

AMAZON RIO REDD+ IFM PROJECT

CCB PROJECT DESCRIPTION



Document Prepared By EBCF

Project Title	Amazon Rio REDD+ IFM (Project ID: 1147)
Version	1.0
Date of Issue	08-March-2024
Project Location	Brazil. Manicoré, Amazonas.
Project Proponent(s)	EBCF - Empresa Brasileira de Conservação de Florestas Contact: Eduardo Covas Barrionuevo (CFO) Email: eduardo@amagroup.com.br / Phone: +55 41 99922 6776
Validation Body	Earthood Services Private Limited / Verifit
Project Lifetime	05 June 2013 – 04 June 2049; 36 year lifetime
GHG Accounting Period	05 June 2013 – 04 June 2022; 10 years total period
History of CCB Status	Validated against CCB 3rd. ed. in november 2017
Gold Level Criteria	Not applicable
Expected Verification Schedule	Public Consultation: 09 march 2024 Field audits: 15 – 18 april 2024 Validation & Verification statement: 21 july 2024

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1 SUMMARY OF PROJECT BENEFITS

This section highlights some of this project's important benefits. Section 1.1 (Unique Project Benefits) should be aligned with a project's causal model and is specific to this project. Section 1.2 (Standardized Benefit Metrics) is the same quantifiable information for all CCB projects. This section does not replace the development of a project-specific causal model or the monitoring and reporting of all associated project-specific impacts (positive and negative) that are described in Sections 2-5 of this document.

1.1 Unique Project Benefits

Table 1. Project impact

Outcome or Impact Estimated by the End of Project Lifetime	Section Reference
1) conservation of 18,859 ha of primary forests in the heart of the Amazon through the creation of an RPDS	Section 1
2) reducing climate impact by avoiding emissions of 3,284,063 tons of CO ₂	Section 3
3) improving the quality of life of 125 families	Section 4
4) preservation of 19 species threatened with extinction + 68 endemic species	Section 5
5)	

1.2 Standardized Benefit Metrics

Table 2. Standardizes Benefit Metrics

Category	Metric	Achievements during Monitoring Period	Section Reference	Achievements during the Project Lifetime
GHG emission reductions & removals	Net estimated emission removals in the project area, measured against the without-project scenario	NA	NA	NA
	Net estimated emission reductions in the project area, measured against the without-project scenario	444,768 tCO ₂ e	3.2.4.3	647.559 tCO ₂ e
Forest ¹ cover	For REDD ² projects: Number of hectares of reduced forest loss in the project area measured against the without-project scenario	NA	NA	NA
	For ARR ³ projects: Number of hectares of forest cover increased in the project area measured against the without-project scenario	NA	NA	NA
Improved land management	Number of hectares of existing production forest land in which IFM ⁴ practices have occurred as a result of the project's activities, measured against the without-project scenario	4,680 ha	NA	7,020 ha
	Number of hectares of non-forest land in which improved land management has occurred as a result of the project's activities, measured against the without-project scenario	NA	NA	NA
Training	Total number of community members who have improved skills and/or knowledge	57 community members	4.3.1	70

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	Achievements during Monitoring Period	Section Reference	Achievements during the Project Lifetime
	resulting from training provided as part of project activities			
	Number of female community members who have improved skills and/or knowledge resulting from training provided as part of project activities of project activities	15 women	4.3.1	50
Employment	Total number of people employed in of project activities, ⁵ expressed as number of full time employees ⁶	6	2.4	10
	Number of women employed in project activities, expressed as number of full time employees	3	2.4	6
Livelihoods	Total number of people with improved livelihoods ⁷ or income generated as a result of project activities	1	2.3.1 4	4
	Number of women with improved livelihoods or income generated as a result of project activities	1	2.3.1 4	20
Health	Total number of people for whom health services were improved as a result of project activities, measured against the without-project scenario	108 benefited families	4.3.1	-
	Number of women for whom health services were improved as a result of project activities, measured against the without-project scenario	-	-	-
Education	Total number of people for whom access to, or quality of, education was improved as a result of project activities, measured against the without-project scenario	48 children	4.3.1	100

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 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	Achievements during Monitoring Period	Section Reference	Achievements during the Project Lifetime
	Number of women and girls for whom access to, or quality of, education was improved as a result of project activities, measured against the without-project scenario	-	-	-
Water	Total number of people who experienced increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	108 benefited families	4.1.1	200
	Number of women who experienced increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	-	-	-
Well-being	Total number of community members whose well-being ⁸ was improved as a result of project activities	125 people	4.1.1 4.3.1	250
	Number of women whose well-being was improved as a result of project activities	-	-	-
Biodiversity conservation	Change in the number of hectares significantly better managed by the project for biodiversity conservation, ⁹ measured against the without-project scenario	4,680 ha	NA	7,020 ha
	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	19	5.1.1 5.3.1	19

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, Health, Education, Water, etc.), but could also include other benefits such as empowerment of community groups, strengthened legal rights to resources, conservation of access to areas of cultural significance, etc.

⁹ 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.

¹⁰ Per IUCN's Red List of Threatened Species

¹¹ In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

2 GENERAL

The Brazilian Forest Conservation Company, EBCF, was created for the preservation of the Amazon rainforest, the protection of its biodiversity, the sustainable development of traditional and riverside communities, and climate change mitigation.

Having entrepreneurship, innovation, socio-environmental commitment, inclusion, transparency, education, economic sustainability, and the formation of partnerships as values, EBCF aims to establish itself as a successful business model in the promotion of services, environmental and digital products, and assets capable of attracting and connecting people, universities, institutions, companies, organizations and owners of forest areas with the cause of protecting the Amazon Forest.

EBCF operates with (i) acquisition and management of native forests with the objective of transforming them into Private Reserves for the protection of ecosystems and associated biodiversity; (ii) sustainable socio-environmental and economic promotion of traditional communities living in and/or surrounding the Private Reserves; (iii) production of non-timber forest products based on management plans for commercialization in the fair and sustainable market; and (iv) working with the voluntary carbon market with a view of reducing CO2 emissions through the implementation of REDD+ projects.

2.1 Project Goals, Design and Long-Term Viability

2.1.1 Project Proponent (G1.1)

Organization name	Empresa Brasileira de Conservação de Florestas S.A. (EBCF)
Contact person	Eduardo Covas Barrionuevo
Title	CFO
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Telephone	+55 41 99922 6776
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2.1.2 Project Objectives (G1.2)

The Amazon Rio project is implemented in four private areas called Amazon Rio I, II, III and IV, totaling 18,559 hectares of primary forests in the Municipality of Manicoré in Amazonas.

The project generates positive impacts on climate, benefits local communities and conserves biodiversity. Within the project scope, positive impacts on climate are achieved avoiding forest degradation caused by logging activities. The project area has a forest management plan authorized by IBAMA since 1998. Between 1999 and 2010, logging operations resulted in the

degradation of 5,429 ha. With the implementation of the project, the Brazilian Forest Conservation Company, hereafter called EBCF, promotes the suspension of the current logging activities, reducing the negative impacts resulting from human actions.

Benefits to local communities will derive from social activities related to better education, access to water, structuring NTFP supply chains and digital inclusion. By maintaining the forest cover and habitats for a range of rare, endemic and threatened species in the Amazon, the project activities will also be positively impacting biodiversity.

The suspension of the logging operations was consolidated with the creation of a Private Sustainable Development Reserve (RPDS) on June 5, 2013. The RPDS was established in the Amazon Rio I, and the others three areas, Amazon Rio II, III and IV was included on this conservation project and donated to EBCF company, perpetuating the conservation effort.

The creation of the reserve constitutes the main conservation action aimed at reducing GHG emissions due to avoided forest degradation, implemented by this project. Since the RPDS creation, the logging operations remains interrupted, between 2013 and 2022 the project will avoid the emission of 614,837 tCO₂e.

During the first decade of project, actions aimed at biodiversity conservation will be carried out through the monitoring of fauna and flora with a focus on endangered, rare, and endemic species, the net impacts will be generated through maintenance of habitat for 370 species of local fauna, including 281 birds, 41 amphibians, 34 reptiles and 18 mammals. Among the species found in the area, 68 are endemic to the Amazon biome and 19 are on the World List of Endangered Species. In turn, actions related to the promotion of social benefits will materialize in the form of infrastructure, digital inclusion, donation of water filters, improved access to water in homes, school classes reinforcement, and training in good practices in the management of Chestnut and Açaí. In addition, with special attention to the gender issue, the project will promote the strengthening of the social organization of women's groups. These actions will be distributed for community groups identified around the project areas.

2.1.3 Physical Parameters (G1.3)

The Amazon Rio Project is located in the southern region of the State of Amazonas, in the municipality of Manicoré. The Project areas are close to the Madeira River and between the Sustainable Development Reserves (RDS) of the Madeira River and the Amapá River (Fig. 01) (Annex 33).

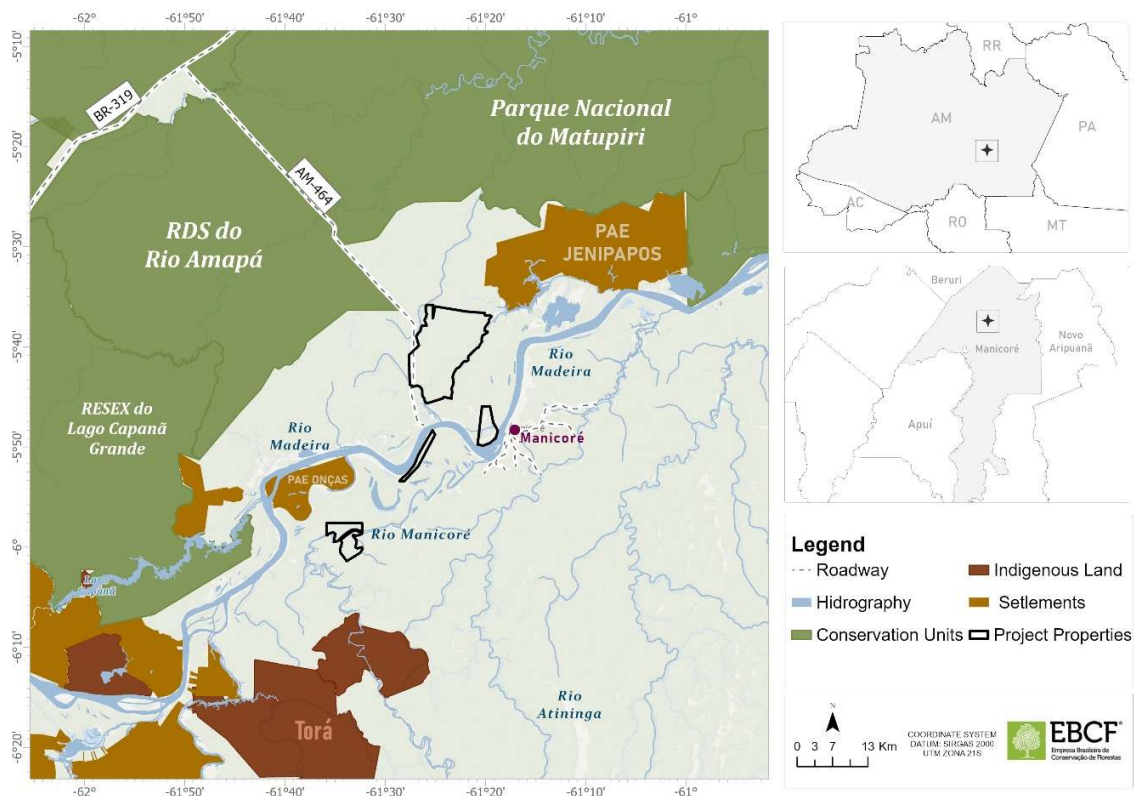


Figure 1. Project Location.

Topography and slope

This region is characterized by a flat topography and primary vegetation consisting of areas of dry land (*terra firme*), floodplains (*várzea*), and some black-water flooded Amazonian forest formations (*igapó*) due to the influence of the Manicoré River. Plains predominate and are characteristically flat and usually rise only a few meters above sea level, but they may also rise to higher altitudes. In this form of topography, more materials are deposited than eroded.

Topography data came from INPE's TOPODATA Program and it were generated in a 30m resolution for the whole of Brazil from the SRTM data (Shuttle Radar Topography Mission).

Figure 2 illustrates the variation in altitude (in meters) within the properties, revealing a predominant expanse of land with modest elevations, between 16 and 70 meters.

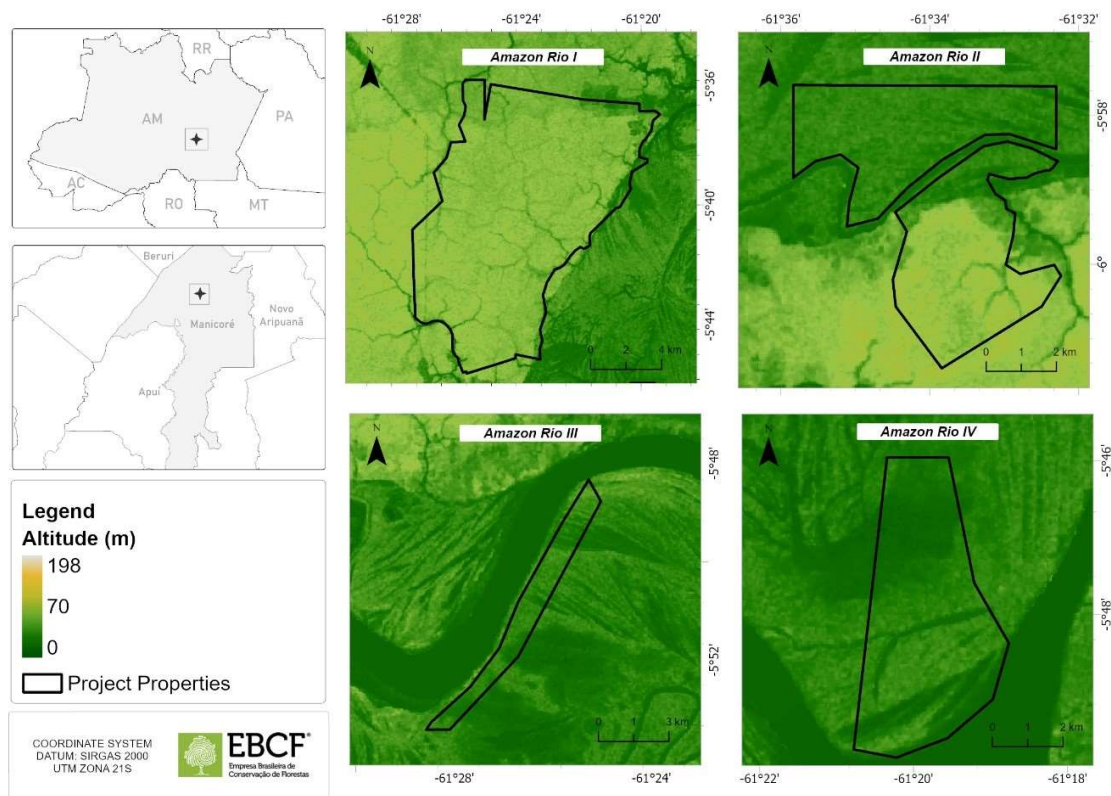


Figure 2. Altitude in the Project Area

The relief of the properties varies from plan to wavy (Figure 3), with a predominance of plan relief according to the EMBRAPA classification (1989). The average slope in the areas is 5.6%, ranging 0.3% to 48.2%.

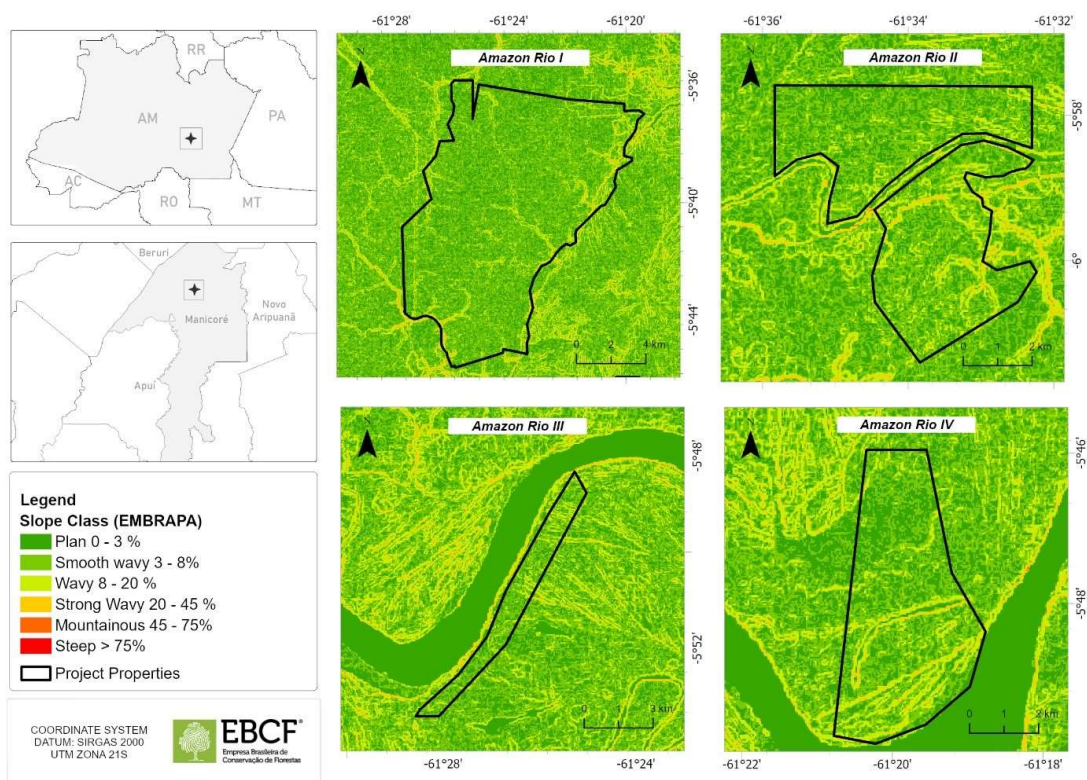


Figure 3. Slope in the Project Area

Geology and geomorphology and soil

Amazonas state is characterized by an extensive phanerozoic sedimentary layer (Paleozoic Era), distributed among the Acre, Solimões, Amazonas and Alto Tapajós basins, deposited on a Precambrian bedrock of igneous, sedimentary and metamorphic rocks (CPRM, 2013). The Amazon Rio project areas are located between the Rio Amapá RDS and the municipality of Humaitá in the same sedimentary basin as the Solimões River, with similar soil characteristics

According to the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* - IBGE) soil database (2000), the Manicoré region is formed mainly of Latosols and Argisols. Gleysols, Spodosols, Alluvial soils, Neosols, Planosols, Plinthosols and Nitosols can also be found. The Brazilian Soil Classification System, produced from surveys by the Brazilian Agricultural Research Corporation (EMBRAPA), between 2001 and 2006, corroborates the classification information for this region.

As depicted in Figure X, the project areas primarily feature gleissol soil. Additionally, in the case of the Amazon Rio I property, alongside gleysol, yellow latosol is also present.

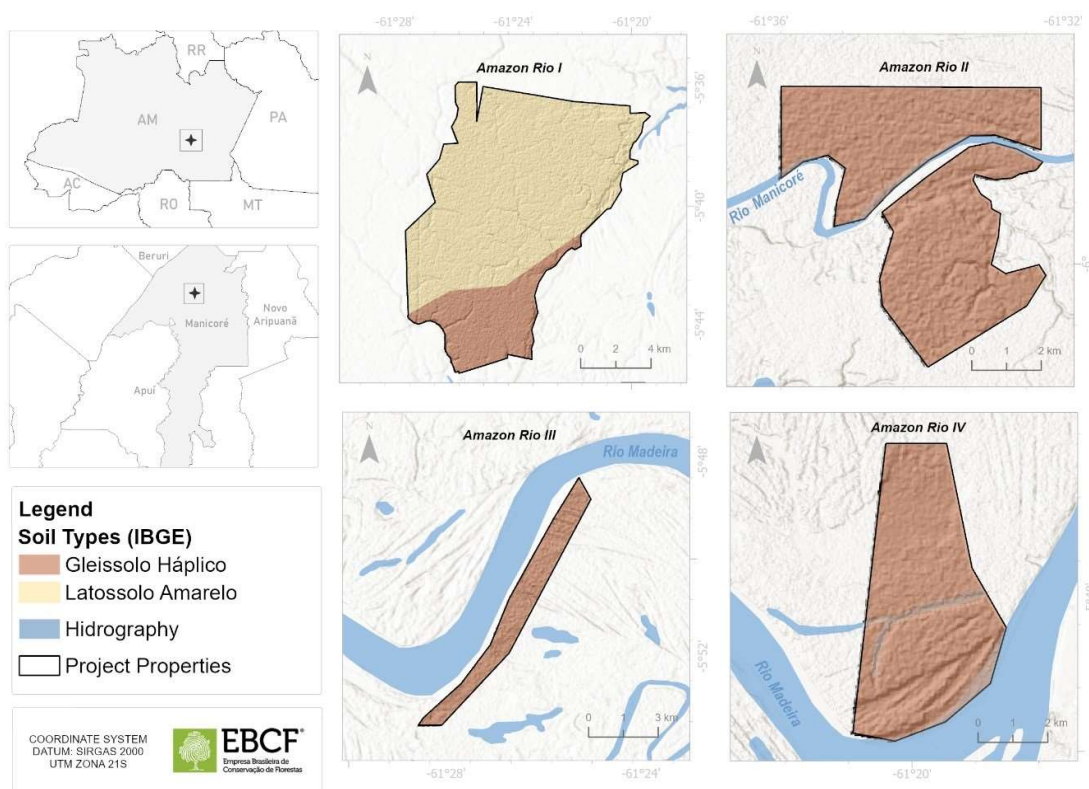


Figure 4. Soils in the Project Area

Latosols are deep mineral soils that have suffered heavy weathering and are therefore virtually void of primary and secondary minerals, and they present low nutrient reserves. Because of the high degree of weathering and poor source of material, these soils are generally very acidic, low in available nutrients and feature high exchangeable aluminum content. Like most weathered soils, organic matter plays a fundamental role in the process of plant nutrition and nutrient cycling.

Gleysols are mineral soils, hydromorphic, from the Holocene period. They occupy wet floodplain environments and poorly or very poorly drained depressions, on flat terrain under hygrophilous and hydrophilic floodplain vegetation that are subject to long periods of flooding and, less frequently, to evergreen floodplain forest (EMBRAPA, 2021).

These soils are highly diverse in their physical, chemical, and morphological characteristics. However, generally, Gleysols have limitations for agricultural use due to the presence of a high-water table and the risk of frequent floods or inundations. They generally have low to moderate natural fertility, with moderate to strong limitations on the use of agricultural machinery under natural conditions due to excess water. After drainage and correction of chemical deficiencies, these soils are mainly suitable for pastures, various annual crops, sugarcane, banana cultivation, and vegetable farming, among others (EMBRAPA, 2021).

Climate and hydrography

According to the Köppen-Geiger classification (Figure 5) the properties climate falls under Group A (Humid Tropical Climate), specifically the Af (Wet Equatorial Climate) and Am subtype.

The Af climate is marked by consistently high temperatures throughout the year, with monthly temperature variations typically less than 3°C (37°F). The limited radiative cooling during the evening can be attributed to the abundance of solar radiation, cloud cover, and high humidity. Additionally, this climate experiences year-round plentiful precipitation, frequent formation of cumulus and cumulonimbus clouds (thunderstorms) in the early afternoons due to intense surface heating and high humidity. The presence of the Intertropical Convergence Zone contributes to the high, constant, and evenly distributed monthly precipitation, resulting in annual amounts usually exceeding 1500 mm.

While Am is characterized as a humid or subhumid tropical climate, it serves as a transition between the climatic types Af and Aw. It is characterized by having an average temperature in the coldest month always above 18°C, with a short dry season that is compensated for by high precipitation totals. This type of climate predominates in the northeast of Espírito Santo, the inland coastal strip of Bahia, Pará, Amapá, western Roraima, parts of Amazonas, Acre, Rondônia, northern Mato Grosso, and northwest Maranhão (Golfari et al., 1978).

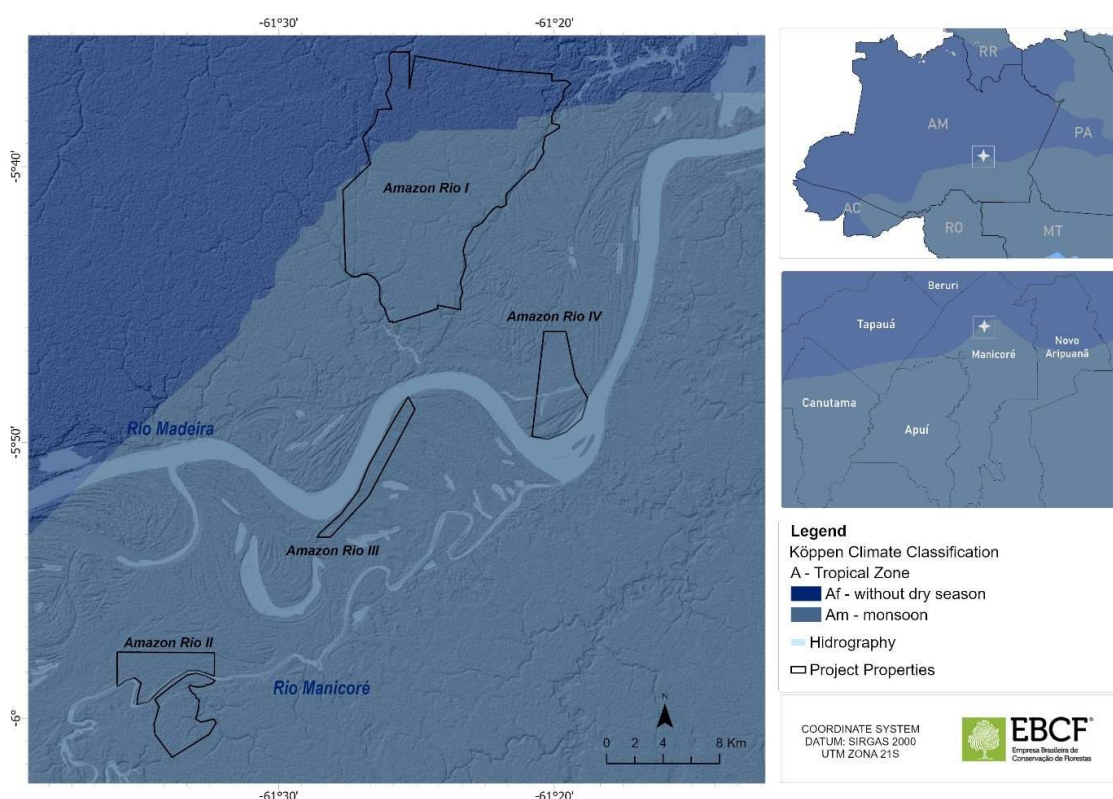


Figure 5. Climate in the Project Area

Geographically, the Amazon region is defined by watersheds formed by the rivers which flow into the Amazon Rio and its mouth, along the entire Eastern coast of Brazil (RIBEIRO et al., 1999). Manicoré is mainly influenced by the Madeira and Manicoré rivers which are whitewater and

blackwater rivers respectively (Figure 6). These rivers contribute to the local climatic conditions along with the characteristics of the vegetation including forests, meadows, savanna (*cerrado*) and floodplains (*várzeas*).

The Madeira River drains three main morpho structural units: the Andes (15%), the Brazilian shield (41% of the basin) and the Amazon plain (44%). The Manicoré River is located in the Brazilian shield and the Amazon plain. The smaller rivers, or tributaries of the Madeira River are: Manicoré River, Aripuanã River, Marmelos River and Canumã River, all located along its right bank.

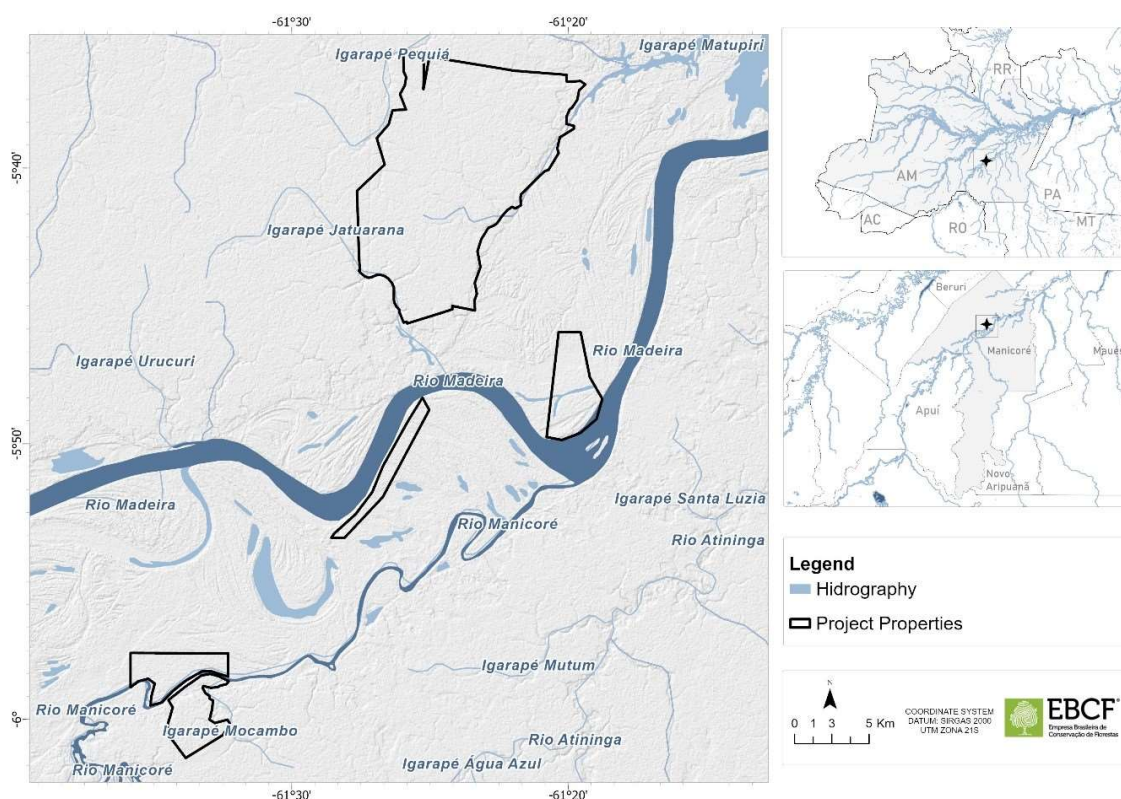


Figure 6. Hydrography in the Project Area

Types of vegetation

For purposes of inventorying local carbon stocks and for project management, the project area was stratified into 2 different groups of forest typology, as indicated by the VM0011, according to the IBGE vegetation map (IBGE/DGC, 2004). The forest types present in the area are rain forest types, divided into 2 categories (Figure 7):

- Dense Ombrophilous Alluvial Forest (*Floresta Ombrófila Densa Aluvial Dossel emergente*) (FDA): forest formations with areas of temporarily flooded forests during floods of the main rivers forming *igapós* or known locally as *Várzea* Forests. The FDA covers an area corresponding to 14.4% of the project area.

- Dense Ombrophilous Lowland Forest (*Floresta Ombrófila Densa Terras Baixas Dossel emergente*) (FDTB): forest formations with forest areas that do not flood seasonally, regardless of river dynamics, locally known as *Terra Firme* Forests. FDTB covers 85.6% of the entire project area.

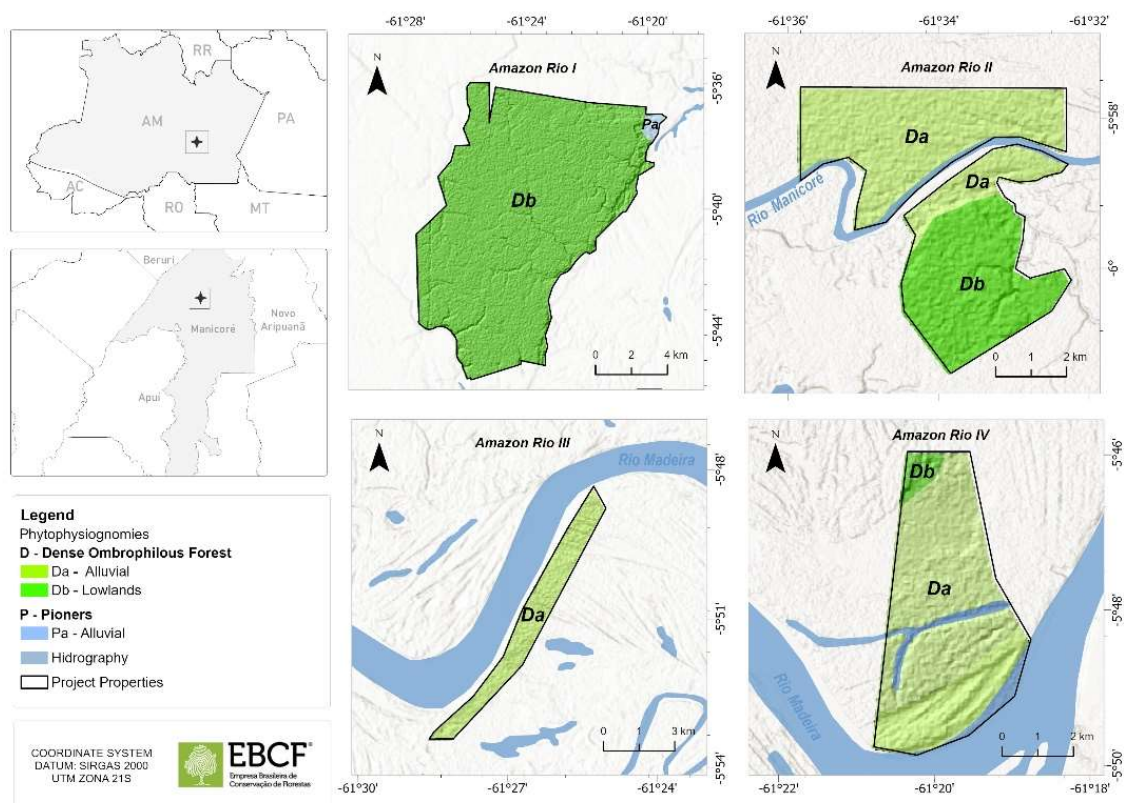


Figure 7. Forest Types in the Project Area

Table 3. Forest Types cover

Forest Type	Area (ha)	Coverage (%)
Open Dense Ombrophyllous (Db)	2,676.38	14.43
Dense Ombrophyllous Submontane (Ds)	15,873.37	85.57
Total	18,549.76	100

2.1.4 Social Parameters (G1.3)

The Amazon Rio project areas are distributed in the Madeira River basin, this region is predominantly occupied by riverside populations who gather in small groups. The main communities identified are on this map:

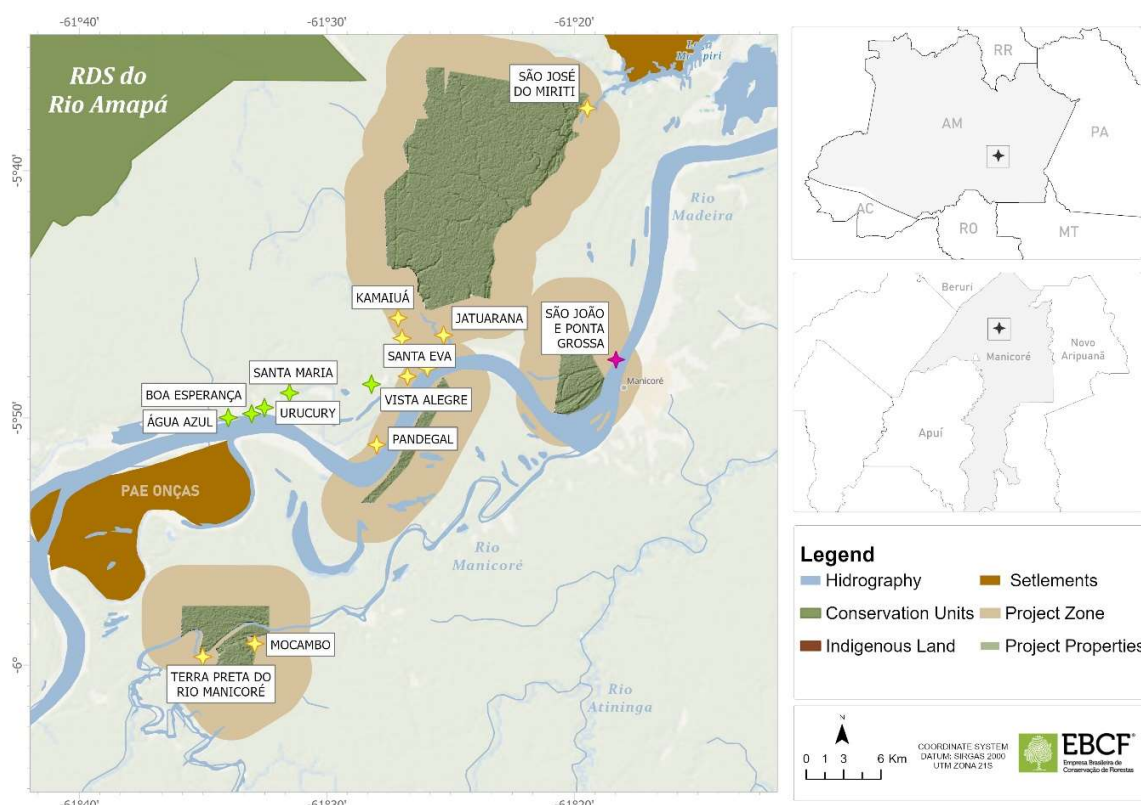


Figure 8. Forest Types in the Project Area

Approximately 530 families are distributed across 15 communities, as shown in table 4, all of which practice hunting and fishing for subsistence. The economy is based on productive activities linked to family farming, especially the cultivation of cassava to make flour, followed by cassava, banana and watermelon. The extraction of non-timber forest products, with an emphasis on Brazil nuts and açaí, are among the main production chains developed in the region. Rubber extraction and vegetable oils (copaiba, andiroba and bacaba) also help to make up family income. The Pandegal community, in particular, presents mining as one of the most significant activities, but they also practice extractivism and planting fields for subsistence.

Table 4. Communities involved with Amazon Rio REDD+ project

COMUNIDADE	Nº FAMÍLIAS	ATIVIDADE PRINCIPAL	ID CULTURAL
1. São José do Miriti	23	Açaí, castanha e farinha	População Ribeirinha
2. Jatuarana	75	Açaí, castanha e banana	População Ribeirinha
3. Democracia	61	Açaí e banana	População Ribeirinha
4. Kamaiúá	42	Açaí e castanha	Povos Indígenas

5. Terra Preta do Ramal	10	Açaí	População Ribeirinha
6. Santa Eva	23	Farinha	População Ribeirinha
7. Vista Alegre	80	Açaí, castanha, banana e farinha	População Ribeirinha
8. Santa Maria	16	Açaí e Banana	População Ribeirinha
9. Urucury	23	Açaí, banana e farinha	População Ribeirinha
10. Boa Esperança	44	Açaí, castanha, banana e óleo de copaíba	População Ribeirinha
11. Água Azul	54	Farinha	População Ribeirinha
12. Terra Preta do Rio Manicoré	23	Açaí, castanha e farinha	População Ribeirinha
13. Mocambo	27	Açaí, castanha e farinha	População Ribeirinha
14. Pandegal	29	Açaí e banana	População Ribeirinha
15. São João e Ponta Grossa	6	Açaí	População Ribeirinha

The religious orientation of the communities located around the private areas is predominantly Catholic, only the Terra Preta do Ramal community has an evangelical church. The Catholicism practiced by these communities is essentially popular with an emphasis on devotion to the saints and the performance of rituals, such as flag-raising, novenas and religious festivals. Many families celebrate annual festivals to honor their patron saints, considered the protectors of their communities.

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

PROJECT ZONE

The Amazon Rio project zone was defined based on the recommendation of the National Environmental Council - CONAMA (Resolution 428/2009) to adopt a Buffer Zone of 3 thousand meters (Figure 9).

According to law 9.985/2000, which establishes the National System of Nature Conservation Units (Snuc), a buffer zone is the surroundings of a conservation unit, where human activities are subject to specific rules and restrictions, with the purpose of minimizing negative impacts on the unit.

Among the 04 areas that make up the project, one of them known as RPDS Amazon Rio I is a type of Private Conservation Unit, recognized by the State of Amazonas, which justifies the adoption of the recommendations by SNUC.

The delimitation of the Project Zone also took into account the relationship of the surrounding communities with the project area, where project activities may directly impact the land and

associated resources, including activities related to the provision of alternative livelihoods and the community development.

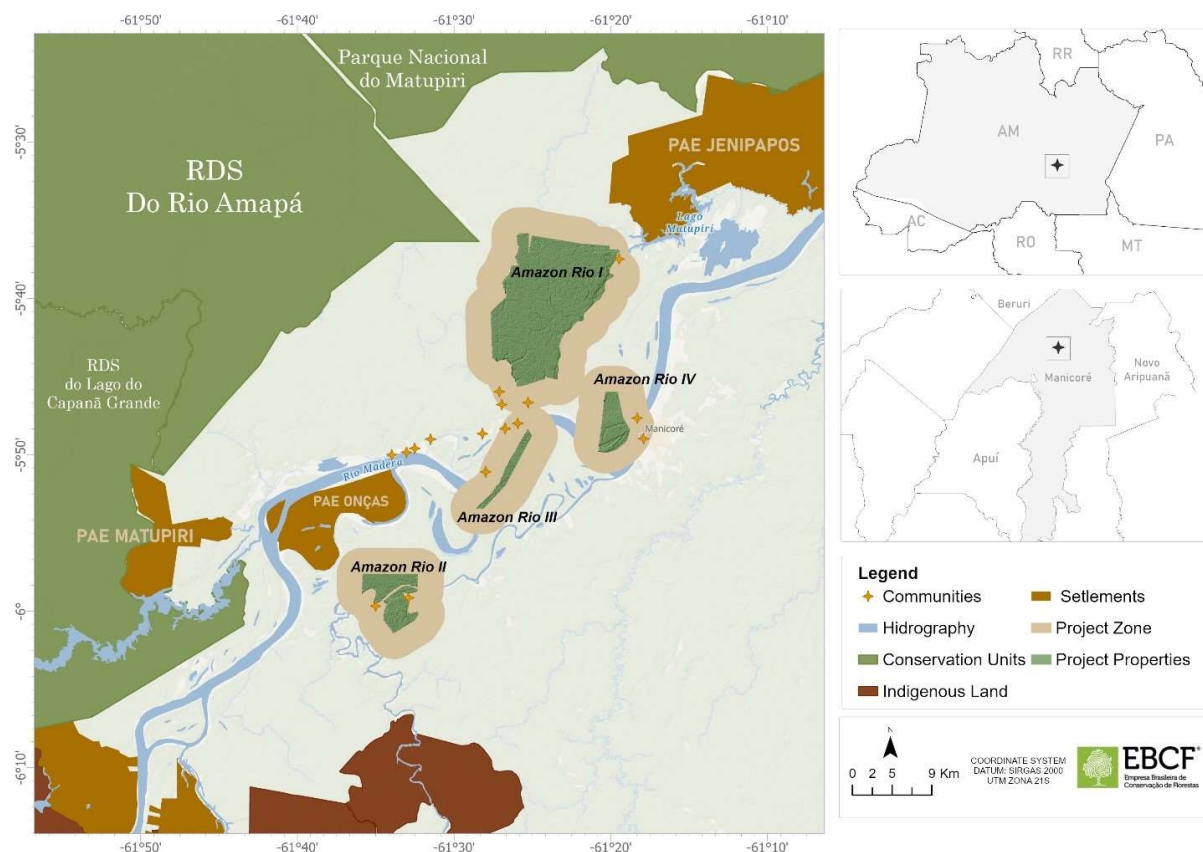


Figure 9. Project Zone

PROJECT AREA

Only land with forest cover where logging is permitted, having been granted permission by Operating Licenses and Exploration Authorizations, is used to define the 18,559.8 ha18 of the Project area (for purposes of calculating the emissions reductions called the Project Area or PA). To define the PA, the areas covered by forests are considered and the Permanent Preservation Areas (Áreas de Preservação Permanente - APPs), bodies of water and no forest areas defined by the PRODES project are excluded.

There is no direct leakage expected from the planned project activities, since there will not be any shifting of logging activities to other areas controlled and owned by the Management Plan and project proponent. The project Management Plan includes the monitoring of possible unanticipated leakages around the project area, as well as the need to report to the relevant authorities whenever logging activities are identified in these areas.

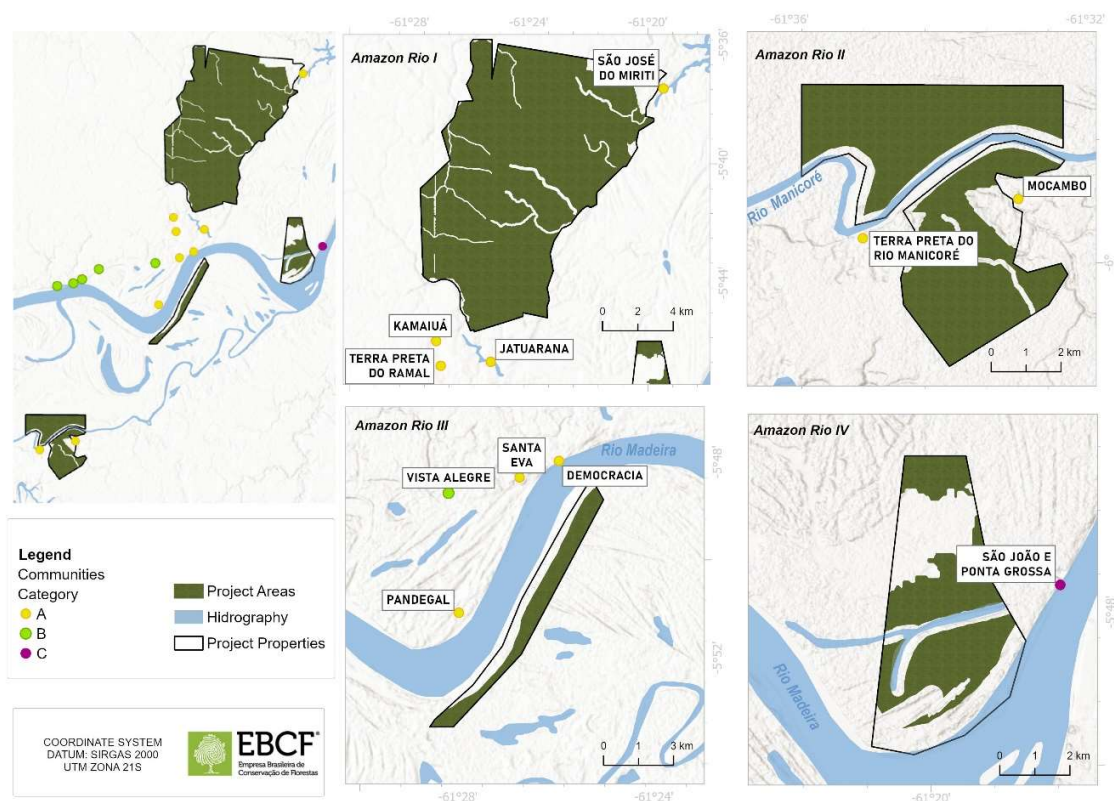


Figure 10. Approximate view of the communities' location and project area

2.1.6 Stakeholder Identification (G1.5)

Stakeholders were identified during visits to communities found around the project areas. To collect data on livelihoods, socioeconomic and cultural aspects, questionnaires were applied (annex 70 and 71). During the project design stage, workshops were also held with various stakeholders, promoting broad discussion about the project.

After completing 10 years since the beginning of the project, the communities were revisited with the aim of understanding their relationship with the Amazon Rio project areas and classifying the level of significance of these populations in relation to their level of use or dependence on the project area. Based on this, three categories of community groups were identified:

- Communities that depend on the project area for their livelihoods;
- Local communities with the same sociocultural standards that do not depend on the project areas for their survival or for other purposes; It is
- Groups that access the project area to extract non-timber forest products seasonally, but do not reside in the surrounding area.

To identify other relevant stakeholders, a consultation was carried out with relevant actors about which organizations and institutions operate in the territory or are important for the project.

It was also possible to get to know the community-based organizations that represent the interests of the surrounding communities and can be recognized as local leaders.

Table 5. List of stakeholders and others relevant social actors

Community– Project Zone
<i>Community groups found around the Project areas that access the area for livelihoods and income (Hunting, fishing and NTFP extraction).</i>
1. Comunidade São José do Miriti 2. Comunidade Jatuarana 3. Comunidade Democracia 4. Comunidade Kamauiá 5. Comunidade Terra Preta do Ramal 6. Comunidade Santa Eva 7. Comunidade Pandegal 8. Comunidade Terra Preta do Rio Manicoré 9. Comunidade Mocambo
Other Local Communities
<i>Similar community groups formed by riverside populations that have the same way of life and operate in the production chain of non-timber products, but do not access or depend on the project areas.</i>
1. Comunidade Vista Alegre 2. Comunidade Santa Maria 3. Comunidade Urucury 4. Comunidade Boa Esperança 5. Comunidade Água Azul
User populations
<i>Groups that access the project area to extract non-timber forest products seasonally, but do not reside in the surrounding area.</i>
1. 2. 3. 4. 5. 6. 7. 8. 9. Comunidade São João e Ponta Grossa
Local leaders
<i>Community leaders representing community groups identified in the reference region.</i>
1. Central das Associações Agroextrativistas da Reserva de Desenvolvimento Sustentável do Rio Amapá - CAARDS 2. Central das Associações Agroextrativistas do Rio Manicoré - CAARIM 3. Conselho das Associações Agroextrativistas de Manicoré - CAAM

4. <i>Conselho Nacional das Populações Extrativistas - CNS</i>
NGOs
<i>Non-governmental organizations that operate in the territory where the project areas are located.</i>
1. <i>Fundação Amazônia Sustentável - FAS</i>
2. <i>Fundação Getúlio Vargas – FGV</i>
3. <i>Instituto Internacional de Educação do Brasil - IEB</i>
Local Government
<i>Public authorities that operate in the territory with topics relevant to the project.</i>
1. <i>Secretaria de Estado de Meio Ambiente do Amazonas – SEMA AM</i>
2. <i>Fundação Nacional dos Povos Indígenas - FUNAI</i>
3. <i>Instituto Chico Mendes de Conservação da Biodiversidade – ICMBio</i>
4. <i>Instituto de Desenvolvimento Agropecuário do Estado do Amazonas - IDAM</i>

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

Stakeholders were divided into five groups and are listed below:

Table 6. Groups of stakeholders

Stakeholder	Rights, Interest and Overall Relevance to the Project
1. <i>Comunidade São José do Miriti</i> 2. <i>Comunidade Jatuarana</i> 3. <i>Comunidade Democracia</i> 4. <i>Comunidade Kamaiúá</i> 5. <i>Comunidade Terra Preta do Ramal</i> 6. <i>Comunidade Pandegal</i> 7. <i>Comunidade Terra Preta do Rio Manicoré</i> 8. <i>Comunidade Mocambo</i>	This group uses natural resources in the project area for livelihood and income (subsistence hunting and fishing and extraction of NTFPs for commercialization). They were interested in improving health care, supporting cultural activities in communities (religious celebrations and football championships for men and women), improving access to water, actions to improve education, digital inclusion, supporting the structuring of production chains (training, equipment and infrastructure for production flow, for example). The São José do Miriti, Jatuarana, Pandegal and Terra Preta do Rio Manicoré communities requested specific support for activities for women's groups, such as various courses, creation of associations and support for female entrepreneurship.
9. <i>Comunidade São João e Ponta Grossa</i>	This group does not use the project area, the majority have farms close to the Amazon Rio IV area, where they develop family farming

	plantations, but reside in the city. Only two families reside in the surrounding area and stated that they do not access the project area frequently or need it to maintain their livelihoods.
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2.1.8 Project Activities and Theory of Change (G1.8)

The activities were discussed with the communities during public meetings and workshops, and the information collected in the social diagnosis carried out was also considered.

Table 7. Project activities

Activity description	Expected climate, community and/or biodiversity			Relevance to project's objectives
	Outputs (short term)	Outcomes (medium term)	Impacts (long term)	
CLIMA				
Cessation of logging activities;	Avoiding degradation by interrupting logging activities in the Project area;	Reduction of 3.2 million tons of carbon that would have been emitted into the atmosphere;	Improvement of climatic conditions through voluntary contributions to reduce emissions from forest degradation;	High
Monitoring of land-use in and around the Project area;	Degraded areas and annual deforestation mapped in and around the Project area;	Understanding vectors of local degradation and deforestation in and around the project area;	Abrupt interruption of forest degradation, controlled deforestation in the Project area and sustainable land use in the regions surrounding the Project area;	High
Monitoring carbon stocks and regeneration of exploited forests;	Report from continuous forest inventories with information on carbon	Generation of primary data on carbon sequestration, regeneration and resilience of	Refinement of information and filling in of gaps for current carbon sequestration practices and	Low

	sequestration, regeneration and resilience of previously logged forests;	previously logged forests;	regeneration and resilience of forests exploited by logging.	
COMMUNITY				
Capacity building for sustainable agro-extractive organization and production;	02 trainings executed focused in good practices of production.	Optimized operating activities, reduction of work related accidents and operating costs.	Optimized operating activities, reduction of work related accidents and operating costs. Increased participation of community members in NTFP activities.	High.
Strengthening community-based social organization.	02 trainings executed focused in assoativism and cooperativism	Development of associative and collaborative actions to strengthen the collective work.	Community empowerment of associations and cooperatives focused on sustainable production of NTFPs.	High.
Support for implementation of sustainable production processes.	03 bridge built on the São José do Miriti Community.	Improvement in infrastructure for production transportation.	Access to markets for commercialization of community production.	High.
	Supply of Personal Protective Equipment kits.	Increase the use of PPE in forestry operations.	Contribute to reducing accidents in the field.	
	Maps and reports, including the area of occurrence, stock and productivity of main NTFP species of	Enhancements in production planning.	Better conditions for commercial agreements between the community and the consumer market.	

	economic value with real market access developed jointly with the communities (Chestnut and Açaí).			
Promotion of improvements in water quality and access to water.	Distribution of filters in 05 communities identified as priority for families.	Improvement in the water quality and access to water.	Improving the health and well-being of beneficiary families.	High.
	Distribution of filters in 05 community schools.			
	Installation of 01 water distribution network in the Jatuarana community.			
Investments in structure for education.	Implementation of 01 school reinforcement program.	Improvement in the access a quality education.	Schools with better conditions to serve students in the communities.	High.
	Support a reforms on the school in Terra Preta do Rio Manicoré community.			
Program to encourage women's empowerment.	02 meetings of women from communities to empower and promote participation	Women's empowerment in consultative processes and community deliberations in the context of the planned Amazon Rio REDD+ IFM	Gender participate in decision-making processes by community representatives within the framework of the Project activities.	High.

		project activities.		
Promotion and incentives for the development of income-generating activities geared towards women's and young people's skills.	02 workshops executed about entrepreneurship on the communities.	Development of income-generating activities geared to mapped women's skills, as well as designing and supporting the implementation of at least one activity in common with as many communities as possible.	Development of income-generating activities geared towards women's and young people's skills.	High.
BIODIVERSITY				
Biodiversity Conservation Program	Campaign to survey the wealth of 04 faunal groups (dry and rainy seasons)	Maintenance of 18,559 hectares that are home to more than 370 species of Amazonian fauna, including 281 birds, 41 amphibians, 34 reptiles and 18 mammals.	In-depth knowledge of the fauna of the Project area, in-situ identification of habitats of endemic and rare species, occurrence of threatened species in the Project area and understanding of the potential resilience of fauna and flora;	Very high. The project areas are included in the territorial outline of areas of extremely high biological importance as assessed by the Ministry of the Environment (MMA, 2016), the aforementioned activities are in line with the Program of Priority Areas for Conservation, Sustainable Use, and Benefit Sharing of Brazilian biodiversity.
	Biodiversity Reports			
	Installation of local fauna monitoring equipment			

2.1.9 Climate, Biodiversity and Community Benefits Assessment Period (G1.9)

The Project began on June 5, 2013, the date on which the Amazon Rio I Reserve was approved by the Secretariat for Sustainable Development as a Conservation Unit in the category of Private Sustainable Development Reserve - (in por.: RPDS). This fact determines the destination of the EBCF forest area for conservation purposes in perpetuity and thus establishing the inaugural milestone of the company's IFM project.

The Project's crediting period is 36 years, starting on June 5, 2013 and ending on June 4, 2049. This period is equivalent to the remaining 11 years of the first authorized management plan (25 years from 1998) added to another 25 years referring to a new forest management plan that was foreseen for the second cutting cycle, according to the common practice of logging operations in native forests in the northern region of Brazil. According to Brazilian law, logging activities could continue beyond 36 years, aiming at a second crediting period.

2.1.10 Differences in Assessment Periods (G1.9)

Explain and justify any differences between the GHG emissions accounting, climate adaptive capacity and resilience, community, and/or biodiversity assessment periods.

2.1.11 Implementation Schedule (G1.9)

Table 8. Implementation schedule

Date	Milestones in the project's development and implementation ¹²
05 Jun 2013	Project Start Date: RPDS creation.
08 Mar 2016	Water filter donation.
15 Feb 2017	Project first audit against the VCS v4.3 and CCB 3 rd ed.
17 Nov 2017	Project validation against the VCS v4.3 and CCB 3 rd ed.
17 Jan 2018	Project verification against the VCS v4.3.
26 Feb 2020	COVID19 outbreak bursts in Brazil.
06 Apr 2020	Project registration at Verra.
15 Oct 2021	Biodiversity monitoring: installation of transects for continuous monitoring and survey of fauna (mammals, reptiles, amphibians, and birds).
03 May 2022	Training with communities on good management practices for açai and nuts.
1 May 2022	Start of school reinforcement activities.
15 May 2022	Water filter donation.
15 May 2022	Biodiversity monitoring: installation of transects for continuous monitoring and survey of fauna (mammals, reptiles, amphibians, and birds).
13 Aug 2022	Infrastructure construction (03 bridges to access the communities of São José do Miriti)

¹² after its first verification, the project was only registered in the year 2020. Thus, the execution of project activities was suspended between 2017 and 2020 due to lack of funding and between 2020 and 2021 due to the COVID19 pandemic.

27 Aug 2022	Digital Inclusion.
15 Sep 2022	Forest Inventory.
15 Sep 2022	Meeting to strengthen the women's group with a focus on biojewelry construction workshops.
29 Nov 2022	Digital Inclusion.

2.1.12 Risks to the Project (G1.10)

Table 9. Risks to the project

Identify Risk	Potential impact of risk on climate, community and/or biodiversity benefits	Actions needed to mitigate the risk
Illegal Logging (risk of climate benefits brought by the project)	Human-induced: illegal logging is a common activity in southern Amazonas, including in conservation units, and can generate forest degradation, GHG emissions, impacts on the climate and the project's objectives.	Illegal logging is mitigated in the territory through monitoring and surveillance. Monitoring actions are carried out using satellite images classified by INPE's DEGRAD System. Surveillance actions take place in loco, through site visits.
Invasions, land tenure, land grabbing and deforestation (risk to climate benefits brought by the project)	Human-induced: invasions, land tenure or land grabbing are common activities in the south of the Amazon and are often preceded by deforestation. Today there are no traditional communities or invaders living within the RPDS. Even so, the occurrence of small deforestation in the project area is observed, indicating the presence and use of the territory by humans. Considering that this is an IFM project, which aims to reduce emissions from legally sanctionable forest degradation, emissions from deforestation are not part of the baseline scenario. Notwithstanding this, the project proponent will treat the issue as a potential risk to the project objectives, as the reduction of forest cover reduces the project area.	Land Invasions, land tenure, land grabbing and deforestation are mitigated in the territory by monitoring actions and surveillance. Monitoring is carried out using satellite images classified by INPE's PRODES System. Surveillance actions take place in loco, through site visits.
Wildfires (risk to climate benefits brought by the project)	Human-induced: wildfires in the Amazon biome are related to deforestation and agricultural production and are therefore caused by the influence of man in the territory. Wildfires can cause the mortality of adult trees, reducing carbon stocks, markedly in drier years, representing a risk to the project's objectives.	Wildfires are mitigated by environmental education actions. The EBCF also promotes monitoring using satellite images based on data published by INPE, in its fire database.

Predatory hunting/fishing (risk to project benefits to biodiversity)	Human-induced: hunting and fishing are activities commonly carried out by traditional communities. Such activities take place for subsistence and cultural reasons, in a disorderly manner in the project area, representing a potential risk to the project's objectives in terms of biodiversity conservation.	The potential impacts of predatory hunting and fishing on biodiversity in the project zone are mitigated by environmental monitoring and education actions. Monitoring identifies rare, endemic, and threatened species, as well as existing game species. Thus, the information is crossed and used to raise awareness of the surrounding communities.
Community conflicts (risk to the social benefits brought by the project)	Induced by man: the implementation of carbon projects brings greater territorial governance, just as the creation of reserves implies greater regulation. Such measures may imply limitations in the activities carried out by neighboring communities with a consequent change in their traditional lifestyle. Such changes may represent conflicts with community members, jeopardizing the social objectives of the project.	Potential risks to the project's intended social benefits are mitigated by FPIC and continued communication with neighboring traditional communities and other relevant actors.

2.1.13 Benefit Permanence (G1.11)

The project's main activity is the creation of a conservation unit. Thus, the project proponent is legally committed to maintaining the forest cover in its territory indefinitely. With the conservation of forestry, it is expected that the benefits sought by the EBCF for the climate, communities, and biodiversity will be maintained beyond the lifetime of the project.

2.1.14 Financial Sustainability (G1.12)

The project actual and projected flow of funds is demonstrated by EBCF's cash flow (Annex 61). This document correlates project activities with their costs and foresees revenues from the sale of VCUs and capital contributions from the company's partners. The consistency of the projections presented in the company's cash flow can be demonstrated by financial statements. This information is commercially sensitive and may be made available to Verra and VVB on demand.

2.1.15 Eligibility Criteria for Grouped Projects (G1.14)

Not applicable. This is not a Grouped Project.

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

Not applicable. This is not a Grouped Project.

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

Not applicable. This is not a Grouped Project.

2.2 Without-project Land Use Scenario and Additionality

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

A range of potential land-use scenarios and the associated drivers of land use changes most likely to occur within the project zone in the absence of the project is described below:

Scenario 1 - Maintenance of Pre-Project Activities (Sustainable Forest Management - SFM)

Under this scenario logging activities would continue to be executed throughout the project areas with the purpose of selling timber in accordance with the Sustainable Forest Management Plan (SFMP) and their Annual Operational Plans (Plano Operacional Anual de Extração - POAs), already approved by the environmental agencies (Annexes 1, 2, 4 and 6).

Scenario 2 - Sustainable Forest Management (SFM) and Farming

The sale of timber in accordance with the Sustainable Forest Management Plan (SFMP) and the Annual Operational Plans (POAs) on 80% of the PA and the clearing of forest cover on the remaining 20%, for agricultural activities.

Scenario 3 - Farming without Forest Management

Complete cessation of the Sustainable Forest Management activities on 80% of the PA, removal of forest cover on the remaining 20% allowed by law for farming and grazing activities, and use of wood harvested from cleared land.

Scenario 4 - Environmental Conservation Unregistered in VCS

Complete cessation of the Sustainable Forest Management activities and incentive of environmental conservation activities in a Private Sustainable Development Reserve (RPDS) without being registered as a VCS AFOLU project.

2.2.2 Most-Likely Scenario Justification (G2.1)

The most likely land use scenario within the project zone in the absence of the project is the continuation of logging in the project area, with the resulting process of forest degradation and associated GHG emissions (scenario 01).

This can be considered as the most-likely scenario as there was an operational forest management plan approved by the competent authorities in the state in the project area since 1999 (Annex 1, 2, 4 and 6).

The logging activities were definitely suspended by the creation of the reserve in 2013, which marks the project start date (Annex 50), as a forest protection plan.

2.2.3 Additionality (G2.2)

The project climate, community, and biodiversity expected benefits would not occur in the absence of the project. A list of significant financial, technological, and institutional barriers that would prevent the implementation of the project activities under the without-project scenario is presented below:

Financial barriers: socio-environmental activities do not typically compound the budget of a logging company that operates in private areas, as these are not directly related to the objectives of forest management plan, which is ultimately profit from logging. In this sense, it is understood that the cost of activities aimed at mitigating climate change, social benefits or biodiversity conservation would represent barriers to the implementation of project activities under the without-project scenario.

Technological barriers: the adequate management of non-timber forest products, as well as the structuring of production chains related to NTFPs, requires technology and involves costs. Despite carrying out such activities in a traditional way, the communities located in the project zone do not necessarily manage or sell NTFPs in an efficient and sustainable way. Adequate management and structuring of NTFP production chains constitute technological barriers under the without project scenario.

Institutional barriers: the state's existing institutional framework to support conservation units is admittedly deficient. The resources available for managing protected areas are insufficient. This results in a lack of governance in these areas, which are subjected to the agents and drivers of deforestation and forest degradation in the project zone. In this context, the lack of government incentive represents an institutional barrier to the implementation of project activities (creation of a reserve) under the without project scenario.

The project activities are not required by law. The lack of laws and arrangements related to the expected project benefits would likely contribute to the maintenance of the most plausible land-use scenario (logging activities) due to economic reasons.

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

The project does not foresee any offsetting activity based on the climate, community and biodiversity benefits generated by the project activity implementation rather than the VCUs commercialization itself.

2.3 Stakeholder Engagement

2.3.1 Stakeholder Access to Project Documents (G3.1)

EBCF delivered the physical version of the project to community leaders and invited the community to attend the company's headquarters in Manicoré when there is interest or need to know more about the project so that a local EBCF staff can make the appropriate presentations and clarifications.



Figure 11. EBCF team inviting key actors to present on the project

Summary and didactic versions were also delivered during meetings and are available at the EBCF office in Manicoré.

EBCF
Empresa Brasileira de
Conservação de Floresta

CONTATO
secretaria@ebcf.org.br
www.ebcf.com.br
@ebcf_amazonia
Quilômetro: www.ebcf.com.br/monitoria
Tel: 977 - 365-3973
End: Travessa Manoel Taimo Barba, 25
Santa Luzia - Manicoré, AM

RPDS

Criamos e gerenciamos a primeira Reserva Particular de Desenvolvimento Sustentável da Amazônia.

O processo de criação da primeira Reserva Particular de Desenvolvimento do Sustentável do Brasil teve início em 2011 e foi concluído em 05 de junho de 2013, com a homologação pelo Centro Estadual de Unidades de Conservação da Secretaria de Meio Ambiente e Desenvolvimento Sustentável do Amazonas (CEUC/SDS), através da Portaria SDS nº 86/2013.

O QUE É UMA RPDS?

A RESERVA PARTICULAR DE DESENVOLVIMENTO SUSTENTÁVEL é uma unidade de conservação de uso sustentável, criada voluntariamente em uma área privada pelo seu proprietário.

LOCAL DA RPDS

Comunidades atendidas, contempladas no Plano de Gestão:
Urucury, Água Azul, Vista Alegre, Boa Esperança, Santa Eva, Santa Maria, Pandegai, Democracia, Jatuarana, Terra Preta do Ramal, Kamayúá, São José do Miriti, São João e Ponta Grossa, Terra Preta do Rio Manicoré e Mocambo.

PROJETO DE CARBONO

O QUE É MUDANÇA CLIMÁTICA?

As mudanças climáticas são alterações de longo prazo nos padrões de temperatura e clima. Antigamente, as principais mudanças ocorriam devido a causas naturais, mas hoje em dia está acontecendo um processo de aceleração dessas mudanças, aumentando a temperatura média e provocando o que chamamos de aquecimento global, dentre outros eventos. Essa aceleração é atribuída, principalmente, às ações humanas através das mudanças no uso da terra, queima de combustíveis fósseis, desmatamento e degradação ambiental.

A EBCF tem como missão combater as mudanças climáticas, a pobreza e o desmatamento na Floresta Amazônica.

Modelo de atuação sustentado em 5 pilares:

ECONÔMICO	CLIMÁTICO	AMBIENTAL	SOCIAL	TECNOLOGICO
Responsável pelo desenvolvimento de produtos, serviços e ativos ambientais e digitais com objetivo de gerar recursos para aplicação nos pilares climático, ambiental e social.	Responsável pelo programa de redução de emissões de aproximadamente 2 milhões de toneladas de CO ₂ , através da implantação do Projeto REDD+ com certificação internacional (VERBA).	Responsável pelas atividades de conservação da floresta e proteção da biodiversidade, com ações voltadas à preservação da fauna, flora e rios, combate ao desmatamento.	Responsável pelo desenvolvimento sustentável de mais de 3.000 pessoas em 15 comunidades tradicionais, através da implantação de projetos sociais nas áreas de saúde, educação, infraestrutura, empoderamento feminino e geração de renda.	Responsável pela identificação e integração de soluções tecnológicas voltadas ao combate do desmatamento, mudanças climáticas, proteção da biodiversidade e desenvolvimento das comunidades ribeirinhas.

Linha do Tempo

- 2009** Aquisição das áreas nativas na Amazônia
- 2013** Homologação da RPDS Amazon Rio
- 2017** Certificação, Auditoria e Verificação
- 2022** Reunião pública para Planejamento de ações e monitoramento participativo
- 2023** Elaboração do projeto de REDD+
- 2024** Monitoramento de biodiversidade

Figure 12. Illustration of informative material distributed to communities

E O QUE SIGNIFICA REDD E REDD+?

R

E

D

D

+

Redução de Emissão de gases de Desmatamento e Degradação

- Conservação dos estoques de carbono;
- Manejo Sustentável das florestas;
- Aumento dos estoques de carbono florestal.



O objetivo do REDD é apoiar os projetos em desenvolvimento que, ao manterem florestas em pé, também estão contribuindo para a redução das emissões de Gases de Efeito Estufa (GEE), dentre os quais está o gás carbônico.

Como vimos, sempre que há desmatamento e degradação florestal são emitidos gases que criam essa "estufa" ao redor da Terra. Por isso, os projetos que continuamente reduzem suas emissões e que mantêm suas florestas em pé devem ser recompensados com incentivos financeiros.

COMO FUNCIONA?

É uma forma de recompensar financeiramente quem contribui para a preservação e proteção das florestas ameaçadas pelo desmatamento e degradação. Os dois principais objetivos do projeto Amazon Rio REDD+ IFM (definidos a partir das oficinas realizadas junto às comunidades, em 2017), são:

- A arrecadação de fundos para a implementação dos programas do plano de manejo;
- A conservação da floresta e recursos associados.

O PROJETO DA EBCF

O projeto de carbono da EBCF teve início em 2013 e está permanentemente em processo de monitoramento, tendo obtido sua certificação e realizado sua primeira verificação em 2017.

Um dos objetivos do projeto é estimular a geração de emprego e renda através da extração e beneficiamento de produtos não madeireiros, em substituição aos métodos tradicionais de exploração de madeira.

Para isso, a EBCF está trabalhando junto as comunidades localizadas no entorno da reserva, em um modelo de desenvolvimento sustentável que abrange toda a região da RPDS Amazon Rio.

São objetivos do projeto:

• Reduzir as mudanças climáticas diminuindo o desmatamento e a degradação florestal;	• Promover a inclusão e empoderamento feminino nas comunidades;
• Substituir um projeto de exploração florestal por um projeto de conservação ambiental com inclusão social;	• Contribuir para melhorar os processos educativos e a atenção à saúde regional;
• Implementar atividades econômicas para as comunidades tradicionais e ribeirinhas;	• Promover pesquisa científica e desenvolvimento tecnológico;
• Contribuir para a proteção da biodiversidade.	• Desenvolver a infra estrutura da região.

QUAIS SÃO OS BENEFÍCIOS PARA AS COMUNIDADES?

Os recursos vêm da comercialização de créditos de carbono. Parte da receita é utilizada para pagar o processo de certificação, o gerenciamento e manutenção do projeto, bem como os projetos nas áreas de saúde, educação, infra estrutura, tecnologia, geração de renda e empoderamento feminino.

A RPDS Amazon Rio é uma área particular que reconhece as comunidades tradicionais em seu entorno. Sendo assim, há um consenso de que as mesmas participem, junto com as instituições parceiras, do planejamento e implementação das ações do projeto através de reuniões, consulta pública e outras formas de diálogo.

É válido ressaltar que cada grupo de atores locais envolvidos no processo apresenta um conjunto distinto de saberes, conhecimentos, prioridades e expectativas, o que resulta em competências e níveis de atuação correspondentes desde o planejamento até a execução e monitoramento das atividades previstas.

Figure 13. Illustration of informative material distributed to communities

The EBCF team will hold offices with communities to disseminate relevant information about the project and strengthen agreements. All documents about the project can also be found printed at the EBCF local office in Manicoré, available for consultation.

2.3.2 Dissemination of Summary Project Documents (G3.1)

The EBCF team brings communities together at public events to present and discuss project documents and event outcomes. At these events, relevant documents, such as the project description and the monitoring report, are delivered to leaders in simplified versions with appropriate language.

2.3.3 Informational Meetings with Stakeholders (G3.1)

The meetings related to the project begin with a presentation of EBCF, reinforcement of key contents such as climate change, carbon project, RPDS and scope of the Amazon Rio project in clear language and in a culturally appropriate way. The meeting schedule encompasses the milestones the project development and planned activities.



Figure 14: Meeting with stakeholders



Figure 15: Presentation of basic concepts "Climate change"



Figure 16: Presentation about key contents.

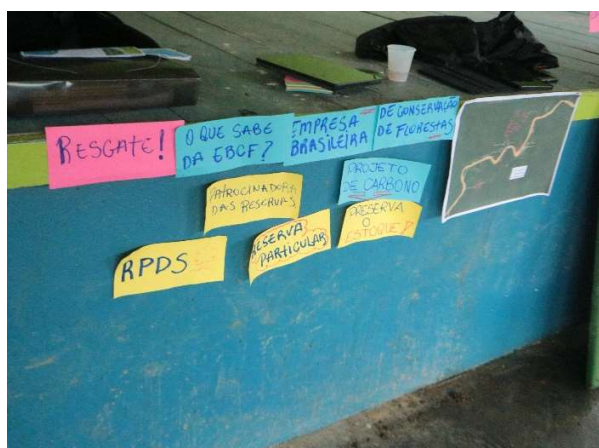


Figure 17: Key contents.



Figure 18: Community reading informative material. Figure 19: Community reading informative material.

Participatory methodologies with open dialogue and visualization dynamics using maps, panels and cardboard tags are used in meetings to record the main considerations. It is worth noting that the events are preceded by printed invitations and mobilization through the leaders of each community involved.



Figure 20: Presentation of basic concepts “Types of Conservation Units and Spatial Planning”



Figure 21: Meeting with stakeholders



Figure 22: Methodology for visualising in the public meeting.



Figure 23: Methodology for visualising in the public meeting.

In 2013, when the project began, workshops and meetings were held with communities to discuss the development of the Amazon Rio REDD+ IFM project. During all the workshops held in the communities surrounding the project area, the program content included information regarding the validation process that the project should be subjected to, including the role of certification organizations.

After the first period of verification (2013-2017) and credit registration in 2020 the project was affected by the effects of the COVID-19 pandemic between 2020 and 2021 that required severe measures of social isolation to cope with the public health emergency.

The return to the communities only took place in 2022, the EBCF team held public meetings with the groups involved, recovering the history of the project and discussing details about the Amazon river project with the community groups.

The first public meeting of 2022 was held on May 7 at the social center of the Democracy community, all community groups were invited. In September and October, another stage of discussion of the project and consultation with the communities was held.

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

At the beginning of the project, an impact analysis matrix of the project activities was created, carried out by the EBCF board together with the collaborators, outlining the relationships between the proposed activities and the project objectives, demonstrating the positive and negative impacts identified in this phase of the project (annex 38).

Based on the results of public meetings and workshops with communities between 2022 and 2023, the Matrix was reviewed and updated, as presented in annex 70, 71 and 71.

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

Communities and other stakeholders were informed of the process for CCB verification by an independent validation/verification body during public meetings held for this purpose.

During the meetings and presentation of project and the results of the project monitoring report, the EBCF team informed the next steps of the validation and verification process, explaining that the project will be audited by an independent verification body.

This process was also described in the booklet delivered to communities and other actors, both this document and the pertinent information are also available in physical version at the EBCF office in Manicoré and digital version on the project's website.

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

After scheduling the audit, communities will receive a document from EBCF printed or digitally sent via whatsapp to leaders and key stakeholders, including a brief description of the verification process, their objectives and dates.

The validation and verification process is described in clear and appropriate language in the Amazon Rio project booklet, this was also discussed in public meetings, making explicit the possibility of interviews with the community during the audit period.

EBCF will provide all information regarding the relevant actors and communities involved and will lead the audit team to communities and other stakeholders at the request of the VVB leaving them willing to conduct interviews and other relevant activities without interference.

2.3.7 Stakeholder Consultations (G3.4)

The stakeholder consultation process is continuous and was initiated during the participatory offices for the design of the project. After the pandemic, EBCF resumed the social engagement process, providing the necessary explanations and clarifications and sending the consultation to the communities.

During these events, communities had the opportunity to speak freely about their vision for the project, their concerns, needs and how they would like the project to help. These meetings generated a report with the activities of interest to the groups involved in the consultation. The activities described in the project reflect the results of this consultation process, considering the technical and financial capacity of the project to meet the defined scope.

Other stakeholder groups, such as NGOs, local leaders and governments were consulted through public events at the EBCF headquarters in Manicoré and previously scheduled institutional visits.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

EBCF has a local team in the municipality of Manicoré, that facilitates the interaction between communities and the project proponent. Community leaders and other relevant stakeholders

know the company's board of directors and have free access to communicate needs and request clarifications.

In addition, the team visits the communities to strengthen the relationship with these groups and report project activities progress among stakeholders. The existence of a local office also serves as a reference point for gatherings and receipt of suggestions and complaints.



Figure 24: EBCF team visit to community and giving the project information material.



Figure 25: Official board of the EBCF office in Manicoré - AM, inaugurated on May 6, 2022.

EBCF also adopted a protocol of workshops planning the actions of the project to be carried out in the first quarter of each year.

Each workshop follows the following steps:

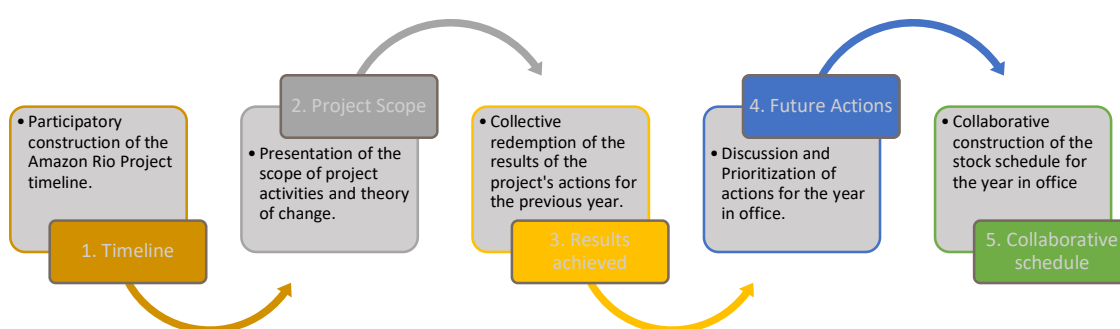


Figure 26: Social engagement protocol.

With this basic programming, local actors, including women and young people who have participated or not in other events, can know the project, its advances, challenges, and results and actively influence the next steps.



Figure 27: Woman expressing her opinions about the implementation of the Amazon Rio project.



Figure 28: Public Meeting for project planning in 2022 - 2023

2.3.9 Stakeholder Consultation Channels (G3.5)

The project's main communication channel is public meetings with communities, where their representatives have the opportunity to share and directly request possible information and their opinions on project implementation.

Furthermore, the EBCF headquarters in Manicoré has a suggestions and complaints box to receive contributions from stakeholders at any time.

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

Communities are involved in the decision-making process and public implementation of the project during meetings and workshops held, being able to make suggestions and express what they think about the development and execution of the project and its results.

To promote effective participation in public meetings and consultations, they are preceded by a mobilization process with the delivery of invitations and preparatory dialogues, special attention is given to vulnerable groups with the holding of gender conversation circles with an emphasis on women.

2.3.11 Anti-Discrimination Assurance (G3.7)

The EBCF has an anti-discrimination policy and a Code of Conduct (annex 43). The document is signed by all partners. The company's articles of incorporation provide sanctions for shareholders in case of non-compliance with established policies. The Code of Conduct and applicable sanctions are also applicable to employees.

2.3.12 Feedback and Grievance Redress Procedure (G3.8)

The mediation and conflict resolution strategy was presented and validated with community leaders and representatives during the workshop sessions held in April 2017 that dealt with updating and redrafting the Amazon Rio REDD+ project (Annex 42a).

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

After forwarding and forwarding a complaint, the complainant can send the resolution process directly to the EBCF team, via WhatsApp or visits to the local office.

The EBCF makes information related to the meetings public and accessible.

2.3.14 Worker Training (G3.9)

The local capacity development strategy imposed by the project takes into account the need generated by the project activities and the demands raised by the communities, whether for income generation or for occupying time and establishing a collaborative network.

Training to train people to work directly in project activities can be linked to forest inventory actions, biodiversity monitoring, socioeconomic data collection and must be carried out according to the project's needs and agenda.

Trainings on demand from communities can have different themes according to the profile of the requesting group, for example:

- Good practices in the management and processing of açai and chestnut.
- Workshop - Generation of Community Income for Young People and Women.

EBCF also works to establish partnerships with different actors and offers different opportunities to develop new skills for people, such as:

- Photography and filming course with mobile camera, offered in May 2022.

Young people and adults from the communities were interested in participating to learn and use these skills and apply them in their daily lives. The group of women from the Jatuarana community took advantage of the course to set up their online product catalog and create an Instagram page for biojatur, a group of women producing biojewelry.



Figure 29: BIOJATUR Instagram Page.



Figure 30: Woman biojewel manufacturing.

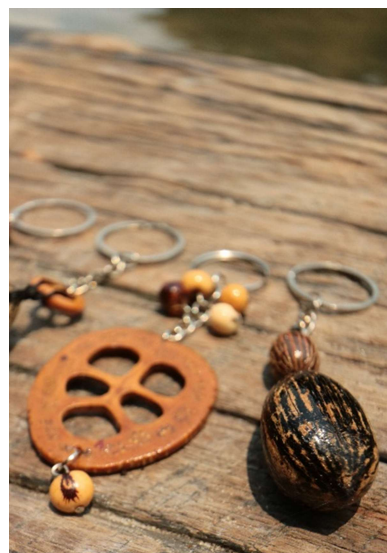


Figure 31: Sample of biojewel and raw material used in the production of the group of women BIOJATUR.

2.3.15 Community Employment Opportunities (G3.10)

To promote access to job opportunities, EBCF conducts training and shares the description of vacancies and requirements for positions with communities, the term of reference for vacancies follow the model in annex 54 and are displayed on the office wall in Manicoré, a copy of the announcement of vacancies is made available to community leaders to disseminate locally.

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

The labor relations resulting from the project implementation are in conformity with the Brazilian labor law. EBCF cares about the integrity of employees and service providers and moves actions in compliance with the obligations imposed by labor law. Thus, the following laws and regulations that guide hiring and other labor relations in Brazil are listed:

- *DECREE-LAW No. 5,452, of May 1, 1943 - CONSOLIDATION OF LABOR LAWS (CLT) and LAW No. 13,426, July 13, 2017 - Amends the Consolidation of Labor Laws (CLT), approved by Decree-Law No. 5,452 of May 1, 1943, and Laws No. 6,019 of January 3, 1974, 8,036, of May 11, 1990, and 8,212, of July 24, 1991, in order to adapt the legislation to new working relationships.*
- *LAW No. 5,889 of June 8, 1973 – Rural Labor Law deals with the rules concerning individual and collective relations of rural work.*
- *LAW No. 6,494/1977 and LEI No. 11,788, of September 25, 2008 – Provides for the internship of students; amends the wording of Article 428 of the Consolidation of Labor Laws - CLT, approved by Decree-Law No. 5,452 of May 1, 1943, and Law No. 9,394 of December 20, 1996; repeals Laws in 6,494, of December 7, 1977, and 8,859, of March 23, 1994, the sole paragraph of Art. 82 of Law No. 9,394 of December 20, 1996, and Art. 6 of provisional measure no. 2,164-41 of August 24, 2001; and makes other arrangements.*
- *LAW No. 9,601, of January 21, 1998 - Provides for the establishment of the Bank of Hours and Contract for a Determined Term*
- *LAW No. 10,748, of October 22, 2003 - establishes the National Program to Stimulate the First Job for Young People - PNPE, linked to actions aimed at promoting the insertion of young people in the labor market and their schooling, strengthening the participation of society in the process of formulating policies and actions to generate work and income, with the aim, in particular, of promoting: 1) the creation of jobs for young people or prepare them for the labor market and alternative occupations, generating income; and 2) the qualification of young people for the labor market and social inclusion.*
- *LAW No. 13,874, of September 20, 2019 - Establishes the Declaration of Rights of Economic Freedom; establishes free market guarantees; amends the Laws in 10,406 of January 10, 2002 (Civil Code), 6,404 of December 15, 1976, 11,598, of December 3, 2007, 12,682, of July 9, 2012, 6,015, of December 31, 1973, 10,522, of July 19, 2002, 8,934, of November 18, 1994, Decree-Law No. 9,760, of September 5, 1946 and the Consolidation of Labor Laws, approved by Decree-Law No. 5,452 of May 1, 1943; repeals Delegated Law No. 4 of September 26, 1962, Law No. 11,887 of December 24, 2008, and provisions of Decree-Law No. 73 of November 21, 1966; and makes other arrangements.*

2.3.17 Occupational Safety Assessment (G3.12)

The Amazon Rio Project aims at forest conservation with the suspension of timber forest management activities, creation of a private reserve for sustainable development and support to the value chains of non-timber products implemented by community groups.

The risk assessment for workers' safety was performed considering the project activities related to the management of Brazil nuts.

Occupational safety and health measures were also included in the courses of good practice for the management and processing of non-timber products, including the types of personal protective equipment.



Figure 32: Practical class record of the Chestnut Management and Processing Course with the use of PPE

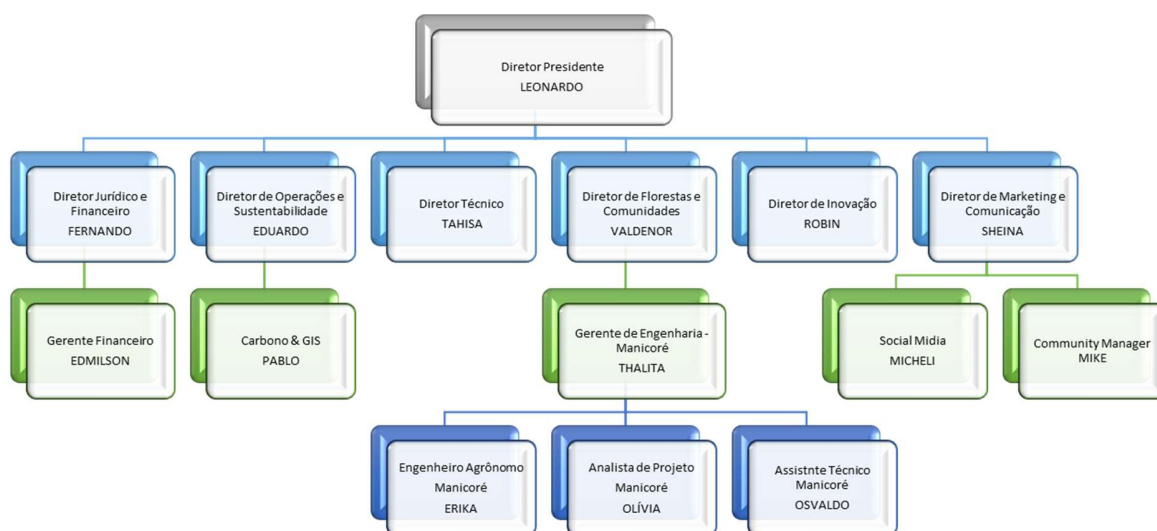


Figure 33: Practical class record of the Chestnut Management and Processing Course with the use of PPE

2.4 Management Capacity

2.4.1 Project Governance Structures (G4.1)

The organization chart below describes EBCF's governance structures for project management and implementation.



The table below describes the roles and responsibilities of all entities involved in project design and implementation.

Table 10. Organizations and actors involved in project design and development

Institution	Representative	Responsibilities
Original Trade Consultoria Especializada	João Tezza Neto	Coordinating the review and update of PD (V3.1) Amazon Rio REDD+ IFM project and conducting the certification process
CO2X Conservação de Florestas Ltda.	Rosana Della Múa	Coordination and drafting of Version 1.0 of Amazon Rio REDD+ IFM project and Management Plan for Reserves
EBCF Curitiba	Leonardo Barrionuevo	Management of the Reserves and Project Implementation
EBCF Manaus	Valdenor da Costa Junior	Coordination and Implementation of the Plan for Climate Social and Biodiversity Monitoring
Renascer Desenvolvimento Humano	André Albuquerque	Implementation of socio-environmental programs
HDOM	Francisco Higuchi	Forest Inventory and technical support for project review

Communities	Community Leaders	Users and implementers
brCarbon	Heberton Barros	Consulting services, project implementation partner, carbon specialist.
For-B	Camila Monteiro	Consulting services, project implementation partner, carbon specialist.

2.4.2 Required Technical Skills (G4.2)

The skills needed to implement the project are related to geoprocessing, biomass inventory, VCS standards and methodologies, CCB standards, carbon calculations and estimates of GHG emission reductions, relevant national policies, social engagement, socioeconomic, cultural and productive diagnoses, holding public workshops with communities, participatory monitoring, surveys and monitoring of biodiversity. The project proponent's technical staff has more than ten years of experience in AFOLU carbon project development, including, methodological tools, the community engagement, biodiversity assessment, carbon measurement and monitoring.

2.4.3 Management Team Experience (G4.2)

The project technical staff is formed by professionals with more than 10 years of experience in elaboration, implementation, monitoring and certification of forest carbon projects. The project team was involved in 18 PD and/or MR elaboration, or validation/verification of carbon projects in Brazil, showing a strong expertise and excellent prior work experience in implementing carbon projects similar as it is described in this PD.

2.4.4 Project Management Partnerships/Team Development (G4.2)

EBCF formed a partnership with brCarbon and with For-B Forest Business for the implementation of the project and this validation and verification period. Together, both institutions have all the necessary expertise for the task.

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

The EBCF's financial resources come from anticipated sales of VCUs, external investors, and contributions from the partners themselves. Company financial statements are considered commercially sensitive information and are available for Verra's and the VVB's consultation upon demand.

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

The EBCF has an anti-corruption policy and a Code of Conduct. The document is signed by all partners. The company's articles of incorporation provide sanctions for shareholders in case of

non-compliance with established policies. The Code of Conduct and applicable sanctions are also applicable to employees, please see Annex 76.

2.4.7 Commercially Sensitive Information (Rules 3.5.13 – 3.5.14)

It is to be considered as commercially sensitive information any trade, financial, commercial, scientific, technical or other information, whose disclosure could reasonably be expected to result in a material financial loss or gain, compromising the contractual terms, deals or other negotiations stated by the project proponent. It is also a sensitive information any information relates or internal policy decisions, financial, commercial, scientific, technical that the public disclosure could reasonably be expected to undermine or negatively affect the development and/or implementation of any project activity. Information related to project social activity, the determination of the baseline scenario, demonstration of additionality, and estimation and monitoring of GHG emission reductions (including operational and capital expenditures) are not considered to be commercially sensitive and are provided in the public versions of the project documents.

2.5 Legal Status and Property Rights

2.5.1 Statutory and Customary Property Rights (G5.1)

For nearly four decades the project area was in the possession of Valdenor Campos da Costa's family. In 2011, the properties were transferred to the Empresa Brasileira de Conservação de Florestas (EBCF), in which Valdenor Campos da Costa Junior became a founding partner, with the goal of transforming these areas into four Private Sustainable Development Reserves (RPDSs). The land titles and other documents are registered at the Land Registry Office of the Municipality of Manicoré, Amazonas, with the following registration numbers: 2045, 2046, 2047, 2048, 2049, 2050, 2052, 2053, book 2-6, pages 116-123 (Annex 11).

The land-use rights within the limits of the project are set by the Amazonas State System of Conservation Units (Centro Estadual de Unidades de Conservação - SEUC), in the category of conservation for sustainable use, establishing the Private Sustainable Development Reserve, and regulated by Decree 30.108 of June 2010. This category is defined as a private conservation area created by voluntary manifestation on the part of the owner with the intent to promote the conservation of natural resources and the practice of sustainable development. The right to use these areas may also be granted to the communities who use their natural resources for their production, economic and cultural mediums.

From a legal point of view regarding the carbon credits generated by the project, EBCF benefits exclusivity from the ownership and commercialization of reduced emission certificates, i.e. the VCUs, since the baseline activities, the property deed, the emission reduction activities and the process of creation of the RPDS are concentrated on the legal form of the Company.

From the point of view of land-use and natural resources, although the communities surrounding the Amazon Rio areas occupy a common territory (unoccupied private areas) and share the use of existing resources there, this does not imply that all resources are communally managed. The right to use the space and the resources are complex and varied: the land is owned by the State and/or

private owners, but the resident families retain traditional rights over them. Internally, the resources are appropriated according to local rules and agreements.

There are basically three types of rights of possession and use of resources in these communities: single use, common use and open access. The single use areas are family-owned areas and include gardens, fields, pastures, cottages, Brazil nut and rubber tree groves, and secondary forests and woodlands (used for extracting straw, oils, timber for building houses, boats and canoes), and the expansion or establishment of new gardens or management units. The common use areas include forest reserves, açaí and buriti planting grounds, lakes, flooded forests and streams, and are appropriate for all residents of the same community that are governed by the agreed-upon rules and procedures.

However, not all common use areas have the same level of control and restriction as other communities and external users. Generally more distant areas are more difficult to control and, in certain circumstances, are considered open access areas, characterized by little or no control or restrictions on use and access. This is the case for some of the Amazon Rio IV areas of use. The areas adjacent to Lake São João, for example, whose surrounding residents cannot control fishing, logging and gathering of acai. These activities are conducted in a predatory manner by outsiders due to the area's proximity to Manicoré.

This over-harvesting compels residents to walk more than two hours in the forest in search of forest products and "good wood" for making boats, canoes and houses. According to the leaders, residents have filed several complaints and signed several "petitions" and submitted them to the municipal authorities but they have not taken any action. These areas are rich in rubber trees, açaí and wood (such as cedar, andiroba, virola, itaúba, angelim, marupá, among others) and thus subject to invasion. Illegal logging occurs especially during the flooded period, when planks and boards cut by chainsaws at the extraction site, can be floated downstream. According to the residents, no families commercially harvest Brazil nuts due to the distance to the trees.

2.5.2 Recognition of Property Rights (G5.1)

Demonstrate that all property rights are recognized, respected, and supported. If applicable, describe measures needed, designed, and implemented by the project to help to secure statutory rights.

All of EBCF's property rights are recognized through the legal documents of ownership of its 12 areas that make up its carbon project and which are fully owned by EBCF itself, areas called: Amago, Amago Segundo, Arumanzal, Tabocal, Mirity I, Mirity II, Mirity III, Vai Quem Quer, Cantão, São Francisco, São João and Vista Alegre. All 12 properties are registered in the name of EBCF with the competent public (state, local) bodies and authorities.

Some of the land documents issued by the State for the 12 properties are:

- Registration
- Domain chain certificate
- Public deed
- CCIR
- CAR
- ITR
- SIGEF Descriptive Memoirs
- SIGEF maps

EBCF, as the legitimate owner of the areas, recognizes, respects, supports and guarantees the right of access and use of natural resources by the people and traditional forest populations residing in the surrounding areas, for their own subsistence and survival of their way of life. traditional, unless any type of illegality or abuse in the use of resources is found, and the dissemination of this right is carried out regularly by EBCF among riverside communities and their representative associations, including obtaining the prior, free and informed consent of the appropriate holders in all stages of the carbon project

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

The project area is private and does not encroach uninvited on private property, community property, or government property. The project activities do not affect any community rights over land tenure or natural resource usage. On the contrary, the project activities foresee incentives for NTFP production and productive chain development from the project area by the surrounding communities.

Nevertheless, workshops were held in Democracia, Água Azul, São José do Miriti, Vista Alegre, Jatuarana, Terra Preta do Ramal, Pandegal, Santa Maria, Santa Eva, Terra Preta do Rio Mancoré, Urucury, Mocambo, Boa Esperança and São João & Ponta Grossa communities for the free, prior and informed consent to be obtained. In the current monitoring period, the perception of project approval by the communities occurs more fluidly and organically through the communication mechanisms created through the project's implementation and workshops held by the EBCF.



Figure 34: Free, Prior and Informed Consent Vote for the development of the REDD+ project by the community leaders of Democracia, Água Azul, São José do Miriti, Vista Alegre, Jatuarana, Terra Preta do Ramal, Pandegal, Santa Maria, Santa Eva and Terra Preta do Rio Mancoré, Urucury, Mocambo, Boa Esperança and São João & Ponta Grossa.

2.5.4 Property Rights Protection (G5.3)

There are no communities within the project area, therefore, the project does not imply in involuntary removal or relocation of property rights holders from their lands or territories. The project works directly with the surrounding communities, encouraging the use of natural resources in the project area, through workshops and training on good management practices and processing of PFNM, with a focus on structuring production chains and respecting the traditional lifestyle of the surrounding communities. This can be demonstrated by the project activities themselves and through interviews with the community.

2.5.5 Illegal Activity Identification (G5.4)

Identify any illegal activities that could affect the project's impacts. Describe measures needed and designed to reduce these activities so that project benefits are not derived from illegal activities.

Illegal activities conducted by residents in nearby communities, such as the sale of game meat and wood, could negatively impact the project. Though sporadic and localized, these actions will be mitigated through awareness campaigns outlined in the Management Plan.

Additionally, the government's plan to pave State Highway AM-174 to connect Federal Highway BR-319 with Manicoré and surrounding areas could lead to more widespread negative effects if access to the Amazon Rio I Private Reserve isn't strictly controlled. This could result in pressures like land grabbing, deforestation, and wildlife exploitation. Hence, investing in an effective and permanent surveillance system, utilizing modern image capture technology and 4WD vehicle patrols, is crucial. Involvement of voluntary environmental agents will further enhance monitoring efforts, yielding both environmental and social benefits for the project area.

2.5.6 Ongoing Disputes (G5.5)

2.5.7 National and Local Laws (G5.6)

Relevant laws and regulations that support the project activities are listed below:

- *State Law no. 4406 of 2016 - Establishes the State Policy for Environmental Regularization, stipulated in the Rural Environmental Registry (Cadastro Ambiental Rural - CAR), the Rural Environmental Registry System (Sistema de Cadastro Ambiental Rural - SISCAR-AM), Environmental Regulation Program (Programa de Regulamentação Ambiental - PRA), in the State of Amazonas*
- *Federal law no. 12.651 of 2012 - establishes the new Forest Code and the Rural Environmental Registry*
- *Federal law no. 12.187 of 2009 - establishes the National Climate Change Policy and Federal Decree no. 7390 of 2010 - regulates the National Policy Climate Change*
- *Federal Law No. 9.985 of 2000 - establishes the Private Natural Heritage Reserve (Reserva Particular do Patrimônio Natural – RPPN)*
- *Federal law no. 6.938 of 1981 - establishing the National Environmental Policy*
- *Brazil's commitment to the UNFCCC, ratified by Decree no. 1 of 02/03/1994*
- *State law no. 53 of June 2007 - establishes the State System of Conservation Units (Sistema Estadual de Unidades de Conservação - SEUC) and Decree No. 30.108 of June 2010 - regulates private Private Reserves for Sustainable Development (Reserva Particular de Desenvolvimento Sustentável - RPDs) ^[L]_[SEP]*
- *State law no. 3135 of June 2007 - establishes the National Climate Change Policy, environmental conservation and sustainable development in the state of Amazonas ^[L]_[SEP]*
- *CONAMA Ruling - no. 406/2009 - establishes technical parameters to be adopted in the preparation, presentation, technical evaluation and implementation of the Plan for Sustainable Forest Management (Plano de Manejo Florestal Sustentável) for the logging of native forests and their forms of succession in the Amazon ^[L]_[SEP]*
- *Decree 5.975/2006 - regulates forestry through forest logging plans, following Art. 19 of Law 4771/1965, as well as the implementation of Articles 15, 16, 20 and 21*
- *Ruling No. 5 11/12/2006/MMA, Ministry of the Environment - provides for all the technical procedures for the preparation, presentation, implementation, and technical assessment of forest logging plans and sustainable forms of succession in the Amazon.*
- *Decree-Law No. 5452/1943 - approves the Consolidation of Labor Laws (Consolidação das Leis do Trabalho - CLT).*

No national and local laws and regulations in the host country that have gone into effect in a way that affects the project activities.

2.5.8 Approvals (G5.7)

At the state level, the state of Amazonas where the project is located has an Environmental Services Policy and the Environmental Services Management System (Law No. 4,266/2015), but does not have an established registration system for private REDD+ projects and does not requires no type of approval to carry out projects in the territory.

Despite the existence of a National Climate Change Policy (Law 12,187, of 2009) that provides for the creation of the Brazilian Emissions Reduction Market, the country still does not have current regulations that establish a mechanism for issuing approval documents for climate change projects. REDD+ in the voluntary carbon credit market.

Currently, a bill to regulate the Brazilian Emissions Reduction market is being processed in the legislative branch, and is registering the existence of private REDD+ projects present in the voluntary carbon market.

2.5.9 Right to Claim Benefits (G5.8)

For nearly four decades the project area was in the possession of Valdenor Campos da Costa's family. In 2011, the properties were transferred to the Empresa Brasileira de Conservação de Florestas (EBCF), in which Valdenor Campos da Costa Junior became a founding partner, with the goal of transforming these areas into one Private Sustainable Development Reserve Amazon Rio I and developed this project on the others three areas: Amazon Rio II, Amazon Rio III and Amazon Rio IV. The land titles and other documents are registered at the Land Registry Office of the Municipality of Manicoré, Amazonas state and INCRA (Federal Registry), please see annex 66.

The land-use rights within the limits of the project are set by the Amazonas State System of Conservation Units (Centro Estadual de Unidades de Conservação - SEUC), in the category of conservation for sustainable use, establishing the Private Sustainable Development Reserve, and regulated by Decree 30.108 of June 2010. This category is defined as a private conservation area created by voluntary manifestation on the part of the owner with the intent to promote the conservation of natural resources and the practice of sustainable development. The right to use these areas may also be granted to the communities who use their natural resources for their production, economic and cultural mediums.

2.5.10 Other Programs (G5.9)

Not applicable. The project is not registered in other GHG, biodiversity and social programs.

2.5.11 Double Counting (G5.9)

The credits generated in the Amazon Rio REDD+ Project are made available on the voluntary market, and there is no intention of paying the credits and/or the project area to a jurisdictional system.

The state of Amazonas has a state climate change policy, containing guidelines and regulations for the creation of the political and fiscal framework, with the creation of the state fund and design of the action plan to mitigate the effects of climate change. However, it does not establish the rules or a system for accounting, recording and trading carbon credits, measurable based on joint efforts between the State and civil society.

EBCF understands that there is no risk of double counting, as there is no jurisdictional or national system implemented at the project site. Efforts to minimize risks must be directed towards

participation in consultation spaces and construction of jurisdictional mechanisms for reducing emissions in the AFOLU sector, with the purpose of covering private areas, creating mechanisms for quantifying and excluding private areas from state performance accounting in reducing emissions.

3 CLIMATE

3.1 Without-Project Climate Scenario

3.1.1 Without-Project Estimated Greenhouse Gas Emissions (CL1.1)

3.1.1.1 Baseline Emissions

Baseline GHG emissions ($C'_{baseline,t}$) are calculated as a function of the GHG emissions related to the forest degradation occasioned by legally sanctioned selective logging ($C'_{degradation,t}$) and the GHG emissions related to the selective logging operation itself ($C'_{emissions,t}$), according to VM0011 v1.1 equation 3-1:

$$C'_{baseline,t} = C'_{degradation,t} + C'_{emissions,t}$$

Equation 1. Annual GHG baseline emissions.

In which:

- $C'_{baseline,t}$ Annual total carbon emissions associated with the baseline scenario in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.
- $C'_{degradation,t}$ Annual total carbon emissions associated with the degradation due to the baseline activity in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.
- $C'_{emissions,t}$ Annual total carbon emissions associated with baseline activity operations of selective logging in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

Table 11. Annual GHG baseline emissions.

Year	$C'_{degradation,t}$ (tCO ₂ -e)	$C'_{emissions,t}$ (tCO ₂ -e)	$C'_{baseline,t}$ (tCO ₂ -e)
2013	25,627	778	26,405
2014	36,945	795	37,740
2015	46,558	790	47,349
2016	54,730	772	55,501
2017	61,680	776	62,456
2018	67,596	768	68,364
2019	72,635	769	73,404

2020	76,933	763	77,696
2021	80,602	791	81,393
2022	83,738	791	84,529
2023	86,423	779	87,202
2024	88,725	779	89,504
2025	90,702	779	91,482
2026	92,404	779	93,184
2027	93,873	779	94,652
2028	95,143	779	95,922
2029	96,244	779	97,024
2030	97,203	779	97,982
2031	98,040	779	98,819
2032	98,773	779	99,552
2033	99,417	779	100,197
2034	99,987	779	100,766
2035	100,493	779	101,272
2036	100,943	779	101,722
2037	101,347	779	102,126
2038	101,710	779	102,489
2039	102,039	779	102,818
2040	102,338	779	103,117
2041	102,612	779	103,391
2042	102,863	779	103,642
2043	103,095	779	103,875
2044	103,311	779	104,090
2045	103,512	779	104,291
2046	103,700	779	104,479
2047	103,877	779	104,656
2048	104,044	779	104,823
2049	104,203	779	104,982
Total	3,284,063	28,835	3,312,898

3.1.1.1.1 GHG Emissions due to Forest Degradation

Annual total GHG emission associated with the forest degradation due to the baseline activity ($C'_{\text{degradation},t}$) is calculated as a function of the GHG emission related to the deadwood decay ($C_{\text{DWdecay},t}$), the oxidation of long-term harvested wood products and residues ($C_{\text{ltHWPoxidation},t}$), the oxidation of short-term harvested wood products and residues ($C_{\text{stHWPoxidation},t}$), the carbon lost due to growth foregone in the aboveground biomass in the project area ($C_{\text{growth_foregone},t}$), the carbon

increase in the biomass due to regrowth following logging ($C_{\text{regrowth}, t}$), and the ratio of the molecular weight of carbon dioxide (44/12), according to VM0011 v1.1 equation 3-2:

$$C'_{\text{degradation}, t} = \left[(C_{\text{DWdecay}, t} + C_{\text{ltHWPoxidation}, t} + C_{\text{stHWPoxidation}, t} + C_{\text{growth_foregone}, t} - C_{\text{regrowth}, t}) \times \frac{44}{12} \right]$$

Equation 2. Annual total carbon emissions associated with degradation as a result of the baseline activity.

In which:

- $C'_{\text{degradation}, t}$ Annual total carbon emissions associated with degradation as a result of the baseline activity in year t (where $t=1,2,3...$ t^* years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.
- $C_{\text{DWdecay}, t}$ Annual carbon leaving the deadwood pool due to the decay of deadwood in year t (where $t=1,2,3...$ t^* years elapsed since the start of the IFM-LtPF project activities), in tC.
- $C_{\text{ltHWPoxidation}, t}$ Annual carbon due to the combined delayed oxidation of long-term harvested wood products and immediate oxidation of long-term harvested wood products residues in year t (where $t=1,2,3...$ t^* years elapsed since the start of the IFM-LtPF project activities), in tC.
- $C_{\text{stHWPoxidation}, t}$ Annual carbon due to immediate oxidation of short-term harvested wood products (commercially harvested fuelwood) and delayed oxidation of short term harvested wood products (paper products) in year t , (where $t=1,2,3...$ t^* years elapsed since the start of the IFM-LtPF project activity), in tC.
- $C_{\text{growth_foregone}, t}$ Annual carbon lost due to growth foregone in the aboveground biomass in the Project Area in year t (where $t=1,2,3...$ t^* years elapsed since the start of the IFM-LtPF project activities), in tC.
- $C_{\text{regrowth}, t}$ Annual carbon increase in the biomass due to regrowth following logging in year t (where $t=1,2,3...$ t^* years elapsed since the start of the IFM-LtPF project activities), in tC.
- 44/12 Ratio of the molecular weight of carbon dioxide to carbon.

Table 12. Annual total carbon emissions associated with degradation as a result of the baseline activity

Year	$C_{\text{DWdecay}, t}$ (tC)	$C_{\text{ltHWPoxidation}, t}$ (tC)	$C_{\text{stHWPoxidation}, t}$ (tC)	$C_{\text{growth_foregone}, t}$ (tC)	$C_{\text{regrowth}, t}$ (tC)	$C'_{\text{degradation}, t}$ (tCO ₂ -e)
2013	-	3,827	-	4,146	984	25,627
2014	3,009	3,904	-	4,146	984	36,945
2015	5,556	3,979	-	4,146	984	46,558

2016	7,711	4,053	-	4,146	984	54,730
2017	9,534	4,125	-	4,146	984	61,680
2018	11,077	4,195	-	4,146	984	67,596
2019	12,383	4,264	-	4,146	984	72,635
2020	13,488	4,331	-	4,146	984	76,933
2021	14,423	4,397	-	4,146	984	80,602
2022	15,214	4,461	-	4,146	984	83,738
2023	15,883	4,524	-	4,146	984	86,423
2024	16,450	4,585	-	4,146	984	88,725
2025	16,929	4,645	-	4,146	984	90,702
2026	17,335	4,704	-	4,146	984	92,404
2027	17,678	4,761	-	4,146	984	93,873
2028	17,969	4,817	-	4,146	984	95,143
2029	18,214	4,871	-	4,146	984	96,244
2030	18,422	4,925	-	4,146	984	97,203
2031	18,598	4,977	-	4,146	984	98,040
2032	18,747	5,028	-	4,146	984	98,773
2033	18,873	5,078	-	4,146	984	99,417
2034	18,980	5,127	-	4,146	984	99,987
2035	19,070	5,174	-	4,146	984	100,493
2036	19,147	5,221	-	4,146	984	100,943
2037	19,211	5,266	-	4,146	984	101,347
2038	19,266	5,311	-	4,146	984	101,710
2039	19,312	5,354	-	4,146	984	102,039
2040	19,351	5,397	-	4,146	984	102,338
2041	19,384	5,438	-	4,146	984	102,612
2042	19,412	5,478	-	4,146	984	102,863
2043	19,436	5,518	-	4,146	984	103,095
2044	19,456	5,557	-	4,146	984	103,311
2045	19,473	5,595	-	4,146	984	103,512
2046	19,488	5,632	-	4,146	984	103,700
2047	19,500	5,668	-	4,146	984	103,877
2048	19,510	5,703	-	4,146	984	104,044
2049	19,519	5,737	-	4,146	984	104,203

3.1.1.1.1 GHG Emissions due to Dead Wood Decay

The annual carbon leaving the deadwood pool due to the decay of deadwood ($C_{DWdecay,t}$) is calculated in function of the cumulative carbon leaving the deadwood pool and emitted into the

atmosphere ($C_{DWout,t}$) in year t and the cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t-1 ($C_{DWout,t-1}$), according to VM0011 v1.1 equation 3-24:

$$C_{DW_{decay},t} = C_{DW_{out},t} - C_{DW_{out},t-1}$$

Equation 3. Annual carbon leaving the deadwood pool due to the decay of deadwood.

In which:

- $C_{DW_{decay},t}$ Annual carbon leaving the deadwood pool due to the decay of deadwood in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
- $C_{DWout,t}$ Cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
- $C_{DWout,t-1}$ Cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t-1, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.

Table 13. Annual carbon leaving the deadwood pool due to the decay of deadwood

Year	$C_{DWout,t}$	$C_{DWout,t-1}$	$C_{DW_{decay},t}$
2013	-	-	-
2014	3,009	-	3,009
2015	8,565	3,009	5,556
2016	16,276	8,565	7,711
2017	25,810	16,276	9,534
2018	36,887	25,810	11,077
2019	49,270	36,887	12,383
2020	62,758	49,270	13,488
2021	77,181	62,758	14,423
2022	92,395	77,181	15,214
2023	108,278	92,395	15,883
2024	124,728	108,278	16,450
2025	141,657	124,728	16,929

2026	158,992	141,657	17,335
2027	176,670	158,992	17,678
2028	194,639	176,670	17,969
2029	212,853	194,639	18,214
2030	231,275	212,853	18,422
2031	249,874	231,275	18,598
2032	268,621	249,874	18,747
2033	287,494	268,621	18,873
2034	306,474	287,494	18,980
2035	325,545	306,474	19,070
2036	344,691	325,545	19,147
2037	363,902	344,691	19,211
2038	383,168	363,902	19,266
2039	402,480	383,168	19,312
2040	421,832	402,480	19,351
2041	441,216	421,832	19,384
2042	460,629	441,216	19,412
2043	480,065	460,629	19,436
2044	499,521	480,065	19,456
2045	518,994	499,521	19,473
2046	538,482	518,994	19,488
2047	557,982	538,482	19,500
2048	577,492	557,982	19,510
2049	597,011	577,492	19,519
Total			76,119

The cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t ($C_{DWout,t}$) is calculated in function of the annual total carbon input to the deadwood pool in year t ($C_{DWin,t}$) and the cumulative carbon remaining in the deadwood pool in year t ($C_{DWpool,t}$), according to VM0011 v1.1 equation 3-23:

$$C_{DW_{out},t} = \sum_{t=1}^{t^*} C_{DW_{in},t} - C_{DW_{pool},t}$$

Equation 4. Cumulative carbon leaving the deadwood pool and emitted into the atmosphere.

In which:

- $C_{DW_{out},t}$ Cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM LtPF project activity), in tC.
- $C_{DW_{in},t}$ Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
- $C_{DW_{pool},t}$ Cumulative carbon remaining in the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.

Table 14. Cumulative carbon leaving the deadwood pool and emitted into the atmosphere

Year	$C_{DW_{in},t}$	$C_{DW_{pool},t}$	$C_{DW_{out},t}$
2013	19,567	19,567	-
2014	39,133	36,124	3,009
2015	58,700	50,135	8,565
2016	78,267	61,991	16,276
2017	97,834	72,023	25,810
2018	117,400	80,513	36,887
2019	136,967	87,697	49,270
2020	156,534	93,776	62,758
2021	176,100	98,920	77,181
2022	195,667	103,272	92,395
2023	215,234	106,956	108,278
2024	234,801	110,073	124,728
2025	254,367	112,710	141,657
2026	273,934	114,942	158,992
2027	293,501	116,831	176,670

2028	313,067	118,429	194,639
2029	332,634	119,781	212,853
2030	352,201	120,925	231,275
2031	371,768	121,894	249,874
2032	391,334	122,713	268,621
2033	410,901	123,407	287,494
2034	430,468	123,993	306,474
2035	450,034	124,490	325,545
2036	469,601	124,910	344,691
2037	489,168	125,265	363,902
2038	508,735	125,566	383,168
2039	528,301	125,821	402,480
2040	547,868	126,036	421,832
2041	567,435	126,219	441,216
2042	587,001	126,373	460,629
2043	606,568	126,503	480,065
2044	626,135	126,614	499,521
2045	645,702	126,707	518,994
2046	665,268	126,786	538,482
2047	684,835	126,853	557,982
2048	704,402	126,910	577,492
2049	723,968	126,958	597,011

3.1.1.1.1.1 Carbon Inputs in Dead Wood Pool

The annual total carbon input ($C_{DW_{in},t}$) into the deadwood pool is calculated according to VM0011 v1.1 equation 3-18:

In which:

$$C_{DW_{in},t} = C_{RSD,t} + C_{branch_trim,t}$$

Equation 5. Annual total carbon input to the deadwood pool.

$C_{DWin, t}$	Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
$C_{RSD, t}$	Annual carbon in the residual stand damage in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
$C_{branch_trim, t}$	Annual carbon in branches and trimmings left over from harvesting in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.

Table 15. Annual total carbon input to the deadwood pool

Year	$C_{RSD, t}$	$C_{branch_trim, t}$	$C_{DWin, t}$
2013	17,328	2,238	19,567
2014	17,328	2,238	19,567
2015	17,328	2,238	19,567
2016	17,328	2,238	19,567
2017	17,328	2,238	19,567
2018	17,328	2,238	19,567
2019	17,328	2,238	19,567
2020	17,328	2,238	19,567
2021	17,328	2,238	19,567
2022	17,328	2,238	19,567
2023	17,328	2,238	19,567
2024	17,328	2,238	19,567
2025	17,328	2,238	19,567
2026	17,328	2,238	19,567
2027	17,328	2,238	19,567
2028	17,328	2,238	19,567
2029	17,328	2,238	19,567
2030	17,328	2,238	19,567
2031	17,328	2,238	19,567
2032	17,328	2,238	19,567

2033	17,328	2,238	19,567
2034	17,328	2,238	19,567
2035	17,328	2,238	19,567
2036	17,328	2,238	19,567
2037	17,328	2,238	19,567
2038	17,328	2,238	19,567
2039	17,328	2,238	19,567
2040	17,328	2,238	19,567
2041	17,328	2,238	19,567
2042	17,328	2,238	19,567
2043	17,328	2,238	19,567
2044	17,328	2,238	19,567
2045	17,328	2,238	19,567
2046	17,328	2,238	19,567
2047	17,328	2,238	19,567
2048	17,328	2,238	19,567
2049	17,328	2,238	19,567

3.1.1.1.1.1.1 Carbon in the Residual Stand Damage

The annual carbon in the residual stand damage ($C_{RSD,t}$) is calculated according to VM0011 v1.1 equation 3-19:

$$C_{RSD,t} = f_{RSD} \times C_{merch,t}$$

Equation 6. Annual carbon in the residual stand damage.

$C_{RSD,t}$	Annual carbon in the residual stand damage in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
f_{RSD}	Factor for residual stand damage, based on the fraction of quantity of carbon damaged in the residual stand to the quantity of carbon in total merchantable logs harvested, dimensionless.

$C_{merch,t}$ Annual total carbon in merchantable logs harvested in the Project Area in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.

We use 2.4 as a factor for residual stand damage (f_{RSD}) proposed by Feldpausch et al. (2005). The author found the ratio assessing the impact of logging in southern Amazonas. The value can be considered accurate, as it was developed in the same region as the project and also because it is within the range of variation for the same parameter found by other authors in studies carried out in different forests, as shown in VM0011 v1.1, table B-3.

Table 16. Annual carbon in the residual stand damage

Year	f_{RSD}	$C_{merch,t}$	$C_{RSD,t}$
2013	2.4	7,220	17,328
2014	2.4	7,220	17,328
2015	2.4	7,220	17,328
2016	2.4	7,220	17,328
2017	2.4	7,220	17,328
2018	2.4	7,220	17,328
2019	2.4	7,220	17,328
2020	2.4	7,220	17,328
2021	2.4	7,220	17,328
2022	2.4	7,220	17,328
2023	2.4	7,220	17,328
2024	2.4	7,220	17,328
2025	2.4	7,220	17,328
2026	2.4	7,220	17,328
2027	2.4	7,220	17,328
2028	2.4	7,220	17,328
2029	2.4	7,220	17,328
2030	2.4	7,220	17,328
2031	2.4	7,220	17,328
2032	2.4	7,220	17,328
2033	2.4	7,220	17,328
2034	2.4	7,220	17,328
2035	2.4	7,220	17,328
2036	2.4	7,220	17,328
2037	2.4	7,220	17,328
2038	2.4	7,220	17,328
2039	2.4	7,220	17,328

2040	2.4	7,220	17,328
2041	2.4	7,220	17,328
2042	2.4	7,220	17,328
2043	2.4	7,220	17,328
2044	2.4	7,220	17,328
2045	2.4	7,220	17,328
2046	2.4	7,220	17,328
2047	2.4	7,220	17,328
2048	2.4	7,220	17,328
2049	2.4	7,220	17,328

Average carbon per hectare in merchantable logs harvested ($C_{merch,t}$) is calculated according to VM0011 v1.1 equation 3-3 and 3-15a:

$$\bar{C}_{merch,j,t=0} = D \times CF_{wood} \times \bar{V}_{merch,j,t=0}$$

Equation 7. Average carbon per hectare in merchantable logs determined ex ante.

In which:

- $C_{merch,j,t=0}$ Average carbon per hectare in merchantable logs in stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year, in tC ha⁻¹.
- D Wood density for the tropical forest with corresponding climate region and ecological zone, in (t d.m.) m⁻³.
- CF_{wood} Carbon fraction of wood for the tropical forest, dimensionless.
- $V_{merch,j,t=0}$ Average merchantable logs volume per hectare in stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year, in m³ ha⁻¹.

Wood density for the tropical forest with corresponding climate region and ecological zone (D) equals 0,68 (t d.m.) m⁻³ and is calculated as the average of wood densities of commercially harvested species in the project area, before the project start date.

Carbon fraction of wood for the tropical forest (CF_{wood}), equals 0,49, which is the value suggested by VM0011 v1.0, appendix B, for tropical forests in America (Feldpausch et al., in IPCC (2006a)).

Average merchantable logs volume per hectare in the project area ($V_{merch,j,t=0}$) equals 27.93 m³ was determined ex-ante through the operating licenses and authorizations for forest harvesting issued by the environmental agency in the state of Amazonas after 2006 (Annexs 4 & 6). The time limit of 2006 was considered due to normative instruction n° 5 of 12/11/2006 of the Ministry

of the Environment, which limits the approved exploration volume to 30 m³ per hectare for corporate forest management. These documents show the area to be explored in hectares and the volume authorized for cutting by species, therefore being considered as a less detailed FIR.

Annual total carbon in merchantable logs harvested ($C_{merch,t}$) is calculated according to VM0011 v1.1 equation 3-15a:

$$C_{merch,t} = \bar{C}_{merch,t=0} \times A_{NHA_annual,t}$$

Equation 8. Annual total carbon in merchantable logs.

In which:

- $C_{merch,t}$ Annual total carbon in the merchantable logs harvested in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
- $C_{merch,t=0}$ Average carbon per hectare in the merchantable logs determined ex ante – before the start of the IFM-LtPF project activity, hence t=0 year, in tC ha⁻¹.
- $A_{NHA_annual,t}$ Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in ha.

Table 17. Average carbon per hectare in merchantable logs determined ex ante

Year	O.L. / A.F.H.	D	CF _{wood}	V _{merch, j, t=0}	C _{merch, j, t=0}	C _{merch, j, t}
2005 to 2007	L.O. 010/99-04	0.68	0.49	29.79	9.87	7,700
2008 to 2009	L.O. 061/08 – ACOF 032/08	0.68	0.49	26.08	8.64	6,741
Average				27.93	9.26	7,220

3.1.1.1.1.1.2 Carbon in the Branches and Trimmings Left Over from Harvesting

The annual carbon in branches and trimmings left over from harvesting ($C_{branch_trim,t}$) is calculated according to VM0011 v1.1 equation 3-20:

$$C_{branch_trim,t} = f_{branch_trim} \times C_{merch,t}$$

Equation 9. Annual carbon in branches and trimmings left over from harvesting.

In which:

- $C_{branch_trim,t}$ Annual carbon in branches and trimmings left over from harvesting in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.

f_{branch_trim}	The fraction of branches and trimmings in the aboveground biomass remaining after trimming of the merchantable logs transferred to the DW pool, dimensionless.
$C_{merch,t}$	Annual total carbon in the merchantable logs harvested in the Project Area in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.

The fraction of branches and trimmings in the aboveground biomass remaining after trimming of the merchantable logs transferred to the DW pool (f_{branch_trim}) equals 0.31, according to Silva et al. (2007). The author evaluated allometry and carbon stocks at experimental sites in tropical forests in central Amazonia.

Average merchantable logs volume per hectare in the project area ($V_{merch,j,t=0}$) equals 27.93 m³.

Table 18. Annual carbon in branches and trimmings left over from harvesting

Year	f_{branch_trim}	$C_{merch,t}$	$C_{branch_trim,t}$
2013	0.31	7,220	2,238
2014	0.31	7,220	2,238
2015	0.31	7,220	2,238
2016	0.31	7,220	2,238
2017	0.31	7,220	2,238
2018	0.31	7,220	2,238
2019	0.31	7,220	2,238
2020	0.31	7,220	2,238
2021	0.31	7,220	2,238
2022	0.31	7,220	2,238
2023	0.31	7,220	2,238
2024	0.31	7,220	2,238
2025	0.31	7,220	2,238
2026	0.31	7,220	2,238
2027	0.31	7,220	2,238
2028	0.31	7,220	2,238
2029	0.31	7,220	2,238
2030	0.31	7,220	2,238
2031	0.31	7,220	2,238
2032	0.31	7,220	2,238
2033	0.31	7,220	2,238
2034	0.31	7,220	2,238
2035	0.31	7,220	2,238
2036	0.31	7,220	2,238

2037	0.31	7,220	2,238
2038	0.31	7,220	2,238
2039	0.31	7,220	2,238
2040	0.31	7,220	2,238
2041	0.31	7,220	2,238
2042	0.31	7,220	2,238
2043	0.31	7,220	2,238
2044	0.31	7,220	2,238
2045	0.31	7,220	2,238
2046	0.31	7,220	2,238
2047	0.31	7,220	2,238
2048	0.31	7,220	2,238
2049	0.31	7,220	2,238

3.1.1.1.1.2 Cumulative Carbon Remaining in Dead Wood Pool

The cumulative carbon remaining in the deadwood pool in year t ($C_{DW_{pool},t}$) is calculated in function of the annual fraction of carbon in the deadwood pool that would remain in the deadwood pool in year t ($F_{DW_remain,t}$) and the annual total carbon input to the deadwood pool in year t ($C_{DW_{in},t}$), according to VM0011 v1.1 equation 3-22a:

$$C_{DW_{pool},t} = \sum_{t=1}^{t^*} (F_{DW_remain,t} \times C_{DW_{in},t})$$

Equation 10. Cumulative carbon remaining in the deadwood pool.

In which:

$C_{DW_{pool},t}$	Cumulative carbon remaining in the deadwood pool in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.
$F_{DW_remain,t}$	Annual fraction of carbon in the deadwood pool that would remain in the deadwood pool in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity) after applying the rate of decay, dimensionless.
$C_{DW_{in},t}$	Annual total carbon input to the deadwood pool in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.

Table 19. Cumulative carbon remaining in the deadwood pool

Year	$C_{DW_{in},t}$	$C_{DW_{in},t}$	$C_{DW_{pool},t}$
------	-----------------	-----------------	-------------------

		Total Acum.	Total Acum.
2013	19,567	19,567	19,567
2014	19,567	39,133	36,124
2015	19,567	58,700	50,135
2016	19,567	78,267	61,991
2017	19,567	97,834	72,023
2018	19,567	117,400	80,513
2019	19,567	136,967	87,697
2020	19,567	156,534	93,776
2021	19,567	176,100	98,920
2022	19,567	195,667	103,272
2023	19,567	215,234	106,956
2024	19,567	234,801	110,073
2025	19,567	254,367	112,710
2026	19,567	273,934	114,942
2027	19,567	293,501	116,831
2028	19,567	313,067	118,429
2029	19,567	332,634	119,781
2030	19,567	352,201	120,925
2031	19,567	371,768	121,894
2032	19,567	391,334	122,713
2033	19,567	410,901	123,407
2034	19,567	430,468	123,993
2035	19,567	450,034	124,490
2036	19,567	469,601	124,910
2037	19,567	489,168	125,265
2038	19,567	508,735	125,566
2039	19,567	528,301	125,821
2040	19,567	547,868	126,036
2041	19,567	567,435	126,219
2042	19,567	587,001	126,373
2043	19,567	606,568	126,503
2044	19,567	626,135	126,614
2045	19,567	645,702	126,707
2046	19,567	665,268	126,786
2047	19,567	684,835	126,853
2048	19,567	704,402	126,910
2049	19,567	723,968	126,958

The annual fraction of carbon in the deadwood pool that would remain in the deadwood pool in year t ($F_{DW_remain,t}$) is calculated in function of the rate of decay of the deadwood pool (k_{decay}) and the years elapsed since the start of the IFM-LtPF project activity (t), according to VM0011 v1.1 equation 3-21:

$$F_{DW_remain,t} = e^{-k_{decay} \times t}$$

Equation 11. Annual fraction of carbon in the deadwood pool that would remain in the deadwood pool.

In which:

$F_{DW_remain,t}$ Annual fraction of carbon in the deadwood pool that would remain in the deadwood pool in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity) after applying the rate of decay, dimensionless.

k_{decay} Rate of decay of the deadwood pool, in years.

t 1,2,3 ... t^* years elapsed since the start of the IFM-LtPF project activity, in years.

Table 20. Annual fraction of carbon in the deadwood pool that would remain in the deadwood pool

k_{decay}	t	$F_{DW_remain,t}$
0.167	0	1.0000
0.167	1	0.8462
0.167	2	0.7161
0.167	3	0.6059
0.167	4	0.5127
0.167	5	0.4339
0.167	6	0.3671
0.167	7	0.3107
0.167	8	0.2629
0.167	9	0.2225
0.167	10	0.1882
0.167	11	0.1593
0.167	12	0.1348
0.167	13	0.1141
0.167	14	0.0965
0.167	15	0.0817
0.167	16	0.0691
0.167	17	0.0585

0.167	18	0.0495
0.167	19	0.0419
0.167	20	0.0354
0.167	21	0.0300
0.167	22	0.0254
0.167	23	0.0215
0.167	24	0.0182
0.167	25	0.0154
0.167	26	0.0130
0.167	27	0.0110
0.167	28	0.0093
0.167	29	0.0079
0.167	30	0.0067
0.167	31	0.0056
0.167	32	0.0048
0.167	33	0.0040
0.167	34	0.0034
0.167	35	0.0029
0.167	36	0.0024

Rate of decay of the deadwood pool is 0.167 according to Chambers *et al* (2000).

3.1.1.1.1.2 GHG Emissions due to Long Term Harvested Wood Products (ltHWPs) Oxidation

The carbon from Long Term Harvested Wood Products ($C_{ltHWP_{oxidation},t}$) is calculated in function of the immediate oxidation of ltHWP residues as a result of timber processing ($C_{ltHWP_{residues},t}$), and the delayed oxidation of ltHWPs ($C_{ltHWP_{net_out},t}$), according to, VM0011 v1.0 equation 3-25:

$$C_{ltHWP_{oxidation},t} = C_{ltHWP_{residues},t} + C_{ltHWP_{net_out},t}$$

Equation 12. Annual fraction of carbon in the deadwood pool that would remain in the deadwood pool.

In which:

- $C_{ltHWP_{oxidation},t}$ Annual carbon due to the combined delayed oxidation of long-term harvested wood products and immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
- $C_{ltHWP_{residues},t}$ Annual carbon due to the immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.

$C_{ItHWPnet_out,t}$ Annual net carbon due to the delayed oxidation of the long-term harvested wood products, leaving the long-term harvested wood products pool in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFMLtPF project activity), in tC.

Table 21. Annual carbon due to the combined delayed oxidation of long-term harvested wood products and immediate oxidation of long-term harvested wood products residues

Year	$C_{ItHWPResidues,t}$	$C_{ItHWPnet_out,t}$	$C_{ItHWPoxidation,t}$
2013	3,827	-	3,827
2014	3,827	77	3,904
2015	3,827	153	3,979
2016	3,827	226	4,053
2017	3,827	298	4,125
2018	3,827	369	4,195
2019	3,827	437	4,264
2020	3,827	505	4,331
2021	3,827	570	4,397
2022	3,827	635	4,461
2023	3,827	697	4,524
2024	3,827	759	4,585
2025	3,827	818	4,645
2026	3,827	877	4,704
2027	3,827	934	4,761
2028	3,827	990	4,817
2029	3,827	1,045	4,871
2030	3,827	1,098	4,925
2031	3,827	1,150	4,977
2032	3,827	1,201	5,028
2033	3,827	1,251	5,078
2034	3,827	1,300	5,127
2035	3,827	1,348	5,174
2036	3,827	1,394	5,221
2037	3,827	1,440	5,266
2038	3,827	1,484	5,311
2039	3,827	1,527	5,354
2040	3,827	1,570	5,397
2041	3,827	1,611	5,438
2042	3,827	1,652	5,478

2043	3,827	1,691	5,518
2044	3,827	1,730	5,557
2045	3,827	1,768	5,595
2046	3,827	1,805	5,632
2047	3,827	1,841	5,668
2048	3,827	1,876	5,703
2049	3,827	1,911	5,737

3.1.1.1.2.1 Carbon in Long Term HWP Residues

The annual carbon due to the immediate oxidation of long-term harvested wood products residues ($C_{ltHWP_{residues},t}$) is calculated in function of average carbon per hectare in merchantable logs in the project area ($C_{merch,p,t=0}$), the lumber recovery factor ($f_{lumber_recovery}$) and the annual net harvest area for the project area according to, VM0011 v1.0 equation 3-26:

In which:

$$C_{ltHWP_{residues},t} = \bar{C}_{merch,p,t=0} \times (1 - f_{lumber_recovery}) \times A_{NHA_annual,t}$$

Equation 13. Annual carbon due to the immediate oxidation of long-term harvested wood products residues.

In which

- $C_{ltHWP_{residues},t}$ Annual carbon due to the immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
- $C_{merch,p,t=0}$ Average carbon per hectare in merchantable logs of forest product type p=sawlog, in the Project Area determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year, in tC ha⁻¹.
- $f_{lumber_recovery}$ Lumber recovery factor for proportion of merchantable log converted to harvested wood product, dimensionless.
- $A_{NHA_annual,t}$ Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in ha.

Table 22. Annual carbon due to the combined delayed oxidation of long-term harvested wood products and immediate oxidation of long-term harvested wood products residues

Year	$C_{merch,p,t=0}$	$f_{lumber_recovery}$	$A_{NHA_annual,t}$	$C_{ltHWP_{residues},t}$
2013	9.26	0.47	780	3,827

2014	9.26	0.47	780	3,827
2015	9.26	0.47	780	3,827
2016	9.26	0.47	780	3,827
2017	9.26	0.47	780	3,827
2018	9.26	0.47	780	3,827
2019	9.26	0.47	780	3,827
2020	9.26	0.47	780	3,827
2021	9.26	0.47	780	3,827
2022	9.26	0.47	780	3,827
2023	9.26	0.47	780	3,827
2024	9.26	0.47	780	3,827
2025	9.26	0.47	780	3,827
2026	9.26	0.47	780	3,827
2027	9.26	0.47	780	3,827
2028	9.26	0.47	780	3,827
2029	9.26	0.47	780	3,827
2030	9.26	0.47	780	3,827
2031	9.26	0.47	780	3,827
2032	9.26	0.47	780	3,827
2033	9.26	0.47	780	3,827
2034	9.26	0.47	780	3,827
2035	9.26	0.47	780	3,827
2036	9.26	0.47	780	3,827
2037	9.26	0.47	780	3,827
2038	9.26	0.47	780	3,827
2039	9.26	0.47	780	3,827
2040	9.26	0.47	780	3,827
2041	9.26	0.47	780	3,827
2042	9.26	0.47	780	3,827
2043	9.26	0.47	780	3,827
2044	9.26	0.47	780	3,827
2045	9.26	0.47	780	3,827
2046	9.26	0.47	780	3,827
2047	9.26	0.47	780	3,827
2048	9.26	0.47	780	3,827
2049	9.26	0.47	780	3,827

Average merchantable logs volume per hectare in the project area ($V_{\text{merch}, j, t=0}$) equals 27.93 m³^[1].

According to Verissimo et al. (1992), lumber recovery factor for proportion of merchantable log converted to harvested wood product ($f_{\text{lumber_recovery}}$) in old tropical forests in Brazil equals 0.47, which can also be checked at VM0011 v1.0, table B-4.

Annual net harvest area for the Project Area equals 780 ha according to the forest management plan approved by the responsible environmental agency in the state (Anexx 2a, page 8).

3.1.1.1.2.2 Carbon in Long Term HWP Pool

The annual net carbon due to the delayed oxidation of the long-term harvested wood products, leaving the long-term harvested wood products pool ($C_{\text{ltHWPnet_out},t}$) is calculated in function of the cumulative carbon leaving the ltHWP pool and emitted into the atmosphere in year t ($C_{\text{ltHWPout},t}$) and the cumulative carbon leaving the ltHWP pool and emitted into the atmosphere in year $t-1$ ($C_{\text{ltHWPout},t-1}$), according to, VM0011 v1.0 equation 3-31:

$$C_{\text{ltHWPnet_out},t} = C_{\text{ltHWPout},t} - C_{\text{ltHWPout},t-1}$$

Equation 14. Annual net carbon due to the delayed oxidation of the long-term harvested wood products, leaving the long-term harvested wood products pool.

In which:

- $C_{\text{ltHWPnet_out},t}$ Annual net carbon due to the delayed oxidation of the long-term harvested wood products, leaving the long-term harvested wood products pool in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.
- $C_{\text{ltHWPout},t}$ Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.
- $C_{\text{ltHWPout},t-1}$ Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere in year $t-1$, (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.

Table 23. Annual net carbon due to the delayed oxidation of the long-term harvested wood products, leaving the long-term harvested wood products pool

Year	$C_{\text{ltHWPout},t}$	$C_{\text{ltHWPout},t-1}$	$C_{\text{ltHWPnet_out},t}$
2013	-	-	-
2014	77	-	77
2015	230	77	153
2016	456	230	226

2017	754	456	298
2018	1,123	754	369
2019	1,560	1,123	437
2020	2,065	1,560	505
2021	2,635	2,065	570
2022	3,270	2,635	635
2023	3,967	3,270	697
2024	4,726	3,967	759
2025	5,544	4,726	818
2026	6,421	5,544	877
2027	7,355	6,421	934
2028	8,345	7,355	990
2029	9,390	8,345	1,045
2030	10,488	9,390	1,098
2031	11,639	10,488	1,150
2032	12,840	11,639	1,201
2033	14,091	12,840	1,251
2034	15,391	14,091	1,300
2035	16,739	15,391	1,348
2036	18,133	16,739	1,394
2037	19,573	18,133	1,440
2038	21,057	19,573	1,484
2039	22,584	21,057	1,527
2040	24,154	22,584	1,570
2041	25,765	24,154	1,611
2042	27,417	25,765	1,652
2043	29,108	27,417	1,691
2044	30,838	29,108	1,730
2045	32,606	30,838	1,768
2046	34,411	32,606	1,805
2047	36,252	34,411	1,841
2048	38,128	36,252	1,876
2049	40,039	38,128	1,911

The cumulative carbon leaving the ItHWP pool and emitted into the atmosphere in year t ($C_{ItHWPout,t}$) is calculated in function of the Annual carbon input to the long-term harvested wood products pool from sawlog ($C_{ItHWPin,t}$) and the Cumulative carbon remaining in the ItHWP pool ($C_{ItHWPpool,t}$), according to, VM0011 v1.0 equation 3-30:

$$C_{ltHWP_{out},t} = \sum_{t=1}^{t^*} C_{ltHWP_{in},t} - C_{ltHWP_{pool},t}$$

Equation 15. Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere.

In which:

$C_{ltHWP_{out},t}$ Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere from year $t=1$ to year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.

$C_{ltHWP_{in},t}$ Annual carbon input to the long-term harvested wood products pool from sawlog in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFMLtPF project activity), in tC.

$C_{ltHWP_{pool},t}$ Cumulative carbon remaining in the ltHWP pool in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.

Table 24. Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere

Year	$C_{ltHWP_{in},t}$	$C_{ltHWP_{pool},t}$	$C_{ltHWP_{out},t}$
2013	3,393	3,393	-
2014	6,787	6,710	77
2015	10,180	9,951	230
2016	13,574	13,118	456
2017	16,967	16,213	754
2018	20,361	19,238	1,123
2019	23,754	22,194	1,560
2020	27,148	25,083	2,065
2021	30,541	27,906	2,635
2022	33,935	30,665	3,270
2023	37,328	33,361	3,967
2024	40,722	35,996	4,726
2025	44,115	38,571	5,544
2026	47,509	41,088	6,421
2027	50,902	43,547	7,355
2028	54,296	45,950	8,345
2029	57,689	48,299	9,390
2030	61,083	50,594	10,488
2031	64,476	52,837	11,639
2032	67,870	55,030	12,840

2033	71,263	57,172	14,091
2034	74,657	59,265	15,391
2035	78,050	61,311	16,739
2036	81,444	63,311	18,133
2037	84,837	65,265	19,573
2038	88,231	67,174	21,057
2039	91,624	69,040	22,584
2040	95,018	70,864	24,154
2041	98,411	72,646	25,765
2042	101,805	74,388	27,417
2043	105,198	76,090	29,108
2044	108,592	77,753	30,838
2045	111,985	79,379	32,606
2046	115,379	80,968	34,411
2047	118,772	82,520	36,252
2048	122,166	84,037	38,128
2049	125,559	85,520	40,039
Total	33,361	35,996	

3.1.1.1.2.2.1 Carbon Inputs in ltHWP

The annual carbon input to the long-term harvested wood products pool from sawlog ($C_{ltHWP_{in},t}$) is calculated in function of the average carbon per hectare in merchantable logs harvested ($C_{merch,t}$), the the lumber recovery factor ($f_{lumber_recovery}$) and the annual net harvest area for the project area according to, VM0011 v1.0 equation 3-27:

$$C_{ltHWP_{in},t} = \bar{C}_{merch,p,t=0} \times f_{lumber_recovery} \times A_{NHA_annual,t}$$

Equation 16. Carbon input to the long-term harvested wood products pool from sawlog.

$C_{ltHWP_{in},t}$	Annual carbon input to the long-term harvested wood products pool from sawlog in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
$C_{merch,p,t=0}$	Average carbon per hectare in merchantable logs of forest product type p=sawlog, in the Project Area determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year, in tC ha ⁻¹ .
$f_{lumber_recovery}$	Lumber recovery factor for proportion of merchantable log converted to harvested wood product, dimensionless.

$A_{NHA_annual,t}$ Annual net harvest area for the Project Area in year t, (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in ha.

Table 25. Carbon input to the long-term harvested wood products pool from sawlog

Year	$C_{merch, p,t=0}$	$f_{lumber_recovery}$	$A_{NHA_annual,t}$	$C_{ltHWPin,t}$
2013	9.26	0.47	780	3,393
2014	9.26	0.47	780	3,393
2015	9.26	0.47	780	3,393
2016	9.26	0.47	780	3,393
2017	9.26	0.47	780	3,393
2018	9.26	0.47	780	3,393
2019	9.26	0.47	780	3,393
2020	9.26	0.47	780	3,393
2021	9.26	0.47	780	3,393
2022	9.26	0.47	780	3,393
2023	9.26	0.47	780	3,393
2024	9.26	0.47	780	3,393
2025	9.26	0.47	780	3,393
2026	9.26	0.47	780	3,393
2027	9.26	0.47	780	3,393
2028	9.26	0.47	780	3,393
2029	9.26	0.47	780	3,393
2030	9.26	0.47	780	3,393
2031	9.26	0.47	780	3,393
2032	9.26	0.47	780	3,393
2033	9.26	0.47	780	3,393
2034	9.26	0.47	780	3,393
2035	9.26	0.47	780	3,393
2036	9.26	0.47	780	3,393
2037	9.26	0.47	780	3,393
2038	9.26	0.47	780	3,393
2039	9.26	0.47	780	3,393
2040	9.26	0.47	780	3,393
2041	9.26	0.47	780	3,393
2042	9.26	0.47	780	3,393
2043	9.26	0.47	780	3,393
2044	9.26	0.47	780	3,393
2045	9.26	0.47	780	3,393

2046	9.26	0.47	780	3,393
2047	9.26	0.47	780	3,393
2048	9.26	0.47	780	3,393
2049	9.26	0.47	780	3,393

Average merchantable logs volume per hectare in the project area ($V_{\text{merch}, j, t=0}$) equals 27.93 m³ [2].

According to Verissimo et al. (1992), lumber recovery factor for proportion of merchantable log converted to harvested wood product ($f_{\text{lumber_recovery}}$) in old tropical forests in Brazil equals 0.47, which can also be checked at VM0011 v1.0, table B-4.

Annual net harvest area for the Project Area equals 780 ha according to the forest management plan approved by the responsible environmental agency in the state (Anexx 2).

3.1.1.1.1.2.2.2 Cumulative Carbon Remaining in ItHWP

The Cumulative carbon remaining in the ItHWP ($C_{\text{ItHWP}_{\text{pool}}, t}$) is calculated in function of the annual fraction of ItHWP that would remain in the ItHWP pool ($F_{\text{ItHWP_remain}, t}$) and the annual carbon input to the long-term harvested wood products pool ($C_{\text{ItHWP}_{\text{in}}, t}$), according to VM0011 v1.0 equation 3-29a:

$$C_{\text{ItHWP}_{\text{pool}}, t} = \sum_{t=1}^{t^*} (F_{\text{ItHWP_remain}, t} \times C_{\text{ItHWP}_{\text{in}}, t})$$

Equation 17. Cumulative carbon remaining in the ItHWP.

$C_{\text{ItHWP}_{\text{pool}}, t}$ Cumulative carbon remaining in the ItHWP pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.

$F_{\text{ItHWP_remain}, t}$ Annual fraction of ItHWP that would remain in the ItHWP pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) after applying the rate of oxidation, dimensionless.

$C_{\text{ItHWP}_{\text{in}}, t}$ Annual carbon input to the long-term harvested wood products pool from sawlog in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFMLtPF project activity), in tC.

Table 26. Cumulative carbon remaining in the ItHWP

Year	$C_{\text{ItHWP}_{\text{in}}, t}$	CDW_{in}, t	CDW_{pool}, t
		Total Acum.	Total Acum.
2013	3,393	3,393	3,393
2014	3,393	6,787	6,710
2015	3,393	10,180	9,951

2016	3,393	13,574	13,118
2017	3,393	16,967	16,213
2018	3,393	20,361	19,238
2019	3,393	23,754	22,194
2020	3,393	27,148	25,083
2021	3,393	30,541	27,906
2022	3,393	33,935	30,665
2023	3,393	37,328	33,361
2024	3,393	40,722	35,996
2025	3,393	44,115	38,571
2026	3,393	47,509	41,088
2027	3,393	50,902	43,547
2028	3,393	54,296	45,950
2029	3,393	57,689	48,299
2030	3,393	61,083	50,594
2031	3,393	64,476	52,837
2032	3,393	67,870	55,030
2033	3,393	71,263	57,172
2034	3,393	74,657	59,265
2035	3,393	78,050	61,311
2036	3,393	81,444	63,311
2037	3,393	84,837	65,265
2038	3,393	88,231	67,174
2039	3,393	91,624	69,040
2040	3,393	95,018	70,864
2041	3,393	98,411	72,646
2042	3,393	101,805	74,388
2043	3,393	105,198	76,090
2044	3,393	108,592	77,753
2045	3,393	111,985	79,379
2046	3,393	115,379	80,968
2047	3,393	118,772	82,520
2048	3,393	122,166	84,037
2049	3,393	125,559	85,520

The annual fraction of lthWP that would remain in the lthWP pool ($F_{lthWP_remain,t}$) is calculated in function of the rate of oxidation for long-term harvested wood products (k_{lthWP_ox}) and the years elapsed since the start of the IFM-LtPF project activity (t), according to VM0011 v1.0, equation 3-28:

$$F_{ItHWP_remain,t} = e^{-k_{ItHWP_ox} \times t}$$

Equation 18. Annual fraction of ItHWP that would remain in the ItHWP pool.

In which:

$F_{ItHWP_remain,t}$ Annual fraction of ItHWP that would remain in the ItHWP pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) after applying the rate of oxidation, dimensionless.

k_{ItHWP_ox} Rate of oxidation for long-term harvested wood products, per year.

t 1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity, in years.

Table 27. Annual fraction of ItHWP that would remain in the ItHWP pool

k_{ItHWP_ox}	t	$F_{ItHWP_remain,t}$
0.023	0	1.0000
0.023	1	0.9773
0.023	2	0.9550
0.023	3	0.9333
0.023	4	0.9121
0.023	5	0.8914
0.023	6	0.8711
0.023	7	0.8513
0.023	8	0.8319
0.023	9	0.8130
0.023	10	0.7945
0.023	11	0.7765
0.023	12	0.7588
0.023	13	0.7416
0.023	14	0.7247
0.023	15	0.7082
0.023	16	0.6921
0.023	17	0.6764
0.023	18	0.6610
0.023	19	0.6460
0.023	20	0.6313
0.023	21	0.6169
0.023	22	0.6029
0.023	23	0.5892

0.023	24	0.5758
0.023	25	0.5627
0.023	26	0.5499
0.023	27	0.5374
0.023	28	0.5252
0.023	29	0.5132
0.023	30	0.5016
0.023	31	0.4902
0.023	32	0.4790
0.023	33	0.4681
0.023	34	0.4575
0.023	35	0.4471
0.023	36	0.4369
0.023	37	0.4270

Rate of oxidation for long-term harvested wood products is 0.023 according to IPCC (2006b), Chapter 12, Table 12.2, p. 12.17, which can be verified in VM0011 v1.0 table B-5.

3.1.1.1.1.3 GHG Emissions due to Short-Term Harvested Wood Products (stHWPs) Oxidation

VM0011 v1.0 considers as stHWP merchantable logs destined to be converted into paper products or commercially harvested fuelwood with a half-life of two years or less. The forest management plan interrupted by the creation of this project had the sole objective of selling wood logs for sawmills. Thus $C_{stHWP_{oxidation},t}$ is considered zero, which can be understood as conservative, as it reduces GHG emissions in the baseline scenario.

3.1.1.1.1.4 Growth Foregone due to Selective Logging

The annual carbon lost due to growth foregone in the aboveground biomass in the Project Area ($C_{growth_foregone,t}$) is calculated in function of the average growth per hectare per year in the aboveground biomass in the merchantable trees in the Project Area ($G_{growth_foregone,t}$), the carbon fraction in the aboveground biomass of trees for the tropical forest (CF_{AGB}) and the annual net harvest area for the Project Area elapsed since the start of the IFM-LtPF project activity ($A_{NHA_annual,t}$) according to the VM0011 v1.0 equation 3-37a:

$$C_{growth_foregone,t} = CF_{AGB} \times \bar{G}_{growth_foregone,t} \times \sum_{t=1}^{t^*} A_{NHA_annual,t}$$

Equation 19. Annual carbon lost due to growth foregone in the aboveground biomass.

In which:

$C_{growth_foregone,t}$ Annual carbon lost due to growth foregone in the aboveground biomass in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.

CF_{AGB}	Carbon fraction in the aboveground biomass of trees for the tropical forest, dimensionless.
$G_{growth_foregone,t}$	Average growth per hectare per year in the aboveground biomass in the merchantable trees in the Project Area in stratum j , (where $j=1,2,3 \dots J$ strata) in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in (t d.m.) $ha^{-1} yr^{-1}$.
$ANHA_{annual,t}$	Annual net harvest area for the Project Area in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in ha.

Table 28. Annual carbon lost due to growth foregone in the aboveground biomass

Table 23: Annual carbon lost due to growth foregone in the aboveground biomass				
Year	CF_{AGB}	$G_{growth_foregone,t}$	$ANHA_{annual,t}$	$C_{growth_foregone,t}$
2013	0.49	10.96	780	4,146
2014	0.49	10.96	780	4,146
2015	0.49	10.96	780	4,146
2016	0.49	10.96	780	4,146
2017	0.49	10.96	780	4,146
2018	0.49	10.96	780	4,146
2019	0.49	10.96	780	4,146
2020	0.49	10.96	780	4,146
2021	0.49	10.96	780	4,146
2022	0.49	10.96	780	4,146
2023	0.49	10.96	780	4,146
2024	0.49	10.96	780	4,146
2025	0.49	10.96	780	4,146
2026	0.49	10.96	780	4,146
2027	0.49	10.96	780	4,146
2028	0.49	10.96	780	4,146
2029	0.49	10.96	780	4,146
2030	0.49	10.96	780	4,146
2031	0.49	10.96	780	4,146
2032	0.49	10.96	780	4,146
2033	0.49	10.96	780	4,146
2034	0.49	10.96	780	4,146
2035	0.49	10.96	780	4,146
2036	0.49	10.96	780	4,146

2037	0.49	10.96	780	4,146
2038	0.49	10.96	780	4,146
2039	0.49	10.96	780	4,146
2040	0.49	10.96	780	4,146
2041	0.49	10.96	780	4,146
2042	0.49	10.96	780	4,146
2043	0.49	10.96	780	4,146
2044	0.49	10.96	780	4,146
2045	0.49	10.96	780	4,146
2046	0.49	10.96	780	4,146
2047	0.49	10.96	780	4,146
2048	0.49	10.96	780	4,146
2049	0.49	10.96	780	4,146

The average growth per hectare per year in the aboveground biomass in the merchantable trees in the Project Area ($G_{\text{growth_foregone},t}$) is calculated in function of the average aboveground biomass of the merchantable trees in the Project Area when current monitoring event occurs ($B_{\text{AGB_merch},j,m_2}$), the average aboveground biomass of the merchantable trees in the Project Area when preceding monitoring event occurs ($B_{\text{AGB_merch},j,m_1}$), and the length of the present monitoring period (Δm), according to VM001 v1.0 equations 3-36a:

$$\bar{G}_{\text{growth_foregone},j,t} = \frac{\bar{B}_{\text{AGB_merch},j,m_2} - \bar{B}_{\text{AGB_merch},j,m_1}}{\Delta m}$$

Equation 20. Average growth per hectare per year in the aboveground biomass in the merchantable trees in the Project Area

In which:

$G_{\text{growth_foregone},j,t}$	Average growth per hectare per year in the aboveground biomass in the merchantable trees in the Project Area in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in (t d.m.) ha ⁻¹ yr ⁻¹ .
$B_{\text{AGB_merch},j,m_2}$	Average aboveground biomass of the merchantable trees in the Project Area in stratum j, (where j=1,2,3 ... J strata) in year, m2 - when current monitoring event occurs, in (t d.m.) ha ⁻¹ .
$B_{\text{AGB_merch},j,m_1}$	Average aboveground biomass of the merchantable trees in the Project Area in stratum j, (where j=1,2,3 ... J strata) in year, m2 - when current monitoring event occurs, in (t d.m.) ha ⁻¹ .
Δm	Monitoring period, the time taken between two consecutive monitoring events, in years.

The average aboveground biomass of the merchantable trees in the Project Area was determined by forest inventory methods through the usage of sample plots and allometric equations in the years of 2022 and 2016. The following equation was used in both monitoring events (adjusted from VM0011 v1.0, equation 3-12):

$$\bar{B}_{AGB_merch,j,t=0} = \frac{1}{A_{s,j,t=0}} * \sum_{s=1}^S \{ \sum_{i=1}^I [\sum_{n=1}^{N_i} f(2.7179 * DBH^{1.8774} * fc * wf)] \}$$

Equation 21. Biomass allometric equation

In which:

$B_{AGB_merch,j,t}$	Average aboveground biomass of the merchantable trees in the Project Area in stratum j, (where j=1,2,3 ... J strata) in year t.
DBH	Diameter at breast height of individual trees n, in sample plots s, for each sampled stratum j, determined after the start of the project, in cm. For the determination of biomass in commercial trees, only individuals with DBH > 50 cm were considered.
Fc	Tree height correction factor for the sampled site, dimensionless.
$A_{s,j,t=0}$	Total area of the plots shown, in stratum j, determined after the start of the IFM-LtPF project activities, in ha.
Wf	Fraction corresponding to the water content contained in the trunks, branches, branches and roots of individual trees.

Tree height correction factor for the sampled site (Fc) applied was 0,1089. The dominant height (Hd) was estimated based on Higuchi (2015), where Hd is an average height of 10% of the thickest trees sampled. This variable is then used to determine a correction factor (Fc) to compensate for the structural difference between the sampled site and the site from which the biomass equation was adjusted (Lima et al., 2012). Dominant Height is calculated based on the formula below:

$$Hd_{pa} = \frac{\sum_{i=1}^n X_{10\%i}}{n_{10\%}}$$

Equation 22. Calculation of dominant height based on average height of tallest trees.

In which:

H_{dPA}	arithmetic mean.
$X_{10\%i}$	height of 10% of the grossest individuals sampled.
$n_{10\%}$	number of individuals representing 10% of the sample.

The dominant height found in the Project Area (Amazon Rio) was estimated at 32.9 m.

The Tree Height Correction Factor (f_c) is calculated based on the Dominant Height (H_d) of the sampled site in relation to the H_d of the site where the biomass equation was adjusted (INPA Tropical Forestry Experimental Station - ZF-2). According to Higuchi (2015), the H_d of the ZF-2 is 30.2 m. The calculated f_c is then incorporated into the equation to compensate for the difference between the sites. The calculation form of the correction factor is presented below:

$$f_c = \frac{H_{dPA}}{H_{dZF-2}}$$

Equation 23. Correction factor applied to estimate tree height

In which:

f_c Tree height correction factor at different sites.

H_{dPA} Dominant height of sampled site (Project Area).

H_{dZF-2} Dominant height of ZF-2 (Site where the equation was developed).

Fraction corresponding to the water content contained in the trunks, branches, branches and roots of individual trees (F_w), equals 0.584 according to Lima et al. (2012).

Total area of the plots shown in 2022 forest inventory ($A_{s,j,t=0}$) is 20ha.

Table 29. Annual average growth per hectare per year in the aboveground biomass in the merchantable trees in the Project Area

Year	BAGB _ merch, j, m1	BAGB _ merch, j, m2	Δm	$G_{growth_foregone,j,t}$
2016	41.5	-	-	-
2022	-	52.46	-	-
Total	-	-	6	10.96

3.1.1.1.1.5 Regrowth after Selective Logging

The annual carbon increase in the biomass due to regrowth following logging ($C_{regrowth,t}$) is calculated in function of the average regrowth per hectare per year of the aboveground biomass after logging ($\bar{G}_{regrowth,t}$), the carbon fraction in the aboveground biomass of trees for the tropical forest (CF_{AGB}) and the annual net harvest area for the Project Area elapsed since the start of the IFM-LtPF project activity ($A_{NHA_annual,t}$) according to the VM0011 v1.0 equation 3-38:

$$C_{regrowth,t} = \left(\bar{G}_{regrowth,t} \times CF_{AGB} \right) \times \sum_{t=1}^{t^*} A_{NHA_annual,t}$$

Equation 24. Carbon increase in the biomass due to regrowth following logging

In which:

- $C_{\text{regrowth},t}$ Annual carbon increase in the biomass due to regrowth following logging in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tC.
- $G_{\text{regrowth}, t}$ Average regrowth per hectare per year of the aboveground biomass after logging in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFMLtPF project activity), in (t d.m.) $\text{ha}^{-1} \text{yr}^{-1}$.
- CF_{AGB} Carbon fraction in the aboveground biomass of trees for the tropical forest, dimensionless.
- $A_{\text{NHA_annual},t}$ Annual net harvest area for the Project Area in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in ha.

The average regrowth per hectare per year of the aboveground biomass after logging ($G_{\text{regrowth}, t}$) is 2.6t according to Mazzei et al. (2010).

The carbon fraction in the aboveground biomass of trees for the tropical forest (CF_{AGB}) is 0,485 according to Silva et a. (2008).

The annual net harvest area for the Project Area elapsed since the start of the IFM-LtPF project activity ($A_{\text{NHA_annual},t}$) equals 780 ha according to the forest management plan approved by the responsible environmental agency in the state (Annex 2 - "anexo 2_Valdenor II projeto mãe (complemento 1).pdf"; pg. 8).

Table 30. Carbon increase in the biomass due to regrowth following logging

Year	$G_{\text{regrowth}, t}$	CF_{AGB}	$A_{\text{NHA_annual},t}$	$C_{\text{regrowth},t}$
2013	2.60	0.485	780	984
2014	2.60	0.485	780	984
2015	2.60	0.485	780	984
2016	2.60	0.485	780	984
2017	2.60	0.485	780	984
2018	2.60	0.485	780	984
2019	2.60	0.485	780	984
2020	2.60	0.485	780	984
2021	2.60	0.485	780	984
2022	2.60	0.485	780	984
2023	2.60	0.485	780	984
2024	2.60	0.485	780	984
2025	2.60	0.485	780	984

2026	2.60	0.485	780	984
2027	2.60	0.485	780	984
2028	2.60	0.485	780	984
2029	2.60	0.485	780	984
2030	2.60	0.485	780	984
2031	2.60	0.485	780	984
2032	2.60	0.485	780	984
2033	2.60	0.485	780	984
2034	2.60	0.485	780	984
2035	2.60	0.485	780	984
2036	2.60	0.485	780	984
2037	2.60	0.485	780	984
2038	2.60	0.485	780	984
2039	2.60	0.485	780	984
2040	2.60	0.485	780	984
2041	2.60	0.485	780	984
2042	2.60	0.485	780	984
2043	2.60	0.485	780	984
2044	2.60	0.485	780	984
2045	2.60	0.485	780	984
2046	2.60	0.485	780	984
2047	2.60	0.485	780	984
2048	2.60	0.485	780	984
2049	2.60	0.485	780	984

3.1.1.1.2 GHG Emissions associated with logging operations

The total emissions due to the baseline activity ($C_{\text{emissions},t}$) is calculated in function of the annual emissions due to harvesting operations such as felling and snigging ($E_{\text{harvest},t}$), annual emissions due to on-site preparation such as trimming of tree heads, butts, branches and defective components ($E_{\text{onsiteprep},t}$), annual emissions due to log hauling ($E_{\text{hauling},t}$), annual emissions due to log transport from collection depot to processing plant ($E_{\text{transport},t}$), annual emissions due to electricity consumption in sawmill ($E_{\text{processing},t}$) and Annual emissions due to transport of the sawn product from the mill to the wharf for export or to the depot for local usage ($E_{\text{distribution},t}$), according to the VM0011 v1.0 equation 3-39:

$$C'_{\text{emissions},t} = E_{\text{harvest},t} + E_{\text{onsiteprep},t} + E_{\text{hauling},t} + E_{\text{transport},t} + E_{\text{processing},t} + E_{\text{distribution},t}$$

Equation 25. Annual total carbon emissions associated with logging operations.

In which

$C'_{\text{emissions},t}$	Annual total carbon emissions associated with the baseline activity of selective logging operations in year t (where $t=1,2,3\ldots t^*$ years elapsed since the start of the IFM-LtPF project activities), in $t\text{CO}_2\text{-e}$.
$E_{\text{harvest},t}$	Annual emissions due to harvesting operations such as felling and snigging in year t (where $t=1,2,3\ldots t^*$ years elapsed since the start of the IFM-LtPF project activities), in $t\text{CO}_2\text{-e}$.
$E_{\text{onsiteprep},t}$	Annual emissions due to on-site preparation such as trimming of tree canopy, roots, branches and defective components in year t (where $t=1,2,3\ldots t^*$ years elapsed since the start of the IFM-LtPF project activities), in $t\text{CO}_2\text{-e}$.
$E_{\text{hauling},t}$	Annual emissions due to log hauling in year t (where $t=1,2,3\ldots t^*$ years elapsed since the start of the IFM-LtPF project activities), in $t\text{CO}_2\text{-e}$.
$E_{\text{transport},t}$	Annual emissions due to log transport from collection site to processing site in year t (where $t=1,2,3\ldots t^*$ years elapsed since the start of the IFM-LtPF project activities), in $t\text{CO}_2\text{-e}$.
$E_{\text{processing},t}$	Annual emissions due to electricity consumption in sawmill in year t (where $t=1,2,3\ldots t^*$ years elapsed since the start of the IFM-LtPF project activities), in $t\text{CO}_2\text{-e}$.
$E_{\text{distribution},t}$	Annual emissions due to transport of the sawn product from the mill to the port for export or to the warehouse for local usage in year t (where $t=1,2,3\ldots t^*$ years elapsed since the start of the IFM-LtPF project activities), in $t\text{CO}_2\text{-e}$.

Table 31. Annual total carbon emissions associated with logging operations

Year	E_{harves} t, t	$E_{\text{onsiteprep},}$ t	E_{haulin} g, t	E_{transpor} t, t	$E_{\text{processing},}$ t	$E_{\text{distribution},}$ t	$C'_{\text{emissions},}$ t
2013	8	1	14	25	42	688	778
2014	8	1	14	25	59	688	795
2015	8	1	14	25	54	688	790
2016	8	1	14	25	36	688	772
2017	8	1	14	25	40	688	776
2018	8	1	14	25	32	688	768
2019	8	1	14	25	33	688	769
2020	8	1	14	25	27	688	763
2021	8	1	14	25	55	688	791
2022	8	1	14	25	55	688	791
2023	8	1	14	25	43	688	779
2024	8	1	14	25	43	688	779
2025	8	1	14	25	43	688	779

2026	8	1	14	25	43	688	779
2027	8	1	14	25	43	688	779
2028	8	1	14	25	43	688	779
2029	8	1	14	25	43	688	779
2030	8	1	14	25	43	688	779
2031	8	1	14	25	43	688	779
2032	8	1	14	25	43	688	779
2033	8	1	14	25	43	688	779
2034	8	1	14	25	43	688	779
2035	8	1	14	25	43	688	779
2036	8	1	14	25	43	688	779
2037	8	1	14	25	43	688	779
2038	8	1	14	25	43	688	779
2039	8	1	14	25	43	688	779
2040	8	1	14	25	43	688	779
2041	8	1	14	25	43	688	779
2042	8	1	14	25	43	688	779
2043	8	1	14	25	43	688	779
2044	8	1	14	25	43	688	779
2045	8	1	14	25	43	688	779
2046	8	1	14	25	43	688	779
2047	8	1	14	25	43	688	779
2048	8	1	14	25	43	688	779
2049	8	1	14	25	43	688	779
Total	297	42	513	938	1,602	25,444	28,835

3.1.1.1.2.1 Emissions Due to Harvesting Operations

The annual emissions due to harvesting operations such as felling and snigging ($E_{\text{harvest},t}$) is calculated in function of the Fuel consumption of equipment employed for felling and snigging per m3 of merchantable log harvested (FC_{harvest}), Fuel emission factor (EF_{fuel}) and the Annual volume of merchantable logs ($V_{\text{merch},t}$), according to VM0011 v1.0, equation 3-40.

$$E_{\text{harvest},t} = FC_{\text{harvest}} \times EF_{\text{fuel}} \times V_{\text{merch},t}$$

Equation 26. Annual emissions due to harvesting operations such as felling and snigging.

$E_{\text{harvest},t}$ Annual emissions due to harvesting operations such as felling and snigging in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

- FC_{harvest} Fuel consumption of equipment employed for felling and snigging per m³ of merchantable log harvested, in kL/m³.
- EF_{fuel} Fuel emission factor, in tCO₂-e/kL.
- $V_{\text{merch},t}$ Annual volume of merchantable logs in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in m³.

Fuel consumption (FC_{harvest}) for chainsaws equals 0.15 kL m⁻³ of gasoline and 0.0031 kL m⁻³ of oil according to Campos et al. (2012). The author calculated the average consumption of equipment in logging operations in the Amazon.

Table 32. Annual emissions due to harvesting operations such as felling and snigging

Year	$FC_{\text{harvest}}_{\text{gas}}$	$FC_{\text{harvest}}_{\text{oil}}$	$EF_{\text{fuel}}_{\text{gasoline}}$	$EF_{\text{fuel}}_{\text{oil}}$	$V_{\text{merch},t}$	$E_{\text{harvest},t}$
2013	0.000150	0.0000031	2.40	3.01	21,785	8
2014	0.000150	0.0000031	2.40	3.01	21,785	8
2015	0.000150	0.0000031	2.40	3.01	21,785	8
2016	0.000150	0.0000031	2.40	3.01	21,785	8
2017	0.000150	0.0000031	2.40	3.01	21,785	8
2018	0.000150	0.0000031	2.40	3.01	21,785	8
2019	0.000150	0.0000031	2.40	3.01	21,785	8
2020	0.000150	0.0000031	2.40	3.01	21,785	8
2021	0.000150	0.0000031	2.40	3.01	21,785	8
2022	0.000150	0.0000031	2.40	3.01	21,785	8
2023	0.000150	0.0000031	2.40	3.01	21,785	8
2024	0.000150	0.0000031	2.40	3.01	21,785	8
2025	0.000150	0.0000031	2.40	3.01	21,785	8
2026	0.000150	0.0000031	2.40	3.01	21,785	8
2027	0.000150	0.0000031	2.40	3.01	21,785	8
2028	0.000150	0.0000031	2.40	3.01	21,785	8
2029	0.000150	0.0000031	2.40	3.01	21,785	8
2030	0.000150	0.0000031	2.40	3.01	21,785	8
2031	0.000150	0.0000031	2.40	3.01	21,785	8
2032	0.000150	0.0000031	2.40	3.01	21,785	8
2033	0.000150	0.0000031	2.40	3.01	21,785	8
2034	0.000150	0.0000031	2.40	3.01	21,785	8
2035	0.000150	0.0000031	2.40	3.01	21,785	8
2036	0.000150	0.0000031	2.40	3.01	21,785	8
2037	0.000150	0.0000031	2.40	3.01	21,785	8
2038	0.000150	0.0000031	2.40	3.01	21,785	8

2039	0.000150	0.0000031	2.40	3.01	21,785	8
2040	0.000150	0.0000031	2.40	3.01	21,785	8
2041	0.000150	0.0000031	2.40	3.01	21,785	8
2042	0.000150	0.0000031	2.40	3.01	21,785	8
2043	0.000150	0.0000031	2.40	3.01	21,785	8
2044	0.000150	0.0000031	2.40	3.01	21,785	8
2045	0.000150	0.0000031	2.40	3.01	21,785	8
2046	0.000150	0.0000031	2.40	3.01	21,785	8
2047	0.000150	0.0000031	2.40	3.01	21,785	8
2048	0.000150	0.0000031	2.40	3.01	21,785	8
2049	0.000150	0.0000031	2.40	3.01	21,785	8

Fuel emission factor (EF_{fuel}) is calculated in function of the IPCC fuel emission factor for greenhouse gas (CO₂, CH₄ or N₂O) ($EF_{IPCCfuel_GHG}$), the heating value of fuel (HV_{fuel}) and the density of fuel (ρ_{fuel}), according to VM0011 v1.0 equation C-3.

$$E_{fuel_GHG} = \frac{EF_{IPCCfuel_GHG} \times HV_{fuel} \times \rho_{fuel}}{1000}$$

Equation 27. Fuel emission factor for the greenhouse gas (CO₂, CH₄ or N₂O).

In which:

EF_{fuel} Fuel emission factor for the greenhouse gas (CO₂, CH₄ or N₂O), in tGHG kL⁻¹.

$EF_{IPCCfuel_GHG}$ IPCC fuel emission factor for greenhouse gas (CO₂, CH₄ or N₂O), in kgGHG TJ⁻¹

HV_{fuel} Heating value of fuel, in TJ kg⁻¹.

ρ_{fuel} Density of fuel, kg kL⁻¹.

Non-CO₂ gas emission factor EF is calculated in function of the fuel emission factors for CH₄ and N₂O (EF_{CH_4} , EF_{N_2O}) and the global warming potential of methane and nitrous oxide (GWP_{CH_4} , GWP_{N_2O}), according to VM0011 v1.0, equation C-2:

$$EF = (EF_{CH_4} \times GWP_{CH_4}) + (EF_{N_2O} \times GWP_{N_2O})$$

Equation 28. Fuel emission factor (EF_{fuel}).

In which:

EF_{CH_4} Emission factor for methane gas, activity data-specific, in tCH₄

GWP_{CH_4} Global warming potential of methane, in tCO₂-e tCH₄⁻¹

EF_{N_2O} Emission factor for nitrous oxide gas, activity data-specific, in tN_2O

GWP_{N_2O} Global warming potential of nitrous oxide gas, in $tCO_2\text{-e } tN_2O^{-1}$

Table 33. Gasoline emission factor for the greenhouse gas (CO₂, CH₄, N₂O)

Gas	EFIPCCfuel_GHG_gasoline	Hvfuel_gasoline	pfuel_gasoline	GWP	Effuel_gasoline
CO ₂	69300	0.0000443	740.70	1	2.2739
CH ₄	170	0.0000443	740.70	21	0.1171
N ₂ O	0	0.0000443	740.70	310	0.0041
Total	-	-	-	-	2.3952

Table 34. Oil emission factor for the greenhouse gas (CO₂, CH₄, N₂O)

Gas	EFIPCCfuel_GHG_oil	Hvfuel_oil	pfuel_oil	GWP	Effuel_oil
CO ₂	74,100	0.0000430	843.90	1	2.6889
CH ₄	4	0.0000430	843.90	21	0.0032
N ₂ O	29	0.0000430	843.90	310	0.3217
Total	-	-	-	-	3.0138

Average merchantable logs volume per hectare in the project area ($V_{\text{merch}, j, t=0}$) equals 27.93 m³.

3.1.1.1.2.2 Emissions Due to On Site Preparations

The annual emissions due to on-site preparation such as trimming of tree heads, butts, branches and defective components ($E_{\text{onsiteprep}, t}$) is calculated in function of fuel consumption of equipment employed for trimming per m³ of trimmed material ($FC_{\text{trim_equip}}$), the fuel emission factor (EF_{fuel}) and the annual volume of the trimmings and branches produced from harvesting ($V_{\text{branch_trim}, t}$), according to VM0011 v1.0 equation 3-42:

$$E_{\text{onsiteprep}, t} = FC_{\text{trim_equip}} \times EF_{\text{fuel}} \times V_{\text{branch_trim}, t}$$

Equation 29. Emissions due to on-site preparation such as trimming of tree heads, butts, branches and defective components

In which:

$E_{\text{onsiteprep}, t}$ Annual emissions due to on-site preparation such as trimming of tree heads, butts, branches and defective components in year t (where $t=1, 2, 3, \dots$ t^* years elapsed since the start of the IFM-LtPF project activities), in $tCO_2\text{-e}$.

$FC_{\text{trim_equip}}$ Fuel consumption of equipment employed for trimming per m³ of trimmed material, in kL/m^3 .

EF_{fuel} Fuel emission factor, in tCO₂-e/kL.

$V_{branch_trim,t}$ Annual volume of the trimmings and branches produced from harvesting in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in m³.

Fuel consumption ($FC_{harvest}$) for chainsaws equals 0.15 kL m⁻³ of gasoline and 0.0031 kL m⁻³ of oil according to Campos et al. (2012). The author calculated the average consumption of equipment in logging operations in the Amazon.

Fuel emission factor (EF_{fuel}) equals 2.40 tCO₂-e/kL for gasoline and 3.01 for oil tCO₂-e/kL.

Table 35. Annual GHG emissions from gasoline consumption due to on-site preparation such as trimming of tree heads, butts, branches and defective components

Year	FC_{trim_equip}	EF_{fuel}	$V_{branch_trim,t}$	$E_{onsiteprep,t}$
2013	0.00015	2.40	3,089	1.11
2014	0.00015	2.40	3,089	1.11
2015	0.00015	2.40	3,089	1.11
2016	0.00015	2.40	3,089	1.11
2017	0.00015	2.40	3,089	1.11
2018	0.00015	2.40	3,089	1.11
2019	0.00015	2.40	3,089	1.11
2020	0.00015	2.40	3,089	1.11
2021	0.00015	2.40	3,089	1.11
2022	0.00015	2.40	3,089	1.11
2023	0.00015	2.40	3,089	1.11
2024	0.00015	2.40	3,089	1.11
2025	0.00015	2.40	3,089	1.11
2026	0.00015	2.40	3,089	1.11
2027	0.00015	2.40	3,089	1.11
2028	0.00015	2.40	3,089	1.11
2029	0.00015	2.40	3,089	1.11
2030	0.00015	2.40	3,089	1.11
2031	0.00015	2.40	3,089	1.11
2032	0.00015	2.40	3,089	1.11
2033	0.00015	2.40	3,089	1.11
2034	0.00015	2.40	3,089	1.11
2035	0.00015	2.40	3,089	1.11
2036	0.00015	2.40	3,089	1.11
2037	0.00015	2.40	3,089	1.11

2038	0.00015	2.40	3,089	1.11
2039	0.00015	2.40	3,089	1.11
2040	0.00015	2.40	3,089	1.11
2041	0.00015	2.40	3,089	1.11
2042	0.00015	2.40	3,089	1.11
2043	0.00015	2.40	3,089	1.11
2044	0.00015	2.40	3,089	1.11
2045	0.00015	2.40	3,089	1.11
2046	0.00015	2.40	3,089	1.11
2047	0.00015	2.40	3,089	1.11
2048	0.00015	2.40	3,089	1.11
2049	0.00015	2.40	3,089	1.11

Table 36. Annual GHG emissions oil consumption due to on-site preparation such as trimming of tree heads, butts, branches and defective components

Year	FC _{trim_equip}	EF _{fuel}	V _{branch_trim,t}	E _{onsiteprep,t}
2013	0.0000031	3.01	3,089	0.03
2014	0.0000031	3.01	3,089	0.03
2015	0.0000031	3.01	3,089	0.03
2016	0.0000031	3.01	3,089	0.03
2017	0.0000031	3.01	3,089	0.03
2018	0.0000031	3.01	3,089	0.03
2019	0.0000031	3.01	3,089	0.03
2020	0.0000031	3.01	3,089	0.03
2021	0.0000031	3.01	3,089	0.03
2022	0.0000031	3.01	3,089	0.03
2023	0.0000031	3.01	3,089	0.03
2024	0.0000031	3.01	3,089	0.03
2025	0.0000031	3.01	3,089	0.03
2026	0.0000031	3.01	3,089	0.03
2027	0.0000031	3.01	3,089	0.03
2028	0.0000031	3.01	3,089	0.03
2029	0.0000031	3.01	3,089	0.03
2030	0.0000031	3.01	3,089	0.03
2031	0.0000031	3.01	3,089	0.03
2032	0.0000031	3.01	3,089	0.03
2033	0.0000031	3.01	3,089	0.03
2034	0.0000031	3.01	3,089	0.03

2035	0.0000031	3.01	3,089	0.03
2036	0.0000031	3.01	3,089	0.03
2037	0.0000031	3.01	3,089	0.03
2038	0.0000031	3.01	3,089	0.03
2039	0.0000031	3.01	3,089	0.03
2040	0.0000031	3.01	3,089	0.03
2041	0.0000031	3.01	3,089	0.03
2042	0.0000031	3.01	3,089	0.03
2043	0.0000031	3.01	3,089	0.03
2044	0.0000031	3.01	3,089	0.03
2045	0.0000031	3.01	3,089	0.03
2046	0.0000031	3.01	3,089	0.03
2047	0.0000031	3.01	3,089	0.03
2048	0.0000031	3.01	3,089	0.03
2049	0.0000031	3.01	3,089	0.03

Annual volume of the trimmings and branches produced from harvesting ($V_{branch_trim,t}$) is calculated in function of the annual carbon in branches and trimmings left over from harvesting ($C_{branch_trim,t}$), the carbon fraction of wood for the tropical forest (CF_{wood}) and the wood density for the tropical forest with corresponding climate region and ecological zone (D), according to VM0011 v1.0 equation 3-41:

$$V_{branch_trim,t} = \frac{C_{branch_trim,t}}{CF_{wood} \times D}$$

Equation 30. Annual volume of the trimmings and branches produced from harvesting.

In which

- $V_{branch_trim,t}$ Annual volume of the trimmings and branches produced from harvesting in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in m^3 .
- $C_{branch_trim,t}$ Annual carbon in branches and trimmings left over from harvesting in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tC .
- CF_{wood} Carbon fraction of wood for the tropical forest, in $tC/(t.d.m.)$.
- D Wood density for the tropical forest with corresponding climate region and ecological zone, in $(t.d.m.)/m^3$.

Annual carbon in branches and trimmings left over from harvesting ($C_{branch_trim,t}$) is 2,238.26 m^3 .

Carbon fraction of wood for the tropical forest (CF_{wood}) is 0.49.

Wood density for the tropical forest is 0.68 (t d.m.)/m³.

Table 37. Annual volume of the trimmings and branches produced from harvesting

Year	C _{branch _ trim,t}	CF _{wood}	D	V _{branch _ trim,t}
2013	2,238	0.49	0.68	3,089
2014	2,238	0.49	0.68	3,089
2015	2,238	0.49	0.68	3,089
2016	2,238	0.49	0.68	3,089
2017	2,238	0.49	0.68	3,089
2018	2,238	0.49	0.68	3,089
2019	2,238	0.49	0.68	3,089
2020	2,238	0.49	0.68	3,089
2021	2,238	0.49	0.68	3,089
2022	2,238	0.49	0.68	3,089
2023	2,238	0.49	0.68	3,089
2024	2,238	0.49	0.68	3,089
2025	2,238	0.49	0.68	3,089
2026	2,238	0.49	0.68	3,089
2027	2,238	0.49	0.68	3,089
2028	2,238	0.49	0.68	3,089
2029	2,238	0.49	0.68	3,089
2030	2,238	0.49	0.68	3,089
2031	2,238	0.49	0.68	3,089
2032	2,238	0.49	0.68	3,089
2033	2,238	0.49	0.68	3,089
2034	2,238	0.49	0.68	3,089
2035	2,238	0.49	0.68	3,089
2036	2,238	0.49	0.68	3,089
2037	2,238	0.49	0.68	3,089
2038	2,238	0.49	0.68	3,089
2039	2,238	0.49	0.68	3,089
2040	2,238	0.49	0.68	3,089
2041	2,238	0.49	0.68	3,089
2042	2,238	0.49	0.68	3,089
2043	2,238	0.49	0.68	3,089
2044	2,238	0.49	0.68	3,089
2045	2,238	0.49	0.68	3,089
2046	2,238	0.49	0.68	3,089
2047	2,238	0.49	0.68	3,089

2048	2,238	0.49	0.68	3,089
2049	2,238	0.49	0.68	3,089

3.1.1.1.2.3 Emissions Due to On Log Hauling

The annual emissions due to log hauling ($E_{hauling,t}$) is calculated in function of the fuel consumption of equipment for hauling per m³ of merchantable log ($FC_{hauling}$), the fuel emission factor (EF_{fuel}) and the annual volume of merchantable logs ($V_{merch,t}$), according to VM0011 v1.0, equation 3-43.

$$E_{hauling,t} = FC_{hauling} \times EF_{fuel} \times V_{merch,t}$$

Equation 31. Annual emissions due to log hauling.

In which:

$E_{hauling,t}$ Annual emissions due to log hauling in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

$FC_{hauling}$ Fuel consumption of equipment for hauling per m³ of merchantable log, in kL/m³.

EF_{fuel} Fuel emission factor, in tCO₂-e/kL.

$V_{merch,t}$ Annual volume of merchantable logs in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in m³.

Fuel consumption ($FC_{hauling}$) of the skidder equals 2.11x10⁻⁴ kL/m³ according to Smidt & Gallanger S/A (Manufacturer).

Fuel emission factor (EF_{fuel}) is 3.01 tCO₂-e/kL.

Annual volume of merchantable logs ($V_{merch,t}$) is 21,785.40 m³.

Table 38. Annual emissions due to log hauling

Year	$FC_{hauling}$	EF_{fuel}	$V_{merch,t}$	$E_{hauling,t}$
2013	0.00021	3.01	21,785	13.85
2014	0.00021	3.01	21,785	13.85
2015	0.00021	3.01	21,785	13.85
2016	0.00021	3.01	21,785	13.85
2017	0.00021	3.01	21,785	13.85
2018	0.00021	3.01	21,785	13.85
2019	0.00021	3.01	21,785	13.85
2020	0.00021	3.01	21,785	13.85
2021	0.00021	3.01	21,785	13.85
2022	0.00021	3.01	21,785	13.85
2023	0.00021	3.01	21,785	13.85

2024	0.00021	3.01	21,785	13.85
2025	0.00021	3.01	21,785	13.85
2026	0.00021	3.01	21,785	13.85
2027	0.00021	3.01	21,785	13.85
2028	0.00021	3.01	21,785	13.85
2029	0.00021	3.01	21,785	13.85
2030	0.00021	3.01	21,785	13.85
2031	0.00021	3.01	21,785	13.85
2032	0.00021	3.01	21,785	13.85
2033	0.00021	3.01	21,785	13.85
2034	0.00021	3.01	21,785	13.85
2035	0.00021	3.01	21,785	13.85
2036	0.00021	3.01	21,785	13.85
2037	0.00021	3.01	21,785	13.85
2038	0.00021	3.01	21,785	13.85
2039	0.00021	3.01	21,785	13.85
2040	0.00021	3.01	21,785	13.85
2041	0.00021	3.01	21,785	13.85
2042	0.00021	3.01	21,785	13.85
2043	0.00021	3.01	21,785	13.85
2044	0.00021	3.01	21,785	13.85
2045	0.00021	3.01	21,785	13.85
2046	0.00021	3.01	21,785	13.85
2047	0.00021	3.01	21,785	13.85
2048	0.00021	3.01	21,785	13.85
2049	0.00021	3.01	21,785	13.85

3.1.1.1.2.4 Emissions Due to On Log Transport

The annual emissions due to log transport haulage from felling location to the collection depot/sawmill ($E_{transport,t}$) is calculated in function of the annual total log transport distance ($KM_{transport_total,t}$), the fuel efficiency ($Eff_{vehicle}$) and the fuel emission factor (EF_{fuel}), according to VM0011 v1.0, equation 3-46.

$$E_{transport,t} = \frac{KM_{transport_total,t}}{Eff_{vehicle}} \times EF_{fuel}$$

Equation 32. Annual emissions due to log transport haulage from felling location to the collection depot/sawmill.

In which:

$E_{transport,t}$	Annual emissions due to log transport haulage from felling location to the collection depot/sawmill in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO ₂ -e.
$KM_{transport_total,t}$	Annual total log transport distance in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in km.
$Eff_{vehicle}$	Fuel efficiency for vehicle type, in km per kL.
EF_{fuel}	Fuel emission factor, in tCO ₂ -e/kL.

Table 39. Annual emissions due to log transport haulage from felling location to the collection depot/sawmill by trucks

Year	$KM_{transport_total,t_truck}$	$Eff_{vehicle_truck}$	EF_{fuel}	$E_{transport,t_truck}$
2013	959	2000	3.01	1.44
2014	959	2000	3.01	1.44
2015	959	2000	3.01	1.44
2016	959	2000	3.01	1.44
2017	959	2000	3.01	1.44
2018	959	2000	3.01	1.44
2019	959	2000	3.01	1.44
2020	959	2000	3.01	1.44
2021	959	2000	3.01	1.44
2022	959	2000	3.01	1.44
2023	959	2000	3.01	1.44
2024	959	2000	3.01	1.44
2025	959	2000	3.01	1.44
2026	959	2000	3.01	1.44
2027	959	2000	3.01	1.44
2028	959	2000	3.01	1.44
2029	959	2000	3.01	1.44
2030	959	2000	3.01	1.44
2031	959	2000	3.01	1.44
2032	959	2000	3.01	1.44
2033	959	2000	3.01	1.44
2034	959	2000	3.01	1.44
2035	959	2000	3.01	1.44
2036	959	2000	3.01	1.44
2037	959	2000	3.01	1.44
2038	959	2000	3.01	1.44
2039	959	2000	3.01	1.44

2040	959	2000	3.01	1.44
2041	959	2000	3.01	1.44
2042	959	2000	3.01	1.44
2043	959	2000	3.01	1.44
2044	959	2000	3.01	1.44
2045	959	2000	3.01	1.44
2046	959	2000	3.01	1.44
2047	959	2000	3.01	1.44
2048	959	2000	3.01	1.44
2049	959	2000	3.01	1.44

Table 40. Annual emissions due to log transport haulage from felling location to the collection depot/sawmill, by ferrys

Year	KM _{transport_total,t_ferry}	Eff _{vehicle_ferry}	EF _{fuel}	E _{hauling,t} E _{transport,t_ferry}
2013	29,890	3,770	3.01	23.89
2014	29,890	3,770	3.01	23.89
2015	29,890	3,770	3.01	23.89
2016	29,890	3,770	3.01	23.89
2017	29,890	3,770	3.01	23.89
2018	29,890	3,770	3.01	23.89
2019	29,890	3,770	3.01	23.89
2020	29,890	3,770	3.01	23.89
2021	29,890	3,770	3.01	23.89
2022	29,890	3,770	3.01	23.89
2023	29,890	3,770	3.01	23.89
2024	29,890	3,770	3.01	23.89
2025	29,890	3,770	3.01	23.89
2026	29,890	3,770	3.01	23.89
2027	29,890	3,770	3.01	23.89
2028	29,890	3,770	3.01	23.89
2029	29,890	3,770	3.01	23.89
2030	29,890	3,770	3.01	23.89
2031	29,890	3,770	3.01	23.89
2032	29,890	3,770	3.01	23.89
2033	29,890	3,770	3.01	23.89
2034	29,890	3,770	3.01	23.89
2035	29,890	3,770	3.01	23.89

2036	29,890	3,770	3.01	23.89
2037	29,890	3,770	3.01	23.89
2038	29,890	3,770	3.01	23.89
2039	29,890	3,770	3.01	23.89
2040	29,890	3,770	3.01	23.89
2041	29,890	3,770	3.01	23.89
2042	29,890	3,770	3.01	23.89
2043	29,890	3,770	3.01	23.89
2044	29,890	3,770	3.01	23.89
2045	29,890	3,770	3.01	23.89
2046	29,890	3,770	3.01	23.89
2047	29,890	3,770	3.01	23.89
2048	29,890	3,770	3.01	23.89
2049	29,890	3,770	3.01	23.89

The annual total log transport distance ($KM_{transport_total,t}$) is calculated in function of the Annual log transport distance from collection depot to processing location ($KM_{transport,t}$), the number of transportation vehicle trips required for log transport from collection depot to processing plant ($N_{trucks_transport,t}$), and the constant (2), indicating return trip, according to VM0011 v1.0 equation 3-45:

$$KM_{transport_total,t} = KM_{transport,t} \times N_{trucks_transport,t} \times 2$$

Equation 33. Annual total log transport distance.

In which:

$KM_{transport_total,t}$ Annual total log transport distance in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in km.

$KM_{transport,t}$ Annual log transport distance from collection depot to processing location in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in km per transportation vehicle.

$N_{trucks_transport,t}$ Number of transportation vehicle trips required for log transport from collection depot to processing plant in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in number of trucks/ferries.

2 Constant, indicating return trip. Dimensionless.

Table 41. Annual total log transport distance

Year	KMtransport _t_truck	KMtransport,t_ ferry	Ntrucks_transpo rt,t_truck	Ntrucks_transport, t_ferry	Constant (return trip)	KMtransport_to tal,t_truck	KMtransport_to tal,t_ferry
2013	33	350	15	43	2	959	29,890
2014	33	350	15	43	2	959	29,890
2015	33	350	15	43	2	959	29,890
2016	33	350	15	43	2	959	29,890
2017	33	350	15	43	2	959	29,890
2018	33	350	15	43	2	959	29,890
2019	33	350	15	43	2	959	29,890
2020	33	350	15	43	2	959	29,890
2021	33	350	15	43	2	959	29,890
2022	33	350	15	43	2	959	29,890
2023	33	350	15	43	2	959	29,890
2024	33	350	15	43	2	959	29,890
2025	33	350	15	43	2	959	29,890
2026	33	350	15	43	2	959	29,890
2027	33	350	15	43	2	959	29,890
2028	33	350	15	43	2	959	29,890
2029	33	350	15	43	2	959	29,890
2030	33	350	15	43	2	959	29,890
2031	33	350	15	43	2	959	29,890
2032	33	350	15	43	2	959	29,890
2033	33	350	15	43	2	959	29,890
2034	33	350	15	43	2	959	29,890
2035	33	350	15	43	2	959	29,890
2036	33	350	15	43	2	959	29,890
2037	33	350	15	43	2	959	29,890
2038	33	350	15	43	2	959	29,890
2039	33	350	15	43	2	959	29,890
2040	33	350	15	43	2	959	29,890
2041	33	350	15	43	2	959	29,890
2042	33	350	15	43	2	959	29,890
2043	33	350	15	43	2	959	29,890
2044	33	350	15	43	2	959	29,890
2045	33	350	15	43	2	959	29,890
2046	33	350	15	43	2	959	29,890
2047	33	350	15	43	2	959	29,890

2048	33	350	15	43	2	959	29,890
2049	33	350	15	43	2	959	29,890

The number of transportation vehicle trips required for log transport from collection depot to processing plant ($N_{trucks_transport,t}$) is calculated in function of the annual volume of merchantable logs ($V_{merch,t}$) and the truck load capacity (Cap_{truck}), according to VM0011 v1.0 equation 3-44:

$$N_{trucks_transport,t} = \frac{V_{merch,t}}{Cap_{truck}}$$

Equation 34. Number of truck trips required for log transport from collection depot to processing sites.

In which:

$N_{trucks_transport,t}$ Number of truck trips required for log transport from collection depot to processing sites in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in number of trucks/ferries.

$V_{merch,t}$ Annual volume of merchantable logs in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in m3.

Cap_{truck} Truck load capacity, in m3 per truck/ferry.

Table 42. Number of truck trips required for log transport from collection depot to processing sites

Year	V_{merch,t_truck}	V_{merch,t_ferry}	Cap_{truck_truck}	Cap_{truck_ferry}	$N_{trucks_transport,t_truck}$	$N_{trucks_transport,t_ferry}$
2013	436	21,350	30	500	15	43
2014	436	21,350	30	500	15	43
2015	436	21,350	30	500	15	43
2016	436	21,350	30	500	15	43
2017	436	21,350	30	500	15	43
2018	436	21,350	30	500	15	43
2019	436	21,350	30	500	15	43
2020	436	21,350	30	500	15	43
2021	436	21,350	30	500	15	43
2022	436	21,350	30	500	15	43
2023	436	21,350	30	500	15	43
2024	436	21,350	30	500	15	43
2025	436	21,350	30	500	15	43
2026	436	21,350	30	500	15	43
2027	436	21,350	30	500	15	43

2028	436	21,350	30	500	15	43
2029	436	21,350	30	500	15	43
2030	436	21,350	30	500	15	43
2031	436	21,350	30	500	15	43
2032	436	21,350	30	500	15	43
2033	436	21,350	30	500	15	43
2034	436	21,350	30	500	15	43
2035	436	21,350	30	500	15	43
2036	436	21,350	30	500	15	43
2037	436	21,350	30	500	15	43
2038	436	21,350	30	500	15	43
2039	436	21,350	30	500	15	43
2040	436	21,350	30	500	15	43
2041	436	21,350	30	500	15	43
2042	436	21,350	30	500	15	43
2043	436	21,350	30	500	15	43
2044	436	21,350	30	500	15	43
2045	436	21,350	30	500	15	43
2046	436	21,350	30	500	15	43
2047	436	21,350	30	500	15	43
2048	436	21,350	30	500	15	43
2049	436	21,350	30	500	15	43

Annual volume of merchantable logs transported by trucks is 436 m³ and by ferrys is 21,350 m³.

The truck load capacity equals 30 m³ and the ferrys capacity equals 500 m³.

The annual log transport distance from collection depot to processing location for trucks is 33 Km (30 Km from the forest to the sawmill in Manicore) for ferrys is 350 Km (from the forest to Itacoatiara port).

The fuel efficiency for truck is 2000 Km/KL and for ferry is 3770 Km/KL according to, Barros & Uhl (1997).

The fuel emission factor is 3.01 in tCO₂-e/KL.

3.1.1.1.2.5 Emissions Due to Timber Processing where Grid Electricity is Available

The annual emissions due to electricity consumption in sawmill ($E_{\text{processing},t}$) is calculated in function of the annual quantity of electricity consumption for processing ($Q_{\text{processing},t}$) and the electricity emission factor for the host country ($EF_{\text{electricity}}$), according to VM0011 v1.0 equation 3-48:

$$E_{\text{processing},t} = Q_{\text{processing},t} \times EF_{\text{electricity}}$$

Equation 35. Annual emissions due to electricity consumption in sawmill.

In which:

$E_{\text{processing},t}$ Annual emissions due to electricity consumption in sawmill in year t (where $t=1,2,3\dots t^*$ years elapsed since the start of the IFM-LtPF project activities), in $t\text{CO}_2\text{-e}$.

$Q_{\text{processing},t}$ Annual quantity of electricity consumption for processing in year t , (where $t=1,2,3\dots t^*$ years elapsed since the start of the IFM-LtPF project activities), in kWh.

$EF_{\text{electricity}}$ Electricity emission factor for the host country, in $t\text{CO}_2\text{-e}$ in kWh.

Table 43. Annual emissions due to electricity consumption in sawmill

Year	$Q_{\text{processing},t}$	$EF_{\text{electricity}}$	$E_{\text{processing},t}$
2013	435,708	0.000096	41.83
2014	435,708	0.000136	59.04
2015	435,708	0.000124	54.20
2016	435,708	0.000082	35.60
2017	435,708	0.000093	40.39
2018	435,708	0.000074	32.24
2019	435,708	0.000075	32.68
2020	435,708	0.000062	26.88
2021	435,708	0.000126	55.07
2022	435,708	0.000126	55.07
2023	435,708	0.000099	43.30
2024	435,708	0.000099	43.30
2025	435,708	0.000099	43.30
2026	435,708	0.000099	43.30
2027	435,708	0.000099	43.30
2028	435,708	0.000099	43.30
2029	435,708	0.000099	43.30
2030	435,708	0.000099	43.30
2031	435,708	0.000099	43.30
2032	435,708	0.000099	43.30
2033	435,708	0.000099	43.30
2034	435,708	0.000099	43.30
2035	435,708	0.000099	43.30
2036	435,708	0.000099	43.30
2037	435,708	0.000099	43.30

2038	435,708	0.000099	43.30
2039	435,708	0.000099	43.30
2040	435,708	0.000099	43.30
2041	435,708	0.000099	43.30
2042	435,708	0.000099	43.30
2043	435,708	0.000099	43.30
2044	435,708	0.000099	43.30
2045	435,708	0.000099	43.30
2046	435,708	0.000099	43.30
2047	435,708	0.000099	43.30
2048	435,708	0.000099	43.30
2049	435,708	0.000099	43.30

The annual quantity of electricity consumption for processing ($Q_{\text{processing},t}$) is calculated in function of the annual volume of merchantable logs ($V_{\text{merch},t}$) and the electricity demand for processing per volume processed (E_{demand}), according to VM0011 v1.0, equation 3-47:

$$Q_{\text{processing},t} = V_{\text{merch},t} \times e_{\text{demand}}$$

Equation 36. Annual quantity of electricity consumption for processing.

In which:

$Q_{\text{processing},t}$ Annual quantity of electricity consumption for processing in year t (where t=1,2,3... ... t*years elapsed since the start of the IFM-LtPF project activities), in kWh.

$V_{\text{merch},t}$ Annual volume of merchantable logs in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in m3.

E_{demand} Electricity demand for processing per volume processed, in kWh m3.

Table 44. Annual quantity of electricity consumption for processing in year

Year	$V_{\text{merch},t}$	E_{demand}	$Q_{\text{processing},t}$
2013	21,785	20	435,708
2014	21,785	20	435,708
2015	21,785	20	435,708
2016	21,785	20	435,708
2017	21,785	20	435,708
2018	21,785	20	435,708
2019	21,785	20	435,708
2020	21,785	20	435,708
2021	21,785	20	435,708

2022	21,785	20	435,708
2023	21,785	20	435,708
2024	21,785	20	435,708
2025	21,785	20	435,708
2026	21,785	20	435,708
2027	21,785	20	435,708
2028	21,785	20	435,708
2029	21,785	20	435,708
2030	21,785	20	435,708
2031	21,785	20	435,708
2032	21,785	20	435,708
2033	21,785	20	435,708
2034	21,785	20	435,708
2035	21,785	20	435,708
2036	21,785	20	435,708
2037	21,785	20	435,708
2038	21,785	20	435,708
2039	21,785	20	435,708
2040	21,785	20	435,708
2041	21,785	20	435,708
2042	21,785	20	435,708
2043	21,785	20	435,708
2044	21,785	20	435,708
2045	21,785	20	435,708
2046	21,785	20	435,708
2047	21,785	20	435,708
2048	21,785	20	435,708
2049	21,785	20	435,708

The annual volume of merchantable logs ($V_{\text{merch},t}$) is 21,785.40 m³.

The electricity demand for for sawmill processing in Brasil (E_{demand}) is 20 kWh m⁻³, according to Poole and Pinheiro (2003).

Electricity emission factor ($EF_{\text{electricity}}$) for Brazil varies per year and is given by MCTIC.

3.1.1.1.2.6 Emissions Due to Log Distribution

The annual emissions due to log transport haulage from felling location to the collection depot/sawmill ($E_{\text{transport},t}$) is calculated in function of the annual total log transport distance ($KM_{\text{transport_total},t}$), the fuel efficiency (Eff_{vehicle}) and the fuel emission factor (EF_{fuel}), according to VM0011 v1.0, equation 3-54.

$$E_{distribution,t} = \frac{KM_{distribution_total,t}}{Eff_{vehicle}} \times EF_{fuel}$$

Equation 37. Annual emissions due to log distribution.

In which:

$E_{distribution,t}$ Annual emissions due to transport of the sawn product from the mill to the wharf for export or to the depot for local usage in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

$KM_{distribution_total,t}$ Annual total log distribution distance in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in km.

$Eff_{vehicle}$ Fuel efficiency for vehicle type, in km per kL.

EF_{fuel} Fuel emission factor, in tCO₂-e/kL.

Table 45. Annual emissions due to log distribution

Year	$KM_{distribution_total,t}$	$Eff_{vehicle}$	EF_{fuel}	$E_{distribution,t}$
2013	57,044	250	3.01	688
2014	57,044	250	3.01	688
2015	57,044	250	3.01	688
2016	57,044	250	3.01	688
2017	57,044	250	3.01	688
2018	57,044	250	3.01	688
2019	57,044	250	3.01	688
2020	57,044	250	3.01	688
2021	57,044	250	3.01	688
2022	57,044	250	3.01	688
2023	57,044	250	3.01	688
2024	57,044	250	3.01	688
2025	57,044	250	3.01	688
2026	57,044	250	3.01	688
2027	57,044	250	3.01	688
2028	57,044	250	3.01	688
2029	57,044	250	3.01	688
2030	57,044	250	3.01	688
2031	57,044	250	3.01	688
2032	57,044	250	3.01	688
2033	57,044	250	3.01	688

2034	57,044	250	3.01	688
2035	57,044	250	3.01	688
2036	57,044	250	3.01	688
2037	57,044	250	3.01	688
2038	57,044	250	3.01	688
2039	57,044	250	3.01	688
2040	57,044	250	3.01	688
2041	57,044	250	3.01	688
2042	57,044	250	3.01	688
2043	57,044	250	3.01	688
2044	57,044	250	3.01	688
2045	57,044	250	3.01	688
2046	57,044	250	3.01	688
2047	57,044	250	3.01	688
2048	57,044	250	3.01	688
2049	57,044	250	3.01	688

The annual total distance ($KM_{distribtotal,t}$) is calculated in function of the annual distance from point of processing to distribution/export point ($KM_{distrib,t}$), the number of transportation vehicle trips required for log transport from collection depot to processing plant ($N_{trucks_distrib,t}$), and the constant (2), indicating return trip, according to VM0011 v1.0 equation 3-53:

$$KM_{distribtotal,t} = KM_{distrib,t} \times N_{trucks_distrib,t} \times 2$$

Equation 38. Annual total log distribution distance.

In which:

$KM_{distribtotal,t}$ Annual total log distribution distance in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in km.

$KM_{distrib,t}$ Annual log distribution distance from point of processing to distribution/export point in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in km per transportation vehicle.

$N_{trucks_distrib,t}$ Number of transportation vehicle trips required for log distribution from point of processing to distribution/export point in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in number of trucks/ferries.

2 Constant, indicating return trip. Dimensionless.

Table 46. Annual total log distribution distance

Year	KM _{distrib,t}	N _{trucks_transport,t}	Constant (return trip)	KM _{distribtotal,t}
2013	6,090	5	2	57,044
2014	6,090	5	2	57,044
2015	6,090	5	2	57,044
2016	6,090	5	2	57,044
2017	6,090	5	2	57,044
2018	6,090	5	2	57,044
2019	6,090	5	2	57,044
2020	6,090	5	2	57,044
2021	6,090	5	2	57,044
2022	6,090	5	2	57,044
2023	6,090	5	2	57,044
2024	6,090	5	2	57,044
2025	6,090	5	2	57,044
2026	6,090	5	2	57,044
2027	6,090	5	2	57,044
2028	6,090	5	2	57,044
2029	6,090	5	2	57,044
2030	6,090	5	2	57,044
2031	6,090	5	2	57,044
2032	6,090	5	2	57,044
2033	6,090	5	2	57,044
2034	6,090	5	2	57,044
2035	6,090	5	2	57,044
2036	6,090	5	2	57,044
2037	6,090	5	2	57,044
2038	6,090	5	2	57,044
2039	6,090	5	2	57,044
2040	6,090	5	2	57,044
2041	6,090	5	2	57,044
2042	6,090	5	2	57,044
2043	6,090	5	2	57,044
2044	6,090	5	2	57,044
2045	6,090	5	2	57,044
2046	6,090	5	2	57,044
2047	6,090	5	2	57,044
2048	6,090	5	2	57,044
2049	6,090	5	2	57,044

The number of transportation vehicle trips required for log distribution from processing plant to distribution/export point ($N_{trucks_distrib,t}$) is calculated in function of the annual volume of volume of long-term harvested wood products ($V_{ltHWP,t}$) and the truck load capacity (Cap_{truck}), according to VM0011 v1.0 equation 3-52:

$$N_{trucks_distrib,t} = \frac{V_{ltHWP,t}}{Cap_{truck}}$$

Equation 39. Number of truck trips required for log distribution.

In which:

$N_{trucks_distrib,t}$ Number of truck trips required for log distribution from point of processing to distribution/export point in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in number of trucks/ferries.

$V_{ltHWP,t}$ Annual volume of merchantable logs in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in m3.

Cap_{truck} Truck load capacity, in m3 per boat.

Table 47. Number of boat trips required for log distribution

Year	$V_{ltHWP,t}$	Cap_{truck_boat}	$N_{trucks_transport,t_boat}$
2013	4,683	1,000	5
2014	4,683	1,000	5
2015	4,683	1,000	5
2016	4,683	1,000	5
2017	4,683	1,000	5
2018	4,683	1,000	5
2019	4,683	1,000	5
2020	4,683	1,000	5
2021	4,683	1,000	5
2022	4,683	1,000	5
2023	4,683	1,000	5
2024	4,683	1,000	5
2025	4,683	1,000	5
2026	4,683	1,000	5
2027	4,683	1,000	5
2028	4,683	1,000	5
2029	4,683	1,000	5
2030	4,683	1,000	5
2031	4,683	1,000	5

2032	4,683	1,000	5
2033	4,683	1,000	5
2034	4,683	1,000	5
2035	4,683	1,000	5
2036	4,683	1,000	5
2037	4,683	1,000	5
2038	4,683	1,000	5
2039	4,683	1,000	5
2040	4,683	1,000	5
2041	4,683	1,000	5
2042	4,683	1,000	5
2043	4,683	1,000	5
2044	4,683	1,000	5
2045	4,683	1,000	5
2046	4,683	1,000	5
2047	4,683	1,000	5
2048	4,683	1,000	5
2049	4,683	1,000	5

Annual volume of merchantable logs transported by boat is 21,350 m³.

The boat capacity equals 1,000 m³.

The annual log distribution distance from point of processing to distribution/export point is 6,090 Km (average distribution distance between the ports of Manicoré-Santos, Manicoré-Paranaguá and Manicoré-Itajaí).

The fuel efficiency for boat is 250 Km/KL.

The fuel emission factor is 3.01 in tCO₂-e/kL.

Annual volume of long-term harvested wood products from harvesting ($V_{ltHWP,t}$) is calculated in function of the annual carbon input to the long-term harvested wood products pool from sawlog ($C_{ltHWP_m,t}$), the carbon fraction of wood for the tropical forest (CF_{wood}) and the wood density for the tropical forest with corresponding climate region and ecological zone (D), according to VM0011 v1.0 equation 3-51:

$$V_{ltHWP,t} = \frac{C_{ltHWP_m,t}}{D \times CF_{wood}}$$

Equation 40. Annual volume of long-term harvested wood products.

In which

$V_{ItHWP,t}$	Annual volume of the long-term harvested wood products from harvesting in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in m^3 .
$C_{ItHWP,t}$	Annual carbon in long-term harvested wood products from harvesting in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tC .
CF_{wood}	Carbon fraction of wood for the tropical forest, in $tC/(t.d.m.)$.
D	Wood density for the tropical forest with corresponding climate region and ecological zone, in $(t d.m.)/m^3$.

Annual carbon in long-term harvested wood products from harvesting ($C_{ItHWP,t}$) is $3,393.49 m^3$.

Carbon fraction of wood for the tropical forest (CF_{wood}) is 0.49.

Wood density for the tropical forest is $0.68 (t d.m.)/m^3$.

Table 48. Annual volume of the long-term harvested wood products from harvesting

Year	$C_{ItHWP,t}$	CF_{wood}	D	$V_{ItHWP,t}$
2013	3,393	0.49	0.68	4,683
2014	3,393	0.49	0.68	4,683
2015	3,393	0.49	0.68	4,683
2016	3,393	0.49	0.68	4,683
2017	3,393	0.49	0.68	4,683
2018	3,393	0.49	0.68	4,683
2019	3,393	0.49	0.68	4,683
2020	3,393	0.49	0.68	4,683
2021	3,393	0.49	0.68	4,683
2022	3,393	0.49	0.68	4,683
2023	3,393	0.49	0.68	4,683
2024	3,393	0.49	0.68	4,683
2025	3,393	0.49	0.68	4,683
2026	3,393	0.49	0.68	4,683
2027	3,393	0.49	0.68	4,683
2028	3,393	0.49	0.68	4,683
2029	3,393	0.49	0.68	4,683
2030	3,393	0.49	0.68	4,683
2031	3,393	0.49	0.68	4,683
2032	3,393	0.49	0.68	4,683
2033	3,393	0.49	0.68	4,683

2034	3,393	0.49	0.68	4,683
2035	3,393	0.49	0.68	4,683
2036	3,393	0.49	0.68	4,683
2037	3,393	0.49	0.68	4,683
2038	3,393	0.49	0.68	4,683
2039	3,393	0.49	0.68	4,683
2040	3,393	0.49	0.68	4,683
2041	3,393	0.49	0.68	4,683
2042	3,393	0.49	0.68	4,683
2043	3,393	0.49	0.68	4,683
2044	3,393	0.49	0.68	4,683
2045	3,393	0.49	0.68	4,683
2046	3,393	0.49	0.68	4,683
2047	3,393	0.49	0.68	4,683
2048	3,393	0.49	0.68	4,683
2049	3,393	0.49	0.68	4,683

^[1] See section 3.2.1.1.1.1.1.

^[2] See section 3.2.1.1.1.1.1.

3.2 Net Positive Climate Impacts

3.2.1 With-Project Estimated Greenhouse Gas Emissions (CL2.1)

3.2.1.1 Project Emissions

The annual total carbon emissions associated with the project activity ($C'_{actual,t}$) is calculated in function of the annual emissions due to administration and project planning ($E_{projplan,t}$), annual emissions from travel for design and set up ($E_{design,t}$), annual emissions due to monitoring for field work ($E_{monitoring,t}$), annual carbon losses due to natural disturbances ($C_{natdisturb,t}$), annual carbon losses due to illegal harvesting ($C_{illegal_harvest,t}$) and the ratio of molecular weight of carbon dioxide to carbon (44/12), according to VM0011 v1.0 equation 4-1:

$$C'_{actual,t} = E_{projplan,t} + E_{design,t} + E_{monitoring,t} + \left[(C_{natdisturb,t} + C_{illegal_harvest,t}) \times \frac{44}{12} \right]$$

Equation 41. Annual carbon emissions associated with the project activity.

In which:

$C'_{actual,t}$	Annual total carbon emissions associated with the project activity in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO ₂ -e.
$E_{projplan,t}$	Annual emissions due to administration and project planning in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO ₂ -e.
$E_{design,t}$	Annual emissions from travel for design and set up in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO ₂ -e.
$E_{monitoring,t}$	Annual emissions due to monitoring for field work in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO ₂ -e.
$C_{natdisturb,t}$	Annual carbon losses due to natural disturbances in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tC.
$C_{illegal_harvest,t}$	Annual carbon losses due to illegal harvesting in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tC.
44/12	The ratio of molecular weight of carbon dioxide to carbon, in tCO ₂ -e tC.

Table 49. Annual volume of the long-term harvested wood products from harvesting

Year	$E_{projplan,t}$	$E_{design,t}$	$E_{monitoring,t}$	$C_{natdisturb,t}$	$C_{illegal_harvest,t}$	$C'_{actual,t}$
2013	0.39	-	58.18	-	-	58.57
2014	0.37	-	8.48	-	-	8.84
2015	0.28	-	9.86	-	-	10.14
2016	0.08	-	34.03	-	-	34.11
2017	-	-	-	-	-	-
2018	-	-	-	-	-	-
2019	-	-	-	-	-	-
2020	-	-	0.77	-	-	0.77
2021	-	-	10.81	-	-	10.81
2022	0.55	-	62.36	-	-	62.90
2023	0.17	-	18.45	-	-	18.61
2024	0.17	-	18.45	-	-	18.61
2025	0.17	-	18.45	-	-	18.61
2026	0.17	-	18.45	-	-	18.61
2027	0.17	-	18.45	-	-	18.61
2028	0.17	-	18.45	-	-	18.61
2029	0.17	-	18.45	-	-	18.61
2030	0.17	-	18.45	-	-	18.61
2031	0.17	-	18.45	-	-	18.61

2032	0.17	-	18.45	-	-	18.61
2033	0.17	-	18.45	-	-	18.61
2034	0.17	-	18.45	-	-	18.61
2035	0.17	-	18.45	-	-	18.61
2036	0.17	-	18.45	-	-	18.61
2037	0.17	-	18.45	-	-	18.61
2038	0.17	-	18.45	-	-	18.61
2039	0.17	-	18.45	-	-	18.61
2040	0.17	-	18.45	-	-	18.61
2041	0.17	-	18.45	-	-	18.61
2042	0.17	-	18.45	-	-	18.61
2043	0.17	-	18.45	-	-	18.61
2044	0.17	-	18.45	-	-	18.61
2045	0.17	-	18.45	-	-	18.61
2046	0.17	-	18.45	-	-	18.61
2047	0.17	-	18.45	-	-	18.61
2048	0.17	-	18.45	-	-	18.61
2049	0.17	-	18.45	-	-	18.61
Total	1.67	-	184.48	-	-	186.14

3.2.1.1.1 Emissions Due to Project Planning

The annual emissions due to administration and project planning ($E_{projplan,t}$) is calculated in function of the annual emissions due to electricity consumption required for administration of the project activity ($E_{admin,t}$) and the annual emissions due to travel for project planning (E_{plan_travel}), according to VM0011 v1.0 equation 4-2:

$$E_{projplan,t} = E_{admin,t} + E_{plan_travel,t}$$

Equation 42. Annual emissions due to administration and project planning.

In which:

- $E_{projplan,t}$ Annual emissions due to administration and project planning in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.
- $E_{admin,t}$ Annual emissions due to electricity consumption required for administration of the project activity in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.
- E_{plan_travel} Annual emissions due to travel for project planning in year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

Table 50. Annual emissions due to administration and project planning

Year	E _{admin,t}	E _{plan_travel}	E _{projplan,t}
2013	0.39	-	0.39
2014	0.37	-	0.37
2015	0.28	-	0.28
2016	0.08	-	0.08
2017	-	-	-
2018	-	-	-
2019	-	-	-
2020	-	-	-
2021	-	-	-
2022	0.55	-	0.55
2023	0.17	-	0.17
2024	0.17	-	0.17
2025	0.17	-	0.17
2026	0.17	-	0.17
2027	0.17	-	0.17
2028	0.17	-	0.17
2029	0.17	-	0.17
2030	0.17	-	0.17
2031	0.17	-	0.17
2032	0.17	-	0.17
2033	0.17	-	0.17
2034	0.17	-	0.17
2035	0.17	-	0.17
2036	0.17	-	0.17
2037	0.17	-	0.17
2038	0.17	-	0.17
2039	0.17	-	0.17
2040	0.17	-	0.17
2041	0.17	-	0.17
2042	0.17	-	0.17
2043	0.17	-	0.17
2044	0.17	-	0.17
2045	0.17	-	0.17
2046	0.17	-	0.17
2047	0.17	-	0.17
2048	0.17	-	0.17
2049	0.17	-	0.17

3.2.1.1.1 Emissions Due to Administration

The annual emissions due to electricity consumption required for administration of the project activity ($E_{admin,t}$), is calculated in function of the annual electricity consumption due to administration of the project activity ($Q_{admin,t}$) and the electricity emission factor for the host country ($EF_{electricity}$), according to VM0011 v1.0 equation 4-4:

$$E_{admin,t} = Q_{admin,t} \times EF_{electricity}$$

Equation 43. Annual emissions due to electricity consumption required for administration of the project activity.

In which:

$E_{admin,t}$ Annual emissions due to electricity consumption required for administration of the project activity in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

$Q_{admin,t}$ Annual electricity consumption due to administration of the project activity in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in kWh.

$EF_{electricity}$ Electricity emission factor for the host country, in tCO₂-e in kWh.

Table 51. Annual emissions due to electricity consumption required for administration of the project activity

Year	$Q_{admin,t}$	$EF_{electricity}$	$E_{admin,t}$
2013	4,079	0.0000960	0.39
2014	2,722	0.0001355	0.37
2015	2,231	0.0001244	0.28
2016	1,015	0.0000817	0.08
2017	-	0.0000927	-
2018	-	0.0000740	-
2019	-	0.0000750	-
2020	-	0.0000617	-
2021	-	0.0001264	-
2022	4,328	0.0001264	0.55
2023	1,437	0.0000994	0.17
2024	1,437	0.0000994	0.17
2025	1,437	0.0000994	0.17
2026	1,437	0.0000994	0.17
2027	1,437	0.0000994	0.17

2028	1,437	0.0000994	0.17
2029	1,437	0.0000994	0.17
2030	1,437	0.0000994	0.17
2031	1,437	0.0000994	0.17
2032	1,437	0.0000994	0.17
2033	1,437	0.0000994	0.17
2034	1,437	0.0000994	0.17
2035	1,437	0.0000994	0.17
2036	1,437	0.0000994	0.17
2037	1,437	0.0000994	0.17
2038	1,437	0.0000994	0.17
2039	1,437	0.0000994	0.17
2040	1,437	0.0000994	0.17
2041	1,437	0.0000994	0.17
2042	1,437	0.0000994	0.17
2043	1,437	0.0000994	0.17
2044	1,437	0.0000994	0.17
2045	1,437	0.0000994	0.17
2046	1,437	0.0000994	0.17
2047	1,437	0.0000994	0.17
2048	1,437	0.0000994	0.17
2049	1,437	0.0000994	0.17

The annual electricity consumption due to administration of the project activity ($Q_{admin,t}$) equals 4,328 kWh (Annex 53).

Electricity emission factor ($EF_{electricity}$) for Brazil varies per year and is given by MCTIC.

3.2.1.1.1.2 Emissions Due to Travel

The annual emissions related to travel for the planning of the project (E_{plan_travel}) are set as zero because the project is currently at the second monitoring period. All GHG emissions related to flights or ground transportation are considered as emissions due to monitoring.

3.2.1.1.2 Emissions Due to Design

Annual emissions from travel for design and set up (E_{design_travel}) are set as zero because the project is currently at the second monitoring period. All GHG emissions related to flights or ground transportation are considered as emissions due to monitoring.

3.2.1.1.3 Emissions Due to Monitoring

The annual emissions related to monitoring for field work ($E_{\text{monitoring}, t}$) is calculated in function of the annual emissions due to ground travel ($KM_{\text{monitoring_ground}, t}$) and the annual emissions related to air travel ($KM_{\text{monitoring_flight}, t}$), according to VM0011 v1.0 equation 4-12, adjusted:

$$E_{\text{monitoring}, t} = E_{\text{monitoring_ground}, t} + E_{\text{monitoring_flight}, t}$$

Equation 44. Annual emissions related to monitoring for field work.

In which:

$E_{\text{monitoring}, t}$ Annual emissions related to travel for the planning of the project in the year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

$E_{\text{monitoring_ground}, t}$ Annual emissions related to ground transportation in the year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

$E_{\text{monitoring_flight}, t}$ Annual emissions due to flights in the year t (where $t=1,2,3... t^*$ years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

Table 52. Annual emissions related to monitoring for field work

Year	$E_{\text{monitoring_ground}, t}$	$E_{\text{monitoring_flight}, t}$	$E_{\text{monitoring}, t}$
2013	3.89	54.29	58.18
2014	3.89	4.59	8.48
2015	3.89	5.97	9.86
2016	3.89	30.14	34.03
2017	-	-	-
2018	-	-	-
2019	-	-	-
2020	-	0.77	0.77
2021	-	10.81	10.81
2022	7.19	55.16	62.36
2023	2.28	16.17	18.45
2024	2.28	16.17	18.45
2025	2.28	16.17	18.45
2026	2.28	16.17	18.45
2027	2.28	16.17	18.45
2028	2.28	16.17	18.45
2029	2.28	16.17	18.45
2030	2.28	16.17	18.45
2031	2.28	16.17	18.45

2032	2.28	16.17	18.45
2033	2.28	16.17	18.45
2034	2.28	16.17	18.45
2035	2.28	16.17	18.45
2036	2.28	16.17	18.45
2037	2.28	16.17	18.45
2038	2.28	16.17	18.45
2039	2.28	16.17	18.45
2040	2.28	16.17	18.45
2041	2.28	16.17	18.45
2042	2.28	16.17	18.45
2043	2.28	16.17	18.45
2044	2.28	16.17	18.45
2045	2.28	16.17	18.45
2046	2.28	16.17	18.45
2047	2.28	16.17	18.45
2048	2.28	16.17	18.45
2049	2.28	16.17	18.45

3.2.1.1.3.1 Emissions Due to Ground Transport

The annual emissions due to ground travel for monitoring ($KM_{\text{monitoring_ground},t}$) is calculated in function of the annual volume of fuel consumed per trip ($V_{\text{fuel_monitoring_ground},y,t}$) and the fuel emission factor (EF_{fuel}), according to VM0011 v1.0 equation 4-14, adjusted:

$$E_{\text{monitoring_ground},t} = \sum_{y=1}^y (V_{\text{fuel_monitoring_ground},y,t} \times EF_{\text{fuel}})$$

Equation 45. Annual emissions due ground travel for monitoring.

In which:

$E_{\text{monitoring_ground},t}$	Annual emissions due to ground transportation in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO ₂ -e.
$V_{\text{fuel_monitoring_ground},y,t}$	Annual volume of fuel consumed per trip y (where y=1,2,3... Y trips), in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in kL.
EF_{fuel}	Fuel emission factor, in tCO ₂ -e kL.

Table 53. Annual emissions due to ground travel for monitoring

Year	V _{fuel_monitoring_ground,y,t}	EF _{fuel}	E _{monitoring_ground,t}
2013	1.62	2.40	3.89
2014	1.62	2.40	3.89
2015	1.62	2.40	3.89
2016	1.62	2.40	3.89
2017	-	2.40	-
2018	-	2.40	-
2019	-	2.40	-
2020	-	2.40	-
2021	-	2.40	-
2022	3.00	2.40	7.19
2023	0.95	2.40	2.28
2024	0.95	2.40	2.28
2025	0.95	2.40	2.28
2026	0.95	2.40	2.28
2027	0.95	2.40	2.28
2028	0.95	2.40	2.28
2029	0.95	2.40	2.28
2030	0.95	2.40	2.28
2031	0.95	2.40	2.28
2032	0.95	2.40	2.28
2033	0.95	2.40	2.28
2034	0.95	2.40	2.28
2035	0.95	2.40	2.28
2036	0.95	2.40	2.28
2037	0.95	2.40	2.28
2038	0.95	2.40	2.28
2039	0.95	2.40	2.28
2040	0.95	2.40	2.28
2041	0.95	2.40	2.28
2042	0.95	2.40	2.28
2043	0.95	2.40	2.28
2044	0.95	2.40	2.28
2045	0.95	2.40	2.28
2046	0.95	2.40	2.28
2047	0.95	2.40	2.28
2048	0.95	2.40	2.28

2049	0.95	2.40	2.28
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Annual volume of fuel consumed per trip ($V_{\text{fuel_monitoring_ground},y,t}$) is 3,003.7 L (Annex 53).

Fuel emission factor is 2,40 tCO₂-e kL for gasoline and 3,01 tCO₂-e kL for oil.

3.2.1.1.3.2 Emissions Due to Flights

The annual emissions due to flights ($E_{\text{monitoring_flight},t}$) is calculated in function of the annual distance traveled per trip ($KM_{\text{monitoring_flight},y,t}$), annual number of passengers per trip ($N_{\text{monitoring_flight},y,t}$) and the flight emission factor for trip ($EF_{\text{flight},y}$), according to VM0011 v1.0 equation 4-13:

$$E_{\text{monitoring_flight},t} = \sum_{y=1}^y (KM_{\text{monitoring_flight},y,t} \times N_{\text{monitoring_flight},y,t} \times EF_{\text{flight},y})$$

Equation 46. Annual emissions due to flights.

In which:

$E_{\text{monitoring_flight},t}$	Annual emissions due to air travel for monitoring in the year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO ₂ -e.
$KM_{\text{monitoring_flight},y,t}$	Annual distance traveled per trip y (where y=1,2,3... Y trips), in the year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in km.
$N_{\text{monitoring_flight},y,t}$	Annual number of passengers per trip y (where y=1,2,3... Y trips), in the year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities).

$EF_{\text{flight},y}$ Flight emission factor for trip, y (where y=1,2,3... Y trips), in tCO₂-e per person per km.

Table 54. Annual emissions due to flights

Year	$KM_{\text{monitoring_flight},y,t}$	$N_{\text{monitoring_flight},y,t}$	$EF_{\text{flight},y}$	$E_{\text{monitoring_flight},t}$
2013	236,749	115	0.00024	54.29
2014	15,789	23	0.00030	4.59
2015	27,340	10	0.00022	5.97
2016	135,662	72	0.00024	30.14
2017	-	-	-	-
2018	-	-	-	-
2019	-	-	-	-
2020	1,421	3	0.00036	0.77
2021	46,282	8	0.00027	10.81
2022	212,278	113	0.00027	55.16

2023	67,552.06	34.40	0.00019	16.17
2024	67,552.06	34.40	0.00019	16.17
2025	67,552.06	34.40	0.00019	16.17
2026	67,552.06	34.40	0.00019	16.17
2027	67,552.06	34.40	0.00019	16.17
2028	67,552.06	34.40	0.00019	16.17
2029	67,552.06	34.40	0.00019	16.17
2030	67,552.06	34.40	0.00019	16.17
2031	67,552.06	34.40	0.00019	16.17
2032	67,552.06	34.40	0.00019	16.17
2033	67,552.06	34.40	0.00019	16.17
2034	67,552.06	34.40	0.00019	16.17
2035	67,552.06	34.40	0.00019	16.17
2036	67,552.06	34.40	0.00019	16.17
2037	67,552.06	34.40	0.00019	16.17
2038	67,552.06	34.40	0.00019	16.17
2039	67,552.06	34.40	0.00019	16.17
2040	67,552.06	34.40	0.00019	16.17
2041	67,552.06	34.40	0.00019	16.17
2042	67,552.06	34.40	0.00019	16.17
2043	67,552.06	34.40	0.00019	16.17
2044	67,552.06	34.40	0.00019	16.17
2045	67,552.06	34.40	0.00019	16.17
2046	67,552.06	34.40	0.00019	16.17
2047	67,552.06	34.40	0.00019	16.17
2048	67,552.06	34.40	0.00019	16.17
2049	67,552.06	34.40	0.00019	16.17

Annual distance traveled per trip ($KM_{\text{monitoring_flight},y,t}$) varies annually (annex 64).

Annual number of passengers per trip varies annually ($N_{\text{monitoring_flight},y,t}$) (annex 53).

Flight emission factor for trip is varies from 0.0002 to 0.00036, according to Ross et al. (2009).

3.2.1.1.4 Emissions Due to Natural Disturbances

There were no natural disasters, such as forest fires (man-induced or not) in the project area during the monitored period, which EBCF verified through classified images produced by INPE monitoring system and also through high spatial resolution images from Sentinel.

The EBCF verified, however, the occurrence of 22.2 ha of deforestation in the project area (Figures 27 & 28). Deforested areas were not treated as areas subjected to natural disasters, since they are different phenomena, which affect carbon stocks and the carbon balance in

different ways over time. Thus, deforested areas were deducted from the annual net harvest area for the Project Area ($ANHA_{annual,t}$), in cases where deforestation occurred in areas that would be exploited in accordance with the forest management plan.

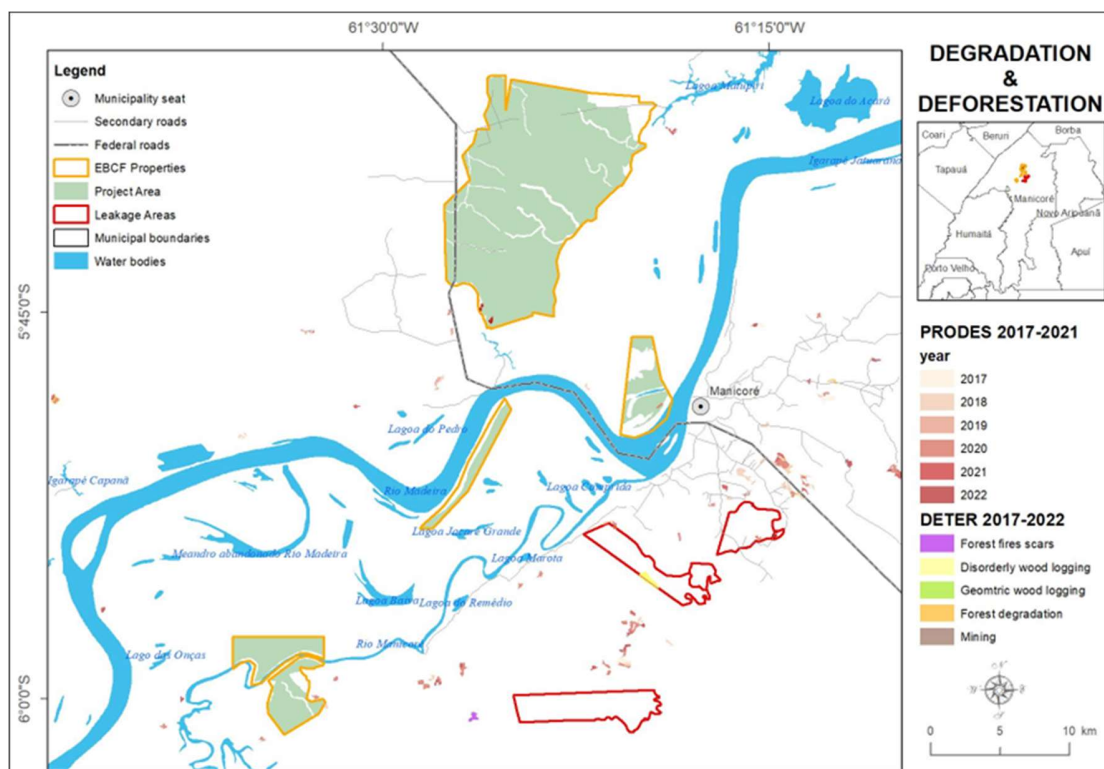


Figure 35. Land Use / Land Cover Monitoring results

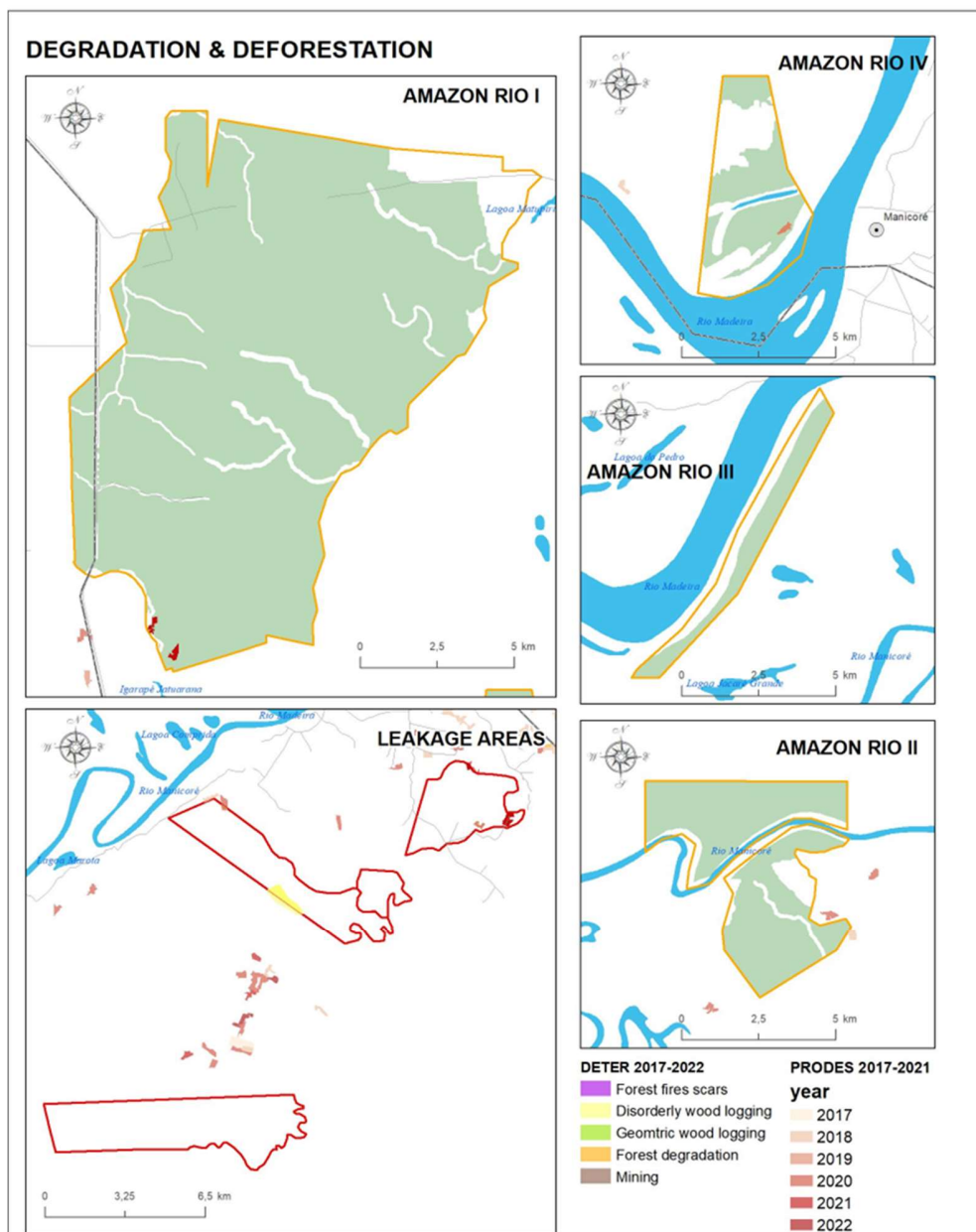


Figure 36. Land Use / Land Cover Monitoring results

3.2.1.1.5 Emissions Due to Illegal Harvesting

No illegal harvesting activity was perceived in the project area during the monitored period, which EBCF verified through classified images produced by INPE monitoring system and through high spatial resolution images from Sentinel.

3.2.2 Net Impact (CL2.2)

Annual net anthropogenic GHG emission reductions ($C'_{IFM-LtPF,t}$) is calculated in function of the annual total carbon emissions associated with the baseline scenario ($C'_{baseline,t}$), the annual total carbon emissions associated with the project activity ($C'_{actual,t}$) and the annual total carbon emissions associated with leakage ($C'_{leakage,t}$), according to the VM0011 v1.0 equation 1-1:

$$C'_{IFM-LtPF,t} = C'_{baseline,t} - C'_{actual,t} - C'_{leakage,t}$$

Equation 47. Annual net anthropogenic GHG emission reductions.

In which

- $C'_{IFM-LtPF,t}$ Total net annual reduction in anthropogenic GHG emissions in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.
- $C'_{baseline,t}$ Total annual carbon emissions associated with the baseline in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.
- $C'_{actual,t}$ Total annual carbon emissions associated with the project activities in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.
- $C'_{leakage,t}$ Total annual carbon emissions associated with leakage in year t (where t=1,2,3... t*years elapsed since the start of the IFM-LtPF project activities), in tCO₂-e.

Table 55. Annual net anthropogenic GHG emission reductions

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)
2013	26,405	58.57	-
2014	37,740	8.84	-
2015	47,349	10.14	-
2016	55,501	34.11	-
2017	62,456	-	-
2018	68,364	-	-
2019	73,404	-	-
2020	77,696	0.77	-
2021	81,393	10.81	-
2022	84,529	62.90	-
2023	87,202	18.61	-
2024	89,504	18.61	-

2025	91,482	18.61	-
2026	93,184	18.61	-
2027	94,652	18.61	-
2028	95,922	18.61	-
2029	97,024	18.61	-
2030	97,982	18.61	-
2031	98,819	18.61	-
2032	99,552	18.61	-
2033	100,197	18.61	-
2034	100,766	18.61	-
2035	101,272	18.61	-
2036	101,722	18.61	-
2037	102,126	18.61	-
2038	102,489	18.61	-
2039	102,818	18.61	-
2040	103,117	18.61	-
2041	103,391	18.61	-
2042	103,642	18.61	-
2043	103,875	18.61	-
2044	104,090	18.61	-
2045	104,291	18.61	-
2046	104,479	18.61	-
2047	104,656	18.61	-
2048	104,823	18.61	-
2049	104,982	18.61	-
Total	3,312,898	688.73	-

3.2.2.1 Uncertainty Assessment

The annual uncertainty (relative error) for the overall IFM-LtPF project ($U_{IFM-LtPF,t}$) is calculated in function of the Annual uncertainty (absolute error) for the overall IFM-LtPF project ($\sigma_{IFM-LtPF,t}$) and the annual net anthropogenic GHG emission reductions ($C'_{IFM-LtPF,t}$), according to VM0011 v1.0 equation 6-5:

$$U_{IFM-LtPF,t} = \frac{\sigma_{IFM-LtPF,t}}{C'_{IFM-LtPF,t}} \times 100$$

Equation 48. Annual uncertainty (relative error) for the overall IFM-LtPF project.

$U_{IFM-LtPF,t}$	Annual uncertainty (relative error) for the overall IFM-LtPF project in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in %.
$\sigma_{IFM-LtPF,t}$	Annual uncertainty (absolute error) for the overall IFM-LtPF project in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.
$C'_{IFM-LtPF,t}$	Annual net anthropogenic GHG emission reductions in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.

Table 56. Annual uncertainty (relative error) for the overall IFM-LtPF project

Year	$\sigma_{IFM-LtPF,t}$	$C'_{IFM-LtPF,t}$	$U_{IFM-LtPF,t}$
2013	18,581	26,405	70.37%
2014	18,581	37,740	49.23%
2015	18,581	47,349	39.24%
2016	18,581	55,501	33.48%
2017	18,581	62,456	29.75%
2018	18,581	68,364	27.18%
2019	18,581	73,404	25.31%
2020	18,581	77,696	23.92%
2021	18,581	81,393	22.83%
2022	18,581	84,529	21.98%
2023	18,581	87,202	21.31%
2024	18,581	89,504	20.76%
2025	18,581	91,482	20.31%
2026	18,581	93,184	19.94%
2027	18,581	94,652	19.63%
2028	18,581	95,922	19.37%
2029	18,581	97,024	19.15%
2030	18,581	97,982	18.96%
2031	18,581	98,819	18.80%
2032	18,581	99,552	18.66%
2033	18,581	100,197	18.54%
2034	18,581	100,766	18.44%
2035	18,581	101,272	18.35%
2036	18,581	101,722	18.27%
2037	18,581	102,126	18.19%
2038	18,581	102,489	18.13%
2039	18,581	102,818	18.07%
2040	18,581	103,117	18.02%

2041	18,581	103,391	17.97%
2042	18,581	103,642	17.93%
2043	18,581	103,875	17.89%
2044	18,581	104,090	17.85%
2045	18,581	104,291	17.82%
2046	18,581	104,479	17.78%
2047	18,581	104,656	17.75%
2048	18,581	104,823	17.73%
2049	18,581	104,982	17.70%

The annual uncertainty (absolute error) for the overall IFM-LtPF project ($\sigma_{\text{IFM-LtPF},t}$) is calculated in function of the annual uncertainty in the annual total GHG emissions as a result of the baseline scenario ($\sigma_{\text{baseline},t}$), Annual uncertainty in the actual (project) activity ($\sigma_{\text{actual},t}$), and the annual uncertainty in leakage ($\sigma_{\text{leakage},t}$), according to VM0011 v1.0 equation 6-4:

$$\sigma_{\text{IFM-LtPF},t} = \sqrt{(\sigma_{\text{baseline},t})^2 + (\sigma_{\text{actual},t})^2 + (\sigma_{\text{leakage},t})^2}$$

Equation 49. Annual uncertainty (absolute error) for the overall IFM-LtPF project

$\sigma_{\text{IFM-LtPF},t}$	Annual uncertainty (absolute error) for the overall IFM-LtPF project in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.
$\sigma_{\text{baseline},t}$	Annual uncertainty in the annual total GHG emissions as a result of the baseline scenario in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFMLtPF project activity), in tCO ₂ -e.
$\sigma_{\text{actual},t}$	Annual uncertainty in the actual (project) activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.
$\sigma_{\text{leakage},t}$	Annual uncertainty in leakage in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.

Table 57. Annual uncertainty (relative error) for the overall IFM-LtPF project

Year	$\sigma_{\text{baseline},t}$	$\sigma_{\text{actual},t}$	$\sigma_{\text{leakage},t}$	$\sigma_{\text{IFM-LtPF},t}$
2013	18,581	12	-	18,581
2014	18,581	12	-	18,581
2015	18,581	12	-	18,581
2016	18,581	12	-	18,581
2017	18,581	12	-	18,581
2018	18,581	12	-	18,581
2019	18,581	12	-	18,581

2020	18,581	12	-	18,581
2021	18,581	12	-	18,581
2022	18,581	12	-	18,581
2023	18,581	12	1	18,581
2024	18,581	12	2	18,581
2025	18,581	12	3	18,581
2026	18,581	12	4	18,581
2027	18,581	12	5	18,581
2028	18,581	12	6	18,581
2029	18,581	12	7	18,581
2030	18,581	12	8	18,581
2031	18,581	12	9	18,581
2032	18,581	12	10	18,581
2033	18,581	12	11	18,581
2034	18,581	12	12	18,581
2035	18,581	12	13	18,581
2036	18,581	12	14	18,581
2037	18,581	12	15	18,581
2038	18,581	12	16	18,581
2039	18,581	12	17	18,581
2040	18,581	12	18	18,581
2041	18,581	12	19	18,581
2042	18,581	12	20	18,581
2043	18,581	12	21	18,581
2044	18,581	12	22	18,581
2045	18,581	12	23	18,581
2046	18,581	12	24	18,581
2047	18,581	12	25	18,581
2048	18,581	12	26	18,581
2049	18,581	12	27	18,581

3.2.2.2 Uncertainty in Baseline Accounting

The annual carbon uncertainty in the annual total GHG emissions as a result of the baseline Scenario ($\sigma_{\text{baseline},t}$) is calculated in function of the Annual uncertainty in the annual emissions produced from degradation due to the baseline activity ($\sigma_{\text{degradation},t}$) and the Annual uncertainty in the annual emissions from the baseline activity ($\sigma_{\text{emissions},t}$) according to VM0011 v1.0 equation 6-6:

$$\sigma_{\text{baseline},t} = \sqrt{(\sigma_{\text{degradation},t})^2 + (\sigma_{\text{emissions},t})^2}$$

Equation 50. Annual carbon uncertainty in the annual total GHG emissions as a result of the baseline scenario.

$\sigma_{\text{baseline},t}$	Annual uncertainty in the annual total GHG emissions as a result of the baseline scenario in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFMLtPF project activity), in tCO ₂ -e.
$\sigma_{\text{degradation},t}$	Annual uncertainty in the annual emissions produced from degradation due to the baseline activity: selective logging in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.
$\sigma_{\text{emissions},t}$	Annual uncertainty in the annual emissions from the baseline activity: selective logging operations in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) , in tCO ₂ -e.

Table 58. Annual carbon uncertainty in the annual total GHG emissions as a result of the baseline scenario

Year	$\sigma_{\text{degradation},t}$	$\sigma_{\text{emissions},t}$	$\sigma_{\text{baseline},t}$
2013	18,581.04	5.82	18,581.04
2014	18,581.04	5.82	18,581.04
2015	18,581.04	5.82	18,581.04
2016	18,581.04	5.82	18,581.04
2017	18,581.04	5.82	18,581.04
2018	18,581.04	5.82	18,581.04
2019	18,581.04	5.82	18,581.04
2020	18,581.04	5.82	18,581.04
2021	18,581.04	5.82	18,581.04
2022	18,581.04	5.82	18,581.04
2023	18,581.04	5.82	18,581.04
2024	18,581.04	5.82	18,581.04
2025	18,581.04	5.82	18,581.04
2026	18,581.04	5.82	18,581.04
2027	18,581.04	5.82	18,581.04
2028	18,581.04	5.82	18,581.04
2029	18,581.04	5.82	18,581.04
2030	18,581.04	5.82	18,581.04
2031	18,581.04	5.82	18,581.04
2032	18,581.04	5.82	18,581.04
2033	18,581.04	5.82	18,581.04
2034	18,581.04	5.82	18,581.04

2035	18,581.04	5.82	18,581.04
2036	18,581.04	5.82	18,581.04
2037	18,581.04	5.82	18,581.04
2038	18,581.04	5.82	18,581.04
2039	18,581.04	5.82	18,581.04
2040	18,581.04	5.82	18,581.04
2041	18,581.04	5.82	18,581.04
2042	18,581.04	5.82	18,581.04
2043	18,581.04	5.82	18,581.04
2044	18,581.04	5.82	18,581.04
2045	18,581.04	5.82	18,581.04
2046	18,581.04	5.82	18,581.04
2047	18,581.04	5.82	18,581.04
2048	18,581.04	5.82	18,581.04
2049	18,581.04	5.82	18,581.04

3.2.2.3 Degradation Uncertainty

The annual uncertainty in the annual emissions produced from degradation due to the baseline activity ($\sigma_{\text{degradation},t}$) is calculated in function of annual uncertainty in carbon from the deadwood (DW) pool due to decay ($\sigma_{\text{DWdecay},t}$), annual uncertainty in carbon from the long-term harvested wood products (ltHWP) pool due to oxidation ($\sigma_{\text{ltHWPoxidation},t}$), annual uncertainty in carbon from the short-term harvested wood products (stHWP) pool due to oxidation ($\sigma_{\text{stHWPoxidation},t}$), annual uncertainty in the carbon lost due to growth foregone in the annual net harvest area ($\sigma_{\text{growth}_{\text{foregone},t}}$), annual uncertainty in the carbon increase in the biomass due to regrowth following logging ($\sigma_{\text{regrowth},t}$) and the ratio of molecular weight of carbon dioxide to carbon ($\frac{44}{12}$), according to VM0011 v1.0 equation 6-7:

$$\sigma_{\text{degradation},t} = \left[\left(\sqrt{(\sigma_{\text{DWdecay},t})^2 + (\sigma_{\text{ltHWPoxidation},t})^2 + (\sigma_{\text{stHWPoxidation},t})^2 + (\sigma_{\text{growth}_{\text{foregone},t})^2 + (\sigma_{\text{regrowth},t})^2} \right) \times \frac{44}{12} \right]$$

Equation 51. Annual uncertainty in the annual emissions produced from degradation due to the baseline activity.

- $\sigma_{\text{degradation},t}$ Annual uncertainty in the annual emissions produced from degradation due to the baseline activity: selective logging in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO₂-e.
- $\sigma_{\text{DWdecay},t}$ Annual uncertainty in carbon from the deadwood (DW) pool due to decay in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.

$\sigma_{ltHWPoxidation,t}$	Annual uncertainty in carbon from the long-term harvested wood products (ltHWP) pool due to oxidation in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
$\sigma_{stHWPoxidation,t}$	Annual uncertainty in carbon from the short-term harvested wood products (stHWP) pool due to oxidation in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
$\sigma_{growth_foregone,t}$	Annual uncertainty in the carbon lost due to growth foregone in the annual net harvest area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFMLtPF project activity), in tC.
$\sigma_{regrowth,t}$	Annual uncertainty in the carbon increase in the biomass due to regrowth following logging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tC.
44/12	The ratio of molecular weight of carbon dioxide to carbon, in tCO ₂ -e tC ⁻¹ .

Table 59. Annual uncertainty in the annual emissions produced from degradation due to the baseline activity

2017 to 2022	$\sigma_{DWdecay,t}$	$\sigma_{ltHWPoxidation,t}$	$\sigma_{stHWPoxidation,t}$	$\sigma_{growth_foregone,t}$	$\sigma_{regrowth,t}$	44/12	$\sigma_{degradation,t}$
σ	2,129	126	-	0	-	44/12	8,265

3.2.2.4 Baseline Emission Sources Uncertainty

The annual uncertainty in the annual emissions from selective logging operations ($\sigma_{emissions,t}$) is calculated in function of the annual uncertainty in the greenhouse gas emissions sources associated with the baseline activity ($\sigma_{baseline_source,g,t}$), according to VM0011 v1.0 equation 6-8:

$$\sigma_{emissions,t} = \sqrt{\sum_{g=1}^G \sigma_{baseline_source,g,t}^2}$$

Equation 52. Annual uncertainty in the annual emissions from selective logging operations.

$\sigma_{emissions,t}$	Annual uncertainty in the annual emissions from the baseline activity: selective logging operations in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.
$\sigma_{baseline_source,g,t}$	Annual uncertainty in the greenhouse gas emissions sources g, (where g=1,2,3... G emission sources) associated with the baseline activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.

Table 60. Annual uncertainty in the annual emissions from selective logging operations

2017 to 2022	$\sigma_{\text{baseline_source,g,t}}$	$\sigma_{\text{emissions,t}}$
σ	12.16	12.16

3.2.3 Uncertainty in Actual Project Accounting

The annual uncertainty in the actual project activity ($\sigma_{\text{actual,t}}$) is calculated in function of the annual uncertainty in the greenhouse gas emissions sources associated with the actual project activity ($\sigma_{\text{proj_source,g,t}}$), according to VM0011 v1.0 equation 6-9:

$$\sigma_{\text{actual,t}} = \sqrt{\sum_{g=1}^G \sigma_{\text{proj_source,g,t}}^2}$$

Equation 53. Annual uncertainty in the annual emissions from the actual project activity.

$\Sigma_{\text{actual,t}}$	Annual uncertainty in actual project activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO2-e.
$\sigma_{\text{proj_source,g,t}}$	Annual uncertainty in the greenhouse gas emissions sources g, (where g=1,2,3... G emission sources) associated with the actual project activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO2-e.

Table 61. Annual uncertainty in the annual emissions from the actual project activity

2017 to 2022	$\Sigma_{\text{proj_source,g,t}}$	$\Sigma_{\text{actual,t}}$
σ	25	25

3.2.4 Uncertainty in Leakage Accounting

The uncertainty associated with leakage is set as zero as no activity shifting leakage nor market leakage were perceived by EBCF in this monitoring period.

3.2.5 Uncertainty Deduction

The annual carbon credits post uncertainty deduction () is calculated in function of the annual uncertainty (relative error) for the overall IFM-LtPF project () and the annual net anthropogenic GHG emission reductions (), according to VM0011 v1.0 equation 6-11:

$$CC_{\text{IFM-LtPF,t}} = \frac{100 - (U_{\text{IFM-LtPF,t}} - 10)}{100} \times C'_{\text{IFM-LtPF,t}}$$

Equation 54. Annual carbon credits post uncertainty deduction.

In which:

- $CC_{IFM-LtPF,t}$ Annual carbon credits post uncertainty deduction in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tCO₂e.
- $U_{IFM-LtPF,t}$ Annual uncertainty (relative error) for the overall IFM-LtPF project in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in %.
- $C'_{IFM-LtPF,t}$ Annual net anthropogenic GHG emission reductions in year t , (where $t=1,2,3 \dots t^*$ years elapsed since the start of the IFM-LtPF project activity), in tCO₂e.

Table 62. Annual carbon credits post uncertainty deduction

Year	$U_{IFM-LtPF,t}$	$C'_{IFM-LtPF,t}$	$CC_{IFM-LtPF,t}$
2013	70.37%	26,405	10,465
2014	49.23%	37,740	22,933
2015	39.24%	47,349	33,502
2016	33.48%	55,501	42,471
2017	29.75%	62,456	50,121
2018	27.18%	68,364	56,619
2019	25.31%	73,404	62,163
2020	23.92%	77,696	66,884
2021	22.83%	81,393	70,951
2022	21.98%	84,529	74,401
2023	21.31%	87,202	77,341
2024	20.76%	89,504	79,874
2025	20.31%	91,482	82,049
2026	19.94%	93,184	83,921
2027	19.63%	94,652	85,536
2028	19.37%	95,922	86,933
2029	19.15%	97,024	88,145
2030	18.96%	97,982	89,199
2031	18.80%	98,819	90,120
2032	18.66%	99,552	90,926
2033	18.54%	100,197	91,635
2034	18.44%	100,766	92,262
2035	18.35%	101,272	92,818
2036	18.27%	101,722	93,314
2037	18.19%	102,126	93,758
2038	18.13%	102,489	94,157
2039	18.07%	102,818	94,519

2040	18.02%	103,117	94,848
2041	17.97%	103,391	95,149
2042	17.93%	103,642	95,426
2043	17.89%	103,875	95,681
2044	17.85%	104,090	95,918
2045	17.82%	104,291	96,139
2046	17.78%	104,479	96,346
2047	17.75%	104,656	96,541
2048	17.73%	104,823	96,725
2049	17.70%	104,982	96,899

3.2.6 VCUs and the Non-Permanence Risk Withholding Buffer Percentage

Annual total tradeable Verified Carbon Units (VCU_t) is calculated in function of the Annual carbon credits post uncertainty deduction ($CC_{IFM-LtPF,t}$) and the annual carbon credits deposited in the VCS non-permanence buffer withholding account ($CC_{NPbuffer,t}$), according to VM0011 v1.0 equation 1-3:

$$VCU_t = CC_{IFM-LtPF,t} - CC_{NPbuffer,t}$$

Equation 55. Annual total tradeable Verified Carbon Units.

VCU_t	Annual total tradeable Verified Carbon Units in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.
$CC_{IFM-LtPF,t}$	Annual carbon credits post uncertainty deduction in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.
$CC_{NPbuffer,t}$	Annual carbon credits deposited in the VCS non-permanence buffer withholding account in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.

Table 63. Annual total tradeable Verified Carbon Units

Year	$CC_{IFM-LtPF,t}$	$CC_{NPbuffer,t}$	VCU_t
2013	10,465	3,075	7,389
2014	22,933	4,433	18,499
2015	33,502	5,587	27,915
2016	42,471	6,568	35,903
2017	50,121	7,402	42,719
2018	56,619	8,111	48,508
2019	62,163	8,716	53,447

2020	66,884	9,232	57,652
2021	70,951	9,672	61,279
2022	74,401	10,049	64,353
2023		10,371	- 10,371
2024	-	10,647	- 10,647
2025	-	10,884	- 10,884
2026	-	11,089	- 11,089
2027	-	11,265	- 11,265
2028	-	11,417	- 11,417
2029	-	11,549	- 11,549
2030	-	11,664	- 11,664
2031	-	11,765	- 11,765
2032	-	11,853	- 11,853
2033	-	11,930	- 11,930
2034	-	11,998	- 11,998
2035	-	12,059	- 12,059
2036	-	12,113	- 12,113
2037	-	12,162	- 12,162
2038	-	12,205	- 12,205
2039	-	12,245	- 12,245
2040	-	12,281	- 12,281
2041	-	12,313	- 12,313
2042	-	12,344	- 12,344
2043	-	12,371	- 12,371
2044	-	12,397	- 12,397
2045	-	12,421	- 12,421
2046	-	12,444	- 12,444
2047	-	12,465	- 12,465
2048	-	12,485	- 12,485
2049	-	12,504	- 12,504
Total	490,511	394,088	96,423

The annual carbon credits deposited in the VCS non-permanence buffer withholding account ($CC_{NPbuffer,t}$) is calculated in function of the annual buffer withholding percentage required for the VCS buffer withholding pool ($NP_{buffer,t}\%$) and the Annual total carbon emissions associated with degradation as a result of the baseline activity ($C'_{degradation,t}$) according to VM0011 v1.0 equation 1-2:

$$CC_{NPbuffer,t} = NP_{buffer,t} \% \times C'_{degradation,t}$$

Equation 56. Annual carbon credits deposited in the VCS non-permanence buffer withholding account.

$CC_{NPbuffer,t}$	Annual carbon credits deposited in the VCS non-permanence buffer withholding account in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.
$NP_{buffer,t}\%$	Annual buffer withholding percentage required for the VCS buffer withholding pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in %.
$C'_{degradation,t}$	Annual total carbon emissions associated with degradation as a result of the baseline activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity), in tCO ₂ -e.

Table 64. Annual carbon credits deposited in the VCS non-permanence buffer withholding account

Year	$NP_{buffer,t}\%$	$C'_{degradation,t}$	$CC_{NPbuffer,t}$
2013	12%	25,627	3,075
2014	12%	36,945	4,433
2015	12%	46,558	5,587
2016	12%	54,730	6,568
2017	12%	61,680	7,402
2018	12%	67,596	8,111
2019	12%	72,635	8,716
2020	12%	76,933	9,232
2021	12%	80,602	9,672
2022	12%	83,738	10,049
2023	12%	86,423	10,371
2024	12%	88,725	10,647
2025	12%	90,702	10,884
2026	12%	92,404	11,089
2027	12%	93,873	11,265
2028	12%	95,143	11,417
2029	12%	96,244	11,549
2030	12%	97,203	11,664
2031	12%	98,040	11,765
2032	12%	98,773	11,853
2033	12%	99,417	11,930
2034	12%	99,987	11,998
2035	12%	100,493	12,059

2036	12%	100,943	12,113
2037	12%	101,347	12,162
2038	12%	101,710	12,205
2039	12%	102,039	12,245
2040	12%	102,338	12,281
2041	12%	102,612	12,313
2042	12%	102,863	12,344
2043	12%	103,095	12,371
2044	12%	103,311	12,397
2045	12%	103,512	12,421
2046	12%	103,700	12,444
2047	12%	103,877	12,465
2048	12%	104,044	12,485
2049	12%	104,203	12,504
Total		3,284,063	394,088

3.3 Offsite Climate Impacts (Leakage)

3.3.1 Types of Expected Leakage (CL3.1)

According to VM0011 methodology for quantification of leakages, the following possibilities should be considered:

- i) Leakages due to shifting of baseline activities (logging) to other areas.
- ii) Market leakage due to changes in supply and demand for the products and services affected by the project activity (timber).

3.3.2 Leakage due Shifting of Baseline Activities

EBCF does not have a Leakage area and forest management operations were not transferred to any other area belonging to the EBCF or its partners, nor did they have their forest exploitation intensity increased in other sites, in a way that configures activity shifting leakage.

3.3.3 Market Leakage

No market leakage occurred due to the project activities commencing, which can be verified by the volume of wood produced in the municipality of Manicoré and in the state of Amazonas in the years following the project start date. According to data from IPAAM, the environmental agency responsible for approving management plans in the state, the volume of wood harvested fell between 2009 and 2010, which proves that there was no market leakage due to the interruption of the management plan in the project area.

Table 65. Historical log production

Year	State of Amazonas (m3/yr)	Municipality of Manicoré (m3 /yr)	Project proponent (m3/yr)
2009	358,709.5	98,643.3	38,895.24
2010	189,063.8	40,330.7	
2011	209,043.9	45,511.5	
2012	320,193.7	71,352.6	
2013	557,721.2	76,070.5	

3.3.4 Quantity of Expected Leakage (CL3.1, 3.3)

Estimate offsite increases in GHG emissions due to project activities using an approved or defensible methodological approach.

Include emissions from non-CO₂ sources if they are likely to cumulatively account for more than 20% of the total leakage emissions.

According to VM0011 methodology for quantification of leakages, the following possibilities should be considered:

Thus, the leakage of the design is the combined total of leakage parameters described above:

$$C'_{leakage,t} = (CL_{activityshifting,t} + CL_{market,t}) \times \frac{44}{12} + CL'_{emissions,t}$$

Equation 57 – General calculation for quantifying leakages. In which:

$C'_{leakage,t}$ - Annual total carbon emissions associated with leakage in year t (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)

$CL_{activityshifting,t}$ - Annual carbon losses due to baseline activity shifting in other lands managed or operated by the Project Proponent in year t (where t = 1,2,3 ... t * years elapsed since the start of the IFM-LtPF project activity)

$CL_{market,t}$ - Annual carbon due to market leakage effects in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)

$CL'_{emissions,t}$ - Annual emissions due to implementation of the shifted baseline activity in other lands managed or operated by the Project Proponent in year t, (where t = 1,2,3 ... t * years elapsed since the start of the IFM-LtPF project activity)

44/12 = The ratio of molecular weight of carbon dioxide to carbon, in tCO₂-e in tC.

Leakage due to Activity Shifting

Activity shifting leakage situations become evident where the project proponent:

- (i) intensifies selective logging operations. That is, there is legal authorization to selective log and the logging increases on other lands to recover the harvest losses due to IFM-LtPF project or;
- (ii) selective logging activities are displaced from the project area to another forest area within the same country.

As such, the carbon losses by activity shifting can be assessed by the following equation:

$$CL_{activityshifting,t} = CL_{IH_activityshifting,t} + CL_{SH_activityshifting,t}$$

Equation 58 – Annual carbon losses due to the baseline activity being shifted to other lands managed or operated by the project proponent.

In which:

$CL_{activityshifting,t}$ - Annual carbon losses due to baseline activity shifting in other lands managed or operated by the Project Proponent in year t (where t = 1,2,3 ... t * years elapsed since the start of the IFM-LtPF project activity)

$CL_{IH_activityshifting,t}$ - Annual carbon losses from activity shifting due to intensification of harvest volumes in year t (where t = 1,2,3 ... t * years elapsed since the start of the IFM-LtPF project activity).

$CL_{SH_activityshifting,t}$ - Annual carbon losses from activity shifting due to shifting of harvest to new area in year t (where t = 1,2,3 ... t * years elapsed since the start of the IFM-LtPF project activity).

The project proponent (EBCF) does not own or operate any other forest areas with plans for logging management, nor is this activity featured among activities that company has proposed⁶³. As such, there is no possibility of:

- Intensified logging in other areas to compensate for the activities suspended in the project area;
- Transfer of logging operations from the project area to any other forest concession in the country.

In this context equation 63 does not apply to the project scenario. Since all the parameters are zero (0), parameter⁶⁴ of VM0011 equations 5-7 is also zero.

It is worth reiterating that EBCF acquired the areas for conservation purposes, with the intent to develop a strategy for generating revenue through conservation and total suspension of logging activities. In this context, EBCF's focus on the project area will be dedicated exclusively to emissions reduction activities and trading of VCUs and CRAs, while allowing the surrounding communities to extract non-timber forest products (NTFPs) and conduct community-based ecotourism. 13

Since there is no possibility of leakages due to shifting of baseline activities (logging management) to other areas, it is zero.

3.3.5 Leakage Mitigation (CL3.2)

Describe the measures needed and designed to mitigate leakage.

The areas where forest management took place were donated to EBCF with the purpose of replacing a forestry exploration activity with a conservation project, creating a conservation unit recognized by the State Legislature of Amazonas (SEUC – State System of Conservation Units), in the Private Sustainable Development Reserve category, established by Ordinance SDS no. 86, of June 5, 2013, where the following procedures must be observed:

Art. 22. The Private Sustainable Development Reserve (RPDS) is private land, voluntarily created by the owner and recorded in perpetuity and may, or may not contain a user population, whose objective is to promote nature conservation and sustainable development through the direct use of natural resources.

§ no. 1 The establishment and functioning of RPDS is predicated on the following:

I - the encumbrance of the caput consists of Letter of Commitment signed by the owner before the Environmental Agency to certify the existence of public interest, and will be recorded in the margin of registration with the Public Registry of Property;

II - management Plan will define the areas of permanent protection, sustainable use and, if possible, ecological corridors;

III – intended to be compatible with permanence and use and a contract between the owner and the traditional communities as well as the user population will be signed;

IV - the RPDS may overlap with an Environmental Protection Area (APA). § no. 2 Throughout the process of creating the RPDS, the Governing Body should assess, for the purpose of analyzing the viability of its proposal, the existence of conflicts between the owner and resident local populations, including in the surrounding area, making the creation of the Conservation Unit impossible.

Also, according to SEUC, a RPDS is one of perpetuity and should have a Management Plan. On their own, these constraints legally ensure forest conservation and maintenance of carbon stocks

The Amazon Rio project consists of the first RPDS in the country. The project was initiated by the project proponent is in perfect alignment with state and federal laws (Climate Change Law of the State of Amazonas⁵⁵, National Climate Change Policy⁵⁶, State System of Conservation Units – SEUC and the National System of Conservation Units - SNUC) ⁵⁸, which regulate the activities related to conservation and sustainable use of protected areas and policies on climate change.

3.4 Climate Impact Monitoring

3.4.1 Climate Monitoring Plan (CL4.1)

Present the plan for monitoring changes in any carbon pool, any non-CO₂ GHGs, and any emissions sources expected to cumulatively contribute more than 20% of total GHG emissions, and leakage using an approved or defensible methodological approach. Identify frequency of monitoring for each defined parameter.

The Monitoring Plan (MP) aims to provide security in the periodic estimates of emissions reductions, especially in monitoring changes in carbon stock. Therefore, emissions from the implementation of the project, ex post estimates of the activities and emissions from any leakages and isolated disturbances (e.g., blowdowns, fires, pests and diseases, among others) can be calculated. The project's climate impact monitoring activities consists of:

- Continuous Forest Inventory for monitoring the dynamics and stock of forest biomass
- Monitoring of land use and land cover changes in the project area, reference region, and project leakage areas for detection of forest cover disturbances of natural origin, such as forest fires and Blowdowns; or of anthropogenic origin, such as illegal logging, fires, and deforestation.
- Storage and recording of information for the calculation of the actual emissions of the project activities, such as the emissions resulting from the implementation of activities aimed at communities, biodiversity, and monitoring.

3.4.1.1 Continuous Forest Inventory

For the monitoring of carbon stocks, a network of permanent sample plots (PSPs) was installed to increase the accuracy of measurements, supporting the collection of data on the entry of new individual trees, mortality, and growth of individual trees.

The first forest inventory was carried out in 2016 by the company HDOM, with 162 plots being installed, totaling a sampled area of 40.5ha. A second forest inventory was conducted in 2022 by the company BRCarbon, and 80 plots were selected for remeasurement and installation of permanent landmarks, totaling 20ha of sampling, defining the plots that will be monitored throughout the the project's lifetime. We reduced the number of plots with the goal of reducing field effort and monitoring costs with continuous forest inventory over the lifetime of the project, while keeping sampling error within acceptance limits for Biomass and Carbon Forest inventories. The estimates were within a 95% confidence interval. The report and spreadsheets containing the description of the methods and the results found in the 1st inventory can be found in annex 23 - Inventário_Florestal_Vs_Final. The report prepared by BRCarbon containing the results of the 2nd forest inventory can be found in the annex annex_57_2nd Forestry Inventory Report.

EBCF's continuous forest inventory is conducted following the Standard Operating Procedure (SOP) by the company HDOM in 2016, developed to meet the project scope, methodological requirements, and quality control and reporting assumptions recommended by the Guidance of Good Practices for IPCC Carbon Inventories (2006). The SOP can be found in Annex 46 - HDOM#P023_Standard-Operating-Procedures_v1 with actualizations incorporate in Appendix 02 of the 2nd Forest Inventory Report (annex 57)

Stratification of The Project Area

Although forest inventories are carried out considering two different forest types, biomass stock calculations consider the grouped data. During the first inventory, hypothesis tests were carried out to verify if there is a difference in the stock between the two different forest types, between the areas under the influence of the flood dynamics of the Madeira River and between the managed and unmanaged areas. As a result, it was found that there are no statistical differences in the three hypotheses tested. In other words, alluvial forests (FDA) and lowland forests (FDTB),

although strongly influenced by the dynamics of the Madeira River, have similar carbon stocks. The results of the tests, and forest inventory can be found in Annex 23c, section 5.2.

According to the IBGE classification (IBGE, 2004), there are two forest types in the project area: Dense Alluvial Ombrophilous Forest (FDA) e Lowland Dense Ombrophilous Forest (FDTB).

- Dense Ombrophilous Alluvial Forest (Floresta Ombrófila Densa Aluvial Dossel emergente) (FDA): forest formations with areas of temporarily flooded forests during floods of the main rivers forming igapós or known locally as Várzea Forests. The FDA covers an area corresponding to 14.4% of the project area.
- Dense Ombrophilous Lowland Forest (Floresta Ombrófila Densa Terras Baixas Dossel emergente) (FDTB): forest formations with forest areas that do not flood seasonally, regardless of river dynamics, locally known as Terra Firme Forests. FDTB covers 85.6% of the entire project area.

Number of PSPs

The number of samples was determined with the aim of obtaining an uncertainty of less than 10%, as recommended by the IPCC (2006) and Soares et al. (2007). With a sample n greater than 30 and following the central limit theorem. The central limit theorem proposes that a large enough sample, drawn at random, will mostly represent the population from which the sample was extracted (Almeida, 2019).

The plots were reconstructed based on the location of the sampling units in the forest inventory of the company Hdom, carried out in 2016 (Figure 26). For this, some sets followed the conglomerate pattern and others followed the transect pattern, with 80 plots being selected from the 162 in the previous inventory to represent the vegetation biomass stock. To carry out this selection of these samples, the Microsoft Office Excel Index function was used.

Table 66. Distribution of the sample plots in the project area by forest types

Forest type	Area (ha)	Coverage (%)	Number of plot	Area of plots (ha)	Plots Coverage (%)
FDTB	15,873.3	85.5	42	10.5	0.1
FDA	2,676.4	14.4	38	9.5	0.4
Waterbodies	10.0	0.1	-		-
Total	18,559.7	100.0	80	20.0	0.4

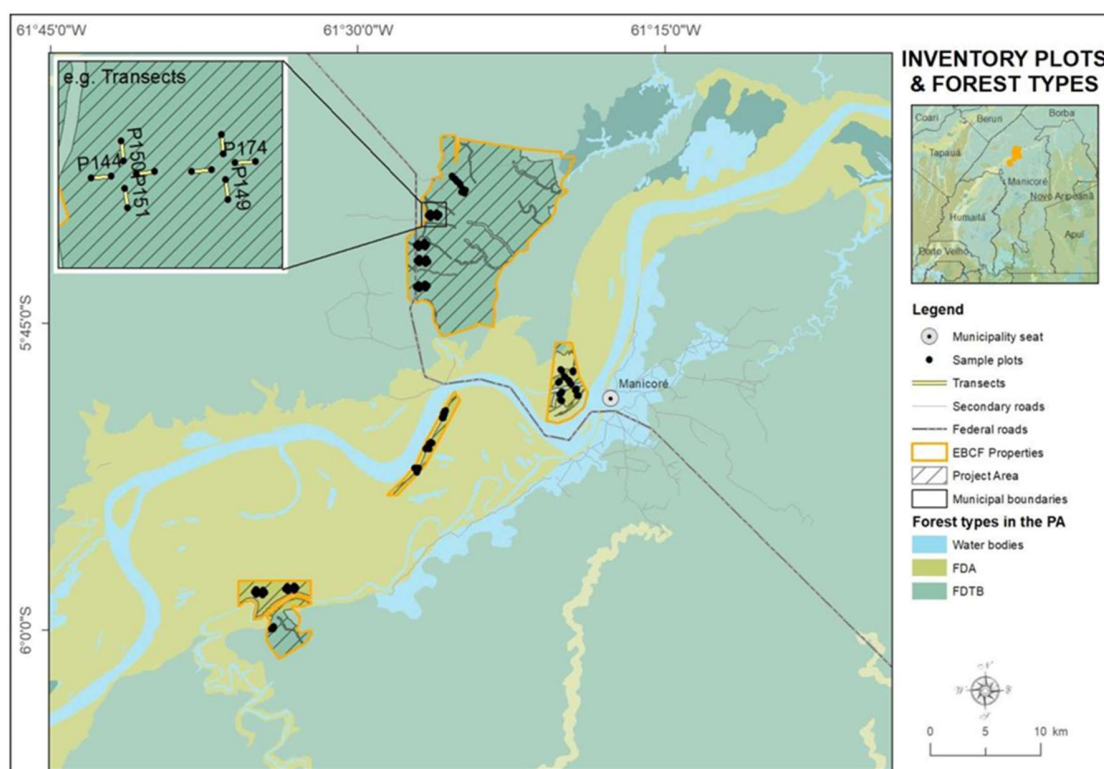


Figure 37. Forest inventory plots network and forest types

3.4.1.2 MONITORING LAND USE AND LAND USE CHANGE

The monitoring of land use and land cover change in the project area and leakage belt is made remotely through classified images from INPE and high spatial resolution from Sentinel. Deforestation and degradation data are made available by the PRODES and DETER-B projects, under the coordination and execution of INPE – Instituto Nacional de Pesquisas Espaciais. These are official data adopted by the government for monitoring deforestation in the Amazon, therefore, emissions derived from project activities are in line with the government's deforestation figures; PRODES, data are validated annually by INPE. Data from the DETER-B Project are generated daily and undergo a daily validation process.

The minimum mapping unit for both systems is 6.25ha, however, in the shapefiles (vector data) made available in polygon format, deforestation, and degradation polygons smaller than 6.25 ha are generated and provided, sometimes reaching values smaller than 1ha.

The data are made available and downloaded in vector format (shapefile) through the Terra Brasilis Platform. The data are provided in a Geographic Coordinate System, adopting the reference DATUM SIRGAS2000.

A validation procedure is carried out for deforestation and degradation data with medium resolution images from the SENTINEL satellite constellation, provided by the European space agency ESA. Data are provided through the Copernicus platform in raster image format, with 10 to 20 m resolution. Images are provided with geometric and radiometric corrections.

3.4.1.3 MONITORING OF ACTUAL PROJECT GHG EMISSIONS

Current emissions due to the implementation of project activities to be monitored are directly associated with Project Management and Administration activities, Implementation of Activities planned for the Social and Biodiversity area with the purpose of improving pre project conditions and Monitoring activities of Project Impacts.

Project management and administration

Emissions due to the Management and Administration of the project come from the consumption of electricity to maintain the headquarters in Manicoré and the individual consumption of electricity by all those involved in the Management and Administration of the Project. In addition to the board of directors and employees involved in the management and administration of the company, this second monitoring event considers the emissions of employees from other company partners that may assist in the management and implementation process of the Amazon Rio REDD+ IFM project, as well as the consumption of electricity by service providers for the preparation of reports and data collection in the field.

In the case of the Manicoré headquarters, all electricity consumption bills are recorded and stored, containing the monthly consumption of electricity, the information is provided in kW consumed.

In the case of employees, electrical consumption estimates are made considering the computer model used to estimate the consumption of electrical equipment, provided by equipment manufacturers in W/h and an estimate of the monthly hours worked by each employee in the period of verification.

All information is recorded in an electronic spreadsheet by EBCF administration employees and the vouchers and documents used to enter the spreadsheets are filed in electronic format in the EBCF cloud data sharing structures for the Amazon Rio REDD+ IFM carbon project.

Implementation of project activities and monitoring

Emissions due to the implementation of activities and monitoring of the project are considered to be emissions derived from the burning of fossil fuels for trips to the municipality of Manicoré, where the EBCF headquarters are located and displacements for incursions within the project area and in the communities located in the project zone, which are covered by the Amazon Rio REDD+ IFM project.

To estimate the parameters associated with air travel, tickets are recorded in an electronic spreadsheet containing the itinerary description (place of departure and destination, or airport code), number of passengers on each trip, date of travel and type of aircraft.

Distances are then calculated based on airport distance queries provided by Google Maps, Google Earth, or similar platforms. We recommend using the www.pt.distance.to platform. These data enter into the ex-post emissions calculation spreadsheet and is revised at each project verification event.

Emissions associated with land and river travel are calculated directly by recording the fuel consumption used to carry out the activities. The record is made by entering the Monitoring Report: VCS Version 4.2 information on the volume and type of fuel consumed contained in the

receipts, invoices or other documents provided by the fuel supplier. All evidence or records of posted values are filed in electronic format in the EBCF cloud data sharing structures for the Amazon Rio REDD+ IFM carbon project.

3.4.1.4 MONITORING FREQUENCY

The monitoring frequency parameters measured in the PSPs will be no greater than 5 years from each measurement. Parameters like changes in land-use in and around the PA, such as deforestation, forest degradation, hotspots and natural disturbances will be regularly monitored as a project routine operation, organized and archived annually. Monitoring of project GHG emissions will also be measured and archived annually.

3.4.2 Dissemination of Monitoring Plan and Results (CL4.2)

Describe how the monitoring plan, and any results of monitoring undertaken in accordance with the monitoring plan, will be disseminated and made publicly available on the internet. Describe the means by which summaries (at minimum) of the monitoring plan and results will be communicated to the communities and other stakeholders.

The results of the amazon rio project monitoring will be available on the EBCF website and can be consulted at any time through the link <https://www.ebcf.com.br/>. Complementing this EBCF, will elaborate a booklet with appropriate language for dissemination in the communities surrounding the project, the copies will be delivered during meetings with the leaders of each community. Other copies will be made available to other stakeholders and will be also accessible at EBCF's headquarter in Manicoré - AM.

3.5 Optional Criterion: Climate Change Adaptation Benefits

3.5.1 Regional Climate Change Scenarios (GL1.1)

The project does not intend to apply for the gold level.

3.5.2 Climate Change Impacts (GL1.2)

The project does not intend to apply for the gold level.

3.5.3 Measures Needed and Designed for Adaptation (GL1.3)

The project does not intend to apply for the gold level.

4 COMMUNITY

4.1 Without-Project Community Scenario

4.1.1 Descriptions of Communities at Project Start (CM1.1)

The population residing in the project area can be divided into two types of specific traditional communities. The largest group is made up of riverside dwellers who live from extractivism and

family farming, also known as caboclos and comprises most of the community groups, while the Kamayúá people are a self-declared indigenous group.

Despite the similarity of the way of travel, the Kamayúá community is identified as belonging to the Munduruku ethnic group, in line with public policies that promoted indigenous self-identification.

The Munduruku are from the Tapajós River Basin and have experienced two major territorial displacements in the modern era, driven away by mining on the Madeira River and attracted by the rubber cycle. Brought from the Tapajós River channel by river boats and rubber merchant colonels, the Munduruku would have occupied territories along navigable rivers, such as the banks of the Madeira River and along the Transamazônica Highway (ISA, 2017). (ISA, 2017). This evidence supports the self-declaration process of the Kamayúá community. As such, the proponents of this project recognize its legitimacy in this process.

Communities have similar cultural characteristics with regard to habits and customs practiced in the context of the community and the daily lives of individuals: language, social structures and structures, housing, hunting and fishing practices, as well as items used in these practices, types of canoes and means of transport, religion and agricultural practices.

Dwellings are preferentially built facing the river and are suspended about one meter above the ground. They are usually built of wood and roofed with asbestos or zinc shingles, clay or straw. Few are made of concrete and the poorest families build houses with walls and roofs of straw. In floodland areas, when the flooding is greater than expected, families suspend the floors of houses and in severe cases are forced to migrate to dry land.

The communities are predominantly Roman Catholic; the only Evangelical church is located in the community of Terra Preta do Ramal. The Catholicism practiced by these communities is traditional with emphasis on devotion of the Saints and performing rituals such as raising the flag, recitation of novenas and religious festivals of *arraias*. Many families celebrate annual festivities to honor the patron saints, who are considered to be protectors of the communities.

Almost all the communities around the Amazon Rio areas have primary schools (up until grade 4) under the responsibility of the Municipality of Manicoré. The main educational centers are in Democracia and Agua Azul where night time distance high school is offered through teleclasses. In the Kamayua community, secondary education is also offered at the local school. There are Youth and Adult Education programs, although frequently suspended, in four communities: Democracia, Jatuarana, São José do Miriti and Mocambo.

Community health care is provided through community health agents and midwives. Almost all the communities have healthcare workers, excluding Santa Maria, Pandegal, the São João Agroextrativist Association and Ponta Grossa. Ponta Grossa, due to its proximity to Manicoré, has easy access to health services. Jatuarana is the only community with a health clinic, but it is inoperative. Healthcare agents use their own homes to provide care, separating a room for emergency care. In more serious cases the agent accompanies the patient to Manicoré. In general, residents complain of the lack of support from the Municipal Department of Health in providing medicine and the lack of training among healthcare workers.

The communities on the project zone, except for Democracia, Vista Alegre, and Pandegal use river or igarapé water for human consumption and cooking, very often any kind of treatment. This use of untreated water raises the occurrence of waterborne diseases, especially among children. Furthermore most families dig shallow wells which carry high risks of contamination. The most common diseases are related to sanitation and nutrition or are endemic.

Every community has Association of Residents, Community Association, and Church Association presidents, who are chosen by the residents. Community leaders, who can have more than one leadership position, have specifically defined obligations and are respected for their ability to mediate internal conflicts and to represent the interests of the community with external institutions. They organize parties and seek partnerships to develop social and productive projects that benefit all residents.

Just as in other regions of the Amazon, these populations engage in various activities to assist vulnerable or at risk community members, to increase food security and to improve the quality-of-life. They split their time between extractivist, agricultural, fishing and hunting activities. Their cultivation and harvesting practices are predominantly traditional and have many traces of indigenous culture.

The communities maintain strong ties to productive activities linked to agriculture, especially cultivation of mandioc for use as flour, bananas and watermelon. Extraction of non-timber forest products such as Brazil nuts is also prevalent and so is, albeit to a lesser degree, the extraction of açai, tucuman, rubber and copaiba oil. The community of Pandegal is an exception as they engage heavily in mining, though extractivism is also practiced. Aside from agriculture and extraction of forest products, governmental aid in the form of social security benefits are important sources of income for these communities.

Despite the wide variety of activities, most families consider the sale of collected Brazil nuts as their main economic activity. This is especially true for the communities of São José do Miriti, Democracia, Jatuarana and Terra Preta do Ramal, who preferentially harvest Brazil nuts from the Rio Amapá RDS and the Amazon Rio I Private Reserve.

4.1.2 Interactions between Communities and Community Groups (CM1.1)

The community groups identified in the project area and other nearby communities have residents' associations and are also part of organizations that bring together several associations. The communities surrounding the RPDS Amazônia Rio I and area III make up the Central das Associações Agroextrativistas de Democracia - CAAD, while the groups neighboring area II meet at the Central das Associações Agroextrativistas do Rio Manicoré - CAARIM. In this way, communities interact with each other discussing their needs and other relevant issues about the territory where they live.

Communities also come together to hold football tournaments for men and women, promoting sports and leisure interactions between groups.

4.1.3 High Conservation Values (CM1.2)

The concept of attributes of high value for conservation was explained to the communities during the workshops for project development and was also part of the discussions on the Management Plan of the RPDS Amazon Rio I. In this process we understand that areas of high value for conservation in the context social directly linked to the use of hunting and fishing resources for food security of this nature and the protection of non-timber forest products for commercialization and composition of family income.

High Conservation Value	Areas that are fundamental for the livelihoods of communities.
Qualifying Attribute	Communities accessed the project area to practice subsistence hunting and fishing activities.
Focal Area	The Focal Area covers all areas of the project and must be monitored to maintain and improve HCVs. In this sense, the project develops fauna monitoring actions focusing on game species, those of nutritional value for communities.

High Conservation Value	Areas that are fundamental for the livelihoods of communities.
Qualifying Attribute	The communities that live in the project zone access the project area to extract nuts, açai and other non-timber forest products. This practice aims to sell raw materials and is fundamental to the composition of these families' income.
Focal Area	The Focal Area covers all project areas and must be managed to maintain and improve HCVs. The project will map the two main species of interest, açai and chestnuts, and will offer training on good management and production practices.

4.1.4 Without-Project Scenario: Community (CM1.3)

In the without-project land use scenario is it likely that the conditions found at the beginning of the project will be maintained. Lack of professionalization in extractive activities, lack of access to treated water or difficulties in water supply conditions in homes, little access to health care programs.

4.2 Net Positive Community Impacts

4.2.1 Expected Community Impacts (CM2.1)

Project activities should generate positive results in various community groups and will not generate risks. Some actions are agreed with the communities and may receive compensation such as labor, for example.

Community Group	Jatuarana, Democracia and São José do Miriti Communities.
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Impact(s)	Improvement in land and natural resource management.
Type of Benefit/Cost/Risk	Direct real benefit: Course of processing and good practices for the management of açai and chestnut. Mapping the potential of non-timber products.
Change in Well-being	These activities should contribute to improving the management and production of non-timber products of interest to communities by adopting good practices in the management of non-timber products and improving territorial management by identifying available resources that can be accessed by community groups.

Community Group	Communities – Project Zone
Impact(s)	Water treatment
Type of Benefit/Cost/Risk	Direct real benefit: Distribution of filters for water treatment.
Change in Well-being	Communities will have access to treated water for various uses. This activity of the project will contribute indirectly to improve the well-being and health of the families benefited by reducing the occurrence of diseases related to water consumption.

Community Group	Communities – Project Zone
Impact(s)	Improvement in education.
Type of Benefit/Cost/Risk	Direct real benefit: Complementary education program on Democracia Community. Direct predicted benefit: Improving the structure of schools
Change in Well-being	School reform contributes to improving the educational process and well-being of students. The education program is a school reinforcement that complements basic education and improves skills and knowledge by raising the learning process of the classes, 50 students belonging to 5 communities surrounding the RPDS Amazon Rio I were involved.

Community Group	Communities – Project Zone
Impact(s)	Social inclusion of women
Type of Benefit/Cost/Risk	Direct real benefit: Workshops on women's empowerment and promotion of specific activities for women's groups and female income generation. Involvement of women in the consult process.
Change in Well-being	These activities generate recognition of women and highlight their role in the community promoting female empowerment, reducing the vulnerability of this minority group and increasing gender-related equality.

Community Group	Jatuarana
Impact(s)	Improvement in water supply in households.

Type of Benefit/Cost/Risk	Direct real benefit: Reactivation of the 40-meter artesian well that had been inactive for 12 years and installation of the water distribution network.
Change in Well-being	The reactivation of artesian well and water pump installation serves 90% of the community's households, improving the welfare condition of riverside families facilitating access to piped water and reducing the physical effort to supply homes.

Community Group	Jatuarana and Democracia
Impact(s)	Improvement in community health care.
Type of Benefit/Cost/Risk	Direct real benefit: training of local health agents to periodically monitor the health of families of the local community, with priority in the elderly and children, serving the Jatuarana, Democracia, Santa Eva and Vista Alegre communities.
Change in Well-being	Investments in training community health agents improves the quality of family care.

Community Group	São José do Miriti
Impact(s)	Improvement in the infrastructure for access and transport of community production
Type of Benefit/Cost/Risk	Predicted direct benefit: construction of bridges to facilitate access and transport during dry periods.
Change in Well-being	The São José do Miriti community is in critical conditions for moving families and transporting products during the dry season. The construction of bridges should enable people's access and the logistics of community production during this period of the year.

4.2.2 Negative Community Impact Mitigation (CM2.2)

The activities described in the scope of the project are defined for forest conservation and do not generate negative impacts on communities. The EBCF authorizes the right to use and access essential natural resources for maintaining livelihoods and the composition of family income in communities in the project area.

The project's actions are protected for the conservation and maintenance of areas of interest for collective use.

4.2.3 Net Positive Community Well-Being (CM2.3, GL1.4)

In view of the social scenario of the communities without the project, where families used water directly from rivers and streams without treatment, have income mostly composed of extractivism, and were not benefited by internet access programs or involved in processes of reducing social inequality and vulnerability of minority (women of young people) it is possible to affirm that the activities planned out generate real positive impacts for all community groups in the project zone.

4.2.4 High Conservation Values Protected (CM2.4)

The actions of the project do not affect any of the HCVs identified by the community groups, since the respective attributes are directly linked to the use of forest resources, either for NTFP value chains derived from extractivism, traditional management associated with culture or for food security as a source of animal protein through hunting and fishing.

The project has as its fundamental premise in its scope the conservation of the forest and all-natural capital eventually accessed by the communities, thus maintaining and improving the attributes of high value for conservation.

4.3 Other Stakeholder Impacts

4.3.1 Impacts on Other Stakeholders (CM3.1)

The project aims at the conservation of forests in a mosaic of private areas, without human occupation, thus not resulting in negative impacts on the well-being of any relevant actors. The project proponent recognizes the project area as a source of renewable natural resources for surrounding social groups, allowing the NTFP management, hunting and fishing traditional practices.

The EBCF offers the opportunity to participate and access benefits generated by the project for other community groups that are not in the project area.

The following are some of the project activities that involve other stakeholders:

Community Group	Other Stakeholders: Santa Eva and Vista Alegre.
Impact(s)	Improvement in community health care.
Type of Benefit/Cost/Risk	Direct real benefit: training of local health agents to periodically monitor the health of families of the local community, with priority in the elderly and children, serving the Jatuarana, Democracia, Santa Eva and Vista Alegre communities.
Change in Well-being	Investments in training community health agents improves the quality of family care.

Community Group	Other Stakeholders: Água Azul, Urucury, Santa Maria, Vista Alegre, Santa Eva and Boa esperança.
Impact(s)	Water treatment
Type of Benefit/Cost/Risk	Direct real benefit: Distribution of filters for water treatment.
Change in Well-being	Communities will can be access to treated water for various uses. This activity of the project will contribut indirectly to improve the well-being and health of the families benefited by reducing the occurrence of diseases related to water consumption.

4.3.2 Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

The project does not foresee negative impacts to other stakeholders, as it only reinforces the prohibition of illegal activities such as deforestation, predatory hunting, and predatory fishing in the project area. On the other hand, the project generates benefits for community groups living around the area, which can be demonstrated by the implementation of the project social activities.

4.3.3 Net Impacts on Other Stakeholders (CM3.3)

The project also prohibits the existence of other community groups with profiles similar to the groups in the project area and those involved in actions that generate benefits to the well-being of these communities.

These groups are also heard during the stakeholder engagement and consultation process.

4.4 Community Impact Monitoring

4.4.1 Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

ACTION	INDICATOR	SAMPLING METHODS	PROJECT OBJECTIVES
Capacity building for sustainable agro-extractive organization and production;	Number of trainings executed	Activity report	Optimized operating activities, reduction of work related accidents and operating costs.
	Number of people trained	Frequency: every 5 years.	Increased participation of community members in NTFP activities.
Strengthening community-based social organization.	Number of trainings executed	Activity report	Development of associative and collaborative actions to strengthen the collective work.
	Number of people trained	Frequency: every 5 years.	
Support for implementation of sustainable production processes.	Number of bridge built	Delivery records, community receipt terms, activity reports.	Better conditions for commercial agreements between the community and the consumer market.
	Number of Personal Protective Equipment kits supplied	Frequency: every 5 years.	

	Number of Maps of non-timber forest products.		
Promotion of improvements in water quality and access to water.	Number of filters distributed	Delivery records, community receipt terms, activity reports. Frequency: every 5 years.	Improving the health and well-being of beneficiary families.
	Number of benefited communities		
	Number of filters distributed for community schools.		
	Types of improvement on water distribution network		
Investments in structure for education.	Number of benefited families		
	Number of student benefited with school reinforcement program.	Activity reports, delivery records and community receipt terms. Frequency: every 5 years.	Improvement in the access a quality education and schools with better conditions to serve students in the communities.
	Number of student benefited with support a reforms on the school		
	Number of reformed schools		
Program to encourage women's empowerment.	Number of meetings of women from communities to empower and promote participation	Activity report Frequency: every 2 years.	Gender participate in decision-making processes by community representatives within the framework of the Project activities.
Promotion and incentives for the development of income-	Number of workshops executed about	Activity report	Development of income-generating activities geared

generating activities geared towards women's and young people's skills.	entrepreneurship on the communities.	Frequency: every 2 years.	towards women's and young people's skills.
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4.4.2 Monitoring Plan Dissemination (CM4.3)

The monitoring plan and the results of the amazon rio project are available on the EBCF website and can be consulted at any time through the link <https://www.ebcf.com.br/>. Complementing this EBCF elaborated a booklet with appropriate language for dissemination in the communities surrounding the project, the copies were delivered during meetings with the leaders of each community. Other copies were made available to other stakeholders and are also accessible at EBCF's head in Manicoré - AM.

5 BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions (B1.1)

The Amazon has immense biological diversity. It is estimated that its forests and rivers harbor approximately 25% of the species known on the planet, with approximately 60,000 plant species (of which 30,000 are higher plant species, including 2,500 species of trees and representing 10% of the world's plant species), 2,000 species of fish, 300 species of mammals (ALBAGLI, 2001), and over 1,000 species of birds (10% of the world).

Regional studies carried out in the southwestern Amazon, particularly near the Madeira River, have shown some of the highest levels of biodiversity in the world. Surveys and biological inventories conducted in the Rio Amapá RDS, located near the project areas, were used to provide details on animal diversity that can be found for the Amazon Rio project zone and its surroundings.

The data used to analyze the plant biodiversity of the Amazon Rio areas were previously collected from forest inventories for logging practices on the properties in 2007 (Annex 7), as well as from an expedited forest inventory (Annex 8), conducted in 2013 to record forest species richness, following the recommendations of Filgueiras et al., (1994).

For analysis of fauna biodiversity, biological inventory information was used from the Rio Amapá RDS, conducted in 2009 by the Amazonas State Secretary of Environment and Sustainable Development (SDS) accessible in the Management Plan (GOVERNO DO ESTADO DO AMAZONAS, 2010).

FLORA

Dryland (terra firme) forest

Forest inventory 100% reported in the Annual Production Unit (Unidade Produtiva Anual - UPA) for the Amazon Rio I area (Annex 7) registered 100% of trees in the dryland (terra firme) logged area and identified 87 species belonging to 30 families and 26 occurrences of an unidentified species. The expedited forest inventory carried out on a dryland area about four kilometers long, west of Amazon Rio I, yielded 43 species in 20 families: predominantly Fabaceae (16%), Sapotaceae (15%), Arecaceae (12%), Burseraceae (9%) and Lecytidaceae (8%). Within these families, the main tree species of copal (*Protium* sp.) and abiurana (*Pouteria* sp.) are abundant and frequently found throughout the region.

The inventory reports the following species as most commonly found in the terra firme area: abiurana branca (*Micropholis mensalis*), acariquara (*Minuartia guianensis*), cedrinho (*Erisma uncinatum*), maparajuba (*Manilkara paraensis*), masaranduba (*Manilkara huberi*), pau marfim (*Calycophyllum acreanum*) and tacacazeiro (*Sterculia speciosa*). There are also noteworthy species of great ecological importance such as: Brazil nut (*Bertholletia excelsa*), copaíba-jacaré (*Eperua oleifera* Ducke), "tento" Red Beadtree/Red Sandalwood (*Adenanthera pavonina* L.), fava (*Abarema* sp.), pajurá (*Licania laevigata* Prance), tauarí (*Couratari guianensis* Aubl.), arurá (*Osteophloeum platyspermum*) and jutaí (*Pterocarpus* sp.).

Of these species, the Brazil nut has significantly contributed to the economy of local residents due to the large-scale commercialization.

Palms are also noted in the inventory: açai (*Euterpe precatoria*), babassu (*Attalea speciosa*), caramuri (*Pouteria elegans*) and patawa (*Oenocarpus bataua*), widely used as food and caranai palm poktamui (*Lepidocaryum tenue*), whose seeds are used for making handicrafts and its leaves used for roofing in the interior of Amazonas. Overall, the palm tree species significantly contribute to the plant diversity of the entire region where the Amazon Rio areas are situated.

Floodplain (várzea) forests

The expedited inventory in floodplain (várzea) areas reveals heterogeneous forest formations which include tree and shrub species. There were 103 forest species in 29 families identified, including 27 trees (not necessarily of the same species) and not identified by the local residents.

On the floodplains, the most abundant plant families are: Arecaceae (18%), Euphorbiaceae (15%), Moraceae (9%), Myristicaceae (7%), Chrysobalanaceae (6%), Fabaceae (6%), Sapotaceae (4%), Meliaceae (4%) and Lecytidaceae (4%), mainly represented by seringa or rubber trees (*Hevea pauciflora*), seringa barriguda (*Hevea spruceana*), jataúba (*Guarea guidonia*), apuí (*Ficus* sp.), assacu (*Hura crepitans*), andiroba (*Carapa guianensis*), cedro (*Cedrela odorata*), muirapiranga (*Brosimum angustifolium*), muiratinga (*Maquira sclerophylla*) and virola (*Virola cuspidata*), also known as ucuúba. These species are all tree species and are used for various purposes such as construction, shipbuilding, furniture, packaging and seeds for handicrafts.

Large rubber plantations exist in the floodplain areas. The history of rubber tapping is evident as both old and new cuts can be seen in the same tree. Also notable is the occurrence of other species which were logged in the past for their timber value, such as paricá (*Schizolobium amazonicum*), copaíba mari-mari (*Copaifera reticulata*), envira de cutia (*Scleronema*

micranthum), garrote (*Brosimum utile*) and copaiba jacaré (*Eperua oleífera*). They represent approximately 89% of the volume of harvested species, according to the 2006 report of the currently suspended post-exploratory logging plan (Annex 6 - Vald. II T05 POA, POS, REV. 2006).

Threats to local flora

Forest species of economic interest in the Amazon Rio project areas have suffered successive removals through selective logging, mainly *Eperua oleífera* (copaiba jacaré), *Brosimum utile* (garrote); *Scleronema micranthum* (envira cutia), *Copaífera reticulata* (copaíba mari-mari), *Schizolobium amazonicum* (paricá), *Simarouba amara* (marupa), *Parkia paraenses* (paricarana), *Brosimum parinarioides* (amapá), *Couratari guianensis* (tauari branco) and *Anacardium giganteum* (caju-açu). These were the 10 most logged species in 2006, in the areas that are now part of the Amazon Rio I RPDS. These 10 species accounted for 96% of all wood removed from the total 19 species logged.

FAUNA

Regarding animal species, biological inventories carried out in the Rio Amapá RDS in the immediate vicinity of the project area indicate the presence of 29 species of mammals, 210 species of birds, 18 species of amphibians and 85 species of fish (GOVERNO DO ESTADO DO AMAZONAS, 2010). Pacas, agoutis, armadillos, deer, spider monkeys, howler monkeys, capuchin monkeys, tapirs, peccaries and catitús are among the main species of animals mentioned by the community during the participatory workshops.

Mammals

From an area of 82 km of dryland forest, records of 47 medium to large mammals were obtained through visual observation and collected material such as tracks, droppings, and skulls. The presence of 29 species distributed among seven orders were confirmed, as presented in the Rio Amapá RDS Management Plan (2010).

The presence of large carnivores, such as jaguars (*Panthera onca*) and cougars (*Puma concolor*), indicates high environmental quality, and may be linked to low anthropic pressure, allowing viable populations of these carnivores to thrive (CULLEN JR. & VALLADARES-PÁDUA, 1999). Moreover, the presence of giant otters (*Pteronura brasiliensis*) in surrounding rivers, such as the Rio Amapá, can be considered a good indicator of environmental balance and water quality.

In the baseline scenario, without the project, there is no specific information on the areas that have suffered anthropogenic changes and impacts from logging activities. Therefore, it may not be possible to find the same richness or abundance of species in private areas that suffer or have suffered from the impacts of economic activities and environmental degradation from anthropogenic actions.

Bird Species

In the Rio Amapá RDS, 210 species of birds have been recorded, four of which are new species: a hawk (gavião in Portuguese) (*Leucopternis* sp), the antwren (chororozinho in Portuguese) (*Herpsilochmus* sp.), the tody-tyrant (maria in Portuguese) (*Hemitriccus* sp), and a jay (gralha in Portuguese) (*Cyanocorax* sp). The geographic distribution of these four new species is limited, probably due to the small interfluvium of the Madeira-Purus.

Another important result is the extent of the distribution of five species along hundreds of kilometers of forest: ocellated crane (maxalalagá in Portuguese) (*Micropygia schomburgkii*), least nighthawk (bacurauzinho in Portuguese) (*Chordeiles pusillus*), black antbird (chororó-preto in Portuguese) (*Cercomacra serva*), citron-bellied attila (tinguaçu-de-barriga-amarela in Portuguese) (*Attila citriniventris*) and wedge-tailed grass finch (canário-do-campo in Portuguese) (*Emberizoides herbicola*), indicating the heterogeneity of the area and the availability of resources throughout the area. According to Menger (2011), in a study of the interfluvium area of the Purus-Madeira, the inequality in species distribution can be explained in part by their sensitivity to environmental variations. This is represented by the composition of palm trees, which are abundant throughout the region, as seen in floristic inventories for the region.

Herpetofauna (reptiles and amphibians)

In the Rio Amapá RDS, 18 amphibian species belonging to five families were recorded, most frequently Hylidae and Leptodactylidae. The dryland forest harbors a wealth of poison dart frogs. *Colostethus caeruleodactylus* had previously been found in the Autazes region and more recently along the Purus River. It was found in large numbers on dryland containing Brazil nut trees, near the Amapá River. The record of occurrence of the species in this area has expanded its area of occupancy about 210 km to the south.

Three species of snakes were also identified in the dryland forests: brown-banded water snake (*Helicops angulatus*), *Dendrophidion dendrophis* and the pitviper *Bothrops* sp (jararaca in Portuguese). The smooth-fronted caiman (*Paleosuchus trigonatus*) was registered on the banks of the Amapá River, a species that lives in dryland igarapés (seasonally flooded streams) and near larger rivers.

Threats to local fauna

According to the Chico Mendes Institute for Biodiversity Conservation (ICMBio), Brazil has the largest biodiversity in the world. There are more than 100,000 invertebrate species and approximately 8,200 vertebrate species: 713 mammals, 1,826 birds, 721 reptiles, 875 amphibians, 2,800 freshwater fish and 1,300 saltwater fish. Within this list, a significant number (627) are listed as endangered species.

The participatory mapping of systems of natural resource use for communities around the Amazon Rio areas, conducted by EBCF in 2013, shows that the most serious threat to local wildlife is overharvesting by local populations, mostly through commercial fishing and hunting.

5.1.2 High Conservation Values (B1.2)

The project's private properties and the project zone are areas of relevant interest for maintaining biodiversity, as they are located in a region with a high concentration of fauna and flora species.

High Conservation Value	Protect area
Qualifying Attribute	The project areas are included in the territorial outline of areas of extremely high biological importance as assessed by the Ministry of the Environment (MMA, 2016), according to map 00 and the aforementioned activities are in line with the Program of Priority Areas for Conservation, Sustainable Use, and Benefit Sharing of Brazilian biodiversity.
Focal Area	According to the Ministry of Environment's map of critical areas for biodiversity conservation, all areas of Amazon Rio and the project zone are focus areas for monitoring and maintaining identified HCVs.

High Conservation Value	Threatened species
Qualifying Attribute	According to the ICMBio 627 are listed as endangered species.
Focal Area	In the project areas, 19 are identified on the World List of Endangered Species.

High Conservation Value	Endemic species.
Qualifying Attribute	Species that occur only in the Amazon biome and depend on good habitat conditions, climate and food availability for survival, reproduction and maintenance.
Focal Area	In the project areas, were identified 68 Endemic Species.

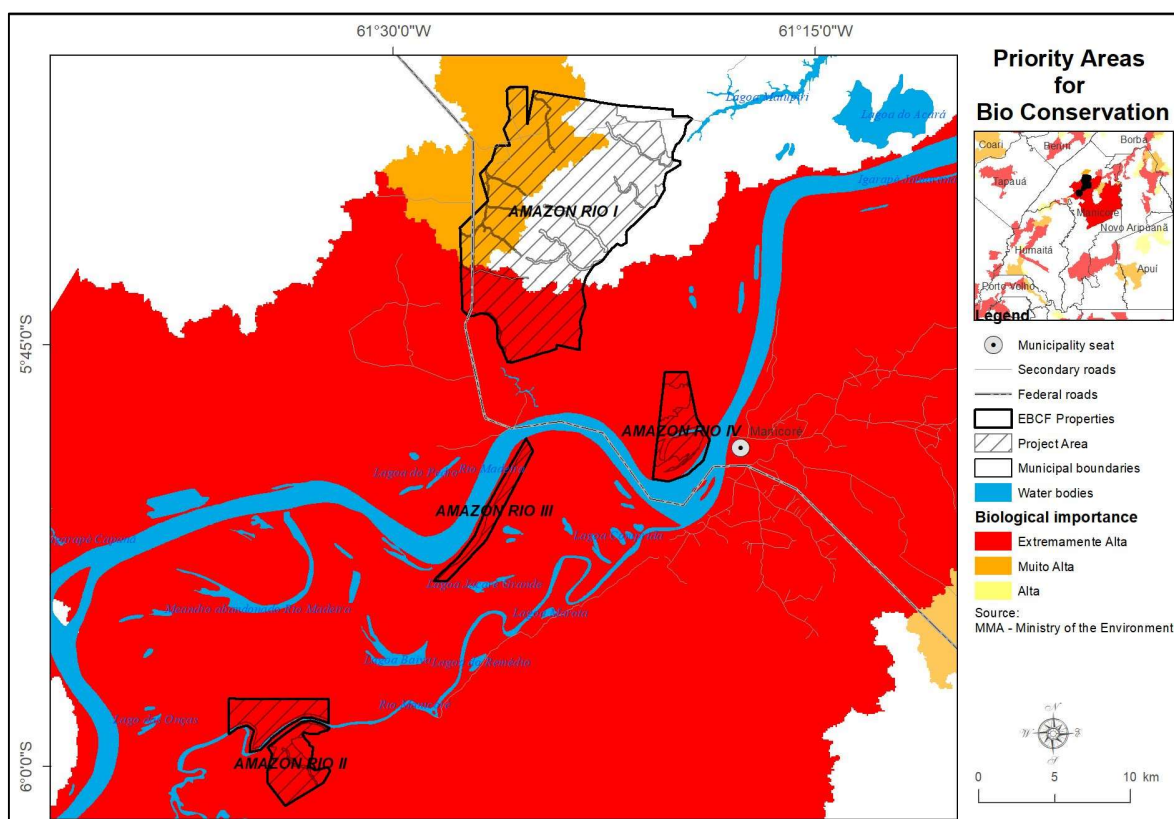


Figure 38. Location of project areas within priority areas for biodiversity conservation

5.1.3 Without-project Scenario: Biodiversity (B1.3)

In the scenario without the project, the lack of information on the richness of important, threatened or endemic species and the continuity of logging and forest management resulting from it can affect biodiversity damage. Predatory hunting activities and habitat loss are among the main causes of species extinction.

5.2 Net Positive Biodiversity Impacts

5.2.1 Expected Biodiversity Changes (B2.1)

Change in Biodiversity	Timber forest species.
Estimated Change	Reduced exploratory pressure.
Justification of Change	The development of the project focused on reducing exploratory intensity with the suspension of the forest management plan

	focused on extraction and timber species. Tree individuals such as <i>Copaifera reticulata</i> (copaiba mari-mari) and <i>Schizolobium amazonicum</i> (paricá), among others, are no longer removed from the forest for commercial purposes.
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Change in Biodiversity	Mammals, birds, amphibians, and reptiles.
Monitored Change	Maintenance of animal biodiversity.
Justification of Change	The conservation of forests corresponding to the Amazon Rio I, II, III and IV areas are habitat for several species of fauna and flora. The project provides for the suspension of logging in the areas, flexibility in environmental manipulation. The implementation of the project must contribute to the maintenance and improvement of environmental and habitat conditions for various species. Monitoring local fauna species will generate important information about the occurrence of endemic or threatened situations.

5.2.2 Mitigation Measures (B2.3)

The project actions do not represent the potential generation of negative impacts, having as its main objective the protection of forest areas located in the south of the state of Amazonas, a region that suffers great exploration pressure. It is important to mention that in addition to the reduction in greenhouse gas emissions, the preservation of forests has the potential to generate positive impacts on biodiversity.

5.2.3 Net Positive Biodiversity Impacts (B2.2, GL1.4)

The implementation of the project promote the reduction of exploration pressure by around 18,559 hectares in the Amazon, avoiding the extraction of tree individuals, the opening of roads, and other potential impacts of anthropic actions as a result of logging. The actions carried out by the project contribute to the improvement of environmental conditions, including natural regeneration in areas already explored and maintenance of the natural habitat of several species of fauna and flora, thus demonstrating its effectiveness in generating net positive impacts on local biodiversity.

5.2.4 High Conservation Values Protected (B2.4)

The conservation of forests, reduction of pressure in the project areas, and creation of the Amazon Rio I Private Sustainable Development Reserve were fundamental for the preservation of HCVs, improving environmental conditions for the maintenance of habitats, fauna and flora species, protection of species endangered and endemic species and ecosystem integrity.

5.2.5 Species Used (B2.5)

Project activities do not foresee the introduction of plant or animal species of any kind.

5.2.6 Invasive Species (B2.5)

Not applicable. Exotic species were not introduced into the project areas, as the main focus of activities is to maintain existing native forests, stop the selective deforestation of trees established in the timber management plan and promote better management of non-timber natural resources.

5.2.7 Impacts of Non-native Species (B2.6)

Not applicable. There were no plant or animal species by design.

5.2.8 GMO Exclusion (B2.7)

Not applicable. The actions of the Amazon Rio project do not foresee the introduction of any species of flora or fauna, nor GMOs.

5.2.9 Inputs Justification (B2.8)

The actions developed by the project are focused on promoting value chains of non-timber products derived from the forest extraction culture, not involving the use of chemical fertilizers or pesticides, therefore, no type of fertilizer or pesticide will be used in the project areas.

5.2.10 Waste Products (B2.9)

No significant waste is expected to be generated by the project activities implementation.

5.3 Offsite Biodiversity Impacts

5.3.1 Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2)

No significant waste is expected to be generated by the project activities implementation.

5.3.2 Net Offsite Biodiversity Benefits (B3.3)

Not applicable, as no negative effects of the project inside or outside the project zone were identified. In this way, all net impacts of the project on biodiversity are positive.

5.4 Biodiversity Impact Monitoring

5.4.1 Biodiversity Monitoring Plan (B4.1, B4.2, GL1.4, GL3.4)

ACTION	INDICATOR	OUTCOMES SAMPLING METHODS (Data, Frequency)	PROJECT OBJECTIVES
bird monitoring	Species diversity Number of endemic species; Number of endangered species; Number of game species.	Rapid Inventory Protocol, component of the RAPPELD method, using active search in monitored transects. Frequency: every 5 years.	Biodiversity conservation
Monitoring of amphibians and reptiles	Species diversity Number of endemic species; Number of endangered species; Number of game species.	Rapid Inventory Protocol, component of the RAPPELD method, using visual search in the monitored transects. Frequency: every 5 years.	Biodiversity conservation
Monitoring of mammals	Species diversity Number of endemic species; Number of endangered species; Number of game species.	Rapid Inventory Protocol, component of the RAPPELD method, using active search and camera traps in the monitored transects. Frequency: every 5 years.	Biodiversity conservation

Monitoring actions are fundamental for the preparation of the list of species that occur in the project zone, thus composing the richness estimate considering seasonality, and forest typologies, evaluating the degree of endemism, the environmental sensitivity of certain species, and the identification of bioindicators quality and structure of habitats.

For sampling the local fauna, the project developed the Rapid Inventory protocol – RAP in dry and rainy periods, for each faunal group specific methodologies were applied:

Active Search: it is indicated to obtain a high number of records of species in a short period of days (Develey, 2003), it was used both for avifauna and for mammalian individuals. The application of this method is important for the registration of species in a given area, where it is possible to estimate the richness of conspicuous species (easy visualization/vocalization), inconspicuous species (difficult visualization and little vocalization), and those that inhabit higher strata.

Visual Search: this method was used for sampling herpetofauna species, it consists of visual inspection of all environments including sampling in Breeding Sites and other suitable places for amphibians and reptiles, with a detailed search of individuals in all available microhabitats as for example, litter, fallen logs, among the bark and inside hollow trees, in the axils of palm trees, among aerial roots, holes in the ground, temporary puddles and other aquatic environments (Heyer et al., 1994).

Photographic traps: this method has been used extensively in several biomes of the planet for studies with mammals (Karanth and Nichols, 1998; Carbone et al., 2002). of mammalian specimens.

Conducting biodiversity surveys and monitoring protocols are of great importance and are fundamental for generating qualified knowledge about the living species of these ecosystems.

5.4.2 Biodiversity Monitoring Plan Dissemination (B4.3)

The results of the monitoring of the Amazon Rio project will be made available on the EBCF website and can be consulted at any time through the link <https://www.ebcf.com.br/>. Complementing this, the team from the Brazilian Forestry Conservation Company prepared a booklet with illustrated biodiversity monitoring results for dissemination in the communities involved in the project. Copies are delivered during meetings with the leaders of each community. Some copies are available to other stakeholders and are accessible at the EBCF headquarters in Manicoré – AM.