16	96.86	-	505.02	326.37	928.26	17,336.98
2039	17	20.28	(0.00)	486.26	377.54	884.08	18,221.07
2040	18	83.04	2.06	244.03	401.15	730.28	18,951.35
2041	19	47.25	-	329.55	565.90	942.70	19,894.05
2042	20	107.20	2.14	386.61	473.77	969.72	20,863.77
2043	21	(0.00)	-	362.96	379.79	742.76	21,606.53
2044	22	84.07	23.10	374.18	361.69	843.03	22,449.56
2045	23	11.95	-	439.53	186.65	638.13	23,087.69
2046	24	132.53	0.00	384.50	432.32	949.35	24,037.04
2047	25	67.78	(0.00)	343.64	202.79	614.22	24,651.26
2048	26	93.68	2.25	255.34	398.46	749.73	25,400.99
2049	27	73.22	-	256.86	325.95	656.03	26,057.02
2050	28	34.73	-	225.51	458.02	718.26	26,775.28
2051	29	16.16	4.02	305.02	369.64	694.83	27,470.12
2052	30	0.64	0.94	29.73	48.03	79.34	27,549.45
TOTAL						**27,549.45**	

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 the same proportions as those observed on lands deforested during the historical reference period in the Reference Region.

Cattle farming accounts for virtually all the deforested land occupation in the project region. An analysis of land-use cover in Bujari over the historical reference period years[143], shows that, of the agricultural land uses, pastureland accounts for over 99% of the area in every year analyzed. Thus, the post deforestation class is considered exclusively as “Cattle farming”.

The Table 3.29 shows the annual estimates of deforestation within the Project Area, obtained by means of modelling.

Table 3.29 - 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 >	Zone 1		
	Project year t	ha	annual $ABSLLK_t$ ha	cummulative ABSLLK ha
2022	0	1,441.91	1,441.91	1,441.91
2023	1	1,498.85	1,498.85	2,940.75
2024	2	1,663.25	1,663.25	4,604.00
2025	3	1,798.78	1,798.78	6,402.79
2026	4	1,924.24	1,924.24	8,327.03
2027	5	2,034.16	2,034.16	10,361.19
2028	6	1,602.20	1,602.20	11,963.39
2029	7	1,347.09	1,347.09	13,310.47
2030	8	1,539.65	1,539.65	14,850.12
2031	9	1,443.12	1,443.12	16,293.24
2032	10	1,429.90	1,429.90	17,723.14
2033	11	1,281.53	1,281.53	19,004.68
2034	12	1,138.36	1,138.36	20,143.03
2035	13	1,355.31	1,355.31	21,498.34
2036	14	1,536.75	1,536.75	23,035.09
2037	15	1,073.75	1,073.75	24,108.84
2038	16	1,198.56	1,198.56	25,307.40
2039	17	1,091.94	1,091.94	26,399.33
2040	18	1,223.20	1,223.20	27,622.53
2041	19	1,185.59	1,185.59	28,808.12
2042	20	1,242.39	1,242.39	30,050.52
2043	21	1,166.22	1,166.22	31,216.74

143 Source, Mapbiomas: https://plataforma.brasil.mapbiomas.org

Year	ID_z >	1	Total baseline deforestation in the project area	
	Name >	Zone 1		
	Project year t	ha	annual $ABSLLK_t$ ha	cummulative ABSLLK ha
2044	22	741.40	741.40	31,958.14
2045	23	948.99	948.99	32,907.13
2046	24	954.33	954.33	33,861.46
2047	25	725.03	725.03	34,586.49
2048	26	979.02	979.02	35,565.51
2049	27	889.88	889.88	36,455.38
2050	28	1,057.74	1,057.74	37,513.12
2051	29	682.07	682.07	38,195.19
2052	30	63.88	63.88	38,259.07
TOTAL		**38,259.07**	**38,259.07**	

The Table 3.30 shows the annual estimates of deforestation within the Leakage Belt, obtained by means of modelling.

Table3. 30 - Annual areas deforested in each zone within the leakage belt area in the baseline case (baseline activity data per zone) (Table 13.c of VM0015)

Year	ID_z >	1	Total baseline deforestation in the leakage belt	
	Name >	Zone 1		
	Project year t	ha	annual $ABSLLK_t$ ha	cummulative ABSLLK ha
2022	0	967.52	967.52	967.52
2023	1	1,071.19	1,071.19	2,038.71
2024	2	947.30	947.30	2,986.01
2025	3	1,281.91	1,281.91	4,267.92
2026	4	1,049.49	1,049.49	5,317.42
2027	5	887.93	887.93	6,205.34
2028	6	1,084.49	1,084.49	7,289.84
2029	7	851.17	851.17	8,141.00
2030	8	1,085.89	1,085.89	9,226.89
2031	9	1,492.32	1,492.32	10,719.21
2032	10	889.23	889.23	11,608.44
2033	11	986.66	986.66	12,595.10
2034	12	933.07	933.07	13,528.17
2035	13	1,037.35	1,037.35	14,565.52
2036	14	863.31	863.31	15,428.82
2037	15	979.90	979.90	16,408.73
2038	16	928.26	928.26	17,336.98
2039	17	884.08	884.08	18,221.07
2040	18	730.28	730.28	18,951.35
2041	19	942.70	942.70	19,894.05
2042	20	969.72	969.72	20,863.77

Year	ID_z >	1	Total baseline deforestation in the leakage belt	
	Name >	Zone 1		
	Project year t	ha	annual $ABSLLK_t$ ha	cummulative ABSLLK ha
2043	21	742.76	742.76	21,606.53
2044	22	843.03	843.03	22,449.56
2045	23	638.13	638.13	23,087.69
2046	24	949.35	949.35	24,037.04
2047	25	614.22	614.22	24,651.26
2048	26	749.73	749.73	25,400.99
2049	27	656.03	656.03	26,057.02
2050	28	718.26	718.26	26,775.28
2051	29	694.83	694.83	27,470.12
2052	30	79.34	79.34	27,549.45
TOTAL		**27,549.45**	**27,549.45**	

Estimation of Baseline Carbon Stock Changes and Non-CO^2 Emissions

This section refers to Step 6 of the VM0015 Methodology, the goal of which is to finalize the baseline assessment by calculating:

- Baseline carbon stock changes; and (optionally)
- Baseline non-CO2 emissions from forest fires used to clear forests.

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 4 Forest Types: Lowland Dense Ombrophilous Forest (Db); 37.4% Submontane Dense Ombrophilous Forest (Ds); 1.7% Alluvial Dense Ombrophilous Forest (Da) and; 0.1% Submontane Open Ombrophilous Forest (As). The 4th National Inventory[144] is a regional document (Tier 2) and a reliable source, used for various actions of the National Plan on Climate Change and for the definition of the Nationally Determined Contribution (NDC) to comply with the Paris Agreement. T

he National Inventory is prepared according to internationally established guidelines, through Decision 17/CP.8 of the Climate Convention[145]. The elaboration of this document is an

[144] https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/noticias/2020/10/4a-comunicacao-nacional-do-brasil-a-convencao-do-clima-das-nacoes-unidas-fortalece-articulacao-institucional
[145] dec17-cp.pdf

interministerial and collaborative work, coordinated by the Ministry of Science, Technology and Innovation (MCTI), with support from the United Nations Development Program (UNDP), through resources from the Global Fund for the Environment, and developed in partnership with several experts and institutions from government, academia and civil society. The scientific basis of the work is subsidized especially by the Brazilian Research Network on Global Climate Change (Rede CLIMA).

As the source follows the guidance below, it is applicable to the project[146]:

- The data are less than 10 years old: The Forth National Inventory was published in 2020,
- The data are derived from spatial modelling which used field work (forest inventory) data; LiDAR data and a vast remote sensing data.
- All species above a minimum diameter are included in the inventories;
- The minimum diameter for trees included is 30 cm or less at breast height (DBH): The minimum diameter used is 31.83 cm, but it is expanded using expansion factors to include trees with DBH between 10 and 31.83 cm.
- Data were sampled from good coverage of the classes over which they will be extrapolated (more details below).

The Table 3.31 shows the carbon stock per hectare of the forest classes of the Project Area

[146] According to the criteria defined in the VM0015 v1.1, Section 6.1.1.

Table 3.31 - 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	Project year t	Initial forest class *icl* Name: FC 1 (As) ID $_{icl}$ 1 Average carbon stock per hectare ± 90% CI													
		Cab $_{icl}$		Cbb $_{icl}$		Cl $_{icl}$		Cwp $_{icl}$ short lived		Cwp $_{icl}$ medium lived		Cwp $_{icl}$ long lived		Ctot $_{icl}$	
		C *stock*	± 90% CI	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}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2022	0														
2023	1		78.19		7.82		4.52		6.13		4.78		5		85.82
2024	2	78.10		7.81		4.51		6.12		4.77		5		85.71	
...	...		78.01		7.80		4.50		6.12		4.76		5		85.61
2052	30														

Year	Project year t	Initial forest class *icl* Name: FC 2 (Da) ID $_{icl}$ 2 Average carbon stock per hectare ± 90% CI													
		Cab $_{icl}$		Cbb $_{icl}$		Cl $_{icl}$		Cwp $_{icl}$ short lived		Cwp $_{icl}$ medium lived		Cwp $_{icl}$ long lived		Ctot $_{icl}$	
		C *stock*	± 90% CI	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}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2022	0														
2023	1		221		90		9		29.72		23.15		23		298
2024	2	219.49		90		9		29.49		22.97		23		295	
...	...		218		89		9		29.26		22.80		22		293
2052	30														

Year	Project year t	Initial forest class *icl* Name: FC 3 (Db) ID $_{icl}$ 3 Average carbon stock per hectare ± 90% CI													
		Cab $_{icl}$		Cbb $_{icl}$		Cl $_{icl}$		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	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}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2022	0														
2023	1		250		78		10		12.64		9.85		10		328
2024	2	249		78		10		12.64		9.85		10		328	
...	...		249		78		10		12.64		9.85		10		327
2052	30														

Year	Project year t	Initial forest class *icl* Name: FC2 (Ds) ID icl: 4 Average carbon stock per hectare ± 90% CI													
		Cab *icl*		Cbb *icl*		Cl *icl*		Cwp *icl* short lived		Cwp *icl* medium lived		Cwp *icl* long lived		Ctot *icl*	
		C *stock*	± 90% CI	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}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2022	0														
2023	1		297		93		12		27.94		21.76		21		381
2024	2	297		93		12		27.94		21.76		21		381	
...	...		297		93		12		27.94		21.76		21		380
2052	30														

The 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 upper limit of the interval was used for the calculations related to the wood products carbon pool, for conservativeness purposes and mitigation of uncertainties.

Table 3.32 - 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).

Ye ar	Pr	Initial forest class *icl*		

		Name:	FC 1 (As)												
		ID $_{icl}$	1												
		Average carbon stock per hectare ± 90% CI													
		Cab $_{icl}$		Cbb $_{icl}$		Cl $_{icl}$		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*	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}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2022	0	78	0	8	0	5	0	6.12	0	4.76	0	5	0	86	0
2023	1														
2024	2														
...	...														
2052	30														

Year	**Project year t**	Initial forest class *icl*													
		Name:	FC 2 (Da)												
		ID $_{icl}$	2												
		Average carbon stock per hectare ± 90% CI													
		Cab $_{icl}$		Cbb $_{icl}$		Cl $_{icl}$		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*	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}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2022	0	219.49	0	90	0	9	0	29.49	0	22.97	0	23	0	295	0
2023	1														
2024	2														
...	...														
2052	30														

Year	**Project year t**	**Initial forest class *icl***													
		Name:	**FC 3 (Db)**												
		ID $_{icl}$	**3**												
		Average carbon stock per hectare ± 90% CI													
		Cab $_{icl}$		**Cbb** $_{icl}$		**Cl** $_{icl}$		**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*	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}	t CO_2e ha^{-1}	t CO_2e ha^{-1}

2022	0	249	0	78	0	10	0	12.64	0	9.84	0	10	0	328	0
2023	1														
2024	2														
...	...														
2052	30														

Year	Project year t	Initial forest class *icl*													
		Name:	FC 4 (Ds)												
		ID icl	4												
		Average carbon stock per hectare ± 90% CI													
		Cab *icl*		Cbb *icl*		Cl *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*	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}	t CO_2e ha^{-1}	t CO_2e ha^{-1}
2022	0	297.04	0	93	0	12	0	27.93	0	21.76	0	21	0	381	0
2023	1														
2024	2														
...	...														

2052	30														

The same reasoning is applicable to post-deforestation classes, for which the upper limit of the interval was taken in the case of above-ground biomass, while the average has been chosen for below-ground biomass, for conservativeness purposes and mitigation of uncertainties.

Table 3.33 - 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	**Project year t**	**Post deforestation class *fcl***													
		Name:	**Pasture**												
		ID $_{fcl}$	**1**												
		Average carbon stock per hectare ± 90% CI													
		Cab $_{fcl}$		**Cbb $_{fcl}$**		**Cl $_{fcl}$**		***Cwp $_{fcl}$***						**Ctot $_{fcl}$**	
								short lived		***medium lived***		***long lived***			
		average stock	**± 90% CI**	***average stock***	**± 90% CI**	***average stock***	**± 90% CI**	***average stock***	**± 90% CI**	***average stock***	**± 90% CI**	***average stock***	**± 90% CI**	***average stock***	**± 90% CI**
		t CO_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}**	**t CO_2e ha^{-1}**	**t CO_2e ha^{-1}**
2022	0														
2023	1		14.69		23.51		0.00		0		0		0		38.2
2024	2	10.68		17.10		0.00		0		0		0		27.78	
...	...		6.68		10.68		0.00		0		0		0		17.4
2052	30														

Average	10.68		17.10		0.00		0		0		0		27.78	
Value applied to the PA	14.69		23.51		0.00		0		0		0		38.20	
Value applied to the LK	6.68		10.68		0.00		0		0		0		17.36	

Table 3.34 - 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**			
		Cab $_{fcl}$ *C stock* t CO_2e ha^{-1}	**Cbb** $_{fcl}$ *C stock* t CO_2e ha^{-1}	**Cl** $_{icl}$ *C stock* t CO_2e ha^{-1}	**Cwp** $_{fcl}$ *C stock* t CO_2e ha^{-1}	**Ctotz** *C stock* t CO_2e ha^{-1}
IDz	**Name**					
1	PA	15	24	0	0	38

Zone	Post -deforestation LU/LC-class *fcl*				
	Name:	**Pasture**			
	ID $_{fcl}$	**1**			
	Cab $_{fcl}$ *C stock*	**Cbb** $_{fcl}$ *C stock*	**Cl** $_{icl}$ *C stock*	**Cwp** $_{fcl}$ *C stock*	**Ctotz** *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}**
2	LK	7	11	0	0	17

The carbon stock change factors shown below were calculated based on VM0015 premises, using Method 1 to Forest Class 3 (Db) and Forest Class 4 (Ds) and Method 2 to Forest Class 1 (As) and Forest Class 2 (Da). The activity data are available for categories to Forest Class 3 (Db) and Forest Class 4 (Ds). The Table 3.35 shows the carbon stock change factors for land-use change categories (ct or ctz) (Method 1) and the Table 3.36 shows the carbon stock change factors for land-use change categories (ct or ctz) (Method 2) for each Forest Class.

Table 3.35: Carbon stock change factors for land-use change categories (ct or ctz) (Method **1**) (Table 20.**a** of VM0015)**.**

FC 3 - Lowland Dense Ombrophylous (Db)							
Year after deforestation		∆Cab icl,t	∆Cbb icl,t	∆Cl icl,t	∆Cwp icl,t short-lived	∆Cwp icl,t medium-lived	∆Cwp icl,t long-lived
1	2022	-249.19	-7.81	-10.08	-12.64	-0.49	0.00
2	2023	0.00	-7.81	0.00	0.00	-0.49	0.00
3	2024	0.00	-7.81	0.00	0.00	-0.49	0.00
4	2025	0.00	-7.81	0.00	0.00	-0.49	0.00
5	2026	0.00	-7.81	0.00	0.00	-0.49	0.00
6	2027	0.00	-7.81	0.00	0.00	-0.49	0.00
7	2028	0.00	-7.81	0.00	0.00	-0.49	0.00
8	2029	0.00	-7.81	0.00	0.00	-0.49	0.00
9	2030	0.00	-7.81	0.00	0.00	-0.49	0.00
10	2031	0.00	-7.81	0.00	0.00	-0.49	0.00
11	2032	0.00	0.00	0.00	0.00	-0.49	0.00
12	2033	0.00	0.00	0.00	0.00	-0.49	0.00
13	2034	0.00	0.00	0.00	0.00	-0.49	0.00
14	2035	0.00	0.00	0.00	0.00	-0.49	0.00
15	2036	0.00	0.00	0.00	0.00	-0.49	0.00
16	2037	0.00	0.00	0.00	0.00	-0.49	0.00
17	2038	0.00	0.00	0.00	0.00	-0.49	0.00
18	2039	0.00	0.00	0.00	0.00	-0.49	0.00
19	2040	0.00	0.00	0.00	0.00	-0.49	0.00
20	2041	0.00	0.00	0.00	0.00	-0.49	0.00
21	2042	0.00	0.00	0.00	0.00	0.00	0.00
22	2043	0.00	0.00	0.00	0.00	0.00	0.00
23	2044	0.00	0.00	0.00	0.00	0.00	0.00
24	2045	0.00	0.00	0.00	0.00	0.00	0.00
25	2046	0.00	0.00	0.00	0.00	0.00	0.00
26	2047	0.00	0.00	0.00	0.00	0.00	0.00
27	2048	0.00	0.00	0.00	0.00	0.00	0.00
28	2049	0.00	0.00	0.00	0.00	0.00	0.00
29	2050	0.00	0.00	0.00	0.00	0.00	0.00
30	2051	0.00	0.00	0.00	0.00	0.00	0.00
31	2052	0.00	0.00	0.00	0.00	0.00	0.00

Table 3.36: Carbon stock change factors for land-use change categories (ct or ctz) (Method **1**) (Table 20.**a** of VM0015)**.**

FC 4 - Submontane Dense Ombrophylous (Ds)							
Year after deforestation		∆Cab icl,t	∆Cbb icl,t	∆Cl icl,t	∆Cwp icl,t short-lived	∆Cwp icl,t medium-lived	∆Cwp icl,t long-lived
1	2022	-297.04	-9.33	-12.06	-27.94	-1.09	0.00
2	2023	0.00	-9.33	0.00	0.00	-1.09	0.00
3	2024	0.00	-9.33	0.00	0.00	-1.09	0.00
4	2025	0.00	-9.33	0.00	0.00	-1.09	0.00
5	2026	0.00	-9.33	0.00	0.00	-1.09	0.00
6	2027	0.00	-9.33	0.00	0.00	-1.09	0.00
7	2028	0.00	-9.33	0.00	0.00	-1.09	0.00
8	2029	0.00	-9.33	0.00	0.00	-1.09	0.00
9	2030	0.00	-9.33	0.00	0.00	-1.09	0.00
10	2031	0.00	-9.33	0.00	0.00	-1.09	0.00
11	2032	0.00	0.00	0.00	0.00	-1.09	0.00
12	2033	0.00	0.00	0.00	0.00	-1.09	0.00
13	2034	0.00	0.00	0.00	0.00	-1.09	0.00
14	2035	0.00	0.00	0.00	0.00	-1.09	0.00
15	2036	0.00	0.00	0.00	0.00	-1.09	0.00
16	2037	0.00	0.00	0.00	0.00	-1.09	0.00
17	2038	0.00	0.00	0.00	0.00	-1.09	0.00
18	2039	0.00	0.00	0.00	0.00	-1.09	0.00
19	2040	0.00	0.00	0.00	0.00	-1.09	0.00
20	2041	0.00	0.00	0.00	0.00	-1.09	0.00
21	2042	0.00	0.00	0.00	0.00	0.00	0.00
22	2043	0.00	0.00	0.00	0.00	0.00	0.00
23	2044	0.00	0.00	0.00	0.00	0.00	0.00
24	2045	0.00	0.00	0.00	0.00	0.00	0.00
25	2046	0.00	0.00	0.00	0.00	0.00	0.00
26	2047	0.00	0.00	0.00	0.00	0.00	0.00
27	2048	0.00	0.00	0.00	0.00	0.00	0.00
28	2049	0.00	0.00	0.00	0.00	0.00	0.00
29	2050	0.00	0.00	0.00	0.00	0.00	0.00
30	2051	0.00	0.00	0.00	0.00	0.00	0.00
31	2052	0.00	0.00	0.00	0.00	0.00	0.00

Table 3.37: Carbon stock change factors for land-use change categories (ct or ctz) (Method **2**) (Table 20.**c** of VM0015)**.**

FC 1 - Submontane Open Ombrophylous (As)							
Year after deforestation		$\Delta Cab_{ctz,t}$	$\Delta Cbb_{ctz,t}$	$\Delta Cl_{ctz,t}$	$\Delta Cwp_{ctz,t}$ short-lived	$\Delta Cwp_{ctz,t}$ medium-lived	$\Delta Cwp_{ctz,t}$ long-lived
1	2022	-76.63	-0.78	-4.51	-6.12	-0.24	0
2	2023	1.47	-0.78	0.00	0.00	-0.24	0
3	2024	1.47	-0.78	0.00	0.00	-0.24	0
4	2025	1.47	-0.78	0.00	0.00	-0.24	0
5	2026	1.47	-0.78	0.00	0.00	-0.24	0
6	2027	1.47	-0.78	0.00	0.00	-0.24	0
7	2028	1.47	-0.78	0.00	0.00	-0.24	0
8	2029	1.47	-0.78	0.00	0.00	-0.24	0
9	2030	1.47	-0.78	0.00	0.00	-0.24	0
10	2031	1.47	-0.78	0.00	0.00	-0.24	0
11	2032	0	0.00	0.00	0.00	-0.24	0
12	2033	0	0.00	0.00	0.00	-0.24	0
13	2034	0	0.00	0.00	0.00	-0.24	0
14	2035	0	0.00	0.00	0.00	-0.24	0
15	2036	0	0.00	0.00	0.00	-0.24	0
16	2037	0	0.00	0.00	0.00	-0.24	0
17	2038	0	0.00	0.00	0.00	-0.24	0
18	2039	0	0.00	0.00	0.00	-0.24	0
19	2040	0	0.00	0.00	0.00	-0.24	0
20	2041	0	0.00	0.00	0.00	-0.24	0
21	2042	0	0.00	0.00	0	0	0
22	2043	0	0.00	0.00	0	0	0
23	2044	0	0.00	0.00	0	0	0
24	2045	0	0.00	0.00	0	0	0
25	2046	0	0.00	0.00	0	0	0
26	2047	0	0.00	0.00	0	0	0
27	2048	0	0.00	0.00	0	0	0
28	2049	0	0.00	0.00	0	0	0
29	2050	0	0.00	0.00	0	0	0
30	2051	0	0.00	0.00	0	0	0
31	2052	0	0.00	0.00	0	0	0

Table 3.38: Carbon stock change factors for land-use change categories (ct or ctz) (Method **2**) (Table 20.**c** of VM0015)**.**

FC 2 - Alluvial Dense Ombrophylous (Da)							
Year after deforestation		$\Delta Cab_{ctz,t}$	$\Delta Cbb_{ctz,t}$	$\Delta Cl_{ctz,t}$	$\Delta Cwp_{ctz,t}$ **short-lived**	$\Delta Cwp_{ctz,t}$ **medium-lived**	$\Delta Cwp_{ctz,t}$ **long-lived**
1	2022	-219.49	-8.98	-8.91	-29.72	-1.16	0.00
2	2023	0.00	-8.98	0.00	0.00	-1.16	0.00
3	2024	0.00	-8.98	0.00	0.00	-1.16	0.00
4	2025	0.00	-8.98	0.00	0.00	-1.16	0.00
5	2026	0.00	-8.98	0.00	0.00	-1.16	0.00
6	2027	0.00	-8.98	0.00	0.00	-1.16	0.00
7	2028	0.00	-8.98	0.00	0.00	-1.16	0.00
8	2029	0.00	-8.98	0.00	0.00	-1.16	0.00
9	2030	0.00	-8.98	0.00	0.00	-1.16	0.00
10	2031	0.00	-8.98	0.00	0.00	-1.16	0.00
11	2032	0.00	0.00	0.00	0.00	-1.16	0.00
12	2033	0.00	0.00	0.00	0.00	-1.16	0.00
13	2034	0.00	0.00	0.00	0.00	-1.16	0.00
14	2035	0.00	0.00	0.00	0.00	-1.16	0.00
15	2036	0.00	0.00	0.00	0.00	-1.16	0.00
16	2037	0.00	0.00	0.00	0.00	-1.16	0.00
17	2038	0.00	0.00	0.00	0.00	-1.16	0.00
18	2039	0.00	0.00	0.00	0.00	-1.16	0.00
19	2040	0.00	0.00	0.00	0.00	-1.16	0.00
20	2041	0.00	0.00	0.00	0.00	-1.16	0.00
21	2042	0.00	0.00	0.00	0.00	0.00	0.00
22	2043	0.00	0.00	0.00	0.00	0.00	0.00
23	2044	0.00	0.00	0.00	0.00	0.00	0.00
24	2045	0.00	0.00	0.00	0.00	0.00	0.00
25	2046	0.00	0.00	0.00	0.00	0.00	0.00
26	2047	0.00	0.00	0.00	0.00	0.00	0.00
27	2048	0.00	0.00	0.00	0.00	0.00	0.00
28	2049	0.00	0.00	0.00	0.00	0.00	0.00
29	2050	0.00	0.00	0.00	0.00	0.00	0.00
30	2051	0.00	0.00	0.00	0.00	0.00	0.00
31	2052	0.00	0.00	0.00	0.00	0.00	0.00

The following tables show the calculation of baseline carbon stock changes in above-ground biomass, below-ground biomass, litter and wood products in the Project Area, using the carbon stock change factors presented in the tables immediately above. The Tables 3.39 – 3.42 show the carbon stock change factors for land-use change categories (ct or ctz) (Method 1) and the Tables 3.43-46 show the carbon stock change factors for land-use change categories (ct or ctz) (Method 2) for each Forest Class.

Table 3.39 - Baseline carbon stock change in the above-ground biomass in the project area (Method 1) - (Table 21.b.1 of VM0015).

Year	Project year t	Total carbon stock change in the above-ground biomass of the initial forest classes in the project area			
		FC3	FC4	annual	cumulative
		$\Delta Cab_{ct,t}$	$\Delta Cab_{ct,t}$	$\Delta CabBSLPA_t$	$\Delta CabBSLPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-258,512	-116,809	-375,321	-375,321
2023	1	-219,874	-155,118	-374,991	-750,313
2024	2	-280,502	-133,755	-414,257	-1,164,570
2025	3	-318,272	-115,847	-434,120	-1,598,690
2026	4	-355,347	-141,712	-497,059	-2,095,748
2027	5	-337,705	-186,585	-524,290	-2,620,039
2028	6	-238,926	-157,047	-395,974	-3,016,012
2029	7	-257,271	-83,354	-340,625	-3,356,637
2030	8	-294,727	-93,893	-388,621	-3,745,258
2031	9	-258,917	-117,827	-376,744	-4,122,001
2032	10	-232,422	-143,070	-375,492	-4,497,494
2033	11	-218,786	-108,668	-327,454	-4,824,948
2034	12	-228,844	-49,238	-278,082	-5,103,030
2035	13	-200,608	-153,451	-354,059	-5,457,089
2036	14	-266,680	-116,494	-383,174	-5,840,263
2037	15	-177,251	-92,810	-270,061	-6,110,324
2038	16	-188,131	-130,397	-318,528	-6,428,852
2039	17	-165,589	-126,959	-292,548	-6,721,400
2040	18	-213,487	-104,602	-318,089	-7,039,489
2041	19	-218,814	-85,391	-304,205	-7,343,694
2042	20	-202,386	-124,798	-327,184	-7,670,878
2043	21	-153,548	-150,535	-304,084	-7,974,962
2044	22	-131,497	-58,538	-190,035	-8,164,997
2045	23	-170,103	-74,263	-244,366	-8,409,363
2046	24	-125,674	-126,433	-252,107	-8,661,470
2047	25	-94,396	-99,822	-194,218	-8,855,688
2048	26	-195,535	-55,335	-250,870	-9,106,558
2049	27	-104,502	-131,585	-236,087	-9,342,645
2050	28	-143,950	-142,596	-286,546	-9,629,192
2051	29	-81,709	-102,612	-184,321	-9,813,513
2052	30	-8,945	-7,600	-16,545	-9,830,058

Table 3.40 - Baseline carbon stock change in the below-ground biomass in the project area (Method 1) - (Table 21.b.2 of VM0015).

Year	Project year t	Total carbon stock change in the below-ground biomass of the initial forest classes in the project area			
		FC3	FC4	annual	cumulative
		$\Delta Cbb_{ct,t}$	$\Delta Cbb_{ct,t}$	$\Delta CbbBSLPA_t$	$\Delta CbbBSLPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-8,098	-3,668	-11,767	-11,767
2023	1	-14,987	-8,539	-23,526	-35,293
2024	2	-23,774	-12,740	-36,514	-71,806
2025	3	-33,744	-16,378	-50,122	-121,929
2026	4	-44,876	-20,828	-65,705	-187,633
2027	5	-55,456	-26,688	-82,143	-269,777
2028	6	-62,941	-31,619	-94,560	-364,337
2029	7	-71,000	-34,237	-105,237	-469,574
2030	8	-80,233	-37,186	-117,419	-586,993
2031	9	-88,345	-40,886	-129,230	-716,224
2032	10	-87,527	-41,710	-129,238	-845,461
2033	11	-87,493	-40,252	-127,745	-973,206
2034	12	-85,875	-37,598	-123,472	-1,096,679
2035	13	-82,189	-38,779	-120,967	-1,217,646
2036	14	-79,411	-37,987	-117,398	-1,335,043
2037	15	-74,384	-35,042	-109,426	-1,444,470
2038	16	-72,793	-34,205	-106,998	-1,551,468
2039	17	-69,921	-35,574	-105,495	-1,656,963
2040	18	-67,376	-35,910	-103,286	-1,760,249
2041	19	-66,120	-34,892	-101,012	-1,861,261
2042	20	-65,179	-34,318	-99,497	-1,960,757
2043	21	-63,135	-35,633	-98,768	-2,059,525
2044	22	-60,085	-35,925	-96,010	-2,155,536
2045	23	-59,130	-33,438	-92,568	-2,248,103
2046	24	-54,712	-33,750	-88,463	-2,336,566
2047	25	-52,117	-33,970	-86,087	-2,422,653
2048	26	-52,349	-31,613	-83,962	-2,506,615
2049	27	-50,435	-31,758	-82,194	-2,588,809
2050	28	-48,257	-32,952	-81,208	-2,670,017
2051	29	-43,962	-33,492	-77,454	-2,747,471
2052	30	-37,902	-29,812	-67,714	-2,815,185

Table 3.41 - Baseline carbon stock change in the litter biomass in the project area (Method 1) - (Table 21.b.4 of VM0015).

Year	Project year t	Total carbon stock change in the litter biomass of the initial forest classes in the project area			
		FC3	FC4	annual	cumulative
		$\Delta CI_{ct,t}$	$\Delta CI_{ct,t}$	$\Delta CIBSLPA_t$	$\Delta CIBSLPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-10,461	-4,744	-15,205	-15,205
2023	1	-8,897	-6,300	-15,197	-30,401
2024	2	-11,350	-5,432	-16,783	-47,184
2025	3	-12,879	-4,705	-17,584	-64,768
2026	4	-14,379	-5,755	-20,134	-84,902
2027	5	-13,665	-7,578	-21,243	-106,145
2028	6	-9,668	-6,378	-16,046	-122,191
2029	7	-10,410	-3,385	-13,796	-135,987
2030	8	-11,926	-3,813	-15,739	-151,726
2031	9	-10,477	-4,785	-15,262	-166,988
2032	10	-9,405	-5,810	-15,215	-182,204
2033	11	-8,853	-4,413	-13,266	-195,470
2034	12	-9,260	-2,000	-11,260	-206,730
2035	13	-8,118	-6,232	-14,350	-221,080
2036	14	-10,791	-4,731	-15,522	-236,602
2037	15	-7,172	-3,769	-10,942	-247,544
2038	16	-7,613	-5,296	-12,908	-260,452
2039	17	-6,701	-5,156	-11,857	-272,309
2040	18	-8,639	-4,248	-12,887	-285,196
2041	19	-8,854	-3,468	-12,322	-297,518
2042	20	-8,190	-5,068	-13,258	-310,776
2043	21	-6,213	-6,114	-12,327	-323,103
2044	22	-5,321	-2,377	-7,698	-330,801
2045	23	-6,883	-3,016	-9,899	-340,700
2046	24	-5,085	-5,135	-10,220	-350,920
2047	25	-3,820	-4,054	-7,874	-358,794
2048	26	-7,912	-2,247	-10,160	-368,954
2049	27	-4,229	-5,344	-9,573	-378,526
2050	28	-5,825	-5,791	-11,616	-390,142
2051	29	-3,306	-4,167	-7,474	-397,616
2052	30	-362	-309	-671	-398,287

Table 3.42 - Baseline carbon stock change in the wood products biomass in the project area (Method 1) - (Table 21.b.6 of VM0015).

Year	Project year t	Total carbon stock change in the wood products of the initial forest classes in the project area			
		FC3	FC4	annual	cumulative
		$\Delta Cwp_{ct,t}$	$\Delta Cwp_{ct,t}$	$\Delta CwpBSLPA_t$	$\Delta CwpBSLPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-511	-428	-939	-939
2023	1	-945	-996	-1,942	-2,880
2024	2	-1,500	-1,486	-2,986	-5,866
2025	3	-2,129	-1,911	-4,039	-9,906
2026	4	-2,831	-2,430	-5,261	-15,166
2027	5	-3,498	-3,113	-6,612	-21,778
2028	6	-3,970	-3,689	-7,659	-29,437
2029	7	-4,479	-3,994	-8,473	-37,910
2030	8	-5,061	-4,338	-9,399	-47,309
2031	9	-5,573	-4,770	-10,343	-57,652
2032	10	-6,032	-5,294	-11,326	-68,978
2033	11	-6,464	-5,692	-12,157	-81,134
2034	12	-6,917	-5,873	-12,789	-93,923
2035	13	-7,313	-6,435	-13,748	-107,671
2036	14	-7,840	-6,862	-14,702	-122,373
2037	15	-8,190	-7,202	-15,392	-137,764
2038	16	-8,562	-7,679	-16,241	-154,006
2039	17	-8,889	-8,144	-17,034	-171,039
2040	18	-9,311	-8,528	-17,839	-188,878
2041	19	-9,743	-8,840	-18,584	-207,462
2042	20	0	0	0	-207,462
2043	21	0	0	0	-207,462
2044	22	0	0	0	-207,462
2045	23	0	0	0	-207,462
2046	24	0	0	0	-207,462
2047	25	0	0	0	-207,462
2048	26	0	0	0	-207,462
2049	27	0	0	0	-207,462
2050	28	0	0	0	-207,462
2051	29	0	0	0	-207,462
2052	30	0	0	0	-207,462

Table 3.43 - Baseline carbon stock change in the above-ground biomass in the project area (Method 2) - (Table 22.b.1 of VM0015).

Year	Project year t	Total carbon stock change in the above-ground biomass of the initial forest classes in the project area			
		FC1	FC2	annual	cumulative
		$\Delta Cab_{ct,t}$	$\Delta Cab_{ct,t}$	$\Delta CabBSLPA_t$	$\Delta CabBSLPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-77	-218	-2,449	-2,449
2023	1	-77	-193	-19,286	-21,735
2024	2	-42	-95	-17,283	-39,018
2025	3	1	-93	-28,393	-67,410
2026	4	1	-13	-4,103	-71,514
2027	5	1	-28	-10,563	-82,077
2028	6	1	-50	-24,415	-106,492
2029	7	1	-13	-6,668	-113,160
2030	8	1	-14	-8,093	-121,253
2031	9	1	-1	-752	-122,004
2032	10	1	-4	-2,529	-124,533
2033	11	1	-14	-7,479	-132,012
2034	12	1	-22	-11,156	-143,168
2035	13	1	-17	-6,783	-149,951
2036	14	-77	-16	-9,775	-159,726
2037	15	1	-25	-10,289	-170,015
2038	16	1	-2	-490	-170,505
2039	17	1	1	467	-170,038
2040	18	1	-11	-2,713	-172,751
2041	19	1	-15	-3,942	-176,693
2042	20	1	-7	-1,770	-178,463
2043	21	1	-35	-9,042	-187,506
2044	22	1	-15	-3,256	-190,761
2045	23	1	-16	-3,221	-193,982
2046	24	0	-25	-5,049	-199,031
2047	25	-77	-12	-1,891	-200,922
2048	26	1	-9	-1,525	-202,447
2049	27	1	-30	-5,758	-208,205
2050	28	1	1	259	-207,946
2051	29	1	-10	-1,670	-209,616
2052	30	1	-2	-295	-209,911

Table 3.44 - Baseline carbon stock change in the below-ground biomass in the project area (Method 2) - (Table 22.b.2 of VM0015).

Year	Project year t	Total carbon stock change in the below-ground biomass of the initial forest classes in the project area			
		FC1	FC2	annual	cumulative
		$\Delta Cbb_{ct,t}$	$\Delta Cbb_{ct,t}$	$\Delta CbbBSLPA_t$	$\Delta CbbBSLPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	1.57	-6.62	-74	-74
2023	1	1.57	-6.62	-626	-701
2024	2	1.57	-6.62	-1,113	-1,813
2025	3	1.57	-6.62	-1,984	-3,797
2026	4	1.57	-6.62	-2,122	-5,920
2027	5	1.57	-6.62	-2,459	-8,378
2028	6	1.57	-6.62	-3,218	-11,596
2029	7	1.57	-6.62	-3,444	-15,040
2030	8	1.57	-6.62	-3,714	-18,754
2031	9	1.57	-6.62	-3,763	-22,517
2032	10	1.57	-6.62	-3,791	-26,308
2033	11	1.57	-6.62	-3,489	-29,797
2034	12	1.57	-6.62	-3,362	-33,159
2035	13	1.57	-6.62	-2,714	-35,873
2036	14	1.57	-6.62	-2,728	-38,600
2037	15	1.57	-6.62	-2,723	-41,323
2038	16	1.57	-6.62	-1,993	-43,316
2039	17	1.57	-6.62	-1,768	-45,084
2040	18	1.57	-6.62	-1,593	-46,677
2041	19	1.57	-6.62	-1,676	-48,353
2042	20	1.57	-6.62	-1,640	-49,993
2043	21	1.57	-6.62	-1,677	-51,669
2044	22	1.57	-6.62	-1,427	-53,097
2045	23	1.57	-6.62	-1,313	-54,410
2046	24	0.00	-6.62	-1,321	-55,731
2047	25	1.57	-6.62	-1,052	-56,783
2048	26	1.57	-6.62	-1,075	-57,858
2049	27	1.57	-6.62	-1,257	-59,114
2050	28	1.57	-6.62	-1,162	-60,276
2051	29	1.57	-6.62	-1,087	-61,364
2052	30	1.57	-6.62	-1,036	-62,400

Table 3.45 - Baseline carbon stock change in the litter biomass in the project area (Method 2) - (Table 22.b.4 of VM0015).

Year	Project year t	Total carbon stock change in the litter biomass of the initial forest classes in the project area			
		FC1	FC2	annual	cumulative
		$\Delta CI_{ct,t}$	$\Delta CI_{ct,t}$	$\Delta CIBSLPA_t$	$\Delta CIBSLPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-4.51	-8.91	-100	-100
2023	1	-4.51	-7.87	-801	-901
2024	2	1.38	1.53	292	-609
2025	3	0.00	0.00	0	-609
2026	4	0.00	0.00	0	-609
2027	5	0.00	0.00	0	-609
2028	6	0.00	0.00	0	-609
2029	7	0.00	0.00	0	-609
2030	8	0.00	0.00	0	-609
2031	9	0.00	0.00	0	-609
2032	10	0.00	0.00	0	-609
2033	11	0.00	0.00	0	-609
2034	12	0.00	0.00	0	-609
2035	13	0.00	0.00	0	-609
2036	14	0.00	0.00	0	-609
2037	15	0.00	0.00	0	-609
2038	16	0.00	0.00	0	-609
2039	17	0.00	0.00	0	-609
2040	18	0.00	0.00	0	-609
2041	19	0.00	0.00	0	-609
2042	20	0.00	0.00	0	-609
2043	21	0.00	0.00	0	-609
2044	22	0.00	0.00	0	-609
2045	23	0.00	0.00	0	-609
2046	24	0.00	0.00	0	-609
2047	25	0.00	0.00	0	-609
2048	26	0.00	0.00	0	-609
2049	27	0.00	0.00	0	-609
2050	28	0.00	0.00	0	-609
2051	29	0.00	0.00	0	-609
2052	30	0.00	0.00	0	-609

Table 3.46 - Baseline carbon stock change in the wood products biomass in the project area (Method 2) - (Table 22.b.6 of VM0015).

Year	Project year t	Total carbon stock change in the wood products of the initial forest classes in the project area			
		FC1	FC2	annual	cumulative
		$\Delta Cwp_{ct,t}$	$\Delta Cwp_{ct,t}$	$\Delta CwpBSLPA_t$	$\Delta CwpBSLPA$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-0.24	-1.16	-13	-13
2023	1	-0.24	-1.16	-114	-127
2024	2	-0.24	-1.16	-205	-332
2025	3	-0.24	-1.16	-357	-689
2026	4	-0.24	-1.16	-381	-1,070
2027	5	-0.24	-1.16	-440	-1,510
2028	6	-0.24	-1.16	-573	-2,083
2029	7	-0.24	-1.16	-612	-2,695
2030	8	-0.24	-1.16	-659	-3,354
2031	9	-0.24	-1.16	-668	-4,022
2032	10	-0.24	-1.16	-686	-4,708
2033	11	-0.24	-1.16	-729	-5,437
2034	12	-0.24	-1.16	-792	-6,229
2035	13	-0.24	-1.16	-831	-7,061
2036	14	-0.24	-1.16	-879	-7,940
2037	15	-0.24	-1.16	-937	-8,877
2038	16	-0.24	-1.16	-942	-9,819
2039	17	-0.24	-1.16	-942	-10,761
2040	18	-0.24	-1.16	-959	-11,720
2041	19	-0.24	-1.16	-982	-12,702
2042	20	0.00	0.00	0	-12,702
2043	21	0.00	0.00	0	-12,702
2044	22	0.00	0.00	0	-12,702
2045	23	0.00	0.00	0	-12,702
2046	24	0.00	0.00	0	-12,702
2047	25	0.00	0.00	0	-12,702
2048	26	0.00	0.00	0	-12,702
2049	27	0.00	0.00	0	-12,702
2050	28	0.00	0.00	0	-12,702
2051	29	0.00	0.00	0	-12,702
2052	30	0.00	0.00	0	-12,702

The following tables show the calculation of baseline carbon stock changes in above-ground biomass, below-ground biomass, litter biomass and wood products in the Leakage Belt, using the carbon stock change factors presented in tables above. The Tables 3.47 – 3.50 show the carbon stock change factors for land-use change categories (ct or ctz) (Method 1) and the Tables 3.51-54 show the carbon stock change factors for land-use change categories (ct or ctz) (Method 2) for each Forest Class.

Table 3.47 - Baseline carbon stock change in the above-ground biomass in the leakage belt area (Method 1) - (Table 21.c.1 of VM0015).

Year	Project year t	Total carbon stock change in the above-ground biomass of the initial forest classes in the leakage belt area			
		FC3	FC4	annual	cumulative
		$\Delta Cab_{ct,t}$	$\Delta Cab_{ct,t}$	$\Delta CabBSLLK_t$	$\Delta CabBSLLK$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-104,388.9	-149,844.4	-254,233	-254,233
2023	1	-132,046.5	-127,915.9	-259,962	-514,196
2024	2	-156,436.3	-68,749.1	-225,185	-739,381
2025	3	-172,780.2	-129,939.9	-302,720	-1,042,101
2026	4	-150,056.0	-108,469.3	-258,525	-1,300,627
2027	5	-91,426.7	-96,501.2	-187,928	-1,488,555
2028	6	-125,640.5	-161,296.4	-286,937	-1,775,492
2029	7	-117,663.7	-101,111.6	-218,775	-1,994,267
2030	8	-127,709.8	-161,787.0	-289,497	-2,283,764
2031	9	-152,137.9	-229,506.2	-381,644	-2,665,408
2032	10	-115,145.7	-112,370.8	-227,516	-2,892,924
2033	11	-122,048.2	-137,714.3	-259,763	-3,152,687
2034	12	-98,549.7	-146,000.8	-244,550	-3,397,237
2035	13	-145,546.9	-107,024.8	-252,572	-3,649,809
2036	14	-139,356.8	-78,881.9	-218,239	-3,868,047
2037	15	-112,175.9	-113,112.4	-225,288	-4,093,336
2038	16	-125,844.8	-96,944.9	-222,790	-4,316,125
2039	17	-121,168.7	-112,144.3	-233,313	-4,549,439
2040	18	-60,809.7	-119,156.8	-179,967	-4,729,405
2041	19	-82,120.0	-168,092.5	-250,213	-4,979,618
2042	20	-96,337.6	-140,726.3	-237,064	-5,216,681
2043	21	-90,445.1	-112,812.9	-203,258	-5,419,939
2044	22	-93,239.5	-107,436.3	-200,676	-5,620,615
2045	23	-109,524.0	-55,442.0	-164,966	-5,785,581
2046	24	-95,812.0	-128,416.4	-224,228	-6,009,810
2047	25	-85,631.4	-60,236.3	-145,868	-6,155,677
2048	26	-63,628.2	-118,356.3	-181,985	-6,337,662
2049	27	-64,006.8	-96,819.2	-160,826	-6,498,488
2050	28	-56,195.1	-136,048.1	-192,243	-6,690,731
2051	29	-76,006.2	-109,795.7	-185,802	-6,876,533
2052	30	-7,409.2	-14,266.8	-21,676	-6,898,209

Table 3.48 - Baseline carbon stock change in the below-ground biomass in the leakage belt area (Method 1) - (Table 21.c.2 of VM0015).

Year	Project year t	Total carbon stock change in the below-ground biomass of the initial forest classes in the leakage belt area			
		FC3	FC4	annual	cumulative
		$\Delta Cbb_{ct,t}$	$\Delta Cbb_{ct,t}$	$\Delta CbbBSLLK_t$	$\Delta CbbBSLLK$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-3,270	-4,706	-7,976	-7,976
2023	1	-7,407	-8,723	-16,130	-24,105
2024	2	-12,308	-10,882	-23,189	-47,295
2025	3	-17,720	-14,962	-32,683	-79,977
2026	4	-22,421	-18,369	-40,790	-120,767
2027	5	-25,285	-21,399	-46,684	-167,451
2028	6	-29,221	-26,464	-55,686	-223,137
2029	7	-32,907	-29,640	-62,547	-285,684
2030	8	-36,908	-34,720	-71,628	-357,312
2031	9	-41,674	-41,928	-83,602	-440,914
2032	10	-42,011	-40,751	-82,762	-523,676
2033	11	-41,698	-41,058	-82,756	-606,432
2034	12	-39,885	-43,484	-83,369	-689,801
2035	13	-39,031	-42,765	-81,796	-771,597
2036	14	-38,696	-41,836	-80,532	-852,129
2037	15	-39,346	-42,357	-81,704	-933,832
2038	16	-39,353	-40,336	-79,689	-1,013,522
2039	17	-39,462	-40,683	-80,145	-1,093,667
2040	18	-37,367	-39,344	-76,711	-1,170,378
2041	19	-35,173	-37,416	-72,589	-1,242,966
2042	20	-34,584	-38,306	-72,890	-1,315,856
2043	21	-33,594	-37,524	-71,118	-1,386,974
2044	22	-33,428	-36,313	-69,741	-1,456,715
2045	23	-32,299	-34,693	-66,992	-1,523,707
2046	24	-30,935	-36,249	-67,184	-1,590,891
2047	25	-30,103	-34,588	-64,692	-1,655,582
2048	26	-28,154	-35,261	-63,415	-1,718,997
2049	27	-26,364	-34,779	-61,143	-1,780,140
2050	28	-26,219	-35,310	-61,529	-1,841,668
2051	29	-26,027	-33,479	-59,506	-1,901,175
2052	30	-23,242	-29,508	-52,749	-1,953,924

Table 3.49 - Baseline carbon stock change in the litter biomass in the Leakage Belt (Method 1) - (Table 21.c.4 of VM0015).

Year	Project year t	Total carbon stock change in the litter biomass of the initial forest classes in the leakage belt area			
		FC3	FC4	annual	cumulative
		$\Delta CI_{ct,t}$	$\Delta CI_{ct,t}$	$\Delta CIBSLLK_t$	$\Delta CIBSLLK$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-4,224	-6,086	-10,310	-10,310
2023	1	-5,343	-5,195	-10,538	-20,848
2024	2	-6,330	-2,792	-9,122	-29,970
2025	3	-6,992	-5,277	-12,269	-42,239
2026	4	-6,072	-4,405	-10,477	-52,716
2027	5	-3,700	-3,919	-7,619	-60,335
2028	6	-5,084	-6,551	-11,635	-71,969
2029	7	-4,761	-4,106	-8,868	-80,837
2030	8	-5,168	-6,571	-11,738	-92,575
2031	9	-6,156	-9,321	-15,477	-108,052
2032	10	-4,659	-4,564	-9,223	-117,275
2033	11	-4,939	-5,593	-10,532	-127,807
2034	12	-3,988	-5,929	-9,917	-137,724
2035	13	-5,890	-4,347	-10,236	-147,960
2036	14	-5,639	-3,204	-8,843	-156,803
2037	15	-4,539	-4,594	-9,133	-165,936
2038	16	-5,092	-3,937	-9,029	-174,965
2039	17	-4,903	-4,554	-9,458	-184,423
2040	18	-2,461	-4,839	-7,300	-191,723
2041	19	-3,323	-6,827	-10,150	-201,872
2042	20	-3,898	-5,715	-9,614	-211,486
2043	21	-3,660	-4,582	-8,241	-219,727
2044	22	-3,773	-4,363	-8,136	-227,863
2045	23	-4,432	-2,252	-6,684	-234,547
2046	24	-3,877	-5,215	-9,092	-243,639
2047	25	-3,465	-2,446	-5,911	-249,551
2048	26	-2,575	-4,807	-7,381	-256,932
2049	27	-2,590	-3,932	-6,522	-263,454
2050	28	-2,274	-5,525	-7,799	-271,253
2051	29	-3,076	-4,459	-7,535	-278,788
2052	30	-300	-579	-879	-279,667

Table 3.50 - Baseline carbon stock change in the wood products biomass in the Leakage Belt (Method 1) - (Table 21.c.6 of VM0015).

Year	Project year t	Total carbon stock change in the wood products of the initial forest classes in the project area			
		FC3	FC4	annual	cumulative
		$\Delta Cwp_{ct,t}$	$\Delta Cwp_{ct,t}$	$\Delta CwpBSLLK_t$	$\Delta CwpBSLLK$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	0	0	0	0
2023	1	0	0	0	0
2024	2	0	0	0	0
2025	3	0	0	0	0
2026	4	0	0	0	0
2027	5	0	0	0	0
2028	6	0	0	0	0
2029	7	0	0	0	0
2030	8	0	0	0	0
2031	9	0	0	0	0
2032	10	0	0	0	0
2033	11	0	0	0	0
2034	12	0	0	0	0
2035	13	0	0	0	0
2036	14	0	0	0	0
2037	15	0	0	0	0
2038	16	0	0	0	0
2039	17	0	0	0	0
2040	18	0	0	0	0
2041	19	0	0	0	0
2042	20	0	0	0	0
2043	21	0	0	0	0
2044	22	0	0	0	0
2045	23	0	0	0	0
2046	24	0	0	0	0
2047	25	0	0	0	0
2048	26	0	0	0	0
2049	27	0	0	0	0
2050	28	0	0	0	0
2051	29	0	0	0	0
2052	30	0	0	0	0

Table 3.51 - Baseline carbon stock change in the above-ground biomass in the leakage belt area (Method 2) - (Table 22.c.1 of VM0015).

Year	Project year t	Total carbon stock change in the above-ground biomass of the initial forest classes in the leakage belt area			
		FC1	FC2	annual	cumulative
		$\Delta Cab_{ct,t}$	$\Delta Cab_{ct,t}$	$\Delta CabBSLLK_t$	$\Delta CabBSLLK$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-77.4	-218.8	-3,438	-3,438
2023	1	-55.2	0.7	-8,538	-11,976
2024	2	-25.7	-215.4	-7,997	-19,973
2025	3	-30.0	0.7	-11,536	-31,510
2026	4	-12.8	-38.8	-6,383	-37,893
2027	5	-22.2	-54.4	-15,402	-53,294
2028	6	-2.7	-75.6	-3,565	-56,860
2029	7	-3.5	0.7	-2,513	-59,373
2030	8	-1.4	-61.5	-3,007	-62,380
2031	9	-9.3	0.7	-7,931	-70,311
2032	10	-3.8	0.7	-3,220	-73,531
2033	11	-2.7	0.7	-2,053	-75,584
2034	12	-3.9	-16.9	-3,363	-78,948
2035	13	-9.9	0.7	-6,783	-85,731
2036	14	-4.0	0.7	-2,560	-88,291
2037	15	-18.6	0.7	-11,216	-99,507
2038	16	-10.6	0.7	-7,109	-106,616
2039	17	-1.8	0.7	-1,141	-107,757
2040	18	-8.4	-110.9	-6,456	-114,214
2041	19	-5.0	0.7	-3,251	-117,464
2042	20	-11.1	-75.4	-8,363	-125,828
2043	21	0.7	0.7	458	-125,370
2044	22	-8.5	-185.0	-11,137	-136,507
2045	23	-0.8	0.7	-489	-136,996
2046	24	-13.5	0.7	-9,844	-146,839
2047	25	-7.5	0.7	-4,841	-151,680
2048	26	-10.6	-16.0	-7,358	-159,038
2049	27	-7.5	0.7	-5,230	-164,268
2050	28	-3.5	0.7	-2,259	-166,527
2051	29	-1.4	-27.4	-1,709	-168,236
2052	30	0.6	-6.1	109	-168,127

Table 3.52 - Baseline carbon stock change in the below-ground biomass in the leakage belt area (Method 2) - (Table 22.c.2 of VM0015).

Year	Project year t	Total carbon stock change in the below-ground biomass of the initial forest classes in the leakage belt area			
		FC1	FC2	annual	cumulative
		$\Delta Cbb_{ct,t}$	$\Delta Cbb_{ct,t}$	$\Delta CbbBSLLK_t$	$\Delta CbbBSLLK$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	0.29	-7.91	12	12
2023	1	0.29	-7.91	43	55
2024	2	0.29	-7.91	-6	49
2025	3	0.29	-7.91	38	87
2026	4	0.29	-7.91	45	132
2027	5	0.29	-7.91	70	202
2028	6	0.29	-7.91	16	218
2029	7	0.29	-7.91	27	245
2030	8	0.29	-7.91	-39	205
2031	9	0.29	-7.91	-8	197
2032	10	0.29	-7.91	-5	192
2033	11	0.29	-7.91	-28	164
2034	12	0.29	-7.91	18	182
2035	13	0.29	-7.91	2	184
2036	14	0.29	-7.91	6	190
2037	15	0.29	-7.91	23	212
2038	16	0.29	-7.91	105	318
2039	17	0.29	-7.91	100	418
2040	18	0.29	-7.91	174	591
2041	19	0.29	-7.91	156	747
2042	20	0.29	-7.91	156	903
2043	21	0.29	-7.91	146	1,050
2044	22	0.29	-7.91	-9	1,040
2045	23	0.29	-7.91	-32	1,008
2046	24	0.29	-7.91	-5	1,003
2047	25	0.29	-7.91	-29	974
2048	26	0.29	-7.91	-47	927
2049	27	0.29	-7.91	-32	894
2050	28	0.29	-7.91	-30	865
2051	29	0.29	-7.91	-71	794
2052	30	0.29	-7.91	-92	702

Table 3.53 - Baseline carbon stock change in the litter biomass in the leakage belt area (Method 2) - (Table 22.c.4 of VM0015).

Year	Project year t	Total carbon stock change in the litter biomass of the initial forest classes in the leakage belt area			
		FC1	FC2	annual	cumulative
		$\Delta Cl_{ct,t}$	$\Delta Cl_{ct,t}$	$\Delta CIBSLLK_t$	$\Delta CIBSLLK$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-4.51	-8.91	-200	-200
2023	1	-3.23	0.00	-499	-699
2024	2	-1.52	-8.77	-437	-1,136
2025	3	-1.77	0.00	-681	-1,817
2026	4	-0.78	-1.60	-379	-2,196
2027	5	-1.32	-2.23	-901	-3,098
2028	6	-0.19	-3.09	-203	-3,301
2029	7	-0.24	0.00	-174	-3,475
2030	8	-0.12	-2.52	-169	-3,644
2031	9	-0.58	0.00	-492	-4,136
2032	10	-0.24	0.00	-220	-4,357
2033	11	-0.16	0.00	-150	-4,507
2034	12	-0.20	-0.52	-216	-4,723
2035	13	-0.39	0.00	-419	-5,142
2036	14	-0.16	0.00	-174	-5,316
2037	15	-0.53	0.00	-672	-5,988
2038	16	-0.32	0.00	-437	-6,424
2039	17	-0.07	0.00	-91	-6,516
2040	18	-0.26	-0.51	-393	-6,909
2041	19	-0.14	0.00	-213	-7,122
2042	20	-0.30	-0.50	-503	-7,624
2043	21	0.00	0.00	0	-7,624
2044	22	-0.22	-3.36	-585	-8,209
2045	23	-0.03	0.00	-54	-8,263
2046	24	-0.32	0.00	-598	-8,861
2047	25	-0.16	0.00	-306	-9,167
2048	26	-0.21	-0.31	-443	-9,609
2049	27	-0.16	0.00	-330	-9,939
2050	28	-0.07	0.00	-157	-10,096
2051	29	-0.03	-0.53	-109	-10,205
2052	30	0.00	-0.12	-11	-10,216

Table 3.54 - Baseline carbon stock change in the wood products biomass in the leakage belt area (Method 2) - (Table 22.c.6 of VM0015).

Year	Project year t	Total carbon stock change in the wood products of the initial forest classes in the leakage belt area			
		FC1	FC2	annual	cumulative
		$\Delta Cwp_{ct,t}$	$\Delta Cwp_{ct,t}$	$\Delta CwpBSLLK_t$	$\Delta CwpBSLLK$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	0.00	0.00	0	0
2023	1	0.00	0.00	0	0
2024	2	0.00	0.00	0	0
2025	3	0.00	0.00	0	0
2026	4	0.00	0.00	0	0
2027	5	0.00	0.00	0	0
2028	6	0.00	0.00	0	0
2029	7	0.00	0.00	0	0
2030	8	0.00	0.00	0	0
2031	9	0.00	0.00	0	0
2032	10	0.00	0.00	0	0
2033	11	0.00	0.00	0	0
2034	12	0.00	0.00	0	0
2035	13	0.00	0.00	0	0
2036	14	0.00	0.00	0	0
2037	15	0.00	0.00	0	0
2038	16	0.00	0.00	0	0
2039	17	0.00	0.00	0	0
2040	18	0.00	0.00	0	0
2041	19	0.00	0.00	0	0
2042	20	0.00	0.00	0	0
2043	21	0.00	0.00	0	0
2044	22	0.00	0.00	0	0
2045	23	0.00	0.00	0	0
2046	24	0.00	0.00	0	0
2047	25	0.00	0.00	0	0
2048	26	0.00	0.00	0	0
2049	27	0.00	0.00	0	0
2050	28	0.00	0.00	0	0
2051	29	0.00	0.00	0	0
2052	30	0.00	0.00	0	0

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, GIS analysis was conducted utilizing data on fire occurrence from the CPTEC/INPE database[147] and Mapbiomas[148], which will be presented at audit under the category "Forest Fire Assessment in the RR". In addition, data published by INPE[149], reveal that the greatest focus of fires occurs in areas that are recently deforested.

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.

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}

[147] Source (last visited on 04/02/2022): http://queimadas.dgi.inpe.br/queimadas/bdqueimadas#exportar-dados
[148] Source . Projeto MapBiomas – Coleção 5.0 da Série Anual de Mapas de Uso e Cobertura da Terra do Brasil (last visited on 04/07/2021): https://mapbiomas.org/colecoes-mapbiomas-1?cama_set_language=pt-BR.
[149] Source . INPE/Terrabrasilis - http://terrabrasilis.dpi.inpe.br/app/dashboard/fires/biomes/aggregated/ (last visited on 05/02/2022).

$EBBN20_{icl,t}$	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

Table 3.55 - Parameters used to calculate non-CO2 emissions from forest fires (Table 23 of VM0015)

Initial Forest Class		Parameters													
		$Fburnt_{icl}$	***Cab***	***Cl***	***$Pburnt_{ab,icl}$***	***$Pburnt_{Cl,icl}$***	***CEab,icl***	***CEcl,icl***	***ECO2-ab***	***ECO2-l***	***EBBCO2-tot***	***$EBBN2O_{icl}$***	***$EBBCH4_{icl}$***	***$EBBtot_{icl}$***
IDcl	**Name**	**%**	**$tCO_2e\ ha^{-1}$**	**$tCO_2e\ ha^{-1}$**					**$tCO_2e\ ha^{-1}$**	**$tCO_2e\ ha^{-1}$**	**$tCO_2e\ ha^{-1}$**	**$tCO_2e\ ha^{-1}$**	**$tCO_2e\ ha^{-1}$**	**$tCO_2e\ ha^{-1}$**
1	FC1 (As)	1.0	78	4.51	0.70	1	0.50	0.99	27	4	32	0.26	3.7	4.00
2	FC2 (Da)	1.0	219.5	9	0.48	1.00	0.5	0.99	53	9	62	0.5	7.29	7.79
3	FC3 (Db)	1.0	249	10	0.80	1.00	0.5	0.99	100	10	110	0.9	12.99	13.89
4	FC4 (Ds)	1.0	297.04	12	0.64	1.00	0.5	0.99	95	12	107	0.9	12.57	13.45

Table 3.56 - 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		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	
		FC1		*FC2*		*FC3*		*FC4*		annual	cumulative
		$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$EBBBSLPA_t$	EBBBSLPA
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2022	0	0.0	4.00	11.2	7.79	1,037.4	13.89	393.2	13.45	19,790	19,790
2023	1	8.8	4.00	85.4	7.79	882.4	13.89	522.2	13.45	19,984	39,775
2024	2	11.3	4.00	76.0	7.79	1,125.7	13.89	450.3	13.45	22,334	62,108
2025	3	0.0	4.00	131.5	7.79	1,277.2	13.89	390.0	13.45	24,017	86,125
2026	4	0.2	4.00	20.9	7.79	1,426.0	13.89	477.1	13.45	26,394	112,519
2027	5	0.0	4.00	50.8	7.79	1,355.2	13.89	628.2	13.45	27,674	140,192
2028	6	0.0	4.00	114.7	7.79	958.8	13.89	528.7	13.45	21,326	161,519
2029	7	0.0	4.00	34.0	7.79	1,032.4	13.89	280.6	13.45	18,384	179,903
2030	8	0.0	4.00	40.8	7.79	1,182.8	13.89	316.1	13.45	21,003	200,905
2031	9	0.0	4.00	7.4	7.79	1,039.0	13.89	396.7	13.45	19,829	220,734
2032	10	0.0	4.00	15.5	7.79	932.7	13.89	481.7	13.45	19,558	240,293
2033	11	0.0	4.00	37.7	7.79	878.0	13.89	365.8	13.45	17,413	257,706
2034	12	0.0	4.00	54.2	7.79	918.4	13.89	165.8	13.45	15,412	273,118
2035	13	0.0	4.00	33.6	7.79	805.1	13.89	516.6	13.45	18,396	291,513
2036	14	41.5	4.00	32.9	7.79	1,070.2	13.89	392.2	13.45	20,566	312,079
2037	15	0.0	4.00	50.0	7.79	711.3	13.89	312.5	13.45	14,475	326,554
2038	16	0.0	4.00	4.6	7.79	755.0	13.89	439.0	13.45	16,430	342,984
2039	17	0.0	4.00	0.0	7.79	664.5	13.89	427.4	13.45	14,981	357,965

Year	Project year t	Emissions of non-CO2 gasses from baseline forest fires		Emissions of non-CO2 gasses from baseline forest fires		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	
		FC1		*FC2*		*FC3*		*FC4*		annual	cumulative
		$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLPA_{icl,t}$	$EBBBSLtot_{icl}$	$EBBBSLPA_t$	EBBBSLPA
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2040	18	0.0	4.00	14.3	7.79	856.7	13.89	352.2	13.45	16,751	374,716
2041	19	0.0	4.00	20.0	7.79	878.1	13.89	287.5	13.45	16,223	390,939
2042	20	0.0	4.00	10.1	7.79	812.2	13.89	420.1	13.45	17,014	407,953
2043	21	0.0	4.00	43.2	7.79	616.2	13.89	506.8	13.45	15,714	423,667
2044	22	0.0	4.00	16.6	7.79	527.7	13.89	197.1	13.45	10,112	433,779
2045	23	0.0	4.00	16.3	7.79	682.6	13.89	250.0	13.45	12,974	446,753
2046	24	0.0	4.00	24.3	7.79	504.3	13.89	425.6	13.45	12,922	459,675
2047	25	0.7	4.00	9.4	7.79	378.8	13.89	336.1	13.45	9,859	469,534
2048	26	0.0	4.00	8.0	7.79	784.7	13.89	186.3	13.45	13,471	483,005
2049	27	0.0	4.00	27.5	7.79	419.4	13.89	443.0	13.45	11,999	495,004
2050	28	0.0	4.00	0.0	7.79	577.7	13.89	480.1	13.45	14,483	509,487
2051	29	0.0	4.00	8.7	7.79	327.9	13.89	345.5	13.45	9,270	518,757
2052	30	0.0	4.00	2.4	7.79	35.9	13.89	25.6	13.45	862	519,618

Table 3.57 - Baseline non-CO2 emissions from forest fires in the leakage belt 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		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 leakage belt	
		FC1		FC2		FC3		FC4		annual	cumulative
		$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	$EBBBSLLK_t$	EBBBSLLK
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2022	0	44.0	4.00	0.1	7.79	418.9	13.89	504.5	13.45	12,782	12,782
2023	1	110.6	4.00	0.0	7.79	529.9	13.89	430.6	13.45	13,597	26,379
2024	2	79.0	4.00	9.1	7.79	627.8	13.89	231.4	13.45	12,222	38,601
2025	3	151.1	4.00	0.0	7.79	693.4	13.89	437.5	13.45	16,121	54,722
2026	4	80.1	4.00	2.0	7.79	602.2	13.89	365.2	13.45	13,614	68,337
2027	5	192.4	4.00	3.8	7.79	366.9	13.89	324.9	13.45	10,266	78,602
2028	6	29.3	4.00	8.0	7.79	504.2	13.89	543.0	13.45	14,488	93,090
2029	7	38.6	4.00	0.0	7.79	472.2	13.89	340.4	13.45	11,293	104,383
2030	8	19.6	4.00	9.1	7.79	512.5	13.89	544.7	13.45	14,595	118,979
2031	9	109.1	4.00	0.0	7.79	610.5	13.89	772.7	13.45	19,311	138,290
2032	10	48.8	4.00	0.0	7.79	462.1	13.89	378.3	13.45	11,703	149,993
2033	11	33.2	4.00	0.0	7.79	489.8	13.89	463.6	13.45	13,173	163,166
2034	12	44.1	4.00	2.0	7.79	395.5	13.89	491.5	13.45	12,297	175,464
2035	13	92.9	4.00	0.0	7.79	584.1	13.89	360.3	13.45	13,333	188,797
2036	14	38.5	4.00	0.0	7.79	559.2	13.89	265.6	13.45	11,496	200,292
2037	15	148.9	4.00	0.0	7.79	450.2	13.89	380.8	13.45	11,972	212,264
2038	16	96.9	4.00	0.0	7.79	505.0	13.89	326.4	13.45	11,794	224,058
2039	17	20.3	4.00	0.0	7.79	486.3	13.89	377.5	13.45	11,915	235,973
2040	18	83.0	4.00	2.1	7.79	244.0	13.89	401.2	13.45	9,134	245,107
2041	19	47.2	4.00	0.0	7.79	329.6	13.89	565.9	13.45	12,379	257,485

Year	Project year t	Emissions of non-CO2 gasses from baseline forest fires		Emissions of non-CO2 gasses from baseline forest fires		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 leakage belt	
		FC1		*FC2*		*FC3*		*FC4*		annual	cumulative
		$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	$ABSLLK_{icl,t}$	$EBBBSLtot_{icl}$	$EBBBSLLK_t$	EBBBSLLK
		ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2042	20	107.2	4.00	2.1	7.79	386.6	13.89	473.8	13.45	12,189	269,674
2043	21	0.0	4.00	0.0	7.79	363.0	13.89	379.8	13.45	10,151	279,825
2044	22	84.1	4.00	23.1	7.79	374.2	13.89	361.7	13.45	10,580	290,404
2045	23	11.9	4.00	0.0	7.79	439.5	13.89	186.7	13.45	8,665	299,069
2046	24	132.5	4.00	0.0	7.79	384.5	13.89	432.3	13.45	11,687	310,756
2047	25	67.8	4.00	0.0	7.79	343.6	13.89	202.8	13.45	7,773	318,529
2048	26	93.7	4.00	2.2	7.79	255.3	13.89	398.5	13.45	9,299	327,828
2049	27	73.2	4.00	0.0	7.79	256.9	13.89	326.0	13.45	8,245	336,073
2050	28	34.7	4.00	0.0	7.79	225.5	13.89	458.0	13.45	9,432	345,505
2051	29	16.2	4.00	4.0	7.79	305.0	13.89	369.6	13.45	9,305	354,811
2052	30	0.6	4.00	0.9	7.79	29.7	13.89	48.0	13.45	1,069	355,880

3.2.2. Project Emissions

The goal of this step (STEP 7 of the VM0015 methodology) is to provide an ex-ante estimate of future carbon stock changes and non-CO2 emissions from forest fires under the project scenario ("actual").

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. There are no planned activities within the project area that will change the carbon stock of the area.

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

To allow ex ante projections to be made, the project proponent shall make a conservative assumption about the effectiveness of the proposed project activities and estimate an Effectiveness Index (EI) between 0 (no effectiveness) and 1 (maximum effectiveness). The estimated value of EI is used to multiply the baseline projections by the factor (1 - EI) and the result shall be considered the ex-ante estimated emissions from unplanned deforestation in the project case. The project design team conservatively considers that surveillance activities are able to attain 90% (see annex 5 to this PD) of effectiveness in avoiding unplanned deforestation inside the Project Area.

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

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

Table 3.58 - 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
2022	0	82,426	82,426	13,861	13,861	-43,541	-43,541	-112,106	-112,106
2023	1	0	82,426	13,861	27,723	-43,322	-86,863	-29,460	-141,566
2024	2	0	82,426	13,861	41,584	-48,331	-135,194	-34,470	-176,036
2025	3	0	82,426	13,861	55,445	-52,865	-188,059	-39,004	-215,040
2026	4	0	82,426	13,861	69,307	-58,433	-246,492	-44,571	-259,611
2027	5	0	82,426	13,861	83,168	-63,449	-309,941	-49,588	-309,199
2028	6	0	82,426	13,861	97,029	-52,683	-362,624	-38,821	-348,021
2029	7	0	82,426	13,861	110,891	-46,153	-408,777	-32,292	-380,312
2030	8	0	82,426	13,861	124,752	-52,437	-461,215	-38,576	-418,888
2031	9	0	82,426	13,861	138,613	-51,559	-512,773	-37,697	-456,586
2032	10	0	82,426	13,861	152,475	-51,418	-564,191	-37,557	-494,142
2033	11	0	82,426	13,861	166,336	-46,647	-610,839	-32,786	-526,928
2034	12	0	82,426	13,861	180,197	-41,368	-652,206	-27,506	-554,435
2035	13	0	82,426	13,861	194,059	-48,422	-700,628	-34,561	-588,995
2036	14	0	82,426	13,861	207,920	-51,294	-751,922	-37,433	-626,428
2037	15	0	82,426	13,861	221,781	-38,704	-790,626	-24,842	-651,271
2038	16	0	82,426	13,861	235,643	-42,366	-832,992	-28,505	-679,775
2039	17	0	82,426	13,861	249,504	-39,315	-872,307	-25,454	-705,229
2040	18	0	82,426	13,861	263,366	-41,970	-914,277	-28,108	-733,337
2041	19	0	82,426	13,861	277,227	-40,352	-954,629	-26,490	-759,828
2042	20	0	82,426	13,861	291,088	-44,335	-998,963	-30,474	-790,301
2043	21	36,580	119,005	19,434	310,522	-42,590	-1,041,553	-59,736	-850,037
2044	22	36,970	155,975	25,065	335,587	-29,843	-1,071,396	-41,747	-891,784
2045	23	34,455	190,430	30,946	366,533	-35,137	-1,106,533	-38,645	-930,430
2046	24	58,329	248,759	40,403	406,935	-35,716	-1,142,249	-53,642	-984,072
2047	25	30,614	279,373	45,303	452,239	-29,112	-1,171,361	-14,423	-998,495
2048	26	0	279,373	45,303	497,542	-34,759	-1,206,120	10,544	-987,951
2049	27	8,384	287,757	46,581	544,123	-33,487	-1,239,607	4,710	-983,241
2050	28	12,280	300,037	48,677	592,799	-38,027	-1,277,634	-1,631	-984,872
2051	29	78,090	378,127	60,572	653,371	-27,201	-1,304,835	-44,718	-1,029,591
2052	30	58,191	436,319	56,643	710,014	-7,093	-1,311,928	-8,642	-1,038,232

Ex ante estimation of actual non-CO2 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

Table 3.59 - Total ex ante estimated actual emissions of non-CO2 gases due to forest fires in the project area (Table 28 of VM0015)

Year	Project year t	Total ex ante estimated actual non-CO2 emissions from forest fires in the Project area	
		annual	cumulative
		$EBBPSPA_t$	EBBPSPA
		tCO_2-e	tCO_2-e
2022	0	1,979	1,979
2023	1	1,998	3,977
2024	2	2,233	6,211
2025	3	2,402	8,613
2026	4	2,639	11,252
2027	5	2,767	14,019
2028	6	2,133	16,152
2029	7	1,838	17,990
2030	8	2,100	20,091
2031	9	1,983	22,073
2032	10	1,956	24,029
2033	11	1,741	25,771
2034	12	1,541	27,312
2035	13	1,840	29,151

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
2036	14	2,057	31,208
2037	15	1,447	32,655
2038	16	1,643	34,298
2039	17	1,498	35,796
2040	18	1,675	37,472
2041	19	1,622	39,094
2042	20	1,701	40,795
2043	21	1,571	42,367
2044	22	1,011	43,378
2045	23	1,297	44,675
2046	24	1,292	45,967
2047	25	986	46,953
2048	26	1,347	48,300
2049	27	1,200	49,500
2050	28	1,448	50,949
2051	29	927	51,876
2052	30	86	51,962

Ex ante estimation of actual carbon stock changes

The table below presents the total ex ante net carbon stock changes and emission of non- Co2 emissions, in the PA.

Table 3.60 - Total ex ante estimated actual net carbon stock changes and emissions of non-CO2 gases in the project area (Table 29 of VM0015).

Year	Project year t	Total ex ante carbon stock decrease due to planned activities		Total ex ante carbon stock increase due to planned activities		Total ex ante carbon stock decrease due to unavoided unplanned deforestation		Total ex ante net carbon stock change		Total ex ante estimated actual non-CO2 emissions from forest fires in the project area	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		$\Delta CPAdPA_t$	$\Delta CPAdPA$	$\Delta CPAiPA_t$	$\Delta CPAiPA$	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$	$EBBPSPA_t$	$EBBPSPA$
		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
2022	0	82,426	82,426	13,861	13,861	-43,541	-43,541	-112,106	-112,106	2,133	2,133
2023	1	0	82,426	13,861	27,723	-43,322	-86,863	-29,460	-141,566	1,998	4,132
2024	2	0	82,426	13,861	41,584	-48,331	-135,194	-34,470	-176,036	2,233	6,365
2025	3	0	82,426	13,861	55,445	-52,865	-188,059	-39,004	-215,040	2,402	8,767
2026	4	0	82,426	13,861	69,307	-58,433	-246,492	-44,571	-259,611	2,639	11,406
2027	5	0	82,426	13,861	83,168	-63,449	-309,941	-49,588	-309,199	2,767	14,173
2028	6	0	82,426	13,861	97,029	-52,683	-362,624	-38,821	-348,021	2,133	16,306
2029	7	0	82,426	13,861	110,891	-46,153	-408,777	-32,292	-380,312	1,838	18,144
2030	8	0	82,426	13,861	124,752	-52,437	-461,215	-38,576	-418,888	2,100	20,245
2031	9	0	82,426	13,861	138,613	-51,559	-512,773	-37,697	-456,586	1,983	22,228
2032	10	0	82,426	13,861	152,475	-51,418	-564,191	-37,557	-494,142	1,956	24,183
2033	11	0	82,426	13,861	166,336	-46,647	-610,839	-32,786	-526,928	1,741	25,925
2034	12	0	82,426	13,861	180,197	-41,368	-652,206	-27,506	-554,435	1,541	27,466
2035	13	0	82,426	13,861	194,059	-48,422	-700,628	-34,561	-588,995	1,840	29,305
2036	14	0	82,426	13,861	207,920	-51,294	-751,922	-37,433	-626,428	2,057	31,362
2037	15	0	82,426	13,861	221,781	-38,704	-790,626	-24,842	-651,271	1,447	32,809
2038	16	0	82,426	13,861	235,643	-42,366	-832,992	-28,505	-679,775	1,643	34,452
2039	17	0	82,426	13,861	249,504	-39,315	-872,307	-25,454	-705,229	1,498	35,951
2040	18	0	82,426	13,861	263,366	-41,970	-914,277	-28,108	-733,337	1,675	37,626
2041	19	0	82,426	13,861	277,227	-40,352	-954,629	-26,490	-759,828	1,622	39,248
2042	20	0	82,426	13,861	291,088	-44,335	-998,963	-30,474	-790,301	1,701	40,949

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	21	36,580	119,005	19,434	310,522	-42,590	-1,041,553	-59,736	-850,037	1,571	42,521
2044	22	36,970	155,975	25,065	335,587	-29,843	-1,071,396	-41,747	-891,784	1,011	43,532
2045	23	34,455	190,430	30,946	366,533	-35,137	-1,106,533	-38,645	-930,430	1,297	44,829
2046	24	58,329	248,759	40,403	406,935	-35,716	-1,142,249	-53,642	-984,072	1,292	46,122
2047	25	30,614	279,373	45,303	452,239	-29,112	-1,171,361	-14,423	-998,495	986	47,107
2048	26	0	279,373	45,303	497,542	-34,759	-1,206,120	10,544	-987,951	1,347	48,455
2049	27	8,384	287,757	46,581	544,123	-33,487	-1,239,607	4,710	-983,241	1,200	49,654
2050	28	12,280	300,037	48,677	592,799	-38,027	-1,277,634	-1,631	-984,872	1,448	51,103
2051	29	78,090	378,127	60,572	653,371	-27,201	-1,304,835	-44,718	-1,029,591	927	52,030
2052	30	58,191	436,319	56,643	710,014	-7,093	-1,311,928	-8,642	-1,038,232	14	52,044

3.2.3. Leakage

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).

Carbon stock changes due to activities implemented in leakage management areas

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. The activities do not intend to effect additional changes to “animal diet and/or animal numbers”, compared to that occurring in the baseline: the training goals will lead to a spatial rearrangement of production sustainably. Thus, the final balance of these training activities will be lower deforestation for a given number of cattle heads.

Planned activities to be implemented in the leakage management area of the Project are not expected to generate a decrease in carbon stock. However, the planned leakage prevention activities and their impact will be monitored during the project's lifetime. In the event of a net sum of carbon stock during a monitoring period is more than zero, indicating an increase in carbon stock, the value will conservatively not be included in the calculation of net GHG emission reductions.

The items below list the steps taken to estimate carbon stock changes in leakage management areas:

a) Prepare a list of the planned leakage prevention activities and briefly describe each of them in the PD.

Table3. 61 - Leakage prevention Activities to be implemented in the Leakage Management Areas.

Project Activity	Expected Activity Impact	Expected Carbon Stock Impact
Training on Fire Brigade	Knowledge in fire control and management techniques, capacitating the community so they can be hired to fight fires when needed, but also to prevent and contain fires that might happen in the LMA.	Maintenance or increase of carbon stock
Strengthening of existing associations and cooperatives in external communities	Empower and engage communities for their self-management, increasing the possibilities of getting support from bodies and institutions and carrying out social development activities in a sustainable way.	Maintenance or increase of carbon stock
Educational workshops on environmental topics	Greater environmental engagement and awareness, in order to decrease deforestation.	Maintenance or increase of carbon stock
Creation of jobs positions, directly or indirectly	Increase source of income and quality of life, in order to decrease the dependency on activities that generate carbon stock decrease, such as cattle ranching and timber production.	Maintenance or increase of carbon stock
Workshops/ trainings to auxiliary in the increment of income for women	Increase in women's income and empowerment, in order to decrease the dependency on activities that generate carbon stock decrease, such as cattle ranching and timber production.	Maintenance or increase of carbon stock

It will be given the opportunity for all deforestation agents to participate in these activities. The monitoring details of each of these activities are described in Section 3.3.3. The results of the parameters monitored will be displayed at Section 3.3.2.

b) Prepare a map of the planned leakage prevention activities showing annual areas of intervention and type of intervention.

The leakage prevention activities mentioned in the table above will happen in accordance to the Community Monitoring Plan (4.4.1), Biodiversity Monitoring Plan (5.4.1) and for the activity Training on Fire Brigade will happen annually. Most of the activities are planned to take place at the community centers and associations. However, in the event of an activity leading to a carbon stock change, such as improvement of technical abilities related to the community's economic activities, this change is expected to be an increase of carbon stock and to happen at the pasture area. Thus, there is no mapped area expected to have carbon stock decrease.

c) Identify the areas where leakage prevention activities will impact on carbon stocks.

As described in items above, no leakage prevention activities will generate decrease in carbon stock, it is only expected to occur the maintenance or increase of carbon stock.

d) Identify the non-forest classes existing within these areas in the baseline case. The pasture is the only non-forest class existing within the LMA (Figure 3.13).

e) Measure the carbon stocks in the identified classes or use conservative literature estimates for each of the identified classes. If some classes have to change carbon stocks in the baseline, do carbon stock projections using growths data and other relevant and verifiable sources of information;

For the calculation of carbon stock change, it was used the value of carbon stock in pasture from the IPCC[150]

Table 3.62 - Carbon Stock for non-forest classes in the leakage management area.

Non-forest class	**Carbon stock (tCO2e/ha)**		
	Cab fcl	**Cbb fcl**	**Ctot fcl**
Pasture	15	24	38

f) Report in table 30.a the projected baseline carbon stock changes in the leakage management areas;

As explained above, there is no expected carbon stock decrease nowhere in the LMA. Thus, no area will be impacted by carbon stock decrease, neither in the baseline case or the project case. The

[150] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 6: Grassland, pg. 6.27, Table 6.4 (no refinement available in the 2019 Refinement).

land use in both cases, baseline and project, is pasture. The tables below show the results of the carbon stock change in the leakage management areas for the baseline case.

Table 3.63 - Ex ante estimated carbon stock change in leakage management areas in the baseline case (Table 30.a of VM0015).

Year	Project year t	Carbon stock changes in leakage management areas in the baseline case								Total carbon stock change in the baseline case	
		Name:	FC1	Name:	FC2	Name:	FC3	Name:	FC4		
		ID $_{icl}$	1	ID $_{icl}$	2	ID $_{icl}$	3	ID $_{icl}$	4	annual	cumulative
		ABSLLKicl,t	Ctoticl,t	*ABSLLKicl,t*	Ctoticl,t	*ABSLLKicl,t*	Ctoticl,t	*ABSLLKicl,t*	Ctoticl,t	*ΔCBSLLKt*	*ΔCBSLLK*
		ha	tCO2-e ha-1	ha	tCO2-e ha-1	ha	tCO2-e ha-1	ha	tCO2-e ha-1	tCO2-e	tCO2-e
2022	0		90.53		320.60		337.84		402.94	0.00	0.00
2023	1		90.53		320.60		337.84		402.94	0.00	0.00
2024	2		90.53		320.60		337.84		402.94	0.00	0.00
2025	3		90.53		320.60		337.84		402.94	0.00	0.00
2026	4		90.53		320.60		337.84		402.94	0.00	0.00
2027	5		90.53		320.60		337.84		402.94	0.00	0.00
2028	6		90.53		320.60		337.84		402.94	0.00	0.00
2029	7		90.53		320.60		337.84		402.94	0.00	0.00
2030	8		90.53		320.60		337.84		402.94	0.00	0.00
2031	9		90.53		320.60		337.84		402.94	0.00	0.00
2032	10		90.53		320.60		337.84		402.94	0.00	0.00
2033	11		90.53		320.60		337.84		402.94	0.00	0.00
2034	12		90.53		320.60		337.84		402.94	0.00	0.00
2035	13		90.53		320.60		337.84		402.94	0.00	0.00
2036	14		90.53		320.60		337.84		402.94	0.00	0.00
2037	15		90.53		320.60		337.84		402.94	0.00	0.00
2038	16		90.53		320.60		337.84		402.94	0.00	0.00
2039	17		90.53		320.60		337.84		402.94	0.00	0.00
2040	18		90.53		320.60		337.84		402.94	0.00	0.00
2041	19		90.53		320.60		337.84		402.94	0.00	0.00
2042	20		90.53		320.60		337.84		402.94	0.00	0.00

Year	Project year t	Carbon stock changes in leakage management areas in the baseline case								Total carbon stock change in the baseline case	
		Name:	FC1	Name:	FC2	Name:	FC3	Name:	FC4		
		ID $_{icl}$	1	ID $_{icl}$	2	ID $_{icl}$	3	ID $_{icl}$	4	annual	cumulative
		ABSLLKicl,t	Ctoticl,t	*ABSLLKicl,t*	Ctoticl,t	*ABSLLKicl,t*	Ctoticl,t	*ABSLLKicl,t*	Ctoticl,t	*∆CBSLLKt*	*∆CBSLLK*
		ha	tCO2-e ha-1	ha	tCO2-e ha-1	ha	tCO2-e ha-1	ha	tCO2-e ha-1	tCO2-e	tCO2-e
2043	21		90.53		320.60		337.84		402.94	0.00	0.00
2044	22		90.53		320.60		337.84		402.94	0.00	0.00
2045	23		90.53		320.60		337.84		402.94	0.00	0.00
2046	24		90.53		320.60		337.84		402.94	0.00	0.00
2047	25		90.53		320.60		337.84		402.94	0.00	0.00
2048	26		90.53		320.60		337.84		402.94	0.00	0.00
2049	27		90.53		320.60		337.84		402.94	0.00	0.00
2050	28		90.53		320.60		337.84		402.94	0.00	0.00
2051	29		90.53		320.60		337.84		402.94	0.00	0.00
2052	30		90.53		320.60		337.84		402.94	0.00	0.00

g) According to the planned interventions, estimate the projected carbon stocks in the leakage management areas under the project scenario. Use conservative growth projections. Report the result in table 30.b; and

Table 3.64 - Ex ante estimated carbon stock change in leakage management areas in the project case (Table 30.b of VM0015).

Year	Project year t	Carbon stock changes in leakage management areas in the project case		Total carbon stock change in the project case	
		IDicl = Pasture		annual	cumulative
		APSLKfcl,t	Ctot fcl,t	∆CPSLKt	∆CPSLK
		ha	tCO_2-e ha^{-1}	tCO_2-e	tCO_2-e
2022	0	0.0	38.20	0	0
2023	1	0.0	38.20	0	0
2024	2	0.0	38.20	0	0
2025	3	0.0	38.20	0	0
2026	4	0.0	38.20	0	0
2027	5	0.0	38.20	0	0
2028	6	0.0	38.20	0	0
2029	7	0.0	38.20	0	0
2030	8	0.0	38.20	0	0
2031	9	0.0	38.20	0	0
2032	10	0.0	38.20	0	0
2033	11	0.0	38.20	0	0
2034	12	0.0	38.20	0	0
2035	13	0.0	38.20	0	0
2036	14	0.0	38.20	0	0
2037	15	0.0	38.20	0	0
2038	16	0.0	38.20	0	0
2039	17	0.0	38.20	0	0
2040	18	0.0	38.20	0	0
2041	19	0.0	38.20	0	0
2042	20	0.0	38.20	0	0
2043	21	0.0	38.20	0	0
2044	22	0.0	38.20	0	0
2045	23	0.0	38.20	0	0
2046	24	0.0	38.20	0	0
2047	25	0.0	38.20	0	0
2048	26	0.0	38.20	0	0
2049	27	0.0	38.20	0	0
2050	28	0.0	38.20	0	0
2051	29	0.0	38.20	0	0
2052	30	0.0	38.20	0	0

h) Calculate the net carbon stock changes that the planned leakage prevention measures are expected to occasion during the fixed baseline period and, optionally, the project crediting period. Report the results of the calculations in table 30.c

Table 3.65 - Ex ante estimated net carbon stock change in leakage management areas (Table 30.c of VM0015)

Year	Project year t	Total carbon stock change in the baseline case		Total carbon stock change in the project case		Net carbon stock change due to leakage prevention measures	
		annual	cumulative	annual	cumulative	annual	cumulative
		ΔCBSLLKt	ΔCBSLLK	ΔCPSLKt	ΔCPSLK	ΔCLPMLKt	ΔCLPMLK
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	0.0	0.0	0	0	0	0
2023	1	0.0	0.0	0	0	0	0
2024	2	0.0	0.0	0	0	0	0
2025	3	0.0	0.0	0	0	0	0
2026	4	0.0	0.0	0	0	0	0
2027	5	0.0	0.0	0	0	0	0
2028	6	0.0	0.0	0	0	0	0
2029	7	0.0	0.0	0	0	0	0
2030	8	0.0	0.0	0	0	0	0
2031	9	0.0	0.0	0	0	0	0
2032	10	0.0	0.0	0	0	0	0
2033	11	0.0	0.0	0	0	0	0
2034	12	0.0	0.0	0	0	0	0
2035	13	0.0	0.0	0	0	0	0
2036	14	0.0	0.0	0	0	0	0
2037	15	0.0	0.0	0	0	0	0
2038	16	0.0	0.0	0	0	0	0
2039	17	0.0	0.0	0	0	0	0
2040	18	0.0	0.0	0	0	0	0
2041	19	0.0	0.0	0	0	0	0
2042	20	0.0	0.0	0	0	0	0
2043	21	0.0	0.0	0	0	0	0
2044	22	0.0	0.0	0	0	0	0
2045	23	0.0	0.0	0	0	0	0
2046	24	0.0	0.0	0	0	0	0
2047	25	0.0	0.0	0	0	0	0
2048	26	0.0	0.0	0	0	0	0
2049	27	0.0	0.0	0	0	0	0
2050	28	0.0	0.0	0	0	0	0
2051	29	0.0	0.0	0	0	0	0
2052	30	0.0	0.0	0	0	0	0

If the sum of the carbon stock changes within a monitoring period will be negative, the significance will be determined with the most recent version of the EB-CDM approved “Tool for testing significance of GHG emissions on A/R project activities”. If the decrease is significant, it will be accounted in the *ex-ante* estimation of leakage and carbon stock changes in the land units where leakage prevention measures are implemented will be subject to MRV. If the decrease is not significant, then the carbon stock change will not be accounted and it will not be subject to MRV.

Ex-ante estimation of CH_4 and N_2O emissions from grazing animals

This item does not apply to the YBYRÁ REDD+ Project, once there is no activity of grazing animals in leakage management areas.

Total ex-ante estimated carbon stock changes and increases in GHG emissions due to leakage prevention measures

The table below summarizes the results of GHG emissions from leakage prevention activities.

Table 3.66 - Ex ante estimated total emissions above the baseline from leakage prevention activities (Table 33 of VM0015).

Year	Project year t	Carbon stock decrease due to leakage prevention measures		Total ex ante increase in GHG emissions due to leakage prevention measures	
		annual	cumulative	annual	cumulative
		ΔCLPMLKt	ΔCLPMLK	ELPMLKt	ELPMLK
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	0.0	0.0	0	0
2023	1	0.0	0.0	0	0
2024	2	0.0	0.0	0	0
2025	3	0.0	0.0	0	0
2026	4	0.0	0.0	0	0
2027	5	0.0	0.0	0	0
2028	6	0.0	0.0	0	0
2029	7	0.0	0.0	0	0
2030	8	0.0	0.0	0	0
2031	9	0.0	0.0	0	0
2032	10	0.0	0.0	0	0
2033	11	0.0	0.0	0	0
2034	12	0.0	0.0	0	0
2035	13	0.0	0.0	0	0
2036	14	0.0	0.0	0	0
2037	15	0.0	0.0	0	0
2038	16	0.0	0.0	0	0
2039	17	0.0	0.0	0	0
2040	18	0.0	0.0	0	0
2041	19	0.0	0.0	0	0
2042	20	0.0	0.0	0	0

Year	Project year t	Carbon stock decrease due to leakage prevention measures		Total ex ante increase in GHG emissions due to leakage prevention measures	
		annual	cumulative	annual	cumulative
		∆CLPMLKt	∆CLPMLK	ELPMLKt	ELPMLK
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2043	21	0.0	0.0	0	0
2044	22	0.0	0.0	0	0
2045	23	0.0	0.0	0	0
2046	24	0.0	0.0	0	0
2047	25	0.0	0.0	0	0
2048	26	0.0	0.0	0	0
2049	27	0.0	0.0	0	0
2050	28	0.0	0.0	0	0
2051	29	0.0	0.0	0	0
2052	30	0.0	0.0	0	0

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 shall be done by multiplying the estimated baseline carbon stock changes for the project area by a “Displacement Leakage Factor” (DLF) representing the percent of deforestation expected to be displaced outside the project boundary.

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

It is expected that 100% of potential deforestation agents in the Reference Region will be given the opportunity to participate in leakage prevention activities. Thus, the “Displacement Leakage Factor” (DLF) is conservatively considered as 0.05 (See Annex 5)

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 equation for ∆CADLK (total ex ante estimated decrease in carbon stocks due to displaced deforestation) is set below:

$$\Delta CADLK_t = (CabBLSPA_t + CbbBSLPAt - CwpBSLPAt)*(DLF)$$

Where:

$CabBLSPA_t$ Baseline carbon stock change in the above-ground biomass at year t in the project area; tCO_2-e

$CbbBSLPA_t$ Baseline carbon stock change in the below-ground biomass at year t in the project area; tCO_2-e

$CwpBSLP_t$ Baseline carbon stock change in the wood products at year t in the project area; tCO_2-e

DLF Displacement Leakage Factor; %

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

The equation for ∆EADLKt (total ex ante estimated increase in GHG emissions due to displaced forest fires) is set below:

$$\Delta EADLK_t = (EBBBSLPA_t)*(DLF)$$

Where:

$EBBBSLPA_t$ Baseline non-CO2 emissions from forest fires at year t in the project area; tCO_2-e

DLF Displacement Leakage Factor; %

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

Table 3.67 - 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	cumulative	annual	cumulative
		$\Delta CADLK_t$	$\Delta CADLK$	$EADLK_t$	$EADLK$
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	-13,807	-13,807	639	639
2023	1	-14,781	-28,588	680	1,319
2024	2	-13,297	-41,885	611	1,930
2025	3	-17,993	-59,878	806	2,736
2026	4	-15,825	-75,703	681	3,417
2027	5	-12,923	-88,627	513	3,930
2028	6	-17,900	-106,527	724	4,655
2029	7	-14,643	-121,170	565	5,219
2030	8	-18,804	-139,973	730	5,949
2031	9	-24,458	-164,431	966	6,914
2032	10	-16,147	-180,579	585	7,500
2033	11	-17,764	-198,343	659	8,158
2034	12	-17,070	-215,413	615	8,773
2035	13	-17,590	-233,003	667	9,440
2036	14	-15,517	-248,520	575	10,015
2037	15	-16,399	-264,919	599	10,613
2038	16	-15,947	-280,867	590	11,203
2039	17	-16,202	-297,069	596	11,799
2040	18	-13,533	-310,602	457	12,255
2041	19	-16,813	-327,415	619	12,874
2042	20	-16,414	-343,829	609	13,484
2043	21	-14,101	-357,929	508	13,991
2044	22	-14,514	-372,443	529	14,520
2045	23	-11,961	-384,404	433	14,953
2046	24	-15,548	-399,952	584	15,538
2047	25	-11,082	-411,034	389	15,926
2048	26	-13,031	-424,066	465	16,391
2049	27	-11,704	-435,770	412	16,804
2050	28	-13,201	-448,971	472	17,275
2051	29	-12,737	-461,707	465	17,741
2052	30	-3,765	-465,472	53	17,794

Ex ante estimation of total leakage

The summary of the total ex-ante estimation of leakage is presented in the table below.

Table 3.68 -Ex-ante estimated total leakage (Table 35 of VM0015)

Year	Project year t	Total ex ante increase in GHG emissions due to displaced forest fires		Total ex ante decrease in carbon stocks due to displaced deforestation		Total net carbon stock change due to leakage		Total net increase in emissions due to leakage	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		$EADLK_t$	$EADLK$	$\Delta CADLK_t$	$\Delta CADLK$	ΔCLK_t	ΔCLK	ELK_t	ELK
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2022	0	639	639	-13,807	-13,807	-13,807	-13,807	639	639
2023	1	680	1,319	-14,781	-28,588	-14,781	-28,588	680	1,319
2024	2	611	1,930	-13,297	-41,885	-13,297	-41,885	611	1,930
2025	3	806	2,736	-17,993	-59,878	-17,993	-59,878	806	2,736
2026	4	681	3,417	-15,825	-75,703	-15,825	-75,703	681	3,417
2027	5	513	3,930	-12,923	-88,627	-12,923	-88,627	513	3,930
2028	6	724	4,655	-17,900	-106,527	-17,900	-106,527	724	4,655
2029	7	565	5,219	-14,643	-121,170	-14,643	-121,170	565	5,219
2030	8	730	5,949	-18,804	-139,973	-18,804	-139,973	730	5,949
2031	9	966	6,914	-24,458	-164,431	-24,458	-164,431	966	6,914
2032	10	585	7,500	-16,147	-180,579	-16,147	-180,579	585	7,500
2033	11	659	8,158	-17,764	-198,343	-17,764	-198,343	659	8,158
2034	12	615	8,773	-17,070	-215,413	-17,070	-215,413	615	8,773
2035	13	667	9,440	-17,590	-233,003	-17,590	-233,003	667	9,440
2036	14	575	10,015	-15,517	-248,520	-15,517	-248,520	575	10,015
2037	15	599	10,613	-16,399	-264,919	-16,399	-264,919	599	10,613
2038	16	590	11,203	-15,947	-280,867	-15,947	-280,867	590	11,203
2039	17	596	11,799	-16,202	-297,069	-16,202	-297,069	596	11,799
2040	18	457	12,255	-13,533	-310,602	-13,533	-310,602	457	12,255

Year	Project year t	Total ex ante increase in GHG emissions due to displaced forest fires		Total ex ante decrease in carbon stocks due to displaced deforestation		Total net carbon stock change due to leakage		Total net increase in emissions due to leakage	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		$EADLK_t$	EADLK	$\Delta CADLK_t$	$\Delta CADLK$	ΔCLK_t	ΔCLK	ELK_t	ELK
		tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2041	19	619	12,874	-16,813	-327,415	-16,813	-327,415	619	12,874
2042	20	609	13,484	-16,414	-343,829	-16,414	-343,829	609	13,484
2043	21	508	13,991	-14,101	-357,929	-14,101	-357,929	508	13,991
2044	22	529	14,520	-14,514	-372,443	-14,514	-372,443	529	14,520
2045	23	433	14,953	-11,961	-384,404	-11,961	-384,404	433	14,953
2046	24	584	15,538	-15,548	-399,952	-15,548	-399,952	584	15,538
2047	25	389	15,926	-11,082	-411,034	-11,082	-411,034	389	15,926
2048	26	465	16,391	-13,031	-424,066	-13,031	-424,066	465	16,391
2049	27	412	16,804	-11,704	-435,770	-11,704	-435,770	412	16,804
2050	28	472	17,275	-13,201	-448,971	-13,201	-448,971	472	17,275
2051	29	465	17,741	-12,737	-461,707	-12,737	-461,707	465	17,741
2052	30	53	17,794	-3,765	-465,472	-3,765	-465,472	53	17,794

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; tCO2e

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

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

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

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

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

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

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

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

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

$$VCU_t = REDD_t - VBC_t$$

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

Where:

VCU_t Number of Verified Carbon Units that can be traded at time t; tCO_2-e

$REDD_t$ 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 subdivided into Internal Risk (5.0), External Risk (0) and Natural Risk (2.5), which is rounded up to 10 points.

The summary of the total ex-ante estimation is presented in the table below.

Table 3.69 - Ex ante estimated net anthropogenic GHG emission reductions (REDDt) and Voluntary Carbon Units (VCUt) - (Table 36 of VM0015)

Year	Project year t	Baseline carbon stock changes		Baseline GHG emissions		Ex ante project carbon stock changes		Ex ante project GHG emissions		Ex ante leakage carbon stock changes	
		annual ∆CBSLPAt tCO2-e	cumulative ∆CBSLPA tCO2-e	annual EBBBSLPAt tCO2-e	cumulative EBBBSLPA tCO2-e	annual ∆CPSPAt tCO2-e	cumulative ∆CPSPA tCO2-e	annual EBBPSPAt tCO2-e	cumulative EBBPSPA tCO2-e	annual ∆CLKt tCO2-e	cumulative ∆CLK tCO2-e
2022	-	403,964.23	403,964.23	19,790.45	19,790.45	108,960.87	108,960.87	1,979.05	1,979.05	13,807.25	13,807.25
2023	1	432,371.99	836,336.22	19,984.17	39,774.62	29,375.86	138,336.73	1,998.42	3,977.46	14,781.18	28,588.44
2024	2	482,466.15	1,318,802.37	22,333.84	62,108.47	34,385.27	172,722.00	2,233.38	6,210.85	13,296.85	41,885.29
2025	3	527,805.84	1,846,608.20	24,016.56	86,125.03	38,919.24	211,641.24	2,401.66	8,612.50	17,992.58	59,877.86
2026	4	583,481.43	2,430,089.63	26,393.70	112,518.73	44,486.80	256,128.04	2,639.37	11,251.87	15,825.49	75,703.36
2027	5	633,646.42	3,063,736.05	27,673.56	140,192.28	49,503.30	305,631.34	2,767.36	14,019.23	12,923.17	88,626.52
2028	6	525,981.78	3,589,717.83	21,326.33	161,518.62	38,736.84	344,368.18	2,132.63	16,151.86	17,900.49	106,527.02
2029	7	460,684.45	4,050,402.28	18,384.13	179,902.74	32,207.10	376,575.28	1,838.41	17,990.27	14,642.50	121,169.52
2030	8	523,526.92	4,573,929.19	21,002.54	200,905.28	38,491.35	415,066.63	2,100.25	20,090.53	18,803.98	139,973.49
2031	9	514,740.40	5,088,669.59	19,829.19	220,734.47	37,612.70	452,679.33	1,982.92	22,073.45	24,457.70	164,431.19
2032	10	514,253.54	5,602,923.13	19,558.17	240,292.64	37,564.01	490,243.34	1,955.82	24,029.26	16,147.34	180,578.54
2033	11	466,546.84	6,069,469.97	17,413.01	257,705.66	32,793.34	523,036.68	1,741.30	25,770.57	17,764.08	198,342.62
2034	12	413,751.34	6,483,221.31	15,411.87	273,117.52	27,513.79	550,550.47	1,541.19	27,311.75	17,069.91	215,412.53
2035	13	484,293.83	6,967,515.14	18,395.58	291,513.11	34,568.04	585,118.51	1,839.56	29,151.31	17,590.24	233,002.77

Year	Project year t	Baseline carbon stock changes		Baseline GHG emissions		Ex ante project carbon stock changes		Ex ante project GHG emissions		Ex ante leakage carbon stock changes	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		∆CBSLPAt	∆CBSLPA	EBBBSLPAt	EBBBSLPA	∆CPSPAt	∆CPSPA	EBBPSPAt	EBBPSPA	∆CLKt	∆CLK
		tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e
2036	14	513,015.59	7,480,530.73	20,566.19	312,079.30	37,440.22	622,558.73	2,056.62	31,207.93	15,517.05	248,519.82
2037	15	387,112.50	7,867,643.23	14,474.84	326,554.14	24,849.91	647,408.64	1,447.48	32,655.41	16,399.49	264,919.31
2038	16	423,733.73	8,291,376.97	16,429.58	342,983.71	28,512.03	675,920.67	1,642.96	34,298.37	15,947.46	280,866.77
2039	17	393,224.49	8,684,601.46	14,981.27	357,964.99	25,461.11	701,381.77	1,498.13	35,796.50	16,202.42	297,069.19
2040	18	419,770.34	9,104,371.80	16,751.26	374,716.24	28,115.69	729,497.47	1,675.13	37,471.62	13,532.63	310,601.82
2041	19	403,591.21	9,507,963.01	16,222.76	390,939.00	26,497.78	755,995.24	1,622.28	39,093.90	16,812.93	327,414.75
2042	20	443,348.49	9,951,311.50	17,013.58	407,952.58	30,473.51	786,468.75	1,701.36	40,795.26	16,413.86	343,828.61
2043	21	425,897.39	10,377,208.89	15,714.34	423,666.92	59,735.83	846,204.58	1,571.43	42,366.69	14,100.67	357,929.28
2044	22	298,427.19	10,675,636.08	10,111.99	433,778.91	41,747.36	887,951.95	1,011.20	43,377.89	14,514.17	372,443.45
2045	23	351,366.50	11,027,002.57	12,974.40	446,753.31	38,645.50	926,597.44	1,297.44	44,675.33	11,960.84	384,404.29
2046	24	357,161.00	11,384,163.57	12,921.60	459,674.90	53,642.37	980,239.82	1,292.16	45,967.49	15,547.55	399,951.84
2047	25	291,121.58	11,675,285.15	9,859.37	469,534.27	14,422.98	994,662.80	985.94	46,953.43	11,082.29	411,034.13
2048	26	347,591.11	12,022,876.26	13,470.71	483,004.98	-10,544.32	984,118.48	1,347.07	48,300.50	13,031.42	424,065.54
2049	27	334,868.16	12,357,744.43	11,999.04	495,004.02	-4,709.74	979,408.74	1,199.90	49,500.40	11,704.19	435,769.73
2050	28	380,273.48	12,738,017.91	14,482.73	509,486.75	1,631.06	981,039.80	1,448.27	50,948.68	13,200.80	448,970.53
2051	29	272,005.41	13,010,023.31	9,269.81	518,756.56	44,718.49	1,025,758.29	926.98	51,875.66	12,736.58	461,707.11
2052	30	86,260.69	13,096,284.00	861.55	519,618.11	10,174.49	1,035,932.77	86.15	51,961.81	3,764.94	465,472.05

Year	Project year t	Ex ante leakage GHG emissions		Ex ante net anthropogenic GHG emission reductions		Ex ante VCUs tradable		Ex ante buffer credits	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		ELKt	ELK	ΔREDDt	ΔREDD	VCUt	VCU	VBCt	VBC
		tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e
2022	-	639.11	639.11	298,368.41	298,368.41	268,868.07	268,868.07	29,500.34	29,500.34
2023	1	679.84	1,318.95	405,520.86	703,889.27	365,221.24	634,089.32	40,299.61	69,799.95
2024	2	611.10	1,930.05	454,273.38	1,158,162.65	409,465.30	1,043,554.62	44,808.09	114,608.04
2025	3	806.07	2,736.12	491,702.85	1,649,865.50	442,814.19	1,486,368.81	48,888.66	163,496.70
2026	4	680.71	3,416.83	546,242.75	2,196,108.25	492,343.29	1,978,712.10	53,899.46	217,396.16
2027	5	513.29	3,930.12	595,612.86	2,791,721.12	537,198.55	2,515,910.65	58,414.31	275,810.47
2028	6	724.39	4,654.52	487,813.75	3,279,534.87	439,089.26	2,954,999.90	48,724.49	324,534.96
2029	7	564.65	5,219.17	429,815.91	3,709,350.78	386,968.18	3,341,968.08	42,847.73	367,382.70
2030	8	729.77	5,948.94	484,404.11	4,193,754.88	435,900.55	3,777,868.63	48,503.56	415,886.26
2031	9	965.54	6,914.48	469,550.73	4,663,305.62	421,837.96	4,199,706.59	47,712.77	463,599.03
2032	10	585.17	7,499.65	477,559.37	5,140,864.98	429,890.41	4,629,597.00	47,668.95	511,267.98
2033	11	658.67	8,158.32	431,002.46	5,571,867.44	387,627.11	5,017,224.11	43,375.35	554,643.33
2034	12	614.86	8,773.18	382,423.45	5,954,290.90	343,799.70	5,361,023.81	38,623.75	593,267.08
2035	13	666.65	9,439.83	448,024.93	6,402,315.82	403,052.35	5,764,076.16	44,972.58	638,239.66
2036	14	574.79	10,014.62	477,993.11	6,880,308.93	430,435.57	6,194,511.73	47,557.54	685,797.20
2037	15	598.59	10,613.21	358,291.87	7,238,600.80	322,065.61	6,516,577.34	36,226.26	722,023.46
2038	16	589.68	11,202.89	393,471.18	7,632,071.98	353,949.01	6,870,526.35	39,522.17	761,545.63
2039	17	595.74	11,798.64	364,448.37	7,996,520.34	327,672.03	7,198,198.38	36,776.34	798,321.97
2040	18	456.69	12,255.33	392,741.46	8,389,261.80	353,575.99	7,551,774.37	39,165.47	837,487.43
2041	19	618.93	12,874.26	374,262.05	8,763,523.85	336,552.71	7,888,327.08	37,709.34	875,196.78
2042	20	609.44	13,483.70	411,163.91	9,174,687.77	369,876.41	8,258,203.49	41,287.50	916,484.27
2043	21	507.55	13,991.24	365,696.25	9,540,384.02	329,080.09	8,587,283.59	36,616.16	953,100.43
2044	22	528.98	14,520.22	250,737.47	9,791,121.48	225,069.48	8,812,353.07	25,667.98	978,768.41
2045	23	433.24	14,953.46	312,003.87	10,103,125.35	280,731.77	9,093,084.84	31,272.10	1,010,040.51

Year	Project year t	Ex ante leakage GHG emissions		Ex ante net anthropogenic GHG emission reductions		Ex ante VCUs tradable		Ex ante buffer credits	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
		ELKt	ELK	∆REDDt	∆REDD	VCUt	VCU	VBCt	VBC
		tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO2-e
2046	24	584.33	15,537.80	299,016.18	10,402,141.53	268,664.32	9,361,749.16	30,351.86	1,040,392.38
2047	25	388.65	15,926.45	274,101.09	10,676,242.62	246,431.23	9,608,180.39	27,669.86	1,068,062.24
2048	26	464.94	16,391.39	356,762.71	11,033,005.33	320,949.17	9,929,129.55	35,813.54	1,103,875.78
2049	27	412.27	16,803.67	338,260.58	11,371,265.91	304,302.79	10,233,432.34	33,957.79	1,137,833.57
2050	28	471.61	17,275.27	378,004.47	11,749,270.38	340,140.22	10,573,572.57	37,864.24	1,175,697.81
2051	29	465.26	17,740.53	222,427.91	11,971,698.29	199,699.22	10,773,271.79	22,728.69	1,198,426.50
2052	30	53.45	17,793.98	73,043.21	12,044,741.50	65,434.59	10,838,706.38	7,608.62	1,206,035.12

Year	Estimated baseline emissions (tCO2e)	Estimated project emissions (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions (tCO2e)
2022	423,754.69	110,939.92	14,446.36	298,368.41
2023	452,356.16	31,374.27	15,461.03	405,520.86
2024	504,799.99	36,618.66	13,907.95	454,273.38
2025	551,822.40	41,320.90	18,798.65	491,702.85
2026	609,875.12	47,126.17	16,506.20	546,242.75
2027	661,319.98	52,270.66	13,436.46	595,612.86
2028	547,308.11	40,869.47	18,624.89	487,813.75
2029	479,068.58	34,045.52	15,207.15	429,815.91
2030	544,529.45	40,591.60	19,533.75	484,404.11
2031	534,569.59	39,595.62	25,423.24	469,550.73
2032	533,811.71	39,519.83	16,732.52	477,559.37
2033	483,959.86	34,534.64	18,422.75	431,002.46
2034	429,163.21	29,054.98	17,684.78	382,423.45
2035	502,689.41	36,407.60	18,256.89	448,024.93
2036	533,581.78	39,496.84	16,091.84	477,993.11
2037	401,587.34	26,297.39	16,998.08	358,291.87
2038	440,163.31	30,154.99	16,537.14	393,471.18
2039	408,205.76	26,959.23	16,798.16	364,448.37
2040	436,521.60	29,790.82	13,989.32	392,741.46
2041	419,813.96	28,120.05	17,431.86	374,262.05
2042	460,362.07	32,174.86	17,023.30	411,163.91
2043	441,611.73	61,307.26	14,608.22	365,696.25
2044	308,539.18	42,758.56	15,043.15	250,737.47
2045	364,340.89	39,942.94	12,394.09	312,003.87
2046	370,082.59	54,934.53	16,131.88	299,016.18
2047	300,980.95	15,408.92	11,470.94	274,101.09
2048	361,061.82	(9,197.25)	13,496.36	356,762.71
2049	346,867.21	(3,509.84)	12,116.46	338,260.58
2050	394,756.21	3,079.33	13,672.41	378,004.47
2051	281,275.22	45,645.47	13,201.84	222,427.91
2052	87,122.23	10,260.64	3,818.39	73,043.21
Total	**13,615,902.11**	**1,087,894.59**	**483,266.03**	**12,044,741.50**

3.3. Monitoring

3.3.1. Data and Parameters Available at Validation

The data and parameters that are determined of available at validation and remain fixed throughout the project crediting period are presented in the tables below.

Data / Parameter	**CF**
Data unit	t Ct-1 d.m
Description	Default value of carbon fraction in biomass
Source of data	Values from the literature (e,g,, 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf)
Value applied	0.47
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	**R** **Root-shoot ratio**
Data unit	dimensionless
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 “2019 refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories”. Page 4.18, Table 4.4

Value applied	*0.22*
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 (Method 1) or BCEF (Method 2) - F1** **BEF: Biomass expansion factor** **BCEF: Biomass Conversion and Expansion Factor**
Data unit	Dimensionless
Description	Biomass Expansion Factor
Source of data	"A: Nogueira, E. M., Fearnside, P. M., Nelson, B. W., Barbosa, R. I., & Keizer, E. W. H. (2008). Estimates of forest biomass in the Brazilian Amazon: new allometric equations and adjustments to biomass from wood-volume inventories. Forest Ecology and Management, 256(11), 1853-1867. B: VM0015 Methodology for Avoided Unplanned Deforestation (Values of BCEF for application to volume data)"
Value applied	1.2 (FC 1); 0.7 (FC 2, 3 e 4)
Justification of choice of data or description of measurement methods and procedures applied	*BEF and BCEF 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 below-ground biomass carbon pool of initial forest class icl
Source of data	Forth Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions and Removals, 2020.
Value applied	FC1: 78.10; FC2: 219.49; FC3:249.19; FC4: 297.04
Justification of choice of data or description of measurement methods and procedures applied	The database is the most recent national publication. It was result of robust modelling involving field work data, LiDAR data and remote sensing data. It was adopted the spatial data which is more conservative than the general average of the forest type.
Purpose of Data	*Calculation of baseline emissions*
Comments	NA

Data / Parameter	**Clticl**
Data unit	tCO2e/ha
Description	Average carbon stock per hectare in the litter carbon pool of initial forest class icl

Source of data	Forth Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions and Removals, 2020.
Value applied	FC1: 4.51; FC2: 8.91; FC3:10.08; FC4: 12.06
Justification of choice of data or description of measurement methods and procedures applied	The database is the most recent national publication. It was result of robust modelling involving field work data, LiDAR data and remote sensing data. It was adopted the spatialized data which is more conservative than the general average of the forest type.
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 pasture conversion
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 6: Grassland, pg. 6.27, Table 6.4 (no refinement available in the 2019 Refinement)
Value applied	10.68
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 pasture conversion
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 6: Grassland, pg. 6.27, Table 6.4 (no refinement available in the 2019 Refinement)
Value applied	17.10
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 can 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	Forest cover areas converted into non-forest areas
Source of data	*Measured through data from MapBiomas collection database.*
Value applied	*Ex-ante total annual deforestation from 2022 to 2052 in RR:* FC1: 12,738; FC2: 11,362; FC3:443,099; FC4: 266,026
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 annual mapping project (MapBiomas). The data generated by this project is used in this project*, *MapBiomas data are applicable for use in this project, according to the criteria listed below (Methodology VM0015): i*) *MapBiomas mapping* occurs in the entire project area and leakage belt, ii) *MapBiomas mapping* occurs in the entire reference region and covers the beginning, *middle and end of the fixed baseline period, iii*) *MapBiomas mapping* 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.*
Purpose of Data	*Calculation of baseline emissions*
Comments	*N/A*

Data / Parameter	***Fburnt***
Data unit	*%*

Description	Proportion of forest area burned during the historical reference period in the forest class icl
Source of data	*Barlow, J., Berenguer, E., Carmenta, R., & França, F. 2020. Clarifying Amazonia's burning crisis. Global Change Biology, 26(2), 319–321.*
Value applied	Estimation of GHG emissions from biomass burning, considering 100% of burnt. This value varies annually, according to the deforested area.
Justification of choice of data or description of measurement methods and procedures applied	Conservative value used as default, considering that it is a common practice the use of fire to clean and prepare the land for other land-use activities.
Purpose of Data	*Calculation of baseline emissions*
Comments	*N/A*

Data / Parameter	***Pburnt***
Data unit	*%*
Description	Average proportion of mass burnt in the carbon pool p in the forest class icl (Cab-CXB)/ Cab
Source of data	*Data calculated according to the values of the Carbon stock Above ground and Carbon Stock removed before burnt.*
Value applied	FC1=0.7; FC2=0.48; FC3=0.8; FC4=0.64
Justification of choice of data or description of measurement methods and procedures applied	*Data obtained from the equation that considers the Carbon Stock Above ground subtracting the Carbon Stock removed before burnt, and the result divided by the value of Carbon Stock Above ground.*

Purpose of Data	*Calculation of baseline emissions*
Comments	*N/A*

3.3.2. Data and Parameters Monitored

The tables below present the data and parameters that will be monitored during the crediting period.

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. If insignificant or not applicable, the value estimated is 0.
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	1) Land use and land cover mapping is assessed using images with spatial resolution superior to 30 meters. Image acquisition is performed during the period of low incidence of clouds and rainfall in the region, as closer as possible to the end of the monitoring period.

	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 table 3.19*
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, as closer as possible to the end of the monitoring period. 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 table 3.18
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, as closer as possible to the end of the monitoring period. 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 results tables below.*
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, as closer as possible to the end of the monitoring period. 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 Table 3.57*
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, as closer to the end of the monitoring period. 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 results tables below*
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, as closer as possible to the end monitoring period.

	2) Images undergo geometric correction by means of geo-referencing, using topographic maps as reference or USG-NASA orthorectified images. 3) For analysis of areas with cloud cover, visual interpretation of radar image is performed. 4) Evaluation of classification accuracy is performed by analysing the overall accuracy and kappa index obtained from a confusion matrix. The minimum accuracy of the classification mapping should be 80%.
Purpose of data	• *Calculation of leakage*
Calculation method	Emissions from planned activities in leakage management areas are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	N/A

Data / Parameter	**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	Indicated in Table 3.55

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, as closer as possible to the end of the monitoring period. 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	If forest fires occur, these non-CO_2 emissions will be subject to monitoring and accounting, when significant.

and procedures to be applied	
Frequency of monitoring/recording	Annually
Value applied	*Indicated in the Table 3.66*
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, as closer as possible to the end of the monitoring period. 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	tCO_2e
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 Table 3.64*
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, as closer to the end of the monitoring period. 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 MapBiomas 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 tables 57 and 58*
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 as closer as possible to the end of the monitoring period.

	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 Table 3.48*
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, as closer as possible to the end of the monitoring period. 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. This plan started to be designed and structured from the beginning of the crediting period as stated in section 2.1.14 (Project Start Date). 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 GIS and Remote Sensing tasks will be implemented to measure the parameters exposed in section 3.3.2, especially deforestation in hectares according to each monitoring report period. 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) The policies for oversight and accountability of monitoring activities
f) Data archiving.
g) Organization and responsibilities of the parties involved in all the above.
h) The procedures for handling non-conformances with the validated monitoring plan

After the regular sessions of this monitoring plan, the YBYRA REDD+ introduces the Forest Integrity Plan – FIP (in Portuguese: "Plano de Integridade Florestal - PIF") as a complementary resource to assist in monitoring and protecting the integrity of the forest in the project area and its boundaries.

In additional, YBYRÁ REDD+ Project will also show the main aspects to monitor the sustainable forest management and post-exploratory reports, in complementing with the supervision of the environmental responsible institution, as explained in the final session of this topic.

3.3.3.1. Monitoring of actual carbon stock changes and GHG emissions within the project area and leakage belt

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).

3.3.3.1.1 Monitoring of land-use and land-cover change within the PROJECT AREA and LEAKAGE BELT

a) **Technical description of the monitoring tasks**.

The monitoring of actual carbon stock changes and GHG emissions within the project area will be carried out using satellite images and remote sensing techniques, with the objective of identifying and quantifying the deforestation that occurred during the monitoring period in the reference region, leakage belt and project area. The analysis of land use changes will be based on primary information due to the unavailability of secondary data such as Prodes or Mapbiomas data. Based on secondary data from the database of the BD/Queimadas (INPE) system, we will evaluate the outbreaks of fires that occurred during the monitoring period for all project boundaries.

b) Data to be collected.

The remote sensing data to be collected consists of annual satellite imagery processed by a supervised classification of optical images from Landsat 8/9 TM or Sentinel 2 orbital sensors. If there is a high incidence of clouds in the mentioned images, the strategy will be to classify radar (SAR) images available from the Sentinel 1 sensor and thus measure all changes in land use within the period defined for the MR according to the requirements demanded by the methodology.

Table 3.70 - Data collected to monitor changes in carbon stock and GHG emissions for periodic verifications

Parameter	Description	Unit	Source	Frequency
ACPAt	Annual area within the Project Area affected by catastrophic events at year *t*	ha	Remote sensing data and GIS; *Supervisor reports*	Each time a catastrophic event occurs
ABSLPAt	Annual area of baseline deforestation in the project area at year t	ha	Remote sensing data and GIS	Annually
ΔCPAdPAt	Total decrease in carbon stock due to all planned activities at year t in the project area.	tCO2e	Documents, remote sensing and GIS	Annually
ΔCUDdPAt	Total actual carbon stock change due to	tCO2e	Remote sensing and GIS	Annually

	unavoided unplanned deforestation at year t in the project area			
EBBPSPAt	Sum of (or total) actual non-CO_2 emissions from forest fire at year *t* in the project area	tCO_2e	*Remote sensing and GIS; Supervisor reports*	*Annually*
Deforestation in the project area and leakage belt	Forest cover areas converted into non-forest areas inside the Project Area and Leakage Belt	ha	Calculated through remote sensing images	*Annually*

c) Overview of data collection procedures

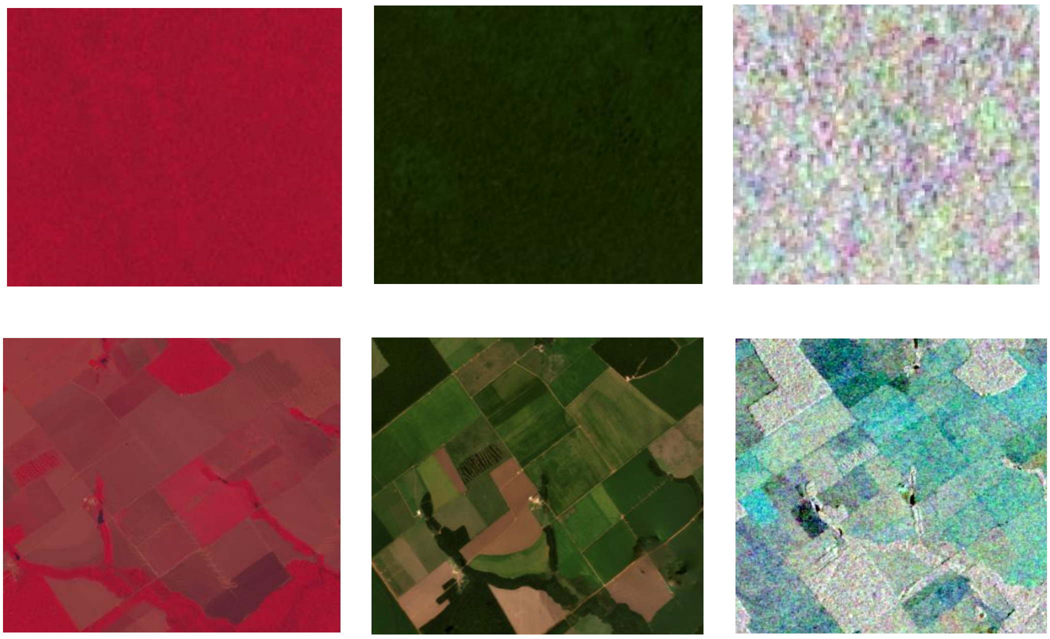
The classification of the selected optical image will use the Random Forest algorithm, in the Google Earth Engine (GEE) environment. Samples for training the Random Forest classifier will be divided into two blocks, with 30% for training and evaluation of the classifier; and 70% for use in the classification process. The classifier was run with 100 decision trees.

The initial result of the classification will be treated in a GIS environment (ArcGIS), in order to reduce residuals and errors of the classifier. Pixel filters such as Majority (ArcGIS) may be applied reduce the so-called “salt and pepper” effect of the classification, identifying isolated pixels and recategorizing it according to the majority value of its eight neighbors. In addition, a visual inspection of the classification product overlaid on the image will be performed with the objective of correcting main errors of the classifier via visual interpretation and vector scanning.

If the quality of image is compromised by high cloud cover, Sentinel-1 SAR images it will be adopted. These images will be used in the GIS environment (ArcGIS) for vectorization by visual interpretation of the increment of deforested areas omitted from the visual images due to the high cloud cover until the end of the monitoring period (Figure 3.26).

The mapping of semi-automatic deforestation and through visual interpretation was carried out through the following steps:

1. **Target identification**: non-forest areas;
2. **Training**: deforestation areas observed in optical satellite images, of equal or better resolution, are overlaid to identify patterns of hue, texture/roughness, shape and location of deforested areas;
3. **Photointerpretation**: identification and vectorization on the radar image of deforestation areas omitted by clouds on the optical image, using as a mask all deforestation already mapped.



Forest

Non Forest

Sentinel-2 imagery – (R8 G4 B3) false color composition – 10 m pixel

Planet imagery (web map service) true color view – 3m pixel

Sentinel 1 SAR Imagery (VH) Polarization – 20m pixel

Figure 3.26. Land use sampling frame for photointerpretation and deforestation measurement.

The data containing the fire areas were specialized in ArcGIS and superimposed on the limits of the project areas, with the objective of identifying the occurrence of fires and possible losses in the forest cover of the project areas.

All fire points found within the project areas were analyzed using high and medium resolution images available and nearest as possible of the likely fire event date. This verification is done by analyzing images in a closed before and another one closed after the hot focus detection data aid to detect any change over forest cover in terms of color, hue, texture and roughness.

d) Quality control and quality assurance procedures.

The validation of land-use data used for measure of land use will be performed by using the confusion matrix, to calculate the overall index of success by period and by class. Three specific classes will be used: forest, deforestation and another one if occurs in the mapping product, such as hydrography, not forest, clouds, roads, residues, unclassified objects, and others.

The analysis of the accuracy of the land use change measurement will be performed by means of the confusion matrix, overall accuracy and Kappa index. The sampling will be stratified, proportionally by area, based on a total of 100 points randomly distributed across the reference region, leakage belt and project area by using the Create Accuracy Assessment Points tool on ArcGIS.

The accuracy assessment points map assigns value to the land use map generated in the classification process in one column. This column will be omitted, and the interpreter populates the Ground Truth field based on the interpretation of the reference data used in such as raw optical image itself and web service maps from ESRI and Planet with higher spatial resolution than the input image. So, the accuracy assessment points table is the input for Compute Confusion Matrix tool on ArcGIS.

Land use classes must have higher values than 90% accuracy for the accuracy and Kappa index, as required in VM0015 1.1 methodology.

e) The policies for oversight and accountability of monitoring activities

The policies of oversight and accountability of monitoring activities will include:

- Use of internal expertise of Carbonext to manage the review of the documents and data from the monitoring plan, ensuring that it complies with the applicable standards;
- Regular review meetings between the project *proponents* to evaluate the monitoring plan;
- To ensure transparency and accountability, the monitoring plan and its results will be available to the VVB and VCS verifiers at each verification.

f) Data archiving

All maps and records generated during project implementation will be conserved and made available to VCS verifiers at verification process. 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.

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

The Figure 3.27 presents an overview of a monitoring plan's actors, considering the governance of the YBYRÁ REDD+ Project. The Carbonext is responsible to remote monitoring (via satellite weekly images which identifies deforestation and burning alerts. The terrestrial monitoring is executed by COOPERCARBON which develops terrestrial patrols in PAs.

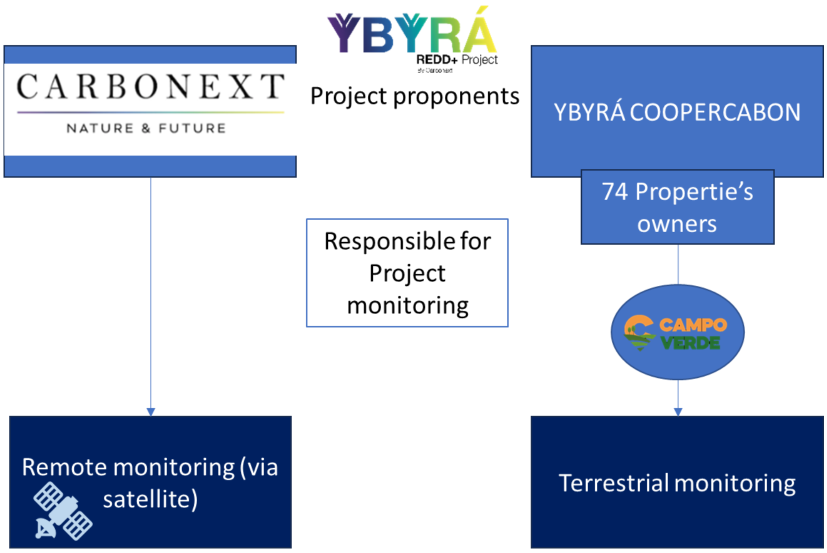


Figure 3.27. Overview of the monitoring actors in the YBYRÁ REDD+ Project.

All satellite imagery assessments will be performed by Carbonext GIS expert time, also responsible for reporting and data archiving (digital version of the original documents), according to VM0015 v1.1, and for aiding during verification audits.

h) The procedures for handling non-conformances with the validated monitoring plan

The project proponents will establish the procedures necessary to deal with non-conformities. All the necessary procedures and guidelines will be drawn up with the objective of meeting the main levels of control.

One of the main objectives will be to minimize the risk of error. To this end, a quality management system of project information will be developed, seeking reliable data to support the monitoring results and thus reduce the possibility of non-conformities. This includes training the team in the various responsibilities to be performed under the YBYRA REDD+ project; Field review, in order to monitor the procedures determined in the methodological guidelines and; Careful review of all relevant information to the project, including monitoring reports, before their release to stakeholders (VVB, governments, institutions...), in order to verify and confirm that all calculations, information, analysis and conclusions are measurable and reliable. These actions will be conducted by Carbonext.

If non-conformities appear during the processes, the data will be reviewed, and the non-conformities will have to be addressed. All deviations will be reported in section 3.1.3 of the Monitoring Report.

3.3.3.1.3. 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.

Non-CO_2 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.

Summaries of 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, will be presented, as required in VM0015 1.1 methodology.

b) Data to be collected.

The mapping of fire outbreaks will be carried out from the following databases:

- BD Queimadas, platform of monitoring and warning of forest fires from National Institute for Spatial Research (INPE), available in https://queimadas.dgi.inpe.br/queimadas/portal.
- Cicatrizes do fogo, platform of monitoring and measure forest fires scares from Mapbiomas Fogo, available in https://plataforma.brasil.mapbiomas.org/fogo.

c) Overview of data collection procedures.

- BD Queimadas: geospatial point features indicating the heat points for the entire reference region during the monitoring report period. The impact of fire within PA and LB will be measure through the comparative analysis of satellite images before and after the date of the hot spot warning.
- Cicatrizes do fogo: geospatial polygons features indicating burned areas over forested land use for the entire reference region during the monitoring report period. The impact of fire within PA and LB will be measure through the overlapping fire scars layer with PA and LB boundaries.

d) Quality control and quality assurance procedures.

The sources cited do not make specific assumptions about the accuracy of the data provided. BD Burnings provides heat data from optical sensors operating in the thermal-medium (4um) range such as AVHRR/3 from NOAA-18 and 19, METOP-B and C, MODIS from NASA TERRA and AQUA, VIIRS from NPP-Suomi and NOAA-20, and images from the geostationary satellites GOES-16 and MSG-3. Fire Scars adopts procedures for assessing scar classification with Landsat images by visual inspection. Considering these limitations, whenever there is indication of fire occurrence by any of the sources within the PA or LB, we will seek to validate the impacts with field incursions (provided that the locations are accessible) or visual inspection of Sentinel 2 or Landsat 8 or 9 satellite images.

e) The policies for oversight and accountability of monitoring activities

The policies of oversight and accountability of monitoring activities will include:

- Use of internal expertise of Carbonext to manage the review of the documents and data's from the monitoring plan, ensuring that it complies with the applicable standards;
- Regular review meetings between the project *proponents* to evaluate the monitoring plan;
- To ensure transparency and accountability, the monitoring plan and its results will be available to the VVB and VCS verifiers at each verification.

f) Data archiving

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

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

All fire impact assessments will be performed by Carbonext GIS expert time, also responsible for reporting and data archiving (digital version of the original documents), according to VM0015 v1.1, and for providing assistance during verification audits.

h) The procedures for handling non-conformances with the validated monitoring plan

The project proponents will establish the procedures necessary to deal with non-conformities. All the necessary procedures and guidelines will be drawn up with the objective of meeting the main levels of control.

One of the main objectives will be to minimize the risk of error. To this end, a quality management system of project information will be developed, seeking reliable data to support the monitoring results and thus reduce the possibility of non-conformities. This includes training the team in the various responsibilities to be performed under the YBYRÁ REDD+ project; Field review, in order to monitor the procedures determined in the methodological guidelines and; Careful review of all relevant information to the project, including monitoring reports, before their release to stakeholders (VVB, governments, institutions...), in order to verify and confirm that all calculations, information, analysis and conclusions are measurable and reliable. These actions will be conducted by Carbonext.

If non-conformities appear during the processes, the data will be reviewed, and the non-conformities will have to be addressed. All deviations will be reported in section 3.1.3 of the Monitoring Report.

3.3.3.1.4. Monitoring of impact of natural disturbances and other catastrophic events

According to the AFOLU Non-Permanence Risk Tool VT0001 applied in this project, the natural disturbances and other catastrophic events are insignificant in the area. For this reason, the monitoring of these attributes is not subject to monitoring and must not be accounted under the project scenario, as described in the VM0015 Methodology. The NPRR is available to the audit to assess.

In the case of extreme significant natural disturbance/ catastrophic event, which is not common in the region, the episode will be considered.

3.3.3.2 Monitoring of leakage

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.
The activity displacement leakage monitoring plan will take place as described in item 3.3.3.1.1. in terms of deforestation, in item 3.3.3.1.3. in terms of forest fires and item 3.3.3.1.4. in terms of catastrophic events.

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 will 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 VM0015 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 VM0015 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 VM0015 1.1 methodology.

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 VM0015 1.1 methodology.

Table 3.71 - Data collected to monitor net ex-post reductions for the YBYRÁ REDD+ project.

Parameter	Unit	Source	Frequency
Reduction of net GHG emissions attributable to the project activities at AUD in the year	tCO_2e	Calculated	Annually
Number of Verified Carbon Units (VCUs) to be made available for sale in the year	tCO_2e	Calculated	Annually

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 deforested areas within the project area and leakage belt shall be updated and presented to VCS verifiers at each verification event. The cumulative area cannot generate additional VCUs in future periods.

e) The policies for oversight and accountability of monitoring activities

The policies of oversight and accountability of monitoring activities will include:

- Use of internal expertise of Carbonext to manage the review of the documents and data's from the monitoring plan, ensuring that it complies with the applicable standards;
- Regular review meetings between the project proponents to evaluate the monitoring plan;
- To ensure transparency and accountability, the monitoring plan and its results will be available to the VVB and VCS verifiers at each verification.

f) Data archiving

All maps and records generated during project implementation and monitoring 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.

g) Organization and responsibilities of the parties involved in all the above

All satellite imagery and other data assessments will be performed by Carbonext SIG expert time, also responsible for reporting and data archiving (digital version of the original documents), according to VM0015 v1.1, and for aiding during verification audits.

Forest Integrity Plan (in Portuguese: Plano de Integridade Florestal PIF)

In addition to the monitoring strategies described in 3.3.3., a continuous monitoring plan called Forest Integrity Plan (PIF) will be proposed to strengthen the protection of forests in the project area. It is important to reinforce that the PIF consists of a set of preventive and combat procedures that will be implemented during the first years of the project and does not provide data for measurement of any parameter listed in section 3.3.2.

PIF is composed of a set of preventive actions such as remote and ground monitoring that will be carried out. For remote monitoring, the MonitoraCarbon alert system will be used. It is a system for automatically deforestation detection through weekly satellite imagery processing. Whenever a deforestation alert is issued, Carbonext will trigger the proponent to take the appropriate measures according to the guidelines developed by Carbonext and partner.

For ground monitoring, surveillance patrols will be carried out continuously on pre-established routes to inspect forest conditions within the project area. As for this monitoring, the evidence of the patrols, as well as of occurrences (illegal invasions, fires, deforestation, others) when they occur, will be collected in a form until it is possible to implement and train the use of a more robust system such as a mobile application.

As for combat actions, a fire brigade will be formed and instituted with the objective of being more efficient in fighting forest fires. In case of any kind of occurrences that compromised the forest integrity within project area, the measures instituted and detailed in the PIF will be adopted, which should follow the recommendations of the legal department of Carbonext, ensuring alignment with the company's compliance policy (see PIF section 5.1).

In addition, the plan also details the responsibilities of the parties involved.

Sustainable Forest Management Monitoring Plan

According to the Tropical Forest Institute (IFT[151]), the process to implement sustainable forest management in the Amazon follows important criteria, represented in the chart below (Figure 3.28).

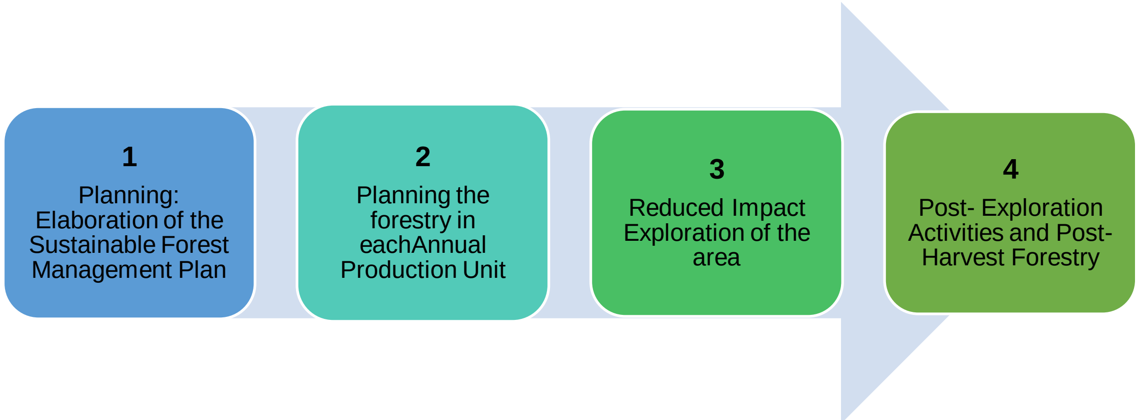


Figure 3.28 - Process to practice sustainable forest management in properties in Pará State.

The step 1 and 2 are important to plan the activities, thus being pre-exploration steps. The step 3 is the implementation of the activity and the fourth step corresponds to the post-exploration processes.

1**) Planning:** Elaboration of the Sustainable Forest Management Plan

This pre-exploration process is essential to plan the costs, areas to be managed, logistics, evaluations and quantifications.

2) Planning the forestry in each Annual Production Unit (UPA -"Unidade de Produção Anual")

The second stage is the planning in a smaller scale, considering the delimitation of each "UPA", also evaluating the costs, areas to be managed, logistics and quantifications.

3) Reduced Impact Exploration of the area

The activity is implemented following sustainable practices proposed by the IFT (Instituto Floresta Tropical)[152], such as control of the direction of tree cutting and better/maximum use of the wood taken. These practices guarantee the sustainability of the activity. A report with evidence and photos of this step is made in order to monitor the process in compliance with the sustainable forest management plan and regulations.

4) Post- Exploration Activities and Post-Harvest Forestry

[151] Available on: https://ift.org.br/wp-content/uploads/2014/11/Informativo-T%C3%A9cnico-1.pdf
[152] Available on: https://ift.org.br/wp-content/uploads/2014/11/Informativo-T%C3%A9cnico-1.pdf

In addition with the exploration report, the monitoring of the area must be held, in order to allow the next cut cycles and regeneration of the trees. The Flora and Biomass inventories will be periodically held along the 30 years of the project.

It is important to emphasize that these four steps and the documents produced during the forestry to acquire authorization are submitted to specific institutions that regulate and evaluate them, in order to guarantee the sustainable implementation of the activity. Thus, besides the monitoring and control of the production by the owner, the information from the sustainable forest management plan and post-exploratory reports will be monitored also by the official regulation institution responsible.

In the YBYRÁ REDD+ Project, the laws applied are according to the Pará State, thus the institution responsible for the assessment of the documents and evidence is the SEMAS ("Secretaria Estadual de Meio Ambiente e Sustentabilidade"). SEMAS is responsible to authorize the management after evaluation of the PMFS and to evaluate the Activities Report post-exploration. The dispatch of new Authorization (AUTEF) depends on the approval and inspection of SEMAS, as stated in the art. 54 of the Normative Instruction No. 02, OF JUNE 16th, 2017[153], responsible to make technical visits and monitor the activity.

The YBYRÁ REDD+ Project is committed with the conservation of the Amazon Forest and sustainable practices for all activities in the properties involved in the project, such as forestry. Thus, the contract between the proponents ensures that the actions/activities respect the Compliance regulations and the Code of Ethics and Organizational Conduct of the Carbonext, presented in item 2.3.11. of the PDD.

The agreement, contract and close relationship established between the proponents of the project also states that all local laws and processes must be respected in order to the REDD+ Project to be successful accomplished. All documentation approved by the responsible organs (such as the AUTEF, OMFS, etc.) will be shared with the technical Team from Carbonext for evaluation. In the case of any disparity found in the checking process of evidence made by Carbonext, the landowner will be notified and must justify.

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 2027. For this purpose, the following tasks will be carried out:

- Updating information on agents, drivers and underlying causes of deforestation, which involves:

[153]Available on: https://www.semas.pa.gov.br/legislacao/normas/view/199

- 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.
- Adjustment of the carbon components 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).

3.3.3.5. Other project activities to reach climate benefits

3.3.3.5.1. Formation of Cooperative – structuring the projects’ governance

In order to unite actions and strengthen the conservation of forest areas in the region of Paragominas, the owners of 74 private properties decided to develop a REDD+ project. As consequence, the landowners needed to organize themselves and structure their legal governance, so the project could be effectively managed and produce the expected positive results, or even surpass them. This unique project, which enabled smaller rural farms with forested areas to unite for a bigger purpose and create a carbon project, foresees the process of creation of the first Carbon Cooperative in Brazil, being an important and essential mark to the projects’ governance and development in general. Thus, one of the main project activities of the MR01 is the process to formation of the COOPERCARBON, given the uniqueness and complexity of articulation and management.

After the start date, the first technical meeting with all the proponents occurred on the 5th of April, 2022, in Paragominas. The landowners began together the discussions on the project development, its governance and other structuring factors, such as the division of carbon credits.

Figure 3.29 - First technical meeting with landowners of the YBYRÁ REDD+ Project.

Between socioeconomic diagnosis and public consultations, the second technical meeting with the proponents happened on the 15th of September of 2022. This meeting stablished the next steps to the structuring of the governance and pointed the necessity to have a participatory workshop of the construction of the governance. On 25th of November of 2022 occurred the Workshop, with 32 proprietaries, to decide whether the governance would be in the format of association, cooperative or others. In this meeting, it was decided to the formation of a cooperative to manage the YBYRÁ REDD+ Project (figure 3.31).

Figure 3.30 - Workshop on Governance with the proprietaries of the YBYRÁ REDD+ Project.

In December, another important step happened: the confirmation of the PAs of each property, on individual meetings with each proprietary. This process allows transparency and certainty on the areas that will participate on the project and guarantees no changes in the perimeters to the definition of projects limits, such as the PA, the RR, etc., to the modeling of GHG reductions estimation. Another important step of the development of the project, happened on the March of 2023 with a workshop with the landowners to establish the monitoring structure of the forest areas. On this meeting, many subjects were discussed, on the methods, frequency, schedule of implementation and others. Thus, the first drafts on the monitoring plan were made. On the 10th to 14th of April 2023, the monitoring plan, with the routes of the terrestrial monitoring and frequency was validated by the landowners. It is important to emphasize that these activities were carried out by Carbonext and Campo Verde.

Finally, on the 30th of June of 2023, the COOPERCARBON was created by the properties' owners as a result of this project actions, being the first carbon credits cooperative of Brazil. The Coopercabon is then defined as the project proponent, with the landowners involved in the YBYRÁ REDD+ Project associated in the cooperative. The legal structure of the project is then stablished, with internal rules and statute, in compliance with the same interests regarding ethics, corruption and seriousness, as the other proponents. Only then it is possible to develop effective actions.

The figure bellow (32) illustrates the resulting formation of the cooperative as a project activity to ensure the implementation of project actions and bring benefits, specially to the climate regulation, with the robust monitoring plan and governance structure. Thus, the cooperative can conduct the YBYRÁ REDD+ Project and promote effective project activities on the protection of forests, avoidance of deforestation and GHG emissions, bringing climate regulation benefits.

Figure 3.31 - Infographic of the formation of the cooperative COOPERBARBON, as a project activity of the YBYRÁ REDD+ Project.

3.3.3.5.2. Recomposition of Permanent Preservation Areas and creation of ecological corridors

Permanent Preservation Areas (PPAs) is a clearly defined geographical space that receives protection because of its recognized natural, ecological, or cultural values. Since the Brazilian Law, Permanent Preservation Areas (PPAs) are natural protected areas with rigid limits of exploitation, where direct economic exploitation is not allowed. PPAs are implemented under Brazilian law 12.651, and farmers must delimit the area according to the forest code and isolate it with natural fences or physical barriers to avoid the entry of external animals and human activities. The protection of PPAs aims to ensure a better quality of life for human populations, and it is necessary that delimitation of the PPA be in accordance with the Forest Code (National Law number 12.651), ensuring compliance with the standard and its effectiveness.

The YBYRÁ REDD+ Project proposes the implementation of project activities that have direct impact on climate effects, such as the protection of forest areas and avoidance of GHG emissions. Another activity that is being studied to be implemented is the foment of strategies to protect and recompose, in small scale, Permanent Preservation Areas located in the properties involved in the project, restoring important ecosystem services that are unbalanced.

The YBYRÁ REDD+ Project is committed with the preservation of the Amazon Forest, local biodiversity present in the project area and regulation of climate. Therefore, measures to reinforce the conservation of the Permanent Preservation Areas (“PPAs”) are important to guarantee a quality environment for the fauna, flora and communities of the region.

According to the Informative Bulletin of the Rural Environmental Registry, prepared by the Brazilian Forest Service based on data reported up to January 2020, there are around 4,436,670 hectares of PPAs covered by native vegetation in the Amazon biome. Despite the large extension of PPAs, there are a massive deforesting process in the last years. Second the study performed in Paragominas municipality[154] which evaluated deforestation and forest regeneration in riparian permanent preservation areas over the past two decades, the legal protection given to riparian forests by Brazilian environmental law has not been sufficient to prevent them from being deforested in Paragominas. Besides they found that deforestation inside riparian APPs was greater than deforestation outside riparian PPAs. The protection of these areas is essential to ensure the provision of ecosystem services and mitigation of climate change.

[154] Nunes, S., Barlow, J., Gardner, T., Siqueira, J., Sales, M., & Souza, C. (2015). A 22-year assessment of deforestation and restoration in riparian forests in the eastern Brazilian Amazon. Environmental Conservation, 42(3), 193-203. doi:10.1017/S0376892914000356

As a project activity in the first monitoring period, it was calculated the deforested riparian PPAs in the project zone aiming to quantify the regional context of PAs. The results are showed in the MR1. There were identified approximately 1,800 ha of degraded riparian PPAs in the Project Zone. These areas correspond to riparian vegetation crucial to water resources and others ecosystem services. The recompositing and protection of some of these areas, together with the development of connections between forest fragments with the implementation of ecological corridors, are activities that can enhance quality of water bodies in the project zone and bring benefits to the climate regulation.

In detail, this project activity aims to foment initiatives with different methodologies in order to, based on scientific results and impacts, replicate the successful experiences in more PPAs. In Brazil, the revegetation of riparian areas and revegetation of degraded areas can be extremely expensive and difficult. The costs can be up to R$ 11,000 /ha of restoration[155], impeding rapid restoration of great areas of PPAs. Considering this, the project will foment with technical and financial support the implementation of prototypes areas to restore degradation, in small scale, with the objective to create knowledge, try new strategies and study the results so new areas can be recomposed by the best strategy found. This activity will also promote the creation of ecological corridors to connect forest fragments through PPAs, increasing connectivity for the biodiversity. For this reason, the landscape fragmentation analysis is carried out as a project activity to 1)quantify landscape fragmentation and connectivity, and 2) to define priority areas to conservation and restoration. The results will be presented in the MR.

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 and folders with the results will be presented to the communities and other stakeholders during the consultations and visits.

3.4. Optional Criterion: Climate Change Adaptation Benefits

In all, there are planned activities to reduce climate effects on the region, however, the YBYRÁ REDD+ Project does not apply for the gold level in climate.

4 Community

[155] https://imazon.org.br/avaliacao-e-modelagem-economica-da-restauracao-florestal-no-estado-do-para/

4.1. Without-Project Community Scenario

4.1.1. Descriptions of Communities at Project Start (CM1.1)

As mentioned in the item 2.1.6, the communities of the YBYRÁ REDD+ project are subdivided in external and internal communities. The external communities are the ones outside of the PA and the internal community is composed by workers of the farms and some families of these workers.

External Communities

The external communities identified in the 20 km buffer of the YBYRÁ REDD+ Project are areas of settlements, rural agglomerations and some Indigenous Lands (Figure 4.1). A total of 51 communities within the 20 km buffer were identified, present in the municipalities of Aurora do Pará, Ipixuna do Pará, Nova Esperança do Piriá, Paragominas, Tomé-Açu and Ulianópolis. Of these 51 communities, 27 were visited and it was found that 9 are not communities, but establishment and farms. More concrete information of the communities, with details of the social development policies in Brazil is in point 2.1.6, 2.1.8 Stakeholder Identification and 2.1.9 Stakeholder Descriptions.

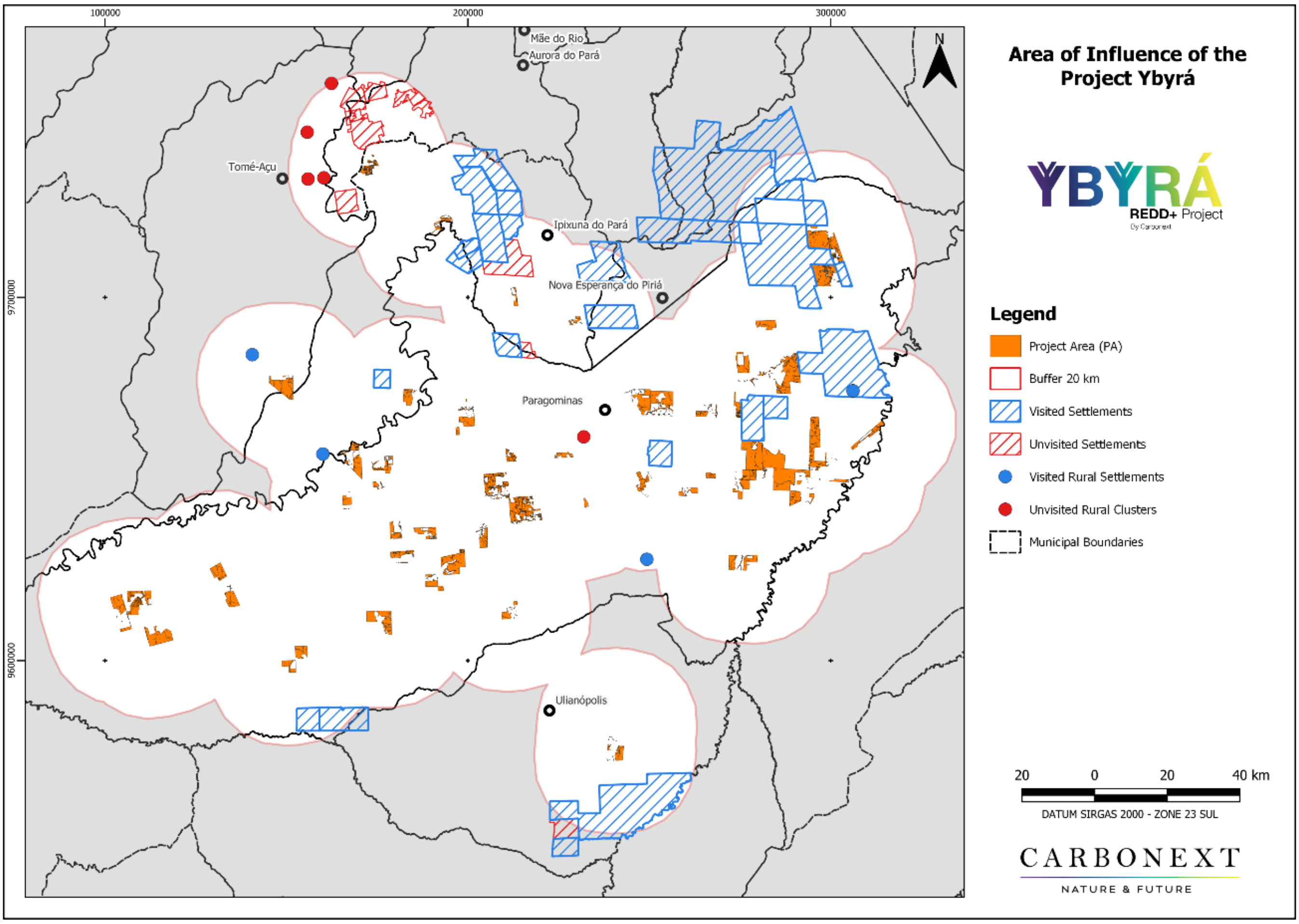


Figure 4.32 - Area of influence according to the buffer of 20 km around the Project Area (PA).

The Project's social team carried out more than 80 visits to the communities present in the project region. During the visits, collective meetings were held, with presentation of the Project, conversations in community associations and socioeconomic survey. It is important to point out that the information that will be presented later comes from participatory surveys carried out with the consulted population. Other socio-economic surveys will be carried out over the 30-year life of the project in order to monitor project activities and impacts.

The communities, in its majority, are composed by agricultural units, coming from the agrarian reform movement of Brazil, movement that was consolidated in the year 1970. Installed by the National Institute of Colonization and Agrarian Reform (INCRA), these units, called the Settlement Project, have become small communities in the areas of the municipalities where they are located and have been donated to the families of farmers or rural workers who do not have the economic conditions to acquire a rural property[156]. The population leaving in the settlements are often neglected by the social policies, and therefore they demand for improvements in their territory, such as road construction, schools, health centers, means of access and technical assistance. More details about the communities selected for project actions are presented in table 4.1.

Table 4.72 - Communities for Project activities.

Communities	Number of families	Population	Population consulted
Alta Floresta	35	245	5
Diamantina II	42	108	13
Minas Pará	100	400	24
Glebinha	42	150	14
Luiz Inácio	50	152	40
Colônia Reunidas	50	250	14
Floresta Gurupi I	90	450	50
Águia Rio Bonito	50	250	34

Most settlement projects have several villages, which are small villages that make up the entire rural settlement. The project team visited more than one village in some of the settlements.

The information above, on the number of families, corresponds to the village consulted, which may differ with information from the INCRA database, contained in item 2.1.6, which corresponds to the settlement project as a whole.

Socio-economic characteristics

[156] https://www.gov.br/incra/pt-br/assuntos/reforma-agraria/assentamentos (Brasil, 2023)

Residents live a simple life, with few financial resources and access. Most have as a source of income the government aid of federal public policies to reduce poverty in the country, such as the “Bolsa Família” Program[157].

Food insecurity is very present in communities. To obtain food, many rely exclusively on agriculture, with cassava, corn, banana, guava, cocoa crops; and raising small animals such as chickens, ducks and pigs. And in the majority, the production of their crops is not enough to support their families. This population have low income and little opportunity for employment and income generation, for different reasons: distance from the municipal headquarters, lack of opportunity in agricultural credit financing programs, lack of technical assistance and improvements in production, lack of education and information, lack of access to the consumer market, among others. It is common for a portion of the population to practice fishing and hunting for subsistence.

Infrastructure

Most communities have poor infrastructure, with dirt roads and wooden bridges for access. The houses are made of wood and masonry, and do not have basic sanitation (figure 4.2.). All the sewage is destined to common, non-septic cesspools, and when they do not have cesspools, they are drained into ditches. Some of the houses have "house bathrooms”, a kind of dry bathroom with hole in the floor, no toilet. When near water, the sewage is discarded direct in the water.

[157] https://www.gov.br/mds/pt-br/acoes-e-programas/bolsa-familia (Brasil, 2023)

Figure 4.33: A typical house in one of the communities in the Project region.

Regarding solid waste, the communities have almost no public garbage collection service. The residues are mostly burned or buried. Some are intended for places reserved for communitarian disposal, which are open areas with massive garbage accumulation, worrisome for human health, diseases and the local biodiversity as well.

There are communities that have no water supply. In these, residents drink water by collecting directly from the river. Others, which do not come from nearby streams, have handmade wells with long depth, and capture the water with the help of an extensive rope tied in a bucket and a cork to pull the rope.

Gender

In terms of gender, the scenario is the same for all communities, with great gender disparity is between men and women.

Women are responsible for housework and childcare on a daily basis. Most of them, in addition to domestic services, also work in the swidden, in plantations, and in general, they are the ones who sustain their families in the day to day work (figure 4.3). Maternity and early pregnancy are present in most women, being 16 years the age group of birth of the first child.

Men, in general, work as farmers. Some, who live close to companies installed in the region, are employees of eucalyptus and palm oil plantation companies, for example.

Leisure conditions are more favorable for men, with football games, drinking alcoholic beverages, bathing in rivers. Women have almost no leisure and are socially intimidated.

Figure 4.34: Resident of the Alta Floresta community. Visit carried out in October 2023

Education

Regarding education, there is also great disparities in some communities. Some schools have a good infrastructure, but others are precarious (figure 4.4). The larger communities have schools for children and youth. In others, children and other pupils move to other places with closer schools. Most communities do not have high schools, and this is one of the main factors that causes many young people to stop studying, generating school dropout. Some other reasons are: the need to help in field services and family income, early pregnancy of women and girls, and low prospects of life and work. Overall, most adults have not completed basic education and some are not literate.

Figure 4.35: Residents of the Floresta Gurupi I community. Visit carried in May 2022

Cultural practices and religion

Some traditional and cultural practices have been lost over the years, such as crafts, medicinal plants and traditional festivities. The reasons run between the lack of continuity of the cultures for the new generations, change of local reality, with accesses that did not exist before, such as internet, for example, present in a few communities. As well as the significant presence of Protestant Christian churches.

Religion is an element very present in the communities, making in many the social dynamics revolve around the activities carried out by the church. The scenario is common in all communities, with a strong presence of evangelical churches.

Community engagement

In the communities visited, there are people who represent the interests of the residents of each settlement and, therefore, formed associations. However, this is not the reality of all the communities. The precariousness of associations as well as misinformation by leaders and residents enable the lack of community engagement. Some leaders hold meetings and assemblies to make decisions on issues that involve the interest of residents, but this is not the common practice. Also, it was observed that these meetings have become less frequent over the years. Many associations are with some level of need for regularization. And most communities, started a community association without knowledge of its functioning.

Figure 4.36: Collective conversation with project presentation YBYRÁ REDD+, Floresta Gurupi I community, Ulianópolis' municipality, in May of 2022

The table below shows summary information on the socioeconomic diagnosis carried out in a participatory manner with the communities. The questionnaires applied will be presented to the VVB in the Validation process.

Table 4.73 - Results from the Socioeconomic diagnosis.

Main Source of Income	Mostly government assistance and retirement; family farming (manioc, açaí, cupuaçu, cocoa); In small numbers, public employees (teachers, health workers, etc).
Religion	Catholicism and protestantism, for the most part.
Adults Educational Level	Elementary Education
Housing infrastructure	Houses made of wood and masonry. Precarious bathrooms, no sanitation system. No garbage collection.
School	Precarious schools. Most, elementary schools
Health Quality	Most communities do not have a health center or transportation resources to get around.
People living on the poverty line	In some communities, the number of people living on the poverty line is higher than in others.

	The poverty lines indicate the population considered in poverty situation when the percentage of people are under the limit established by the World Bank[158].
Community Infrastructure	Some have public water supply. All communities have access to electricity connected to the public grid. The roads are dirt. In some, with precarious access bridges, which sometimes collapse in times of rain, leaving residents isolated. No community has a sanitation system.
Women	Represents more than half of the population and works with agriculture and domestic work. There are no leisure activities for women.
Motherhood	Average 80% of women are mothers, and first pregnancy with an average age of 16 years.
Children	The children go to school and help the family with household activities.
Climate Change Impacts	Heat throughout the year with rainy season from December to June. Humidity always above 50%.
Environmental 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	An identified conflict between a community accessing an Indigenous Land
Leadership	Most communities have an Association, with the presence of a leader.

The project activities designed considering the information from the diagnoses (table 4.2), will be implemented in 8 communities, as described in section 2.1.11

Internal Community

158 https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/35687-em-2021-pobreza-tem-aumento-recorde-e-atinge-62-5-milhoes-de-pessoas-maior-nivel-desde-2012#:~:text=O%20Banco%20Mundial%20adota%20como,R%24%20168%20mensais%20per%20capita.

The internal community is characterized as the workers of the properties involved in the YBYRÁ REDD+ Project (figure 4.6). In October of 2022, a situational diagnosis of the 74 farms was made, in which a survey of internal structures such as accommodations, houses, sheds, farm headquarters, among others, was conducted, in addition to verifying the working conditions of all employees such as legal documentation (Signed Employment Card) and occupational health and safety protocols, working conditions and leisure.

Altogether the project properties have approx. between 200 to 250 employees, including permanent and temporary workers. Most of the workers live on the farm, some with its family also living in the property. The majority of employees are men (70%). The complete diagnosis of the internal community will be finished by the MR2.

Figure 4.37 - Presentation of the YBYRÁ REDD+ Project to employees of Fazenda Avernsa I e II.

Regarding the permanence of workers on the farms, they are usually single, and reside in lodgin/ accommodations s with other workers. Some of the workers are married, and live in single-family houses on the farm. In both cases, these workers have free access to enter and leave the farm on their days off. Few leisure activities are available to farm workers. In addition, they also reported that the internet network is available for them to communicate with family and friends.

4.1.2. Interactions between Communities and Community Groups (CM1.1)

As a grouped project, the buffer region of YBYRÁ REDD+ is extensive, covering 6 municipalities. With this, the interactions between the communities of the Project happen in a punctual way, for some communities, especially those that are closer. Others, which are located further away, there is no external interaction, only internal, between the residents themselves. For those closer, interactions are related to the presence of children and young people in schools, which in general, students move to the nearby community where the school is located. At school meetings, school festivities too.

In the territory of communities, local interactions occur when there are meetings related to community association and/or religion. Leadership invites to participate in matters of common interest. These interactions are few, as associations go through a process of lack of engagement.

Other interactions occur when families, especially women, receive monetary benefits from the federal government's relief program and retirement. Usually, they can receive in the headquarters of the municipalities, in banks agreed with the government, and there is little transport and financial resource.

There are communities that are adjacent to the project areas, which access forest areas to search for food and other resources, as presented in item 2.1.6. In these interactions there are no conflicts between the community and the owner. This scenario already existed before the project.

It was also identified other interactions, on a smaller scale, that refers to conflicts between communities. In the municipality of Paragominas, there are communities that border with Alto Rio Guama Indigenous Land. During visits to these communities, residents reported that they enter the areas of indigenous peoples to harvest food, fruit, and hunt, causing conflicts.

The Sarauá Indigenous Land, located in the region of Ipixuna do Pará, has many conflicts regarding land tenure[159]. Since 2002, the Indigenous have been expelled from their lands and the area is now used by land-grabbers to illegally exploit timber and other resources, and engage in other illegal activities such as invasions followed by cattle ranching, soy production and hunting of wild animals. These "grileiros" formed the Balalaica community.

Conflicted communities are not involved in the YBYRÁ REDD+ project, since the project does not seek to influence in any conflict.

[159] https://g1.globo.com/pa/para/noticia/2022/02/25/justica-da-90-dias-para-nao-indigenas-deixarem-terra-saraua-pa-no-para.ghtml

4.1.3. High Conservation Values (CM1.2)

The YBYRÁ REDD+ Project started the process of community consultations and socioeconomic diagnosis in the April of 2022. For the first diagnosis obtained, in the context of community well-being, High Conservation Values were not identified spontaneously by the communities, according to community reports and analysis of the Project team during the visits.

It was identified that a small number of communities make use of the project area for subsistence activities such as hunting and fishing. The project is already committed to maintaining preserved forest areas. In addition, the activities of the project for Communities seek, as expected impacts, to increase household income, food security with sustainable agriculture and well-being.

In this sense, over the time of the activities of the Project, families who make use of the forest areas of the Project for subsistence may no longer need to do so, because the activities of the Project can substantially reduce the use of hunting and subsistence, since new means of family food security will be implemented.

Along the 30-year project lifetime, the site visits to communities will be continuous, thus the Project will continue to evaluate areas of High Conservation Value that may arise. And if it does, it will be reported in the proper Monitoring Report.

Although no HCV was spontaneously identified by the communities, the HCV 4 was identified in the project region, regarding permanent preservation areas (APPs), because these areas and water bodies play a crucial role in the protection and conservation of natural ecosystems, and benefit directly the communities near them with numerous ecosystem services, such as water provision, climate regulation, control of erosion, and many others.

In addition, these areas are of strategic importance for the maintenance of biodiversity, the quality of water resources and ecological balance. According to the Guide to “High Conservation Value Forests “[160](PROFOREST, 2003) a High Conservation Value forest can be, for example, a riparian zone protecting a stream which is the only source of drinking water for a community or a small fragment of a rare ecosystem.

By using PPAs as HCVs, it is possible to reconcile environmental conservation with sustainable economic development. This approach involves careful planning and efficient management of these areas. The project has therefore identified its permanent preservation areas present on the project farms as HCVs. There are project activities directed designed to recompose some areas as pilot projects, so in the project lifetime, the areas can be protected and recomposed effectively and with support of scientific data.

[160] https://ecconsa.com.br/alto-valor-de-conservação-avc-64-setembro-2020/

The table below presents the characteristics of the HCV 4 of the YBYRÁ REDD+ Project.

Table 4.74 - HCV identified for communities of the YBYRÁ REDD+ Project.

High Conservation Value	HCV 4 – Ecosystem Services
Qualifying Attribute	Enable the availability as well as the range and distribution of abundance patterns for the local flora and fauna
Focal Area	Permanent preservation areas present on project properties

Since the RR of the project is extent and the map showing all the PAs makes not possible to clearly see the PPAs areas, the following figure shows a clipping of the project region, presenting the PPAs inside and adjacent to 3 properties involved in the REDD+ Project (figure 4.7). As it can be seeing, the forest areas of the Fazenda Santa Luiza and Santa Celia can be connected through the PPAs and interlink the forest areas fragmented.

Figure 4.38 - Permanent Preservation Areas on rural properties involved in the project.

4.1.4. Without-Project Scenario: Community (CM1.3)

The socioeconomic characteristics presented in the region's communities are similar in terms of the absence of basic needs. The scenario projected for the absence of the project is to maintain or decrease the social conditions already existing today, based on official data and field surveys that point out no significant change on the quality of life and well-being of the communities over the last 20 years, as described in item 2.1.6.

The main characteristic of the population is in a state of subsistence, rudimentary agricultural practices and dependence on resources provided by social benefits, without prospects of increasing income and consumption power. There are no expectations of change in their society, with no changes in habits and maintenance of already existing technics and practices.

Fire is a very present element in communities' territories[161], provoked mainly by human activities, causing deforestation (figure 4.8). It is responsible for large amounts of GHG emitted in the atmosphere, which affects carbon stock, soil quality and forest cover and climate change. In the without project scenario, the fire will remain being used for burning waste and for agriculture, due to the low cost, lack of technical assistance, low access to public services and equipment to improve family farming activities. In addition, the fire will still be a major degradation problem in their territories.

Figure 4.82 - Presence of fire in the project region

In the without project scenario, the communities will continue to have low political engagement and will maintain their inefficient articulation of institutions and organizations to demand for their rights. In addition, the women will remain in social vulnerability and unempowered in their communities, without trainings, capacitation and opportunities to diversify their incomes.

161 Barlow et al. 2012. The critical importance of considering fire in REDD+ programs. Biological Conservation v. 154, pp.1-8

The without project scenario does not guarantee improvements on well-being for the internal and external communities, nor access to trainings on sustainable practices, increase of production, diversification of production and nor the implementation of agroforestry. As mentioned before, the without project scenario does not bring any perspective of change in their social condition, poverty, food insecurity and also income diversification.

The YBYRÁ REDD+ project aims to contribute to the improvement of the social well-being of families present in these territories, directing efforts in various fronts, as food security, communitarian empowerment, women protagonism, sustainable development, environmental education, mitigation of climate impacts, and many other expected positive impacts.

Figure 4.40: Women washing clothes in the creek - Communities in the Project region

In this sense, in view of the planned structuring actions, the efficiency and adherence of the activities under development will be evaluated using indicators. These assessments are essential so that joint management can adapt measures throughout the process, considering the short, medium and long term. More information on project activities are presented in the item 2.1.11.

4.2. Net Positive Community Impacts

4.2.1. Expected Community Impacts (CM2.1)

The impacts for the communities were estimated based on the ”Theory of change”, described in item 2.1.11 of this document. In order to understand the social vulnerabilities and to create a relationship with the communities, the first phase of the project is characterized by a complete socioeconomic diagnosis of the communities. Thus, the first project activities to identify and diagnose the communities was carried out in May of 2022, through interviews and meetings with more than 25 communities, which extended throughout the year. The main objectives of the meetings were the introduction of the YBYRÁ REDD+ Project to the communities, to learn about the local reality, characteristics and fragilities, as well as to obtain a participatory socioeconomic diagnosis, so the project activities could be designed accordantly and effectively.

The impacts, benefits and risks of the project were also estimated, direct and indirect related to social, environmental and economic aspects of community groups. The tables below present them for the external (table 4.4), internal communities (table 4.5) and the communities in the LMA (table 4.6).

Table 4.75 - Expected External Communities Impacts.

Community Group	External Communities
Impact(s)	- Increased family income (monetary and non-monetary) with sustainable development; - Access to water; - Market access; - Digital Inclusion; - Access to capacitation, courses, training and non-formal education; - Empowerment and health of women;
Type of Benefit/Cost/Risk	Benefit - Improving the quality of life of communities - *direct* - Improvement in women's quality of life - *direct* - Conservation of biodiversity in communities - *direct* - Increase in knowledge on environmental topics - *direct* Risk - Non-adhesion of the proposed activities to the communities - Non-adherence of public actors - Dissatisfaction with the activities - Change of location (rural exodus) due to insecurity or other opportunities
Change in Well-being	- Improving the quality of life of communities - Improvement in women's quality of life - Conservation of biodiversity in communities

Table 4.76 - Expected Internal Communities Impacts.

Community Group	Internal Communities

Impact(s)	- Well-being at work: - Increased quality of life for employees of project area properties - Access to training and capacitation
Type of Benefit/Cost/Risk	- Capacity building related to deal with occasional forest fires - *actual and direct* - Diseases prevention and increase in access to healthcare - *direct* - Increase in knowledge on environmental topics - *actual and direct* - Increase in health and safety working aspects - *direct* - improvement of internal procedures and standardization - *actual and direct* - Guarantee of good working and housing conditions for the project workers, according to the Brazilian Regulatory Norms (NRs) - *direct*
Change in Well-being	- Positive change in routine/ work activities - Better working conditions - Occupational health and safety procedures

Table 4.77 - Expected Impacts on Communities located in leakage Management Areas .

Community Group	Communities located in leakage Management Areas
Impact(s)	- Increasing family income (monetary and non-monetary) with sustainable land use practices - Market access - Access to capacitation, courses, training and non-formal education - Women empowerment
Type of Benefit/Cost/Risk	Benefit - Improving the quality of life of communities - *direct* - Improvement in women's quality of life - *direct* - Conservation of biodiversity in communities - *direct* - Reduced need to deforest to replace income - *direct* Risk - Non-adhesion of the proposed activities to the communities

	- Non-adherence of municipal public actors - Dissatisfaction with the activities - Change of location (rural exodus) due to insecurity or other opportunities
Change in Well-being	- Improving the quality of life of communities - Improvement in women's quality of life - Conservation of biodiversity in communities

4.2.2. Negative Community Impact Mitigation (CM2.2)

The Project maintains a social database and a Risk Matrix that directs and guides the technical and social team to assess and mitigate unforeseen occurrences that may arise throughout the Project.

As demonstrated in the section 4.2.1 - Expected Community Impacts, the estimated impacts on the community groups of the project are expected to be positive throughout the project lifetime, and such positive benefits include socio-economic well-being and benefits for ecosystem services. Therefore, till the moment, no negative impacts have been identified regarding the community and other stakeholder groups.

A research on possible negative impacts was carried out, considering negative consequences that may occur and that can be mitigated with the presence of the project in the territories, as shown in table 4.7.

Table 4.78 - Possible Negative Impacts and Mitigation Measures.

Possible Negative Impacts	Direct Relationship with the Project?	Causal Relationship	Mitigation Measures
Continue conflict between Indigenous Land and community	No	Community accesses Indigenous Land area to harvest food and hunt	Implementation of the activities of the YBYRÁ REDD+ Project with the promotion of sustainable agriculture, food production and income diversification in the community territories
Conflict between communities due to lack of information on REDD+ Projects	Yes	False information about REDD+ projects in communities	Implementation of the activities of the YBYRÁ REDD+ Project with relationship channels and delivery of information materials about the Project

Another impact that can be related to the communities interests is regarding biodiversity aspects. In the case of success of the project activities directed to biodiversity, wildlife populations can increase in the forest areas of the PAs and other adjacent areas in the project zone. Thus, the encounters between individuals of different species and humans can increase in the project zone. This can be a risk to the communities of the project. In order to mitigate accidents with animals, the environmental education activities can address trainings on how to react to an encounter and what to do in case of accidents with animals, if along the project lifetime the encounters increase as consequence. More specific trainings can be given in the case of any other theme that appear important with the increase of fauna species in the region.

4.2.3. Net Positive Community Well-Being (CM2.3, GL1.4)

Project activities directed to the communities involved in the YBYRÁ REDD+ Project aim to bring only positive impacts to communities and the environment. For the 8 communities selected to be included in project activities, the expected net community impacts are as follows:

Table 4.79 - Net Positive Community Well-Being.

Impact	Action designed to reach the impact
Increase in the community's well-being, including increase in income and socioeconomic conditions	Community involvement in participatory trainings, workshops, and meetings, to empower associations and groups to claim for their rights by public organs; increase access to water, digital inclusion, sustainable practices to increase production and gain income; women empowerment;
Increase in environmental awareness such as sustainable development, climate change, ecosystem services, environmental and biodiversity conservation, waste and pollution.	Educational workshops on environmental and climate to support sustainable development and conservation of species and ecosystem services.
Decrease gender disparities	Lectures and workshop only for girls and women on integration, health and development of economic activities; Trainings with qualifications to generate income and female well-being.
Regulation of climate change	Recomposition of Permanent Preservation Areas adjacent to the PAs and near communities; avoid deforestation of forest areas and avoid emission of GHG.

4.2.4. High Conservation Values Protected (CM2.4)

The HCVs related to community well-being will not be negatively affected by project activities, on the contrary, it is expected to create positive impacts. Section 4.2.2 "Mitigation of Negative Impact on the Community" describes the procedures that will be adopted for the monitoring of negative effects by the project, through its communication channels and partners that assist on the monitoring of impacts. The projected activities will contribute to the integrity of the forest within the Project Area and promote environmental awareness about ecosystem services, highlighting its importance to the people living around it, contributing to the maintenance of the natural attributes of these HCVs such as water bodies in the PPAs.

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 is not expected to generate negative impacts during the lifetime. No other stakeholders have been identified to use or depend on the resources in the Project Area, other than the ones already identified in the item 2.1.9. The positive impacts on stakeholders 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.
- Increased conservation of forests close to Indigenous Lands;
- Partnership with local institutions.
- Increase on the visibility of the communities.
- Strengthen ties between the communities, landowners and other stakeholders.

The Project is in articulation with local secretariats, formulating partnerships in the areas of health, education, social assistance, among others, with the objective of better development of the project activities.

No concerns regarding the project or any negative impacts were reported to the Carbonext team till the moment. Despite this, as a possible negative impact, the project anticipates that conflicts may occur due to a lack of understanding of the project activities or fake news about REDD+ projects.

4.3.2. Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

As mentioned in the previous item, there are no negative offsite impacts expected on other stakeholders, thus, no mitigation strategies are required till the moment. If the necessity of mitigation measures on other stakeholders arises over the project lifetime, the proponents will rapidly respond, design, and implement actions according to the situation.

Regarding conflicts that may occur due to a lack of understanding of REDD+ projects, the project provides informative materials on actions and benefits of REDD+ projects (Figure 4.11), in particular, the YBYRÁ REDD+ Project, on all visits. In addition, the Project has relationship channels (Figure 4.10) with different means of access and a team available to answer questions from different stakeholders.

Figure 4.84: YBYRÁ REDD+ project relationship channels delivered to stakeholders

Figure 4.42: Information booklet on the YBYRÁ REDD+ Project delivered to stakeholders

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, through the design of project activities based on local vulnerabilities presented in public and institutional consultations. Thus, not anticipating any negative impacts on the well-being of other stakeholders. If the necessity of mitigation measures on other stakeholders arises over the project lifetime, the proponents will rapidly respond, design, and implement actions according to the situation.

4.4. Community Impact Monitoring

4.4.1. Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

In order to measure the effectiveness of the activities implemented by the Project in the Communities, in achieving the proposed objectives, the YBYRÁ REDD+ project monitoring plan is a strategic management tool, designed to monitor project impacts on communities and other stakeholders.

In this sense, the community monitoring plan is based on the structured activities designed to improve the vulnerabilities initially raised through socioeconomic diagnosis and the indicators established to achieve the projects' goals. These structuring actions are focused to generate income by sustainable land use, sustainable socioeconomic development and improving the quality of life of communities.

Given the structuring actions planned, the efficiency and adherence of the activities in development will be evaluated through indicators. These assessments are essential for joint management to adapt measures throughout the process, considering the short, medium and long term.

However, to identify whether there were positive or negative impacts throughout the project, it is necessary to carry out an evaluation of results considering the social baseline observed before the implementation of project activities compared to the evolution of the communities through time after project activities implementation. The baseline for the communities was gathered in the socioeconomic diagnosis and secondary data on the characteristics of the region. The objective of this strategy is to identify whether the presence of the project in the region is achieving the proposed objectives which is to improve the quality of life of communities and the promotion of social well-being.

At each implementation of the activities, the results obtained will be presented to stakeholders, with a summary in Portuguese of the Monitoring Report for each community group and other parties, such as public institutions. In addition, with the implementation of the Project's activities, it is expected to achieve the main goal of YBYRÁ REDD+ project, which is to prevent deforestation of areas of the Amazon rainforest and avoid GHG emission.

The table below (4.9.) presents the monitoring plan, summarizing the project activities designed to beneficiate the communities involved in the project, as well as goals, costs, indicators and other factors.

Table 4.80 - Community Monitoring Plan.

Program	Class	Vulnera-bility	Activities	Community Group	Goal	Frequency	Expected Results	Predicted Impact	Indicators	Benefits	Scratchs	Method
Community Empowerment	Social Well-Being	Lack of on-site community information	Diagnoses of communities	Communities that make use or not of the Project area and communities located in Leakage Management Areas	Strengthen human interactions and community engagement so that communities can build public social welfare goals	At the beginning of the project only	United and engaged community in project activity that generate social well-being.	Greater number of social interaction meetings; social and collective awareness in the search for improvements within the communities' territories	Number of participants in the specific activities and evolution over time; evaluation of activity satisfaction.	Human empowerment; social bonds and social welfare	Non-adherence of the proposed activities; not satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation
		Lack of community interaction activities and collective achievements	Participatory workshops with planning activities in communities			At least one MR-driven action until satisfactory engagement is achieved.						
		Difficulty in community engagement and management of associations	Training in associativism and cooperativism	Communities that make use or not of the Project area and located in Leakage Management Areas	Strengthen community institutions through information on associations and cooperative		Communities able to manage associations and cooperatives	Increase in the number of residents with access to information on community management practices and non-formal education; Engagement and organization of community associations and territories	Number of people trained; assessment of satisfaction with activities; number of associations and cooperatives formed and regularized; number of members or its increase	Human empowerment; formation of social collectives; formation of constructive processes within the communities' territories	Non-adherence of the proposed activities; not satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation
	Access to market	Poor communities in communication and internet access; lack of training and income information	Digital inclusion, entrepreneurship training, social media training courses	Communities that make use of the Project area and located in Leakage Management Areas including	Empower communities, bring connectivity to associations and bring a new perspective of income alternatives	Once in each community and/or when there is a need to repeat the action	Improve the ability to undertake new businesses; have more access to information through technology; expand the	Increased access to information and communication; increase knowledge about ways to access the market; increase in opportunities and income prospects.	Number of trained persons; Evaluation of activity satisfaction; number of people who included the internet in their	Increased capacity for business development linked to the digital age.	Non-adherence of the proposed activities; not satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation

				the young.			alternative income perspective.		businesses; number of people who created new businesses.			
	Access to water	Lack of water supply for family use and agriculture activities	Feasibility study of community well	Communities that make use of the Project area and located in Leakage Management Areas	Identify the best solution to guarantee the water supply	Once in each community selected	Develop an action plan to implement the best solution.	Access to drinking water and dignified health; increased quality of life of communities due to access to water; Opportunity to grow food that requires minimally irrigation . Increasing monetary and non-monetary income through the ease of water in agriculture	A final report with analysis, conclusion and an action plan.	Improvement in people's quality of life in terms of well-being, health and increased income	Unfeasibility of the activity; Conflict of interests with public bodies and/or other investors;	Final report generated by the feasibility study.
			Implementation of the best solution	Communities that make use of the Project area and located in Leakage Management Areas	Water supply for family use, breeding and irrigation of productive plantations	Once in each community depending on specifications	Improvement in people's quality of life in terms of well-being and increase of production		Number of communities and families that will have access to water supply; Activity satisfaction assessment; increase of agricultural productivity			Attendance list, interviews, questionnaires and observation
	Social Well-Being	Insufficient infrastructure and lack of improvements in activities	Actions to improve infrastructure, safety and health at work	Internal communities	Promote the social well-being of internal communities	Once in each property that applies and/or when there is a need to repeat the action	Satisfaction of internal communities in their workplaces without risk of accident	Improving the quality of life of employees of the project area properties	Number of properties with improvement actions; evaluation of activity satisfaction; number of PPE made available;	Quality at work and employees aware of beneficial impacts of REDD+ projects	Non-adherence of the proposed activities; not satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation
Income alternative with land use	Food Safety and income	Insufficient livelihood practices	Training in agroforestry and other sustainable	Communities that make use or not of	Train the community with new techniques of sustainable crops	Continuous training until	Producers developing plantations with more	Increase knowledge about agricultural farming practices	Number of trained persons; evaluation of	Sustainable land use with low carbon	Non-adherence of the proposed	Attendance list, interviews, questionnai

			agriculture practices	the Project area and communities located in Leakage Management Areas		satisfactory knowledge is reached.	knowledge and achieving good production and good quality product	in the region, better awareness of the possibilities for family farming;	activity satisfaction;	activities, improve food self-sufficiency.	activities; not satisfaction of the activities performed;	res and observation
			Support community in the implementation of SAFs		Improve food quality and income with sustainable techniques crops	Gradual implementation over the first years of the project.		Increasing sustainable farming practices in the region, better land management, diversified agricultural production.	Amount of implanted area (ha); increase of household income; quantity and diversity of production;			Attendance list, interviews, questionnaires and observation
			Fish farming course (suspended tanks)	Communities that make use of the Project area and communities located in Leakage Management Areas	Train communities in fish farming to produce food for consumption	Once in each community and/or when there is a need to repeat the action	Farmers trained in sustainable livelihood practices	Reduce social vulnerability and improve food self-sufficiency.	Number of trained persons; evaluation of activity satisfaction; better knowledge of the subject; increase of fish and chicken production in the community; increase of household income	Lead to greater food security, diversification of income sources, reduced pressure on other resources	Non-adherence of the proposed activities; not satisfaction of the activities performed; improper disposal of waste	Attendance list, interviews, questionnaires and observation
			Courses for raising free range chicken and laying hen		Train communities in raising free rang chicken							Attendance list, interviews, questionnaires and observation
	Sustainable land use practices	Lack of technical assistance for soil management	Articulate with institutions that provide training on silviculture, harvesting and negotiation	Communities that make use of the Project area and communities located in Leakage	Bring soil management knowledge to communities	Once in each community and/or when there is a need to repeat the action	Farmers trained in sustainable practices in soil management	Increase the productivity of family farming and make it more sustainable	Number of trained people; evaluation of activity satisfaction; Production cost;	Soil quality for planting; increase of production; decrease the search for new areas for agricultural production;	Non-adherence of the proposed activities; not satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation

				Management Areas								
		Lack in acquisition of basic machinery for soil management	Support partnerships between public institutional stakeholders to provide machine for soil management	Communities that make use or not of the Project area and communities located in Leakage Management Areas	Increase production	At each planting period in the communities, in accordance with the partnership with the municipal agriculture departments	Ensure producers have access to the necessary machinery.	Increase the production of farmers and improve the quality of life by reducing heavy manual work	Number of families that received support; evaluation of activity satisfaction; productivity and performance;	Increase in family income; Fomentar a agricultura familiar local.	Non-adherence of the proposed activities; non-adherence of municipal public stakeholders; non satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation
		Lack of assistance to grow local crops	Cassava cultivation courses and processing with existing crops (cupuaçu, açai, cocoa)	Communities that make use of the Project area and communities located in Leakage Management Areas that have the potential to grow	Boost local production in family crops for own consumption and runoff	Once in each community and/or when there is a need to repeat the action	Increase in production and family income	Increase and extend the production of farmers with local crops; increase knowledge on the subject among farmers	Number of trained persons; evaluation of activity satisfaction; increased production of local crops; income increment.	Lead greater food security, diversification of income options.	Non-adherence of the proposed activities; non satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation

				certain crops								
	Reduction of deforestation	Cultural practices of soil management with fire	Training in fire control and fire management for community residents	Communities located in Leakage Management Areas	Train communities in fire management, in their gardens, until they can change cultural practice	Once in each community and/or when there is a need to repeat the action	Prevent deforestation of forests; reduce GHG emissions from fires in the region; contribute to the preservation of biodiversity	Communities with knowledge in fire management	Number of trained people; knowledge acquired in training; deforestation (ha); number of people who adhered to new practices;	Decreased risk of burning in forests, improvement soil quality for agriculture, Raising awareness of communities in sustainability	Non-adherence of the proposed activities; not satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation
		Lack of sustainable soil management practices	Articulate public agents who provide training on forestry, harvesting and negotiation		Bring soil management knowledge to communities			Communities in leakage management areas with sustainable land use practices				Attendance list, interviews, questionnaires and observation
	Reduction of deforestation	Lack of practices in fire brigade	Fire brigade training with community residents	Internal communities	Train employees of the properties of project areas in firefighting	Annual	Employees of the properties of project areas trained in firefighting	Decrease forest loss by fires;	Number of trained staff; forest lost by fire (ha); brigade response time;	Reduced risk of burning in forests, reduced risk to the local biodiversity	Dissatisfaction with the activities performed	Attendance list, interviews, questionnaires and observation

Women	Social Well-Being	Lack of detailed gender information	Participatory diagnoses of women	Women of the project communities	Collect information on women's demands in the communities' territories	Once in each community and/or when there is a need to repeat the action	Plan meaningful benefits activities for women and create an action plan based on their needs.	Participation and satisfaction of women	Number of participating women consulted; evaluation of activity satisfaction; action plan	Giving visibility to women brings them justice, creates powerful and inspiring role models, and motivates all generations of women.	Non-adherence of the proposed activities; not satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation
	Health	Lack of information and access to women's health	Participatory actions and lectures	Women of the project communities	Increasing the awareness of Science and Knowledge	Annual	Women with access to personal information about their health	Increased quality of life for women	Number of participating women in the activities; evaluation of activity satisfaction; Knowledge acquired;	Improving the quality of life of women	Non-adherence of the proposed activities; non-adherence of municipal public stakeholders; non satisfaction of the activities performed	Attendance list, interviews, questionnaires and observation
			Women's health campaigns		Increase access to women's health in communities		Women with access to medical care		Number of women assisted; frequency of queries; exams made available;			Attendance list, interviews, questionnaires and observation

	Education and income	Lack of female driving activities and training	Meetings to discuss gender issues; training in activities of interest; promotion of female entrepreneurship;	Women of the project communities	Insert women in different activities in the community, promote recreational activities, and non-formal education for women	Twice a year	Women empowerment	Socially more participatory women	Number of women participating in the activities; evaluation of activity satisfaction; Number of women in leadership positions; Number of women entrepreneurs ;	Decrease of gender disparity; improvement in women's quality of life; female empowerment	Non-adherence of the proposed activities; not satisfied with the activities performed; risk of cultural conflict	Attendance list, interviews, questionnaires and observation

The geographic scope is presented in the map 2.15, in the item 2.1.6 of this PDD, presenting the internal and external communities that will participate on project activities.

The following forms will be applied after the completion of any of the activities proposed by the Project:

I. **Attendance list**: It contains the name of the participant, type of affiliation with the project and signature.
II. **Evaluation of satisfaction**: 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 present evidences of the monitoring, by means of photos, interviews, and documents.

All records generated during project implementation will be conserved and made available to VVBs at verification for inspection to demonstrate that the AUD project activity has 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 VERRAs website, on the VCS and CCB standards platforms, with all documents and information of the project will be published. The Carbonext website (**Carbonext.com.br**) will present the results as well. 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 YBYRÁ REDD+ Project.

4.5. Optional Criterion: Exceptional Community Benefits

The project is not intended to be validated for Gold Level for exceptional community benefits.

5 BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions *(B1.1)*

As described in section 2.1., the Project Area is located in five different cities in the Pará state, in Brazil: Paragominas, Ipixuna do Pará, Ulianópolis, Aurora do Pará and Tomé-Açu. These cities are inserted in the Amazon Forest Biome, the largest Brazilian biome. It is estimated that the biome is home to at least 10% of all known biodiversity in the world, containing numerous endemic and endangered species[162]. The biodiversity in the region is extremely high due to the diverse vegetation and hydrography, with direct influence from the Capim River Bay, the Gurupi River Bay and the Uraim River Bay.

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[163] and Chico Mendes Conservation of Biodiversity Institute - ICMBIO[164]). Database platforms for occurrence, sightings and vulnerability status were also used, such as Wikiaves[165], the IUCN Red List of Threatened Species[166], the Red Book of the Brazilian Fauna Threatened with Extinction[167] and the CNCFlora's 2014 Red List of Threatened Brazilian Flora[168].

No biodiversity survey has been conducted ex ante to the project, as it will be conducted by a third part company, specialized in fauna and flora in the Amazon, after sale of carbon credits (between 2024 and 2025). In order to ensure the qualifications of the company, there is an internal Operational Process of Carbonext, that presents the minimum criteria to perform a quality fauna and flora inventory. The specialized company or person hired must have vast field experience

[162] WWF, 2022. Available on: https://wwf.panda.org/discover/knowledge_hub/where_we_work/amazon/about_the_amazon/. Acessed in: 15/02/2022.
[163] 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.
[164] ICMBIO - Instituto Chico Mendes de Conservação da Biodiversidade. Offical website: https://www.icmbio.gov.br/portal/centrosdepesquisa/biodiversidade-amazonica. Accessed in 15/02/2022.
[165] WikiAves, a Enciclopédia das Aves do Brasil. Offical website: http://www.wikiaves.com.br. Accessed in : 15/02/2022.
[166] IUCN. 2022. The IUCN Red List of Threatened Species. Version 2021-3. https://www.iucnredlist.org. Accessed in: 15/02/2022.
[167] ICMBIO 2018 - Livro Vermelho da Fauna Brasileira Ameaçada de Extinção: Volume I / -- 1. ed. -- Brasília, DF: ICMBio/MMA, 2018.
[168] CNCFlora, 2014. Source: https://specieslist.sibbr.gov.br/speciesListItem/list/drt1565629935045?lang=pt_BR. Accessed in 15/03/3022.

with biodiversity surveys and fauna/flora inventory in conservation projects, with specialization in the taxons of interest.

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, 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, covering about 6 million km², with 1,100 tributaries. Its main river, the Amazon River, crosses the continent flowing into the Atlantic Ocean.

In Brazil, the Amazon biome extends over more than 45% 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 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[169], 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 insects, arachnids, crustaceans, and many other groups. 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[170], the Red Book of endangered Fauna of Brazil (ICMBIO, 2014) cited 180 species, of which 124 are endemic from this biome.

[169] ISPN – Instituto Sociedade População e Natureza. Available on: https://ispn.org.br/biomas/amazonia/fauna-e-flora-da-amazonia/ . Accessed in 15/02/2022.
[170] 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.

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 more than 90 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, are also practiced for sport and in retaliation for the predation of livestock, such as the persecution suffered by the big felines that sporadically feed on cattle ranches (Portal Amazônia). The capture of live individuals is practiced sustaining 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 highway construction, mining, housing development, unorganized tourism and increased urbanization[171].

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[172]. Currently, there are 8 endemism's areas delimited in the Amazon: Imeri, Guiana, Napo, Inambari, Belém, Rondônia, Tapajós and Xingu. The region of the project also has the influence of the Conservation Unit Reserva Biológica do Gurupi, with 271,197.51 ha of forest areas. This CU is near some PAs, thus influencing directly in the biodiversity and its distribution. The cities of the project (Paragominas, Ipixuna do Pará, Ulianópolis, Aurora 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 area of endemism in Brazil[173], mainly due to habitat loss, consequence of deforestation for expansion of agriculture and cattle raising activities in the region. The figure below (figure 5.1) presents the forest cover in the Amazonian region. It can be clearly seen that in the Belém Endemism area the deforestation is predominant.

[171] ICMBIO 2018 - Livro Vermelho da Fauna Brasileira Ameaçada de Extinção: Volume I / -- 1. ed. -- Brasília, DF: ICMBio/MMA, 2018.
[172] Conservation Internacional. Available on: https://www.conservation.org/brasil/onde-trabalhamos/centro-de-endemismo-belem. Accessed in 15/02/2022.
[173] "The situation of the areas of endemism of the Amazonia with respect to deforestation and protected areas". Braz, L.C.; Pereira, J.L.G.; Ferreira, L.V.; Thalês, M.C. Bol. geogr., Maringá, v. 34, n. 3, p. 45-62, 2016.

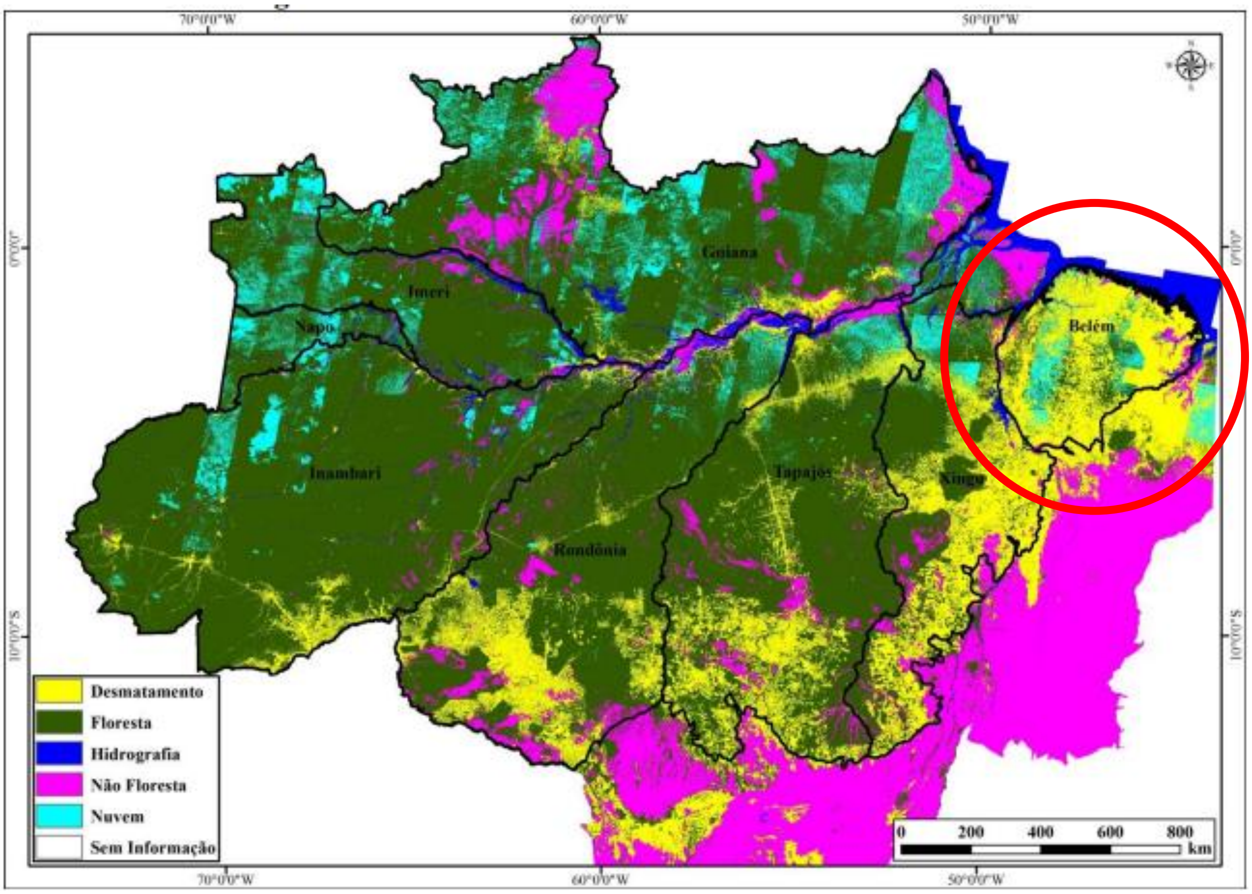


Figure 5.43 - Forest cover in the Amazonian region. Source: Braz et al. 2016.

More than 70% of its forest's covers are already turned in to other uses of land such as cattle raising, agriculture of soybean 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[174]). These activities characterize the RR turning into an extremely fragmented forest area, which impacts directly in the promotion of high levels of biodiversity loss and edge effect[175].

[174] 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.
[175] Firmino, C. T., Costa, G. A., Ferrari, J. L., & Pirovani, D. B. (2017). FRAGMENTAÇÃO FLORESTAL: DEFINIÇÃO E IMPACTOS SEGUNDO A LITERATURA CIENTÍFICA. *Revista Univap*, *22*(40), 786. https://doi.org/10.18066/revistaunivap.v22i40.1590. Available in PDF.

In order to evaluate the biodiversity of the project region, data from specific studies close to the region were accessed, such as scientific papers and databases[176] [177] [178] [179], an "Socio-environmental atlas: cities of Tomé-Açú, Aurora do Pará, Ipixuna do Pará, Paragominas and Ulianópolis'[180] and the data from the Reserva Biológica do Gurupi[181]. The Study of Environmental Impact ('EIA") of the construction of the Pará railroad[182], 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, 2018) 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

The species were classified according to the Red List´s criteria, and the legend of the classification is showed above. The species classified as NT, VU, EN and CR were in this PD mentioned as species with some level of threat. Although the classification "NT" is not commonly yet considered threatened, on this PD it was considered as "with some level of threat" since this status can mean vulnerability in a local scale (by the Brazilian Government) but not in the IUCN list for example (and vice-versa). However, the total of considered threatened species is often mentioned as 65 on this PD, considering the species classified from VU to CR.

[176] CMS: Forest Inventory and Biophysical Measurements, Para, Brazil, 2012-2014. Available on: https://daac.ornl.gov/cgi-bin/dsviewer.pl?ds_id=1301.

[177] 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.

[178] 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.

[179] De Freitas et al, 2017. Available on: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5242272/pdf/zookeys-643-141.pdf

[180] "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.

[181] Available on: https://www.gov.br/icmbio/pt-br/assuntos/biodiversidade/unidade-de-conservacao/unidades-de-biomas/amazonia/lista-de-ucs/rebio-do-gurupi

[182] EIA - Estudo de impacto ambental : Ferrovia Paraense S.A. 2017. Volume VI.Terra Meio Ambiente.

Based on the biodiversity survey carried out with secondary data obtained from the above-mentioned works, 1,751 species of flora and vertebrate fauna can be found in the region of the project (Table 5.1). It is important to mention that the fauna and flora inventory *in locu* will validate some of the species found, since the first survey is only the starting point to evaluate the local species.

Table 5.81 - 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	541
Mammals	83
Herpetofauna	239
Ichthyofauna	114
Flora	774
Total biodiversity	**1751**

Avifauna

To evaluate the avifauna, bird sighting data from WikiAves for the municipalities of Paragominas, Ipixuna do Pará, Ulianópolis, Aurora do Pará and Tomé- Açu and the article from Aleixo et al. (2013)[183] were used. A total of 541 species are expected in the project region, of which 42 are threatened in some level (Table 5.2).

Table 5.82 - 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).

	Species name	IUCN	ICMBIO2018	ICMBIO 2022
1	*Aburria cujubi*		NT	VU
2	*Amazona farinosa*	Near Threatened		
3	*Ara chloropterus*		NT	
4	*Celeus torquatus*	Near Threatened		
5	*Contopus nigrescens*			VU
6	*Crax fasciolata*	Vulnerable		
7	*Dendrocolaptes medius*		VU	VU
8	*Falco deiroleucus*	Near Threatened		
9	*Guaruba guarouba*	Vulnerable	VU	VU
10	*Harpia harpyja*	Vulnerable	VU	VU

[183] 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.

11	*Hylopezus paraensis*		VU	VU
12	*Lepidothrix iris*	Vulnerable	EN	EN
13	*Lophornis gouldii*	Near Threatened	VU	VU
14	*Micrastur mintoni*		NT	
15	*Morphnus guianensis*	Near Threatened	VU	VU
16	*Neomorphus geoffroyi*	Vulnerable	VU	VU
17	*Nyctibius leucopterus*		CR	CR
18	*Nystalus torridus*		NT	
19	*Penelope pileata*	Vulnerable	VU	VU
20	*Penelope superciliaris*	Near Threatened		
21	*Piculus paraensis*		EN	VU
22	*Pionites leucogaster*	Endangered		
23	*Primolius maracana*	Near Threatened	NT	
24	*Psophia obscura*	Critically Endangered	CR	CR
25	*Pteroglossus bitorquatus*	Endangered	NT	
26	*Pyrilia vulturina*	Vulnerable	VU	VU
27	*Pyrrhura amazonum*	Endangered		VU
28	*Pyrrhura coerulescens*		VU	VU
29	*Pyrrhura lepida*	Vulnerable	VU	
30	*Ramphastos tucanus*	Vulnerable		
31	*Ramphastos vitellinus*	Vulnerable		
32	*Sarcoramphus papa*		NT	
33	*Spizaetus ornatus*	Near Threatened	NT	
34	*Tinamus guttatus*	Near Threatened		
35	*Tinamus tao*	Vulnerable	VU	VU
36	*Touit huetii*	Vulnerable		
37	*Xipholena lamellipennis*	Near Threatened		VU
38	*Zebrilus undulatus*	Near Threatened		
39	*Contopus cooperi*	Near Threatened	NT	
40	*Crypturellus strigulosus*		NT	
41	*Ibycter americanus*		NT	
42	*Selenidera gouldii*		EN	

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[184]. 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 species *Aburria cujubi* is classified as "NT" by the ICMBIO List from 2018, but in the updated list from 2022, this bird is categorized as "VU", meaning increase of threat for their individuals in 4 years.

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[185]. *Guaruba guaruba* is also vulnerable in both lists, and appears with the same status at the resolution n° 54 from the Pará state[186] ("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[187]. 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 5.2 a to c).

[184] Parque das Aves, 2022. Available on: https://www.parquedasaves.com.br/nosso-trabalho/o-problema/caca/. Accessed in 23/03/2022.
[185] IUCN. 2022. Available on: https://www.iucnredlist.org/species/22695998/197957213 . Accessed in 11/04/2022.
[186] 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.
[187] Source: https://www.ioc.fiocruz.br/pages/diretoria/noticias/julho03/mat04.htm

Figure 5.44 a, b and c - In order from left to rigth: *Psophia obscura, Lepidothrux íris and Pyrrhura amazonum*, Photos: Wikiaves[188].

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.[189]), and on the Study of Environmental Impact of the Pará railroad. Considering these projects, 83 mammals species occur in the region. Of these, 17 species are classified with some degree of threat (Table 5.3).

Table 5.83 - Mammals species under some level of threat in the region of the YBYRÁ Project. Source: IUCN (2022), ICMBio (2018).

Nº	Family	Species	Common name	Red List IUCN	Red List ICMBIO (2018)
1	Myrmecophagidae	*Myrmecophaga tridactyla*	Tamanduá-bandeira	VU	VU

[188] https://www.wikiaves.com.br/
[189] PDF available to the VVB.

Nº	Family	Species	Common name	Red List IUCN	Red List ICMBIO (2018)
2	Atelidae	*Alouatta belzebul*	Guariba-de-mãosruivas	VU	VU
3	Atelidae	*Ateles paniscus*	Macaco-aranha	VU	
4	Cebidae	*Cebus kaapori*	Caiarara	CR	CR
5	Cebidae	*Sapajus libidinosus*	Macaco-prego	NT	NT
6	Callitrichidae	*Saguinus niger*	Sagui-una	VU	VU
7	Callitrichidae	*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	Canidae	*Speothos venaticus*	Cachorro-vinagre	NT	VU
14	Felidae	*Leopardus wiedii*	Gato-maracajá	NT	VU
15	Felidae	*Leopardus tigrinus*	Gato-do-mato	VU	EN
16	Felidae	*Panthera onca*	Onça-pintada	NT	VU
17	Felidae	*Puma concolor*	Onça-parda		VU

Mammals are fundamental to the maintenance of ecosystems[190] 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*

[190]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.

terrestris) are essential in the maintenance of the ecosystems because of seed dispersal [191]. Carnivores on the top of the food chain (like *Atelocynus microtis, Speothos venaticus, Leopardus wiedii, Leopardus tigrinus, 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 conserve their populations end up also preserving other species in the community, being 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. 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 5.4 a and b).

[191] 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.

Figure 5.45 - 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 considered. The species *Alouatta belzebul, Cebus kaapori*[192], *Saguinus niger*[193] and *Chiropotes satanás* are even more relevant because they are exclusive to the Belém Endemism Area[194]. This fact shows the necessity to maintain and conserve these species and the own Belém Endemism Area itself.

Although the fauna and flora inventory are scheduled to happen after accreditation, some species are already reported to be seen in the project area by the farm workers. One species that have

[192] https://ava.icmbio.gov.br/mod/data/view.php?d=17&rid=2491
[193] https://repositorio.inpa.gov.br/bitstream/1/11911/1/Disserta%C3%A7%C3%A3o_%20INPA.pdf
[194] https://www.ioc.fiocruz.br/pages/diretoria/noticias/julho03/mat04.htm

been sighted and photographed in farms inside the Reference Region of the YBYRÁ REDD+ Project is the jaguar (*Panthera onca*) (Figure 5.5).

Figure 5.46 - Two jaguars in the roads inside the project area. Photo taken by the owner of the property, located in the municipality of, Ipixuna do Pará and Tomé-Açu, inside the RR of the YBYRÁ REDD+ Project.

Herpetofauna

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 239 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 5.4).

Table 5.84 - Chelonian species under some level of threat. Source: IUCN (2022) , ICMBio (2018).

Nº	Family	Species	Common name	Red List IUCN	Red list ICMBIO (2018)
1	Podocnemididae	*Podocnemis unifilis*	Tracajá	VU	NT

2	Podocnemididae	*Podocnemis expansa*	Tartaruga-da-Amazônia		NT

Both species showed above are chelonians present in the Capim River (figure 5.6 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 5.47 – 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 114 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"[195]. 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[196], 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 5.7). The main threats to this group are the pollution and disturbances on the environment and the excessive fishing.

[195] 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.

[196] 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.

Figure 5.48 - 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 and also from floristic inventory from dos Santos et al (Forest Inventory and Biophysical Measurements, Brazilian Amazon, 2009-2018)[197]. Considering these studies, 774 species of flora were found. Of these, 23 species are considered threatened (table 5.5).

Table 5.85 - Flora species with some degree of threat on the global (IUCN, 2018) and national (CNCFlora, 2014) red lists.

Nº	Family	Species	Common name	Red List IUCN	Red List CNCFlora
1	Sapotaceae	*Pouteria krukovii*	Maparajuba	VU	
2	Sapotaceae	*Pouteria oppositifolia*	Abiurana	VU	NT
3	Sapotaceae	*Pouteria platyphylla*		NT	
4	Sapotaceae	*Manilkara excelsa*	Maparajuba	VU	
5	Fabaceae	*Apuleia leiocarpa*	Cumaru Cetim		VU
6	Fabaceae	*Mora paraensis*	Pracaúba Branca	NT	
7	Fabaceae	*Vouacapoua americana*	Acapu	CR	EN
8	Fabaceae	*Chamaecrista xinguensis*		NT	
9	Fabaceae	*Hymenaea parvifolia*	Jutaí		VU
10	Fabaceae	*Parkia paraensis*	Visgueiro	NT	
11	Fabaceae	*Dipteryx polyphylla*	Cumaruana	NT	

[197] Available on: https://daac.ornl.gov/cgi-bin/dsviewer.pl?ds_id=2007

Nº	Family	Species	Common name	Red List IUCN	Red List CNCFlora
12	Fabaceae	*Dipteryx alata*	Baru	VU	
13	Myristicaceae	*Virola surinamensis*	Ucuúba	EN	VU
14	Rutaceae	*Euxylophora paraensis*	Pau Amarelo	EN	EN
15	Bignoniaceae	*Handroanthus serratifolius*	Ipê-amarelo	EN	
16	Bignoniaceae	*Handroanthus impetiginosus*	Ipê-preto	NT	
17	Bignoniaceae	*Handroanthus incanus*	Ipê	VU	
18	Annonaceae	*Annona scandens*	Envira biriba grande	VU	
19	Apocyanaceae	*Aspidosperma parvifolium*	Guatambu branco	EN	EN
20	Lecythidaceae	*Bertholletia excelsa*	Castanheira do Pará ou do Brasil	VU	VU
21	Lecythidaceae	*Couratari guianensis*	Tauari	VU	
22	Meliaceae	*Cedrela odorata*	Cedro	VU	VU
23	Lauraceae	*Mezilaurus itauba*	Itaúba		VU

Among these important species, the *Handroanthus sp.*, *Voucapoua americana, Virola surinamensis, Euxylophora paraenses, Mezilaurus itauba and Cedrela odorata* are endangered due to the exploration of their timber (figure 5.8 a to d), overexploitation by the industry and illegal logging as well. The *Bertholletia excelsa* is one of the most known Amazonian species in the world, famous for the “castanha do Pará”, that is essential to many communities as bioproduct. Some of these species are also used to local medications and oils (local production).

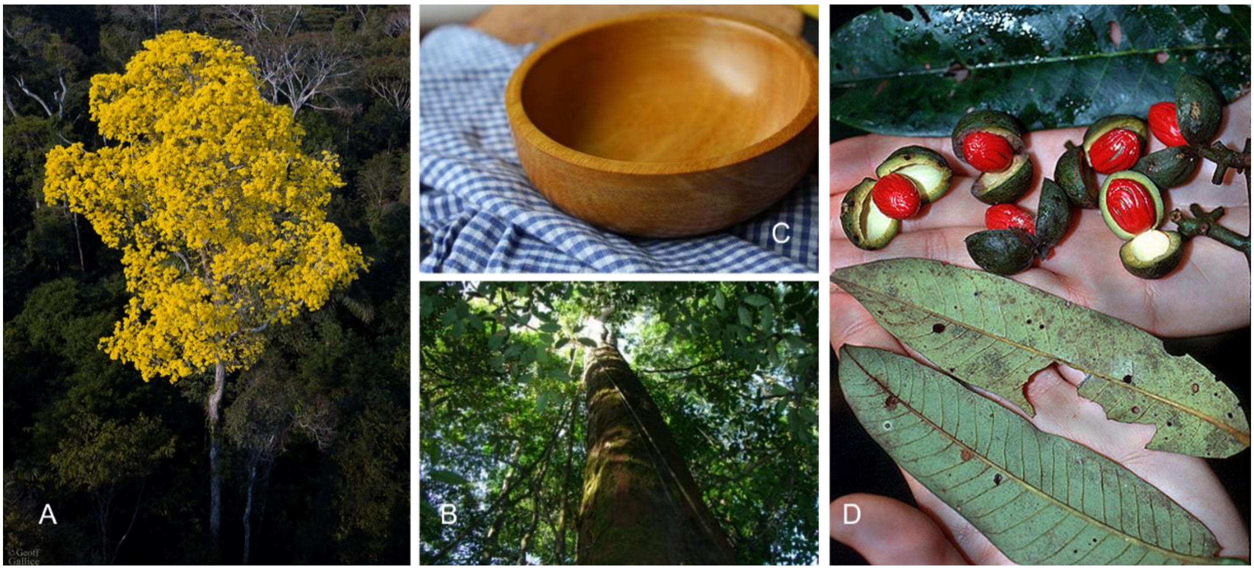


Figure 5.49 -a) *Handroanthus serratifolius* (Photo by Geof Gallice, available on https://live,staticflickr,com/65535/50291272947_3d906a016d_z,jpg, Accessed in 04/04/2022), b) *Voucapoua americana* (Photo available on http://www,amazonflora,com,br/product-page/acap%C3%BA , last accessed in 04/04/2022), 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, HCV 3 - Ecosystems and Habitats and HCV 4 – Ecosystem Services presented in the following tables (5.6 – 5.8).

Table 5.86 - Biodiversity HCV identified.

High Conservation Value	HCV 1 – Diversity of Species: rich biodiversity and 12 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 the totality of the current vegetation in the project area (approx. 76 thousand 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. The foment of initiatives to implement ecological corridors is also relevant to increase the connectivity between forest fragments, bringing benefits to the biodiversity.

Table 5.87 - Another biodiversity HCV identified for the YBIRÁ 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 28 million people (2020) living in the Legal Amazon region, and they are dependent on the forest for shelter, water, food, source of income, recreation and tourism[198], with a unique cultural value. The Central Amazon Humid Forest is considered "vulnerable" (VU) in the IUCN Red List of Ecosystems[199]. Nationally, the RR and the PA are inside of the Amazon Priority Area for Conservation, Sustainable Use and Brazilian Biodiversity Benefit Sharing (2° edition) from the Environmental Ministry from Brazil[200].
Focal Area	It is necessary to conserve and protect the totality of the current vegetation in the project area (approx. 76 thousand ha),

[198] Greenpeace, 2022. Available on https://www.greenpeace.org/usa/issues/brazil-and-the-amazon-forest/. Accessed in 18/03/2022.
[199] The IUCN Red List of Ecossystems, 2022. Available on https://assessments.iucnrle.org/assessments/299. Accessed 11/04/2022.
[200] Áreas e ações prioritátias para conservação, uso sustentável e repartição dos benefícios da biodiversidad brasileira. MMA.2018.Available in: https://www.gov.br/mma/pt-br/assuntos/ecossistemas-1/conservacao-1/areas-prioritarias/2a-atualizacao-das-areas-prioritarias-para-conservacao-da-biodiversidade-2018. Accessed 14/10/2022.

	maintaining constant monitoring to protect it from illegal exploration, degradation, fires, invasion, and others.

The following map (figure 5.9) shows the priority conservation areas established by the MMA of Brazil overlaping with the PA of the YBYRÁ REDD+ Project.

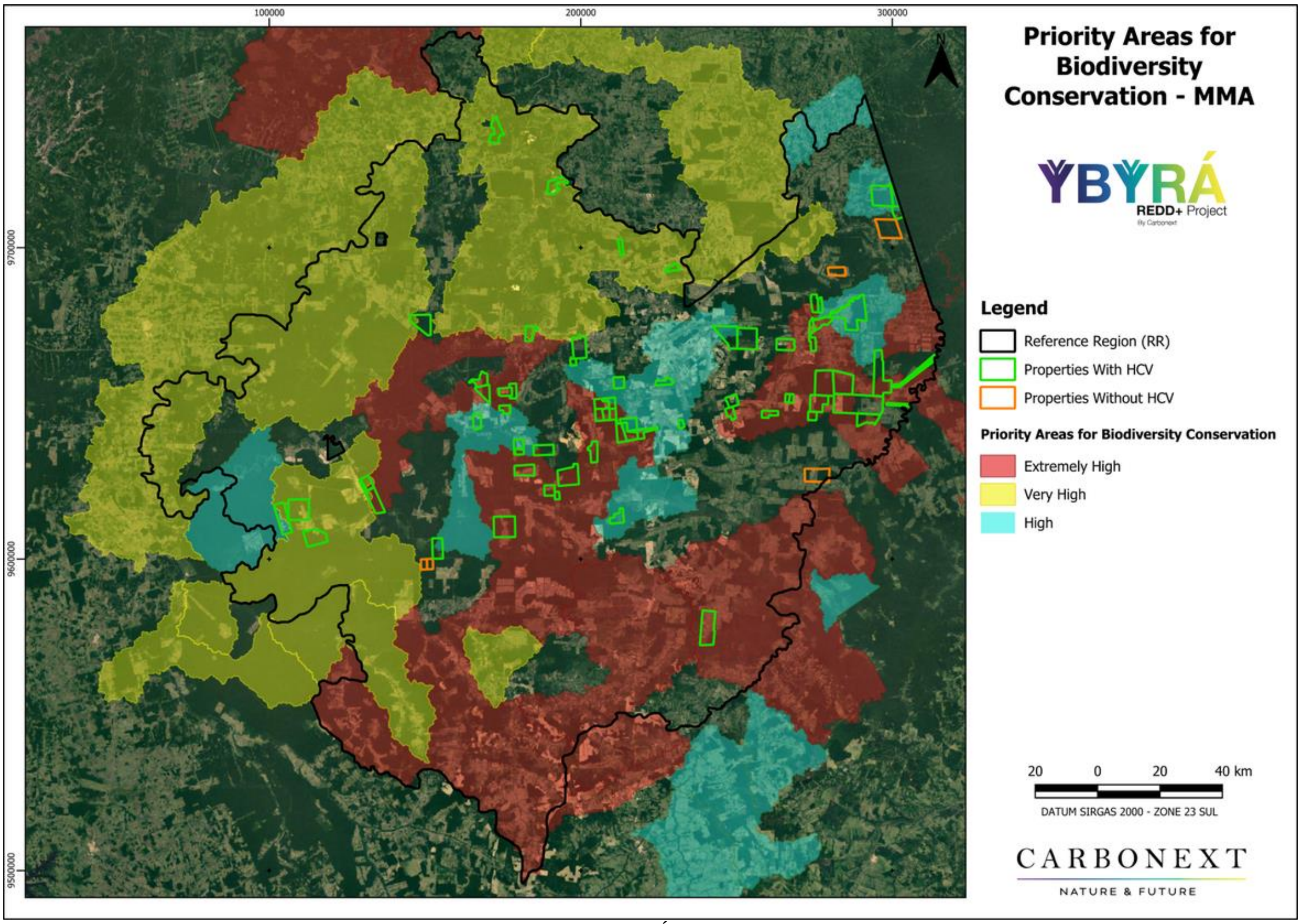


Figure 5.50 - Priority conservation areas in the region of the YBYRÁ REDD+ Project.

Table 5.88 - Another biodiversity HCV identified for the YBIRÁ REDD+ Project.

High Conservation Value	HCV 4 – Ecosystems Services
Qualifying Attribute	In addition to what was already said in HCV 3, the presence of important bodies of water in the region makes the project an important agent on the maintenance and recovery of hydrographic bodies and its ecosystem services, especially adjacent and with direct influence on the forest areas of the PA. This area is equivalent to 12 ha of water bodies within properties

	involved in the YBYRÁ REDD+ Project, that will be monitored with the forest areas of the PA.
Focal Area	It is necessary to conserve and protect the totality of the current vegetation of the PA and water bodies adjacent to the PA, avoiding degradation and maintaining constant monitoring, so the ecosystem services can be maintained.

5.1.3 Without-project Scenario: Biodiversity *(B1.3)*

The implementation of the Carbonext YBYRÁ REDD+ Project will protect 76,481.34 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.

The project also intends to foment initiatives to promote the connectivity between some forest fragments, with the creation of ecological corridors within the properties involved in the project. Priority areas will be defined together with the properties' owners to implement different strategies to, for example, recompose vegetation or protect with fences the Permanent Preserved Areas (PPAs/APPs), in order to create safe passages to fauna, known as ecological corridors.

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, because only knowing the biodiversity, it is possible to protect it and propose actions to conserve it effectively.

The YBYRÁ 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 logging and bring environmental awareness. Besides their intrinsic importance, the species are also essential to the ecosystem services that directly benefits all the living beings, including the humans.

Other actions aimed at social well-being, professionalization and sustainable practices are being planned and developed to be implemented with the communities in the region. These activities aim to benefit the people directly, but also indirectly the environmental and biodiversity aspects. Some activities planned aim to lead to, for example, reduce hunting, increase sustainable agriculture practices, bring knowledge of ecosystem services, training to prevent forest fires, activities related to conservation of priorities species of fauna and flora, zoonoses, among others, which are connected to the reduction of deforestation, habitat loss, and biodiversity protection.

In conclusion, in the without-project scenario, the protection 76,481.34 ha of Amazon Forest, the implementation of biodiversity monitoring, the environmental education activities, the foment on initiatives to create ecological corridors, the trainings on fire brigade and sustainable practices, and other actions that the YBYRÁ REDD+ Project plans to implement in the PA and project region, would not happen and would not bring benefits to biodiversity, climate nor the community.

Further items bring more details on the main drivers of deforestation that negatively impact environment and the species of fauna and flora of the region, which the YBYRÁ REDD+ Project has the intention to conserve with project activities and monitoring.

5.1.3.1. Deforestation

According to data from Terra Brasilis[201] , based on Prodes/IBGE, since 2006, the state of Pará has been the one that most deforests in Brazil, for 16 consecutive years. 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.

There are several different deforestations causes in the state, all of which are associated with anthropic activities. The main causes are: logging and timber exploration, expansion of agricultural frontiers, increase in the production and in the value of soybean, other crops, cattle/meat and mining.

One of the main factors that must be considered in the without project scenario is the landscape if the project region, since it influences directly in the biodiversity and ecosystem.

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

5.1.3.2. Landscape fragmentation

The landscape is a heterogeneous mosaic formed by interactive units, according to an observer and in a certain observation scale, and this heterogeneity exists for at least one factor[202]. Landscape units deal with each component of the landscape, such as land use and occupation, vegetation classes and ecosystems present[203]. Fragmentation can be understood as a subdivision of a unit that initially appeared in a continuous form, leading to changes in the configuration of the landscape through the formation of fragments. The anthropic factors that cause fragmentation are associated with various activities, such as agriculture, cattle ranch, logging, construction of roads in addition to the dynamics of use and occupation of the territory and urban expansion of society modern.

There are several impacts of the fragmentation. One of its main consequences is the edge effect. Edges are transition areas between landscape units, where the intensity of biological flows between landscape units changes abruptly, and which, because they are in the perimeter portion of the fragment, are more subject to external disturbances[204]. In the edge region, effects occur that alter the physical gradients, the distribution of species and several ecological processes. The main effects in the edge region are greater light incidence and wind intensity, changes in temperature gradient, reduction of air and soil moisture, increase in plant evapotranspiration, greater accumulation of litter, greater susceptibility to fires, increase in damage and mortality of trees and favouring the development of invasive species.

Persistent forest loss in the Brazilian Legal Amazon is responsible for carbon emissions, reduction of ecosystem services, and loss of biodiversity[205]. Forest fragmentation has a significant impact on biodiversity in the Amazon rainforest as far as promotes the break with the habitat continuously. In the fragmented context, landscape connectivity refers to the ability of the landscape (or landscape units) to facilitate biological flows, depending on the proximity of habitat components, the density of corridors and steppingstones, and the permeability of the matrix[2]. The larger the connectivity of the landscape, the lesser the impact on the biological flow and, in turn, on the persistence of more habitat-exigent species.

The effects on biodiversity are intrinsically related to the reduction of carbon storage capacity. Fragmented and disturbed forests have a diminished carbon storage capacity compared to undisturbed primary rainforests. Studies have shown that fragmented forests may experience a

202 Turner, M.G.; Gardner, R.H.; O'neill, R.V. (2001) Landscape ecology in theory and practice: pattern and process. Springer-Verlag, New York.
203 Metzger, J.P. (2001) O que é ecologia de paisagens? Biota Neotropica, v.1, n.1-2, p. 1-9.
204 Metzger, J.P. (1999) Estrutura da paisagem e fragmentação: análise bibliográfica. Anais da Academia Brasileira de Ciências, 71(3-I): 445-463.
205 Montibeller B, Kmoch A, Virro H, Mander Ü, Uuemaa E (2020) Increasing fragmentation of forest cover in Brazil's Legal Amazon from 2001 to 2017. Sci Rep 10:5803.

loss of biomass, leading to a decrease in carbon storage. Besides, landscape fragmentation caused by deforestation enhances the forest's flammability, especially during severe droughts. The fragmentation of the landscape increases the likelihood of forest fires, contributing to changes in the fire regime in the Amazon Forest which will promote an increase in gas emissions[206].

Despite the Pará State remains with 75% of forest cover[207], the forest fragmentation in Pará State has been increasing from 2001 to 2017, with the mean patch size of forest cover fragments decreasing from 77.5 ha in 2000 to 41.8 ha in 2017[4]. Specifically in the municipalities where the Project Areas are localized, the forest cover is lower than the Pará State value. Paragominas municipality, the municipality, where the significant PAs are present, has 67%; Tomé-Açu municipality has 59%, Ipixuna do Pará municipality has 58% and Ulianópolis municipality is the more deforested municipality, with 49% of forest cover[6]. The leading causes of forest fragmentation in this region include deforestation by agricultural expansion; selective logging; road construction and infrastructure development. The causes are interconnected and often reinforce each other[208].

In summary, landscape fragmentation is the breaking up of continuous natural landscapes into smaller, isolated patches. It has significant implications for biodiversity, carbon emissions, and the effectiveness of REDD+ initiatives. Monitoring and addressing landscape fragmentation are crucial for sustainable land use and conservation efforts. In this context, the landscape fragmentation analyses around the Project Areas of YBYRÁ REDD+ Project are crucial to better understand forest fragmentation and deliver forest conservation initiatives of the CCB activities. Aiming to understand the landscape context of YBYRÁ REDD+ Project, it was performed a landscape fragmentation analyses which is more detailed in the Monitoring Report 1. This study is the first step to conducting the Ecological Corridors Program which aims to increase the forest connectivity in the region and to mitigate climate changes due to deforestation and degradation. To achieve this goal, this study presents the structural fragmentation analysis of a 20-km buffer from PAs of the YBYRÁ REDD+ Project.

The landscape studied was delimited with a 20-km buffer from all 74 Project Area limits of the YBYRÁ REDD+ Project. The total landscape area corresponds to 2,826,624 ha. To classify land use and land cover classes were used MapBiomas 7.1 Collection[45] database (reference year 2021). More information about land cover map is available in the Table 3.9 of section 3.1.4.1.1 of this PDD.

[206] Alencar, A.A., Brando, P.M., Asner, G.P. & Putz, F.E. (2015) Landscape fragmentation, severe drought, and the new Amazon Forest fire regime. Ecological Applications, 25, 1493–1505.
[207] MapBiomas Project – Collection 7.1 of the Annual Series of Land Cover and Land Use Maps of Brazil, accessed on 07/06/2023 through the link: https://mapbiomas.org/
208 E.N. Broadbent, G.P. Asner, M. Keller, D.E. Knapp, P.J.C. Oliveira, J.N. Silva. Forest fragmentation and edge effects from deforestation and selective logging in the Brazilian Amazon Biol. Conserv., 141 (2008), pp. 1745-1757.

The landscape fragmentation analyses considered 5 landscape metrics (Table 5**.9)** which will be monitored each 3 years as biodiversity monitoring. It was expected that the project activities will be act avoiding the deforestation and forest degradation and consequently the landscape metrics will show better connection between the habitat patches.

Table 5.9. Landscape metrics utilized.

Landscape metric	Description	Unit
1) Forest cover	The proportion of forest in the landscape	%
2) Forest fragment number	Number of forest fragments in the landscape	number
3) Forest fragment size range	Minimum and Maximum area of a forest fragment in the landscape	ha
4) Forest fragment size mean	The average area of a forest fragment in the landscape	ha
5) Edge density	Proportion of the forest fragment area which is in the first 200 meters from the edge.	%

The metrics were calculated to total landscape. In addition, the total landscape was subdivided into 3 parts based on the main water basin division: Capim River Basin (1,398,701 ha); Uraim River Basin (1,290,196 ha), and; Acará-Mirim River Basin (137,188 ha). Figure 5.10 shows the total landscape and the division in River Basin.

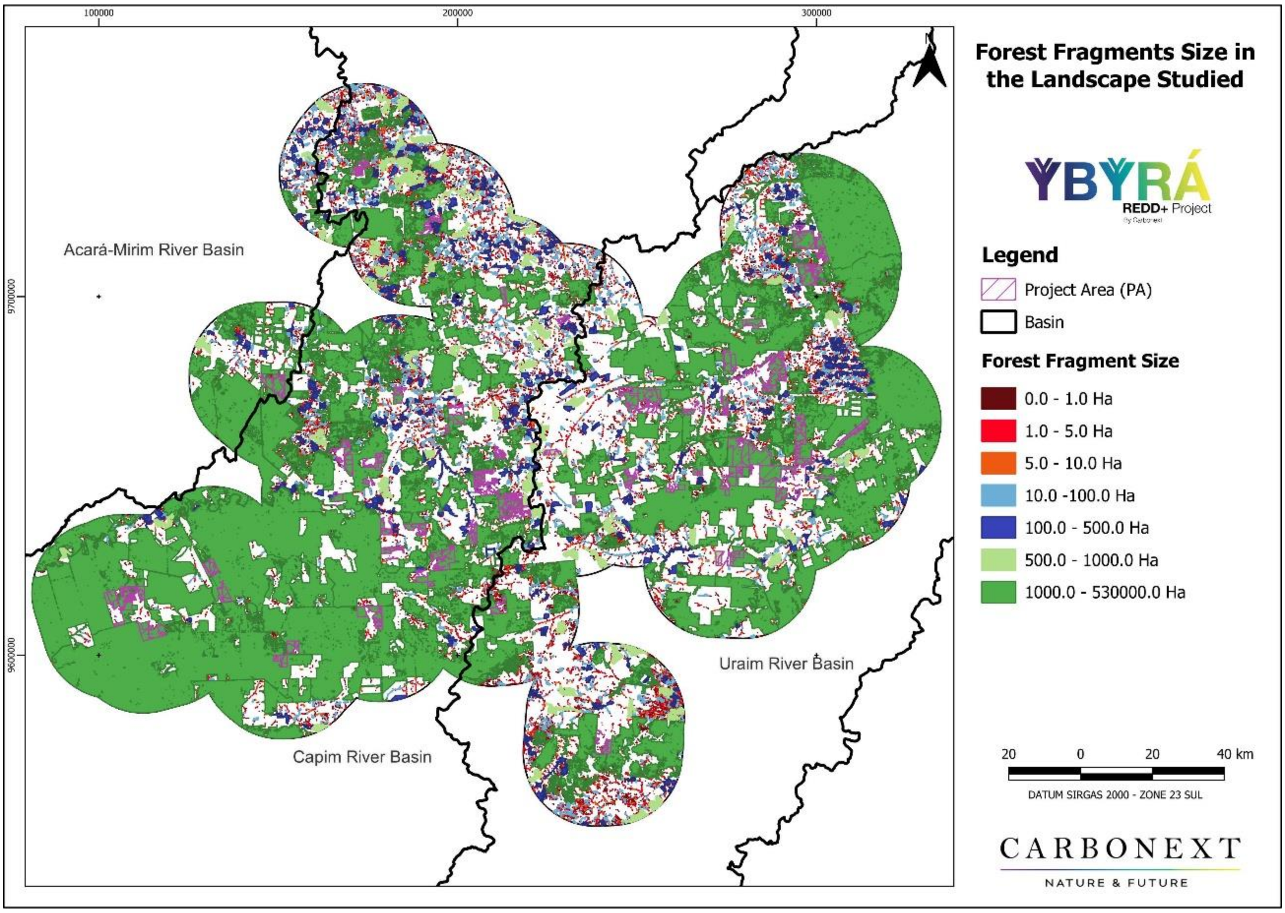


Figure 5.10. Forest fragment size in the landscape studied.

Considering the Amazonian Forest cover context, even by Pará state standards, the landscape context of the YBYRÁ REDD+ Project is highly fragmented as the landscape fragmentation analyses showed (see Monitoring Report 1 to more details). Although the region has large forest continuums, the high number of smaller fragments and the low average fragment size compromise the forest remnants' connectivity. The smaller fragments are acting as links in the biodiversity connection, which indicates the need to strengthen these fragments with the objective of preserving biodiversity conservation. As most of the fragments are found in edge areas, conservation strategies are needed that aim to increase these areas, since they become extremely susceptible to forest degradation. The without-project scenario was presented with details in the item 2.2. of the PDD. As it is presented, the deforestation for implementation of pasture and expansion of soy culture, as well as to legal and illegal logging will likely continue to increase in the coming years, reducing drastically the species present in the region and leading to possible local extinction, as is expected in the without-project scenario.

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 10.6% of the entire cattle herd in Brazil[209]. According to Carvalho et al.[210], in Paragominas in the period from 2008 to 2014 there was an expansion of the livestock area of clean pasture by 369%. Another research, conducted in Santarém and Paragominas, in the Pará state, concluded that 24,000 km^2 of forests are converted into pasture in the amazon region (Nunes et al., 2022)[211]. Livestock farming has been identified as the activity that most deforests new areas in Pará and it is also considered to be the baseline of the YBYRÁ REDD+ Project: in the municipality of Paragominas, changes in land use occur due to the 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)[212].

Considering the non-forest areas in the RR, presented in the table below (5.9), the pasture for cattle production corresponds to more than 75% of the area.

Table 5.89 – Detail of land use and vegetation of 2021 in RR. Source: Mapbiomas.

Land Use Classes	Vegetation	Area (ha)
Forest	Forest	2,182,356
Savanna Formation	Forest	788.63
Non-Forest Natural Formation	Non-forest	11,520.57
Pasture	Non-forest	1,006,689
Agriculture	Non-forest	89,728.78
Soybean	Non-forest	196,669.7
Forest Plantation	Forest	16,795.46
Urban Area	Non-forest	2,780.08
Mining	Non-forest	7,556.86
Water	Non-forest	11,384.88
Total	**Forest and Non-forest areas**	3,526,270.00
Total	**Only Non-forest areas**	1,326,329.91
Proportion of Pasture in non-forest areas	**Only Non-forest areas**	**75.9%**

209 IBGE, 2021. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/18/16459. Accessed in: 21/03/2023.

210 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.

211 Available on: https://doi.org/10.1073/pnas.2202310119 Accessed in: 21/03/2023.

212 https://www.ppgsp.propesp.ufpa.br/ARQUIVOS/teses_e_dissertacoes/dissertacoes/2018/201820%20-%20ROS%C3%81RIO.pdf

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, Aurora do Pará, Ulianópolis and Tomé-Açu is another relevant economic activity. The production of roundwood and firewood in 2021 in the municipalities corresponded to 586,755 m³ of wood removed[213]. 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[214], illegal logging in the state of Pará reached 27,595 hectares (from 2019-2020). 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 and Ulianópolis, in tenth (Figure 5.11). Considering the 3 municipalities, the total area deforested for illegal timber exploration from 2019 to 2020 was of 9,645 ha, representing almost 40% of the total area deforested by the 10 cities.

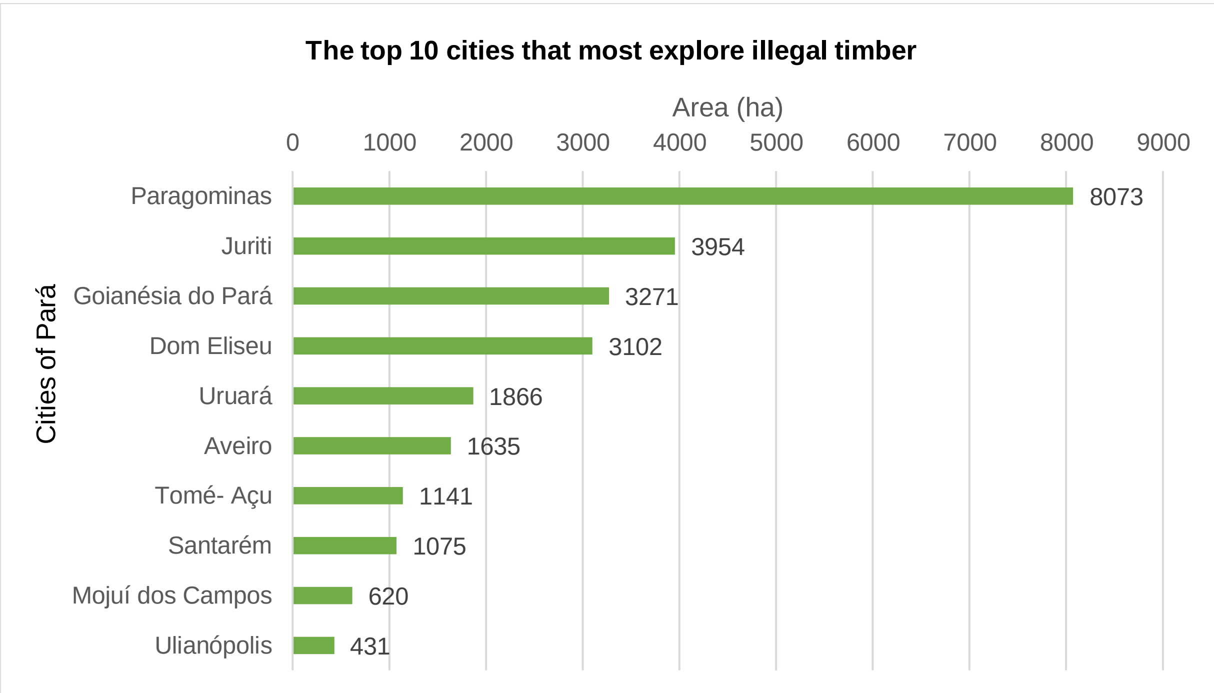


Figure 5.51 - Ranking with the top 10 cities of Pará that most explore illegal logging between 2019-2020. Source: Imazon and Simex (2021).

[213]IBGE, 2021. **Cidades Paragominas**. Available on: https://cidades.ibge.gov.br/brasil/pa/paragominas/pesquisa/16/12705. Accessed in 21/03/2023.
[213] IBGE, 2020. Cidades: Tomé-Açu. Available on: https://cidades.ibge.gov.br/brasil/pa/tome-acu/pesquisa/16/12705. Accessed in 14/04/2022.
[213] IBGE, 2020. Cidades: Ipixuna do Pará. Available on: https://cidades.ibge.gov.br/brasil/pa/ipixuna-do-para/pesquisa/16/12705
[214] 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.

5.1.3.5. Soybean cultivation and production

Although the soybean agriculture is not the baseline scenario for deforestation of the YBYRÁ REDD+ project, duo to the recent increase of production in the state of Pará in the last few years, its cultivation and rentability are also an important and increasing pressure of deforestation to be considered for the next years. This grain is being produced in Pará on a large scale and its production has been growing rapidly over the last few years. In 2021, the state of Pará produced 2,232,499 tons of soybeans in approximately 750 thousand hectares[215].

The municipality of Paragominas has soybean cultures as one of the main points of its economy nowadays and its production has been growing exponentially, as can be seen in the figure below. Ulianópolis and Ipixuna do Pará also showed and slight increase (Figure 5.10). Aurora do Pará and Tomé-Açu do not produce significant amount of soybean.

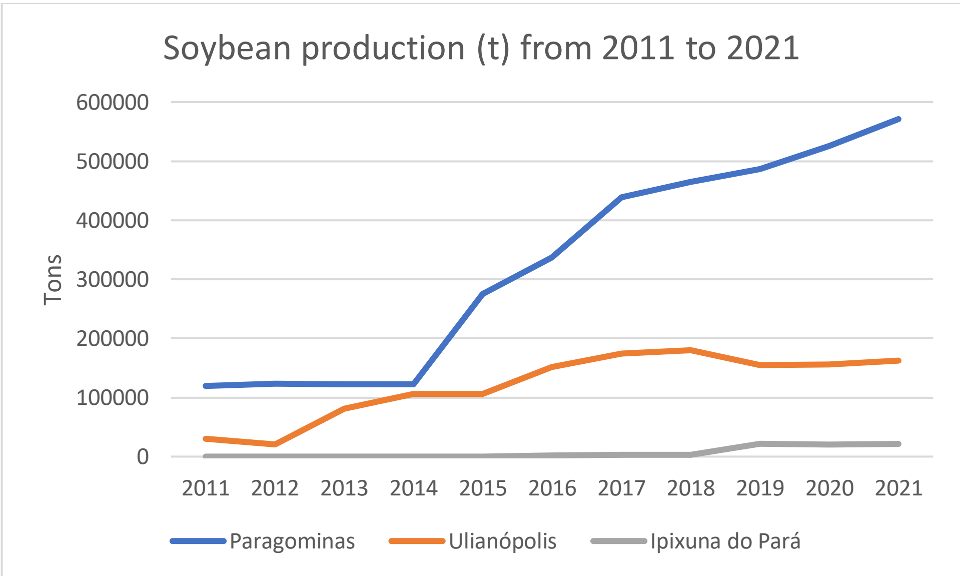


Figure 5.52 - Soybean production (in tons) from 2011 to 2021 in the cities of Paragominas, Ipixuna do Pará and Ulianópolis, in Pará State. Source: IBGE, 2021.[216]

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[217]. Still according to Pastana

[215] IBGE, 2021. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193. Accessed in: 21/03/2023.
[216] IBGE, 2021. Available on: https://cidades.ibge.gov.br/brasil/pa/pesquisa/14/10193. Accessed in: 21/03/2023.
[217] 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.

Filho[76], another factor that encourages its extensive plantation is profitability in relation to other activities. The price of the soybean increased from R$75.99 in 2019 to R$173.45 in 2021[218], an 128% increase. 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.

5.2 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 5.10 to 5.12):

Table 5.90 - Expected beneficial changes in the fauna with the YBYRÁ 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 project will also foment initiatives to bring more connectivity between forest fragments with the creation of ecological corridors. The maintenance of the vegetation cover allows adequate living conditions for the countless Amazonian species and individuals present in the region. The avoidance of deforestation of more than 76 thousand hectare of the PA minimizes threats to fauna species, reducing habitat loss, biodiversity 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 reliable data for scientific studies and mitigation measures proposition, for example. Partnerships with universities and

[218] https://www.noticiasagricolas.com.br/cotacoes/soja/soja-indicador-cepea-esalq-porto-paranagua/2021-06-08. Accessed in: 21/03/2023.

	science centres are being consider and can be presented in the next MRs.

Table 5.91 - Expected beneficial changes in the flora with the YBYRÁ REDD+ Project.

Biodiversity Element	Flora
Estimated Change	Habitat / Biodiversity Conservation (positive)
Justification of Change	The avoidance of deforestation of more than 76 thousand hectare in of Amazon forest minimizes threats to flora species, reducing habitat loss and fragmentation. This project also aims on monitoring the flora with different status of threat and endemism, producing reliable data for scientific studies and mitigation measures proposition, for example. Partnerships with universities and science centres are being consider and can be presented in the next MRs. Furthermore, the activities of the project also aim to foment initiatives to promote connectivity between forest fragments and enhance preservation of important areas to the provision of ecosystem services, such as permanent protected areas, through the creation of ecological corridors in small scale.

Table 5.92 - Expected beneficial changes in the fauna and flora with the YBYRÁ REDD+ Project.

Biodiversity Element	Fauna and Flora
Estimated Change	Encouraging knowledge formation and conservation through building of Environmental Awareness, developing sustainable practices, and changing habits.
Justification of Change	The YBYRÁ 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 YBYRÁ 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, remote monitoring via satellite, local surveillance, and security of the project area to avoid deforestation, habitat loss and fragmentation. 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 and capacitation in sustainable practices, as well as other benefits detailed in items 3 and 4 of this PDD. The pilot project to protect and restore riparian areas adjacent to the PA and create ecological corridors between forest fragments is also planned as project activity. 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, mostly to maintain and/or enhance the HCV attributes presented in the item 5.1.2.

The Sustainable Forestry Management Plan of the Santa Célia, Sossego e Santa Carmem farms also play an important role in forest and biodiversity maintenance. Sustainable Forest Management is the administration of the forest to obtain economic, social and environmental benefits, respecting the mechanisms of support of the ecosystem and considering, cumulatively or alternatively, the use of multiple wood species, multiple products and non-timber by-products, as well as the use of other forest goods and services. There are studies[219] showing that the impacts of the rotation in the forestry areas are low in the local biodiversity since the rotation enables the fauna to hide away when there is management and comeback later for the area. The close engagement between the proponents and the control of the forestry activities by local authorities will mitigate eventual impacts, if caused, by this activity.

Another project activity is being developed, related to the evaluation of the Permanent Protected Areas (APPs) in the project area. Some small, degraded areas will be selected to be prototype of initiatives to recompose and/or fence in order to protect the areas and re-establish the forest. The protected areas will be determined as ecological corridors, promoting connectivity between forest

[219] Available in: https://www.researchgate.net/profile/Marcelo-Ferronato/publication/347613046_Manejo_florestal_Sustentavel_e_a_mastofauna_amazonica_O_caso_da_fazenda_Manoa_Rondonia_Brasil/links/6036679d92851c4ed59515d1/Manejo-florestal-Sustentavel-e-a-mastofauna-amazonica-O-caso-da-fazenda-Manoa-Rondonia-Brasil.pdf. Accessed in 11/05/2022.

fragments that belong to the farms involved in the project. It is important to explain that in the first years of the project, only small areas will be evaluated to implement such actions, since the costs to recompose degraded areas in Brazil are elevated. The idea is to stablish partnerships to develop strategies to protect these areas, as prototypes, and the most effective ones can be replicated in other areas of the properties along the project lifetime, with a long-term positive impact. As products, new strategies can be developed and knowledge will be produced to the improvement of technics to recompose degraded areas. This initiative will influence other actions to improve the degradation in PPAs in the region.

All project activities are proposed aiming to maintain or enhance the HCV attributes presented in item 5.1.2., thus considering the precautionary principle. This means that all actions designed by the project take preventive measures in the face of uncertainties, adding a cautious diagnosis phase, the first biodiversity inventory to confirm the species found in the PA and constant consultations with the community so the activities can cause engagement and be effective. These measures enable the exploration of a wide range of alternatives to avoid negative impacts.

Table 5.13 presents activities that can be implemented over the 30 years of the project period to conserve the HCVs identified by the YBYRÁ 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 5.93 - Mitigation measures proposed by the project, through analysis and assessment carried out by Carbonext's technical and social team.

Strategic lines	Mitigation measures to be implemented
Illegal Logging Prevention and mitigation	• Maintain and reinforce the surveillance and security of the project area. • Environmental education activities to raise sustainable practices in the community. • Possibility of capacity trainings/courses in sustainable practices and to improve income/productivity.
Fire Prevention and mitigation	• Orientations to prevent and fight fires. • Fire brigade trainings with the internal community of the properties and population close to forest areas.
Biodiversity loss prevention and mitigation	• Maintain and reinforce the surveillance and security of the project area. • Promote environmental education to raise awareness about the importance of sustainable practices,

Strategic lines	Mitigation measures to be implemented
	conservation of nature and local biodiversity, focusing on priority species (to be selected). • Periodic monitoring of species and evaluation of the environment. In case of negative impacts detected, the project will evaluate which is the most suitable mitigation measure. • Generate data for further studies and other conservation projects.
Deforestation prevention and mitigation	• Implementation of Carbonext´s deforestation Alert System named MonitoraCarbon™ in the project region, which emits alerts when forest fires or deforestation are identified. • Promote environmental awareness through environmental education with the communities. • Local surveillance of the project areas.
Sustainable Forestry Management	• Sustainable Forestry Management Plan to reduce impacts of the forestry. • Rotation of the Annual Production Units. • Program to chase away fauna species in areas to be managed, if applicable.
PPAs (APPs) recomposition and creation of Ecological Corridors	• Analysis of forest fragmentation and definition of priority areas for reforestation/protection. • Recomposition of Permanent Protected Areas of the properties in the project (through revegetation methods and/or fencing). • Small pilot project in different areas so the strategies can be evaluated and the most secure, effective and productive one can be selected and replicated in other areas. • Creation of Ecological Corridors between forest fragments to improve biological connectivity between PAs.
Others	• Periodic environmental education activities and other actions will be directed to different topics over the 30 years of the project, according to the fragilities identified by the Carbonext's social team. These can be

Strategic lines	Mitigation measures to be implemented
	directed to: health, professional courses/workshops, associativism consultancy, sustainable agriculture trainings, agroforestry systems implementation, among others. Indirectly, all these activities influence on the relationship of the people to the forest and biodiversity. • Description and implementation of project activities follow internal protocols of quality, to prevent and mitigate disparities and errors. • With success of the project activities and increase of wildlife populations in the forest areas of the PAs and other adjacent in the project zone, the encounters with individuals of different species can increase in the project zone. This can be a risk to the communities of the project. In order to mitigate accidents with animals, the environmental education activities can address trainings on how to react to an encounter, what to do in case of accidents and . More specific trainings can be given in the case of any other theme that appear important with the increase of fauna species in the region.

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 expensive 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 YBYRÁ 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 massive deforestation, land use conversion and degradation in the coming years, mostly due to invasion of the land to implement pasture for cattle raising, agriculture and wood extraction in the region, which are economically attractive activities and in constant search for new areas for expansion. The fragmentation would grow consequently, provoking edge effects, habitat and biodiversity loss, and eventually, local extinction of species.

The YBYRÁ 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 affected by deforestation makes its protection even more important for the species that live in the remaining forest fragments. These animals have, each year, less habitat and resources, leading to decrease of population and even local extinction.

Furthermore, the initiatives to recompose, even if in small scale, priority Permanent Protected Areas (APPs) in the project area and to form ecological corridors promote maintenance of ecosystem services and connectivity between forest fragments, essential to the protection of species. It is critical to address and mitigate the effects of landscape fragmentation in the Amazon Forest to protect biodiversity, maintain carbon storage, and preserve the ecological integrity of this vital ecosystem.

Considering that the project only makes beneficial propositions for preservation and conservation of the forest and living organisms, its resulting impact is 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 PA and even in the region, as it is expected that environmental awareness will be built and carried in the next generations. The mitigation measures are designed and if necessary, activities can adapt and new ones can be designed, to guarantee the reduction of negative impacts and the increase on positive ones.

5.2.4 High Conservation Values Protected *(B2.4)*

The YBYRÁ REDD+ 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, the HCV 3 - Ecosystems & Habitats and the HCV 4 – Ecosystem services (all detailed in sector 5.1.2.) are not going to be negatively affected by the project activities planned, since there are no negative impacts on the environment and biodiversity anticipated. In case of any negative impact on the HCV identified, the project will rapidly act to implement mitigation measures and adequate project activities, so the HCVs are protect along the 30 years of the project.

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 nor the use of non-native species for other purposes.

5.2.8 GMO Exclusion *(B2.7)*

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 identified and separated to recycling or composter, whenever possible. The other residues will be discarded in normal waste or, if infectable, will be discarded accordingly in specialized places. 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, prevention and mitigation measures are related to environmental education activities and sustainable practices trainings, for example, to prevent and minimize degradation, deforestation, hunting, pollution, and other threats to biodiversity and its habitat.

If any negative impacts on biodiversity, both locally and outside the project zone, are observed and proved to be 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 YBYRÁ 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. The project activities designed can be revisited in the items of 5.2 and the mitigation measures in the item 5.2.2. Fauna and flora monitoring, development of environmental awareness with environmental education and sustainability agriculture trainings with communities are some examples of project activities that will bring benefits to the project region.

The maintenance of forest areas in the PA and conservation of species will also bring indirect benefits to the population of the region, since ecosystem services produced by them will be protected, guaranteeing its provision.

5.4 Biodiversity Impact Monitoring

Monitoring impacts on biodiversity aims to manage the consequences that the project may have on fauna and flora. It may 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 and not otherwise.

The forestry management carried out by some of the farms will be monitored through the verification of all documents, authorizations, reports etc. by the Carbonext team, in order to control the impact of this activity in the area, maintaining the sustainability and guaranteeing the legality of the activity.

Since the inventory of fauna is planned to happen after the sale of carbon credits (between 2024 and 2025), the definitive Biodiversity Monitoring Plan will be developed according to the methods used by the specialized company that will be hired or in partnership with universities' researchers and professors. But, in order to already provide a view on the monitoring of fauna of the YBYRÁ REDD+ Project, an indication for biodiversity monitoring plan (as document) was developed by Carbonext, and will be presented in the audit.

5.4.1 Biodiversity Monitoring Plan *(B4.1, B4.2, GL1.4, GL3.4)*

For the YBYRÁ REDD+ project, monitoring of the project 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.

According to the results of the assessment made from the monitoring data, improvements and new actions to promote biodiversity conservation during the project execution time will be constantly evaluated, adapted 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. These methods and methodology will be assessed by the internal committee on biodiversity of Carbonext, to ensure the quality of the executed inventory.

Some of the fauna and flora parameters that will be monitored are available in table 5.14, in accordance with the activities presented in the Theory of Change (item 2.1.11).

Table 5.94 – Biodiversity Monitoring plan of project activities of the YBYRÁ REDD+ Project.

Activity	**Description**	**Biodiversity goal**	**Location**	**KPIs monitored**	**Frequency**
Fauna and Flora monitoring	Continuous local inventories of fauna and flora species in fixed sampling points of the PA carried out by specialized company to monitor indicators of impact and promote project activities' adaptations.	Monitor and conserve Fauna species	PA	• Total number of fauna species; • Number of threatened fauna species; • Change in the frequency of occurrence.	Every 3 years
		Monitor and conserve Flora species	PA	• Total number of flora species; • Number of threatened flora species;	Every 3 years
Environmental education program with the communities	Activities, events, workshops and trainings, to internal and external communities. The topics can vary according to the main vulnerabilities presented in each community: endangered species and conservancy, ecosystem services related to biodiversity, waste and recycling, sustainability, zoonoses and others.	Promote environmental awareness and conservation of species of the region, producing socio-environmental positive impacts	PA (internal communi-ties) and external communi-ties involved in the project	• Total number of people participating on environmental education activities; • Number of events /activities carried out; • Number of initiatives related to conservation of the nature generated after environmental education activities; • Change of perception on environmental and conservancy aspects;	Annual
Protection and monitoring or forest areas	Implementation of unified terrestrial and satellite monitoring of the forest areas of the Project Area of 74 properties, to avoid	Reduction of habitat loss, fragmentation and	PA	• Area protected; • Area of avoided deforestation;	Monthly (terrestrial patrol) and weekly

	deforestation, invasions, fire and hunting	biodiversity loss, with reduction of deforestation of forest areas and avoidance of invasions in the PA		• Number of patrols carried out; • Number of occurrences in the patrols; • Number of alerts emitted;	(satellite alerts)
Fire brigade training and formation	Formation of fire brigade to respond to fire events in the PA. The trainings will occur annually.	Reduction of habitat loss, fragmentation and biodiversity loss, with reduction of degradation of forest areas by fire	PA (internal communi-ties) and external communi-ties adjacent to areas that fire is common	• Number of participants of the trainings; • Number of responses by the fire brigade;	Annual
Pilot project to recompose small PPAS and create ecological corridors between forest fragments of the PA	Pilot projects to protect and/or recompose small areas of PPAs between PAs, combined with the creation of ecological corridors between forest fragments of the PA	Maintenance of ecosystem services, recomposition of healthy areas and protection of PPAs. Improve of biological connectivity and genetic variability, conservatio	Private properties involved in the project (since the allocation of PA must exclude PPAs); private properties not involved in the project but with facilitation to project activities (for example for farms that the owner has also an PA in the	• Number of hectare recomposed/protected /; • Number of individuals utilizing the corridors to move; • Improve in landscape analysis indexes.	Implementation: every 3 years; Monitoring: annually.

	n of the biodiversity.	YBYRÁ Project).		

After the first local fauna and flora inventory, new project activities can be proposed to monitor biodiversity and bring benefits to local species. As an example, if an important species is identified, special and directed actions to the conservation of this species can be proposed and implemented in the PA and with the communities involved in the project.

Although parameters of deforestation advance are not monitored exclusively because of the biodiversity monitoring, the maintenance and avoidance of deforestation of forest areas is directly associated with the well-being and balance of the ecosystem and the species of fauna and flora. Thus, the area deforested or protected in hectare is also an important parameter and, together with the other activities related to protect and enhance biodiversity parameters such as the creation of ecological corridors, will be periodically monitored until the end of the project lifetime. Thus, avoiding habitat loss through deforestation and improving biological connectivity in the region. These measures are important to assess and guarantee the monitoring of impacts in the HCVs previously presented in item 5.1.2.

The Biodiversity Monitoring Plan is still under development, since it will be finished and validated with the consultation of researchers and/or experienced environmental company, after accreditation of carbon credits so the first inventory can be accomplished. However, the monitoring considers the CCB Guidance and will be based on it to the development of the official Monitoring Plan for biodiversity.

In order to address the most frequently encountered weaknesses in biodiversity monitoring, the YBYRÁ REDD+ Project proposes:

• Data collection directed to specific ecological and natural history questions, such as the number of species in the PA, their location, abundancy, and others that will be determined on the Biodiversity Monitoring Plan with the consultation of specialized people, after accreditation.

- Study design and methodology development by serious and specialized researchers/ experienced environmental company, in order to prevent inconclusive results and mislead the development of the indicators selected.

- Contract the same experienced company and people, whenever possible, so the same methods and efforts can be replicated. If it is not possible, the project will agree with the new company to use the same methods used initially, so the results are comparable. If there is the necessity to change the methods, a justification must be presented and henceforth alter the methodology of the future monitorings.

- Choose appropriate methods for habitats or species, based on scientific studies.

- Carry out a constant monitoring with the internal communities' participation, so the timing or frequency of data collection is sufficient to draw conclusions.

5.4.2 Biodiversity Monitoring Plan Dissemination *(B4.3)*

The results obtained in the monitoring of Biodiversity KPIs 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 YBYRÁ REDD+ Project activities. If there is a consensus established between the parties, the data obtained in the monitoring can be used in scientific studies and other conservation initiatives to promote benefits to local biodiversity.

5.5 Optional Criterion: Exceptional Biodiversity Benefits

The region of the Carbonext YBYRÁ 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[220], the Brazilian Red List of Threatened Species of the ICMBIO[221] and CNCFlora's Red List of Threat of Brazilian Flora[222], presented in item 5.1.1.2.

According to this biodiversity survey, in the YBYRÁ REDD+ Project region there are 16 species considered “critically endangered” and/or “endangered” (CR and EN) and, in addition to these, and 45 species are classified as “vulnerable” (VU), in compliance with the Gold Level criteria for Biodiversity defined by the CCB Standard.

However, for the first monitoring period, the YBYRÁ REDD+ Project does not seek the verification for GOLD Level in Biodiversity, because the monitoring plan and target species will be defined after the fauna and flora inventory, that is planned to happen after the sale of credits (between 2024 and 2025). Yet, the project intends to seek for the Biodiversity Gold Level for CCB in the future, since the official monitoring plan for the project will be developed together with specialized fauna and flora monitoring company or in partnership with universities’ researchers and professors. Thus, the objectives, sampling methods, indicators and parameters will be defined in the official biodiversity monitoring plan for the target species that will be identified *in loco* in the project area.

For this reason, this section for CCB Gold Level for Biodiversity is already added in the PD of the YBYRÁ REDD+ Project, identifying the 16 endangered species found in the secondary data research, that will be further validated in the fauna inventory, and can be included in the monitoring plan for biodiversity for Gold Level on further monitoring periods of the YBYRÁ REDD+ Project.

5.5.1 High Biodiversity Conservation Priority Status *(GL3.1)*

According to the biodiversity survey with secondary data, in the YBYRÁ REDD+ Project region there are 16 species considered “critically endangered” and/or “endangered” (CR and EN) and, in addition to these, 45 species are classified as “vulnerable” (VU). The list of the 16 species with CR and/or EN status and their respective population trends is presented in table 5.15 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.

[220] 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

[221] 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/

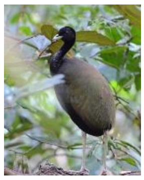
[222] Lista Vermelha de Ameaça da Flora Brasileira. Centro Nacional de Conservação da Flora – CNCFlora. 2014 Available on: https://specieslist.sibbr.gov.br/speciesListItem/list/drt1565629935045?q=astrocaryum&lang=pt_BR. Accessed in 09/04/2022.

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 conservation. If monitoring of biodiversity identifies other priority species, these can be added to project activities for their conservation.

Table 5.95 - 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 (Order Fabales)	*Vouacapoua americana*	Acapú[223] 	CR	EN
	Myristicaceae (Order Magnoliales)	*Virola surinamensis*	Ucuubeira[224] 	EN	VU
	Rutaceae (Order Sapindales)	*Euxylophora paraensis*	Pau Amarelo [225] 	EN	CR
	Apocynaceae (Order Gentinales)	*Aspidosperma parvifolium*	Guatambu[226] 		EN
	Bignoniaceae (Order Lamiales)	*Handroanthus serratifolius*	Ipê-amarelo[227] 	EN	

[223] http://www.amazonflora.com.br/product-page/acap%C3%BA
[224] https://plantidtools.fieldmuseum.org/pt/nlp/catalogue/3671302
[225] https://lpf.florestal.gov.br/pt-br/?option=com_madeirasbrasileiras&view=especieestudada&especieestudadaid=112
[226] https://www.arvores.brasil.nom.br/new/guatambu/index.htm
[227] https://www.soflor.com.br/produto/ipe-amarelo-sementes-handroanthus-serratifolius/

Kingdom	Taxon	Species	Common name (portuguese) and image	Red List IUCN	Red list CNCFlora/Icmbio
Animalia	Pitheciidae (Order Primates)	*Chiropotes satanas*	Cuxiú-preto [228] 	EN	CR
	Cebidae (Order Primates)	*Cebus kaapori*	Caiarara [229] 	CR	CR
	Felidea (Order Carnivora)	*Leopardus tigrinus*	Gato do mato no norte[230] 	VU	EN
	Psophiidae (Order Gruiformes)	*Psophia obscura*	Jacamim-de-costas-escuras[231] 	CR	CR
	Ramphastidae (Order Piciformes)	*Pteroglossus bitorquatus*	Araçari-de-pescoço-vermelho[232] 	EN	NT
	Psittacidae (Order Psittaciformes)	*Pionites leucogaster*	Marianinha-de-cabeça-amarela[233]	EN	

[228] https://www.ecoamazonia.org.br/black-bearded-saki-chiropotes-satanas-in-the-amazonchiropotes-satanas-cuxiu-preto/
[229] https://mamiferosdomundo.blogspot.com/2018/04/cebus-kaapori-macaco-prego-do-maranhao.html
[230] https://www.google.com/url?sa=i&url=https%3A%2F%2Fpt.wikipedia.org%2Fwiki%2FGato-do-mato-pequeno&psig=AOvVaw3MXTWgqYZEKfhf8IZKTaq8&ust=1686949875187000&source=images&cd=vfe&ved=0CBMQjhxqFwoTCKjAxZKYxv8CFQAAAAAdAAAAABAE
[231] Wikiaves
[232] Wikiaves
[233] Wikiaves

Kingdom	Taxon	Species	Common name (portuguese) and image	Red List IUCN	Red list CNCFlora/Icmbio
					
		Pyrrhura amazonum	Tiriba-de-Hellmayr[234] 	EN	
	Pipridae (Order Passeriformes)	*Lepidothrix iris*	Cabeça-de-prata [235] 	VU	EN
	Picidae (Order Piciformes)	*Piculus paraensis*	Pica-pau-dourado-de-Belém[236] 	EN	VU
	Ramphastidae (Order Piciformes)	*Selenidera gouldii*	Saripoca-de-Gould[237] 	EN	
	Nyctibiidae (Order Caprimulgiformes)	*Nyctibius leucopterus*	Urutau-de-asa-branca[238] 	CR	CR

[234] https://avibase.bsc-eoc.org/species.jsp?avibaseid=A950292F22812378
[235] https://ebird.org/species/opcman1?siteLanguage=pt_PT
[236] https://www.wikiaves.com.br/wiki/pica-pau-dourado-de-belem
[237] WikiAves
[238] WikiAves

5.5.2 Trigger Species Population Trends *(GL3.2, GL3.3)*

The project activities will focus on the preservation of species, especially on those 15 highlighted in this section, after their presence in the project area is validated in the fauna inventory *in loco*. The project can consider the possibility to monitor only specific species that are bioindicators of the quality of the environment, since the efforts to the conservation of mammals, for example, as the monkey species under threat, will also protect other species. The same happens with the protection of carnivores of the top of the food chain, such as the Jaguars and Pumas, since they are considered “umbrella-species”, as stated before in item 5.1.1.2.

As previously mentioned, the recompostition of degraded areas in the PPAs of the project area can maintain the ecological services related to the water bodies and also promote the connectivity between the biological species through the creation of ecological corridors between forest fragments of the properties involved in the project. These kinds of initiatives offer an opportunity to continue collaborating with local communities and civil society organizations as key partners to reinforce their sense of belonging to the natural environment and the wildlife species they live with.

Considering these important points, the YBYRÁ REDD+ Project will evaluate priority areas to recomposition of Permanent Protected Areas and the creation of ecological corridors as a project activity, aligned with the CCB Biodiversity Gold Level. If this measure is positive and feasible, it will be implemented.

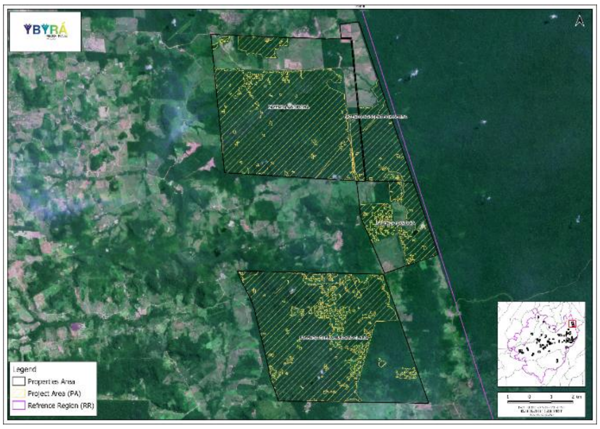
The inventory of fauna and flora is predicted to happen after the accreditation and sale of carbon credits (between 2024 and 2025). A specialized company will be hired and will define the methods, sampling, and areas according to the area of the project in order to guarantee a realistic and representative data collection. Further indicators, such as number of species, diversity, richness, occurrence frequency and number of threatened species, will be established according to the consultation, notes and propositions of the specialized company in fauna and flora, or in partnership with universities’ researchers and professors. Thus, the fauna and flora can be monitored with quality and reliable indicators, enabling decision making based on results of the project activities directed to the benefits of the biodiversity. The official Monitoring Plan of the YBYRÁ REDD+ Project will be developed together with specialized company in Fauna and Flora Monitoring, or in partnership with universities’ researchers and professors, for further monitoring periods, implementing measures directed to the Biodiversity Gold Level Standard.

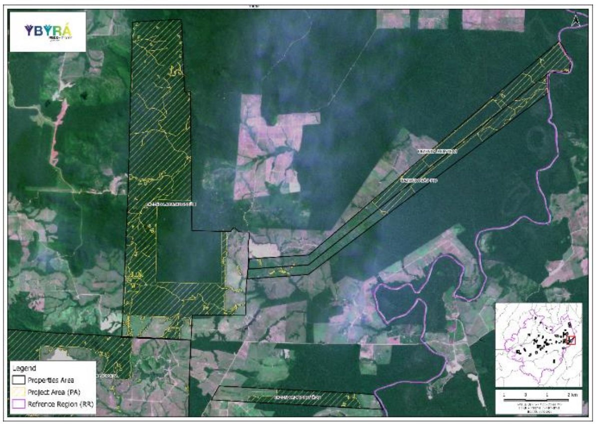
According to the list of identified endangered (EN) and critically endangered (CR) species, considered in the YBYRÁ REDD+ Project as trigger species (presented above in sector 5.5.1.), the trends on their populations, the threats on these species and the activities to address them will be presented in respective Monitoring Report, when the project intents to be verified for Gold

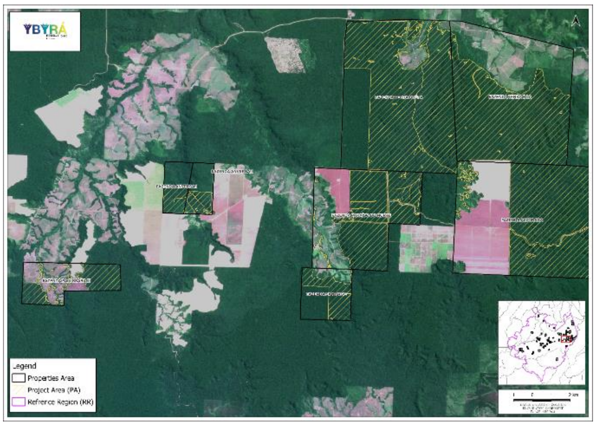
Criteria for Biodiversity. But in advance, all the 15 species cited above have decreasing population trend, according to the IUCN and ICMBIO, as it one of the criteria to be classified as EN and/or CR species. After the execution of the fauna and flora inventory, the species here identified as trigger species, may suffer alteration according to primary data and assessment.

ANNEX 1

The annex 1 is composed by the 25 images of the Project Area. The Vertix points are also available for consultation for the VVB. All the KML files of the PA are available for Audit and also in VERRA.



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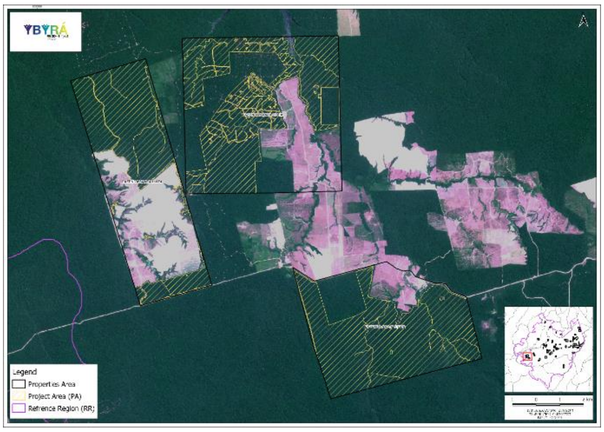
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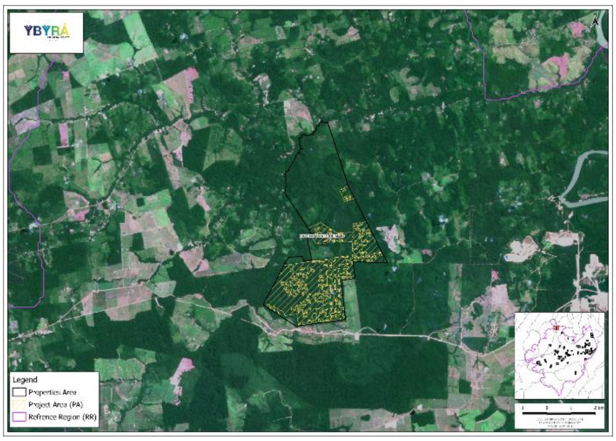
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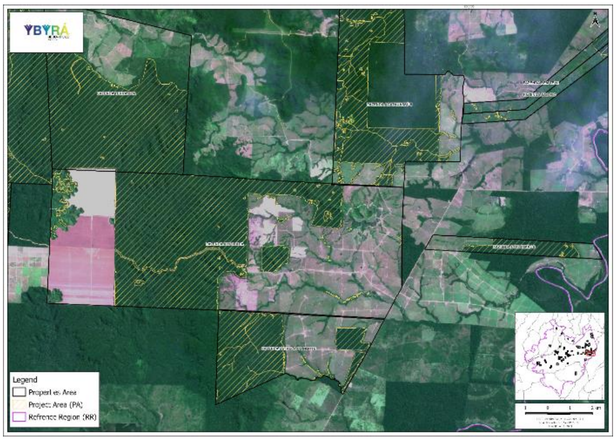
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