



**Verified Carbon
Standard**



socialcarbon

AGROCORTEx REDD PROJECT



Document Prepared by Ecológica Assessoria

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Prepared By	Ecológica Assessoria Ltda.
Contact	Rua Doutor Bacelar, 368, Conj. 23 Vila Clementino, São Paulo – SP, Brazil Postal Code: 04026-001 T: + 55 (11) 2649-0036 marcelo@ecologica.org.br

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1. PROJECT DETAILS

1.1. Summary Description of the Implementation Status of the Project

Brazil has more than 490 million hectares of forest, covering 59% of its entire territory, putting it in second place for nations with most forest area worldwide¹. Brazil has at times also been the country with the highest levels of forest loss in the world, for example 53,167,000 ha were deforested from 1990 to 2015 at an average rate of 0.4%/year². The expansion of the agricultural frontier due to cattle ranching, soy farming, timber collection, infrastructure and colonization have contributed to this historically high deforestation rate, which is concentrated in the northern portion of the country, where the Amazon Rainforest lies.

The primary objective of the Agro cortex REDD Project is to avoid the unplanned deforestation (AUD) of the 186,067.04 ha project area, consisting of 100% Amazon rainforest. The project area is located within a private property named “Fazenda Seringal Novo Macapá”, which is situated in the municipalities of Manoel Urbano, Pauini and Boca do Acre, in the States of Acre and Amazonas, South-western Amazon.

The project proponent is Agro cortex Madeiras do Acre Agro florestal Ltda., a Brazilian private company responsible for the operations of Agro cortex Florestas do Brasil S.A – the holding. The latter also holds Agro cortex Florestas Tropicais Ltda., which owns another private company named Batisflor Florestal Ltda. – the landowner of Fazenda Seringal Novo Macapá.

In March/2014, the Agro cortex holding company and Batisflor Florestal Ltda. established an agreement to harvest forest products/by-products and non-timber forest products (NTFPs) in the Project Area, in a manner that is consistent with local ecosystem conservation, granting rights of 1) timber harvesting, 2) NTFPs extraction and 3) carbon credits to Agro cortex Madeiras do Acre Agro florestal Ltda. (hereafter, “Agro cortex” or “the company”).

Agro cortex is a sustainable development company engaged in conserving the environment through sustainable forest and NTFP management, generating greenhouse gases (GHG) emission reductions, and NTFPs. Agro cortex started the sustainable forest management operations in June-2014, which defines the project start date because the activity resulted in reduced GHG emissions. Agro cortex have maintained the Sustainable Forest Management Plan (SFMP) operational and according to planned since the project start date. Until the end date of this monitoring report, seven Annual Production Units (APUs) were harvested.

¹ FAO. Global Forest Resource Assessment 2015: Desk reference. Rome, 2015. 253 p. Available at: <<http://www.fao.org/3/a-i4808e.pdf>>. Last visited on: 29-March-2022.

² FAO. Global Forest Resources Assessment 2015 Country Reports: Brazil. Rome, 2014. 148 p. Available at: <<http://www.fao.org/3/a-az172e.pdf>>. Last visited on: 21-March-2017.

The present REDD project is estimated to avoid a predicted 30,006 ha of deforestation, equating to 14,507,808 tCO₂e in emissions reductions over the 30 year project lifetime (01-July-2014 to 30-June-2044).

The project is located in the border between the States of Acre and Amazonas, within the agricultural expansion frontier region, around 25km south of the BR-364, the main highway that crosses the State of Acre. The main deforestation and degradation agents acting within the reference region are: cattle ranching, mainly producing beef cattle; and timber harvesters, acting both legally and illegally. Deforestation in the region involves spatially overlapping activities: firstly, extraction of commercially valuable tree species for sale to timber companies. The final step is the slash-and-burn deforestation of the area above for pasturelands and cattle ranching.

Agrocortex developed a sustainable forest management plan (SFMP) that is certified by the Forest Stewardship Council (FSC), and is considered a tool for forest conservation, maintenance of forest carbon stocks, and decreasing deforestation rates in the project region. These benefits are mainly due to the following:

- the use of reduced impact logging techniques;
- reduced social and environmental operational impacts;
- increased surveillance in the area; and
- increased economic value from forest resources.

The increased complexity and costs associated with the sustainable operation of the forest as well as other factors such as bureaucratic constraints and price fluctuations of certified timber prices, make sustainable forest management less competitive than illegal logging. Thus, revenue from the sales of the Verified Carbon Units (VCUs) is essential for the project activity to compete with profitable alternative land-use scenarios.

In addition to contributing to the long-term conservation of the region, the Agrocortex REDD Project also establishes a barrier against the advancement of deforestation, making it an important contribution to the conservation of South-western Amazon biodiversity and also to climate regulation in Brazil and South America.

This is the third monitoring period of the project. The prevention of unplanned deforestation in the Project Area reduced the emission of 881,853 tCO₂e during the period from 01-January-2020 to 31-December-2021, both days included. This figure of emissions reductions is the net anthropogenic GHG emission reductions after subtractions for project, leakage and buffer emissions.

The contribution to sustainability is being monitored applying the SOCIALCARBON® Standard, which is based in six main pointers: Technology; Natural; Financial; Human; Social and Carbon Resources. This is the third SOCIALCARBON Report, related to Point 2, and the project applies the SOCIALCARBON Standard since the first monitoring period. Agrocortex REDD Project achieved a general score of 4,7 during this monitoring period.

1.2. Sectoral Scope and Project Type

14. Agriculture, Forestry, Land Use (AFOLU)

Reducing Emissions from Deforestation and Degradation (REDD) through Avoided Unplanned Deforestation.

1.3. Project Proponent

Organization name	Agrocortex Madeiras do Acre Agroflorestal Ltda.
Contact person	Marcos Preto
Title	CEO, Executive Director
Address	Rua: Vergueiro, 2253, 7º andar, sala 713/714 Postal Code: 04101-100 São Paulo – SP, Brazil
Telephone	+55 11 3254-4777
Email	marcos.preto@agrocortex.com

1.4. Other Entities Involved in the Project

Organization name	Ecológica Assessoria Ltda.
Role in the project	Project developer. As the authorized contract, Ecológica was given the responsibility of developing the present Project Document and SOCIALCARBON Report.
Contact person	Marcelo Hector Sabbagh Haddad
Title	Technical Coordinator
Address	Rua Doutor Bacelar, 368, Conj. 23 Vila Clementino, São Paulo – SP, Brazil Postal Code: 04026-001 marcelo@ecologica.org.br
Telephone	+ 55 11 2649-0036

Email

marcelo@ecologica.org.br

1.5. Project Start Date

The Project Start Date is 02-June-2014. “Fazenda Seringal Novo Macapá” is a private land owned by Batisflor Florestal Ltda, a Brazilian company owned by Agro cortex Florestas Tropicais Ltda. On 17/March/2014, an agreement was established between the Agro cortex holding company and Batisflor Florestal Ltda., granting rights of timber harvesting, NTFPs extraction and carbon credits to Agro cortex Madeiras do Acre Agro florestal Ltda. (i.e., the project proponent).

Agro cortex obtained the logging authorization from the Brazilian Environmental Agency³ for operating the area on 02-June-2014. From this date, the first Annual Production Unit (APU) was harvested through sustainable forest management plan (SFMP) and reduced impact logging techniques. This was the main action of the company in terms of reducing GHG emissions and initiating the present REDD project and is thus the designated project start date.

Furthermore, the greater presence in the area increased the surveillance, which helps to avoid unplanned deforestation or illegal logging within the project area by external agents.

1.6. Project Crediting Period

The project has a crediting period of 30 years, from 01-July-2014 until 30-June-2044.

This is the third monitoring period, from 01-January-2020 to 31-December-2021.

Although the Project Start Date is 02-June-2014, 01-July-2014 was considered as the start of Project Crediting Period to facilitate the emission reduction calculation and mapping, starting at the beginning of the month after the project start date.

1.7. Project Location

The Agro cortex REDD Project is situated in three municipalities within the South-western Amazon region: Manoel Urbano in the State of Acre (AC), and Pauini and Boca do Acre, in the State of Amazonas (AM). The project area is composed of one single property (in Portuguese: Fazenda) covered almost in its totality by native vegetation: Fazenda Seringal Novo Macapá, totaling 190,210 ha.

³ The responsible environmental agency in this case is the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - IBAMA.

In accordance with VCS requirements, stipulated in the Approved VCS Methodology VM0015, version 1.1, the project area may only include areas composed of “forest”⁴ for a minimum of ten years prior to the project start date. Satellite images from 2003 and 2013 were analyzed and classified. Images from those years were chosen due to the lack of availability of images for the first semester of 2014 (before the Project Start Date).

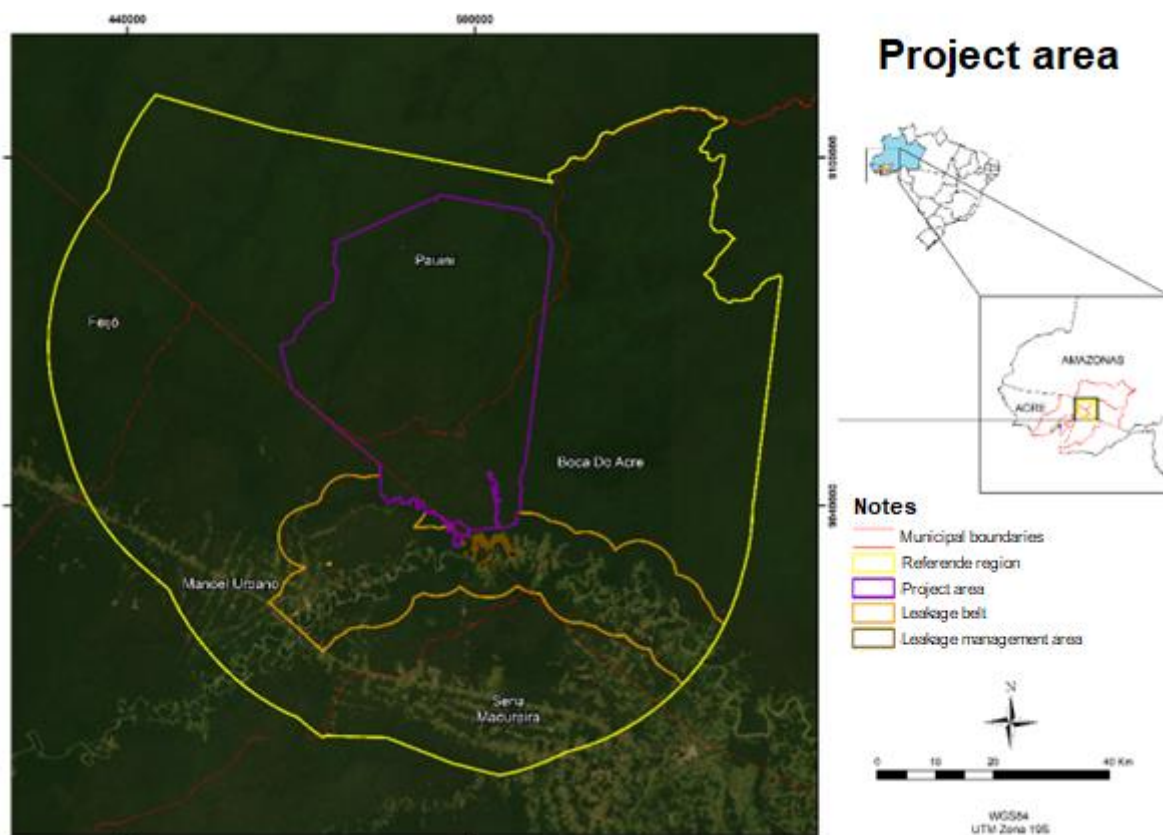
A portion of land measuring 3,690.22 ha located on the south border of Fazenda Seringal Novo Macapá was excluded from the Project Area, as the ownership of this area is being transferred to the local community. It is important to note that this area is not located within the Project Area. The remaining areas within Fazenda Seringal Novo Macapá that were defined as forest in 2013 and in 2003 were identified and utilized to compose the project area. In addition, some non-forest areas were also excluded, such as rivers, rocks, and non-forest vegetation.

As shown in Figure 1 below, the size of the areas that were considered “non-forest” (i.e. deforested areas, non-forest vegetation, hydrography or rock formations) within the project area at the project start date was 452.74 ha. This was also excluded from the initial area of 190,210 ha, resulting in 186,067.04 ha, which was then defined as project area.

The project geodetic coordinates utilizing Datum WGS84 are provided in Appendix I.

⁴ Brazilian Forestry Service. Brazil adopts FAO forest definition: “Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity in situ.” Available at: <<https://snif.florestal.gov.br/pt-br/florestas-e-recursos-florestais/167-definicao-de-floresta>>. Last visited on: 29-March-2022.

Figure 1. Agrocorrex REDD Project Area



1.8. Title and Reference of Methodology

Approved VCS Methodology VM0015: Methodology for Avoided Unplanned Deforestation, version 1.1, published on 03-December-2012.

In addition, the SOCIALCARBON Methodology⁵, Indicators for REDD + SFMP Projects, Version 1.2⁶ is being applied as a sustainability tool in association with VCS Standard.

Furthermore, the following tools were used:

⁵ SOCIALCARBON Methodology was developed by Ecológica Institute (www.ecologica.org.br). It was founded on the principle that transparent assessment and monitoring of the social and environmental performance of projects improves their long-term effectiveness. The methodology uses a set of analytical tools that assess the social, environmental and economic conditions of communities affected by the project and demonstrates through continuous monitoring the project's contribution to sustainable development.

⁶ Available at <https://www.socialcarbon.org/documentation> Last visited on 29-March-2022.

- VT0001 - Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities, v3.0, published on 01-February-2012;
- AFOLU Non-Permanence Risk Tool: VCS Version 4, published on 19-September-2019;
- CDM-approved and VCS-endorsed Tool for testing significance of GHG emissions in A/R CDM project activities, v01

1.9. Participation under other GHG Programs

The project activity is not included in an emission trading program or any other mechanism that includes GHG allowance trading.

The project area has not created any other form of environmental credit. This project has not been registered in any other credited activity. The project does not intend to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under this VCS project.

This project has not been registered and is not seeking registration under any other GHG Programs.

1.10. Other Forms of Credit

The project activity is not included in an emission trading program or any other mechanism that includes GHG allowance trading.

The project area has not created any other form of environmental credit. This project has not been registered in any other credited activity.

The project does not intend to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under this VCS project.

1.11. Sustainable Development

The primary objective of the Agro cortex REDD Project is to avoid the unplanned deforestation (AUD) of the 186,067.04 ha project area, consisting of 100% Amazon rainforest. The Project also has the function of establishing a barrier against the advancement of deforestation, making an important contribution to the conservation of South-western Amazon biodiversity and also to climate regulation in Brazil and South America.

These measures contribute to several nationally stated sustainable development priorities, such as the following objectives from the Brazilian Government related to the Sustainable Development Goals, and are monitored through the verification reports and applied SOCIALCARBON Standard:

- **Objective 12: Ensure sustainable production and consumption patterns.** - The carbon project nurtures a better environmental management system since increases stakeholder awareness concerning the climate changes mitigations, and whichever environmental activity the landowners intend to apply. Alongside, the project is based on encouraging sustainable development and maintaining the standing forest through the sustainable use of its resources, and it aims to optimize access to non-timber forest products and the consumption of local inputs. One of the main objectives is to reduce illegal deforestation and profit from this activity, offering alternatives for income and extraction. This SDG is monitored in the following resources: Human Resource (6. Community education and training), Financial (7. Alternative income sources), Natural (11. Social and environmental investments), Biodiversity (13. Non-timber forest products (NTFPs), and Carbon (17. Stakeholder consultation).

Agrocortex has progressively contributed to this SDG since its main activity is sustainable forest management, with less impact, and FSC certification, to ensure the transparency and effectiveness of its actions. In addition to the impact reports on permanent plots, sustainable management plan and reduced exploitation within the cycle allowed by the applicable authorizations in order to reduce the impacts of its production process, Agrocortex also invests in the training of its employees and in the purchase of supplies from local producers, encouraging circular economy and production. The results can be followed in the Social Carbon report through the score's history and hexagon.

- **Objective 13: Take urgent action to combat climate change and its impacts.** - Another of the main objectives of the REDD project is to reduce greenhouse gas emissions through the conservation of standing forest. Thus, its activity is already an action to combat climate change and its effects. In addition, the project stimulates biodiversity monitoring initiatives in a measure to combat climate changes. This SDG is monitored in the Biodiversity (14. Biodiversity monitoring, 15. Impact on remaining flora) and Carbon (16. Buffer reduction, 18. Project performance) resources in the SOCIALCARBON Report.

Mitigation of the climate crisis is the core activity of the Agrocortex REDD Project, since it is a conservation project that aims to keep the forest standing. Through the Project performance indicator, it is possible to verify that the performance of the project is very high, demonstrating the effectiveness of Agrocortex in reducing unplanned deforestation.

- **Objective 15: To protect, restore and promote the sustainable use of terrestrial ecosystems, to manage forests sustainably, to combat desertification, to halt and reverse land degradation, and to halt the loss of biodiversity.** - The project is based on the conservation and restoration of forests in the Amazon biome, ensuring forest services, preservation of natural resources, and biodiversity. This SDG is monitored in the Natural (11. Social and environmental investments) and Biodiversity (14. Biodiversity monitoring, 15. Impact on remaining flora, 15. Impact on remaining flora) resources in the SOCIALCARBON Report.

For more information on Agro cortex's achievements and results of the Social Carbon Standard during this monitoring period, please check section 6.

Reducing deforestation and promoting sustainable development in the Amazon is also a key component to Brazil's Nationally Determined Contribution (NDC) under the Paris Agreement. According to the Brazilian Government Ministry for the Environment (in Portuguese, Ministério do Meio Ambiente), the implementation of REDD+ activities are an important component to meet the Country's contribution under the United Nations Framework Convention on Climate Change while preserving natural forest resources⁷.

The following components of the Brazilian commitments under the Convention are reinforced by the development of the Agro cortex REDD Project:

- Strengthening and enforcing the implementation of the Forest Code, at federal, state and municipal levels;
- Strengthening policies and measures with a view to achieve, in the Brazilian Amazon, zero illegal deforestation by 2030 and compensate for greenhouse gas emissions from legal suppression of vegetation by 2030;
- Enhancing sustainable native forest management systems, through georeferencing and tracking systems applicable to native forest management, with a view to curb illegal and unsustainable practices.

In addition, implementation of REDD and SOCIALCARBON mechanisms together with FSC-certified SFMP promotes sustainable forest use. Beyond the project's ecological and carbon benefits, a proportion of the carbon credits generated will be dedicated to improving the social and environmental conditions in the project region, specifically contributing to improving deforestation control, and developing environmental education and other social activities.

⁷ Brazil's Nationally Determined Contribution towards achieving the objective of the United Nations Framework Convention on Climate Change can be accessed in full at: <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Brazil/1/BRAZIL%20iNDC%20english%20FINAL.pdf>. Last visited on 29-March-2022.

2. SAFEGUARDS

2.1. No Net Harm

Agrocortex performs the social and environmental impact assessment of the sustainable forest management performed on the Project Area yearly. This assessment was performed by Agrocortex management team with support from an experienced consultant. The assessment included consultations with local stakeholders, who were asked about their impressions on the expected impacts related to Agrocortex activities.

The first assessment was performed in 2015, and according to it, there were 95 families living around the Project Area at the time of the study. As part of the surveys performed, all 95 families have been consulted on potential social and environmental impacts resulting from the forest management performed by Agrocortex. In addition, local presentations and meetings were performed for one of the communities where 10 families lived at the time of the survey.

A new assessment of potential environmental and socio-economic risks of the Project was performed on April 2017 as part of the design of the SOCIALCARBON Indicators for REDD+SFMP Projects, which were developed by Ecológica Assessoria for their application to the Agrocortex REDD Project⁸. This assessment took in consideration the findings of the assessment performed by Agrocortex in 2015 and identified the main risks that should be evaluated as part of SOCIALCARBON certification.

During this monitoring period, Agrocortex conducted a third social and environmental diagnosis in 2020. The 8 communities were consulted, resulting in 95 families and 177 people.

Table below provides details on the potential risks identified:

⁸ Indicators available at: < https://www.socialcarbon.org/s/Template_Submission_of_new_indicators_REDDSFMP_v12_EN11.pdf >. Last access on 01-April-2022. These indicators were approved by the Ecológica Institute and can now be applied for similar REDD projects.

Table 1. Potential environmental and socioeconomic impacts related to the Agrocortex REDD Project

Activity	Aspect	Impact	Effect		Comments/ Observation
			Beneficial	Adverse	
Sustainable forest management	Frighten animals	Hunting shortage		X	- Biodiversity resource: Biodiversity monitoring; Impact on remaining flora
Sustainable forest management	Vehicle transport	Air Pollution, Noise and soil erosion		X	- Human resource: Conflict management
Sustainable forest management	Land demarcation processes	Land tenure	X		- Natural resource: Land tenure
Sustainable forest management	Presence of company/workers on local communities	Conflicts between company/workers and local communities		X	- Human resource: Conflict management; Public health - Carbon resource: Stakeholder consultation
REDD carbon project	Conservation of Amazon Rainforest	Avoided deforestation	X		- Carbon resource: Project performance; Buffer reduction
REDD carbon project	Empowerment	Increase independence of communities in the project area.	X		- Social resource: Associations and cooperatives; Women inclusion - Human resource: Community education and training

					- Financial resource: Alternative income sources - Biodiversity resource: Non timber forest products (NTFPs)
REDD carbon project	Application of the Social Carbon methodology	Encouragement, monitoring and investment on social, economic and environmental aspects in the project region.	X		- Social resource: Women inclusion; Expansion of community activities - Financial resource: Secure funds; Carbon credit Investments - Natural resource: Social and Environmental Investments; Control and Quality monitoring

As available on the table above, three negative impacts were considered for the SOCIALCARBON certification and shall be monitored as part of the indicators created.

The impact of hunting shortage is monitored through the indicators described on the last column of the above table: biodiversity monitoring and impact on remaining flora. The following measures were planned by Agrocorrex to mitigate this risk:

- Restrict the circulation of personnel and equipment on the Project Area during sustainable forest management activities in order to avoid frightening or modifying the behavior of animals. It is important to note that equipment and people can only access the project area during the harvest season, i.e., when Agrocorrex opens roads inside the forest to carry out the SFMP. All employees are communicated about the prohibition of hunting and fishing within the project area. In addition, during the harvesting period, Agrocorrex follows all the IBAMA rules for the Sustainable Forest Management.
 - In addition, Agrocorrex has a checkpoint in the entrance of the property, located in the end of the only road that reaches the project area. This checkpoint controls the entrance and exit of all personnel during 24h-day, avoiding the risk of hunting and illegal logging.
 - Furthermore, Agrocorrex monitors the impact of SFMP activities on fauna through biodiversity reports, which concluded that there is minimal impact on fauna.
- Regular meetings with communities living within the leakage management area explaining about the difference between the customary and the predatory hunting and fishing⁹;
- Timber harvesting should be performed on annual plots and not at several locations simultaneously;
- Establish procedures to monitor fauna on traditional hunting spots inside each APU.

Air pollution, noise and soil erosion is monitored through the conflict management indicator. The following measures were planned by Agrocorrex to mitigate this risk:

- Monitor vehicles for their compliance on driving speed;
- Establish speed bumps and spray roads with water near populated areas
- Establish and monitor time limits for harvest transportation to avoid disturbing locals during rest periods.

⁹ It is constantly clarified that the customary activity that communities practice may continue as it has always been; however, the predatory activity is prohibited because it can bring harmful results for the biodiversity and for the community itself, since it may lead to a decrease of animals supply. It is important to note that Agrocorrex offers all meals for all employees, thus there is no need of fishing/hunting within the project area.

Finally, the impact related to conflicts between company/workers and local communities is monitored through the indicators of conflict management, public health and stakeholder consultation. The following measures were planned by Agro cortex to mitigate this risk:

- Establish and monitor a Code of Conduct for employees, including information related to issues such as drugs and alcohol, prostitution, the use of firearms, amongst others;
- Promote lectures and educational campaigns on respecting local culture;
- Establish procedures to ensure employee's health is assessed on a regular basis to prevent the spread of infectious diseases.

During this third monitoring period there was no record of significant harms in regard to the risks described above. Agro cortex maintained the established procedures to monitor and report on environmental or socioeconomic impacts from its forest operations throughout the entire monitoring period.

In addition, Agro cortex utilizes the concepts of High Conservation Values (HCV) to manage the Project Area. Agro cortex has established criteria to define HCV and the corresponding areas of significant value or extreme importance at regional or global levels. Definitions on such areas were taken considering 2012 guidelines from the HCV Resource Network, documents from other institutions, internal data and information from the consultation of local communities.

Such definitions allowed Agro cortex to map the locations and boundaries of areas of significant value. On such areas, specific monitoring and maintenance measures are taken to prevent environmental impacts and to ensure their environmental and socioeconomic values are preserved. Measures include applying reduced impact harvesting, supervising worker's operations around these areas, incidents record, and report on the status of HCV areas by the end of each harvest season.

2.2. Local Stakeholder Consultation

The purpose of the local stakeholder consultation is:

- Ensure that all stakeholders are aware and informed about the REDD project and its objectives;
- Assist the project proponent/developer in identifying potential topics for local communities;
- Provide different opportunities to stakeholders for discussion and participation in the validation process.

The main stakeholders considered in this project are:

- The local community surrounding the project area;
- Local community associations and labour unions;
- Agrocortex employees;
- Agrocortex shareholders;
- The Brazilian Environmental Agency (IBAMA);
- The State Environmental Agency of Acre (SEMA-AC);
- The State Environmental Agency of Amazonas (SEMA-AM);
- The Climate Change Institute of Acre (IMC);
- The State System of Incentives for Environmental Services of Acre (SISA);
- The Environmental Institute of Acre (IMAC);
- The Institute of Lands of the State of Acre (ITERACRE);
- The Educational Agency of Manoel Urbano Municipality;
- The Health Agency of Manoel Urbano Municipality;
- The Department of Forest Development, Commerce, Industry and Sustainable Services of Acre (SEDENS);
- The State Department of Agroforestry Extension and Family Production of Acre;
- The State Technology Foundation of Acre (FUNTAC);
- The Chico Mendes Institute for Biodiversity Conservation (ICMBio);
- The Institute of National Historical and Artistic Heritage (IPHAN);
- The Tropical Forest Institute;
- The Forest Stewardship Council (FSC);
- The National Indigenous Foundation (FUNAI);
- Certification bodies;
- Banks;
- The Brazilian Biodiversity Fund (FUNBIO);
- The Brazilian Department of Biodiversity and Forest (SBF);
- Sustainable forest management companies;
- Non-Governmental Organizations (NGOs);
- Universities and Institutes.

Table 2 below shows the number of people/organizations informed about the project, organized by type.

Table 2. Stakeholders informed about the Agro cortex REDD Project, organized by type

Stakeholder classification	Number of People/ Organizations informed about the Agro cortex REDD Project
Governmental entities	28
Local communities	6
Local community associations and labour unions	3
Agro cortex employees	30
Agro cortex shareholders	4
Certification bodies	5
Banks	2
Sustainable forest management companies	5
NGOs	10
Universities	5
TOTAL	98

As part of the validation of this Project, a local stakeholder consultation was performed in 2017. The results of the consultation are described in the VCS PD.

A permanent communication channel with local stakeholders was created in order to receive any comments or suggestions regarding the present REDD project. Agro cortex maintains contact with the communities through e-mail and telephone. Furthermore, local communities surrounding the project area will be regularly visited as part of the applied methodology, which requires a social analysis and assessment about the impacts of the carbon project in the local communities. All comments will be received, and outcomes will be documented and stored in digital format. The SOCIALCARBON methodology will also analyze the frequency and methods used for addressing the outcomes of each local stakeholder consultation. The project proponent intends to conduct a stakeholder consultation at each monitoring period.

Due to the COVID-19 Pandemic, during this monitoring period, visits and activities with communities were restricted, and were reduced to avoid contact and exposure to the virus. Thus, no formal Local Stakeholder Consultation was conducted during this monitoring period. When the situation improved, Agro cortex resumed the visits to finish the socio-environmental diagnosis, taking the opportunity to update communities on the actions of the management project in general.

Agrocortex also released a public summary for the years 2020 and 2021, with a summary of the operational activities, main guidelines and strategies developed by the company in the two years. Therefore, communication with the presented Stakeholders during this monitoring period took place during the socio-environmental diagnosis and partnership meetings with state and municipal governments, universities and organizations, where it was possible to present information on the activities carried out in the project area.

During this period's site visit, communities were consulted to verify their perception of the project, and to collect any criticisms or comments on Agrocortex's activities. The communities and employees were communicated of the VVB's visit a week earlier, explaining the procedures of auditing and who they would receive during the site visit and when it would take place. They were notified via telephone, Whatsapp and internal communication for the employees.

2.3. AFOLU-Specific Safeguards

Local Stakeholder Identification and Background

Stakeholders were identified through research and previous social activities developed by Agrocortex in the project area. The main stakeholders included representants from communities living outside the project area, Governmental agents, Environmental and Agricultural Agencies, and private sector. The list is available at section Local Stakeholders Consultation above.

According to the social impact studies, there are communities from 9 localities affected by the project. The Sustainable Forest Management Plan includes 95 families. It is important to note that environmental and social activities carried out by the project will try to benefit all communities. This was measured by SOCIALCARBON indicators during the current monitoring period, which analysed the extent of alternative income generation sources and further programs and alternative income sources, besides the applied methods for local stakeholders consultation.

Risks to Local Stakeholders

The main potential environmental and socio-economic risks for stakeholders were evaluated as part of SOCIALCARBON certification at each verification event. The identified risks were described at Section 2.1 above (No Net Harm).

As described above, Agrocortex management team has expertise and prior experience in implementing projects with community engagement within the project region, such as the partnership with the State of Acre's government to reduce bureaucracy and expand the production and generation of income and work. It generates 150 direct jobs, being 600 during high production. Partnership with the government to donate wood residues for the artisan's associations, stimulating the production of handicrafts. The program helps 40 artisans, indirectly benefiting 250 families. In addition, the Sustainable Forest Management Plan with FSC incorporates alternative income into the community. 50% of the activities are developed with the local community.

The project proponent understands that some risks are inherent to the project activity, and that others may arise from stakeholder's doubts. Considering this, the table below presents potential risks and impacts to local stakeholders and measures taken to mitigate those.

Table 3. Risks to Local Stakeholders

Aspect	Impact	Effect		Comments/ Observation
		Beneficial	Adverse	
Sustainable Forest Management Plan	Logging		X	The properties have a Sustainable Forest Management Plan, exploring a volume within the authorized by the Exploitation License. Monitored by SOCIALCARBON Standard resources and indicators: Biodiversity: - Impact on remaining flora Natural: - Quality Control
Sustainable Forest Management Plan	Reduced access to land due to expansion of exploration		X	The region where the communities live is not within the Management Plan, and therefore will not be affected by logging activities. In any case, the expansion of the exploration is not foreseen, and, if any, it will be communicated and carried out in order to avoid the displacement of residents or limitation of land access. Monitored by SOCIALCARBON Standard resources and indicators: Natural: - Quality Control - Land Tenure
Resources	Withdrawal of natural, economic and cultural resources (water, food, alternative income, cultural events, etc.) from families		X	The region where the communities live is not within the Management Plan, and therefore will not be affected by logging activities. The project's objective is to guarantee financial resources to maintain sustainable and certified wood management and also to expand the socio-environmental benefits for the communities within and around the Project Area. Thus, certifications and the

				use of Social Carbon are a guarantee that there will be no reduction in access and/or withdrawal of resources from impacted families. Monitored by SOCIALCARBON Standard resources and indicators: Biodiversity : - Non-timber forest products (NTFPs) Carbon: - Stakeholder consultation Financial: - Alternative income sources
Land access	Reduced access to traditional areas		X	The management plan area does not include communities' access regions, and therefore, they will not be affected by the maintenance of activities. There are no plans to expand the management area, and communities are guaranteed access to customary land. Monitored by SOCIALCARBON Standard resources and indicators: Natural: - Quality Control - Land Tenure
Land use	Displacement of families due to project activity		X	Families will not be removed from the area currently used. The project owner maintains a relationship with the families, and one of the objectives of the carbon project is to expand social and environmental benefits. The owner recognizes the permanence and land use of the families in the project area, and any changes will be previously communicated. Monitored by SOCIALCARBON Standard resources and indicators:

				Human: • Conflict management Natural: • Land Tenure
Food Security	Withdrawal of land used for food production or income generation		X	The management plan area does not include communities' access regions, and therefore, they will not be affected by the maintenance of activities. The areas for planting / ranching for subsistence or for selling for income generation will not be included in the management plan and the removal of these lands is not planned. Monitored by SOCIALCARBON Standard resources and indicators: Biodiversity : • Non-timber forest products (NTFPs) Natural: • Land Tenure
Climate change adaptation	Adaptations and impacts related to the climate crisis	X		The main objective of the project is forest conservation, avoiding unplanned deforestation. The maintenance of the standing Forest is essential to mitigate the effects of the climate crisis and the maintenance of natural resources for the population. The project also contributes to achieving climate justice, since the groups that suffer most from climate change are the vulnerable and traditional communities¹⁰. Monitored by SOCIALCARBON Standard resources and indicators:

¹⁰ Agrocortex has communities of Ribeirinhos (riverines) on its surroundings, a traditional community that is designated as those that lives on the banks of rivers. The Ribeirinhos are isolated not only from general culture, but also from access to written, television and radio media, and also from other residents of the community, as the distance between residences can be over 2000 meters. These Information available at <https://www.scielo.br/j/rcefac/a/fm3wGQQnWsgjr5Lpkjvp7jt/?lang=pt#:~:text=O%20termo%20ribeirinho%20designa%20qualquer,ser%20superior%20a%202000%20metros.>> Last visited on 12/05/2022.

				Financial: - Carbon Credit Benefits Natural: - Social and environmental investments Carbon: - Project performance
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Respect for Local Stakeholder Resources

The project owner recognizes, respects and supports local stakeholders' customary tenure/access rights to territories and resources. The project will never encroach on private property or relocate people off their lands without consent. In the event there are any ongoing or unresolved conflicts over property rights, usage or resources, the project shall undertake no activity that could exacerbate the conflict or influence the outcome of an unresolved dispute.

Through education activities, Agro cortex offered workplace security, first aid and fire training programs for the community, under the "Jovem Aprendiz" (young apprentice) program and in the SFMP itself. In addition, the company established a partnership to donate wood residues to the Artisans association, stimulating the production of handicrafts, in addition to the creation of job opportunities for the young and adult population under the "Jovem aprendiz".

Any conflict management was monitored by SOCIALCARBON indicators, specifically Stakeholder consultation and support for the project.

In addition, the project did not introduce any invasive species or allow an invasive species to thrive through project implementation. If the project implements any reforestation project with non-native species over native species in the future, the possible risks and adverse effects of exotic species will be justified and explained to communities.

Communication and Consultation

The project took all appropriate measures to communicate and consult with local stakeholders in an ongoing process for the life of the project. As described above, the project conducted a local stakeholders consultation and meetings during the validation of the project, which were monitored by SOCIALCARBON certification. This consultation communicated:

- The project implementation, including the project results and the importance of forest conservation activities.
- The risks, costs and benefits the project brings to local stakeholders.

- The benefit sharing mechanism.
- Procedures related to resolve eventual conflicts with stakeholders.
- The process of VCS Program validation and verification and the validation/verification body's site visit.

Grievance redress and conflict management procedures, as well as benefit sharing mechanisms, have been discussed with communities through stakeholders consultations. Furthermore, a permanent communication channel with local stakeholders was created in order to receive any comments or suggestions regarding the present REDD project. All comments received were responded. Moreover, in case of any grievances, this will be resolved in a suitable timeframe whenever possible, taking into account culturally-appropriate conflict resolution methods.

Agrocortex maintains constant communication with the stakeholders, during the visits for the social diagnosis report and activities conducted with the communities, or during meetings with the local government.

3. IMPLEMENTATION STATUS

3.1. Implementation Status of the Activity

The VCS PD was validated by the Validation and Verification Body (VVB) RINA Services S.p.A. and this present monitoring report is being verified by Designated Operational Entity Earthood Services Private Limited.

Agrocortex has maintained the SFMP and the project activities fully operational since the starting date of the crediting period. The project activities include banning of illegal logging, social education and supervision of deforestation by a management team and through satellite images.

The monitoring data was kept according to the monitoring plan described in the approved VCS PD. This Monitoring Report refers to the third monitoring period of this project and includes data from 01-January-2020 to 31-December-2021.

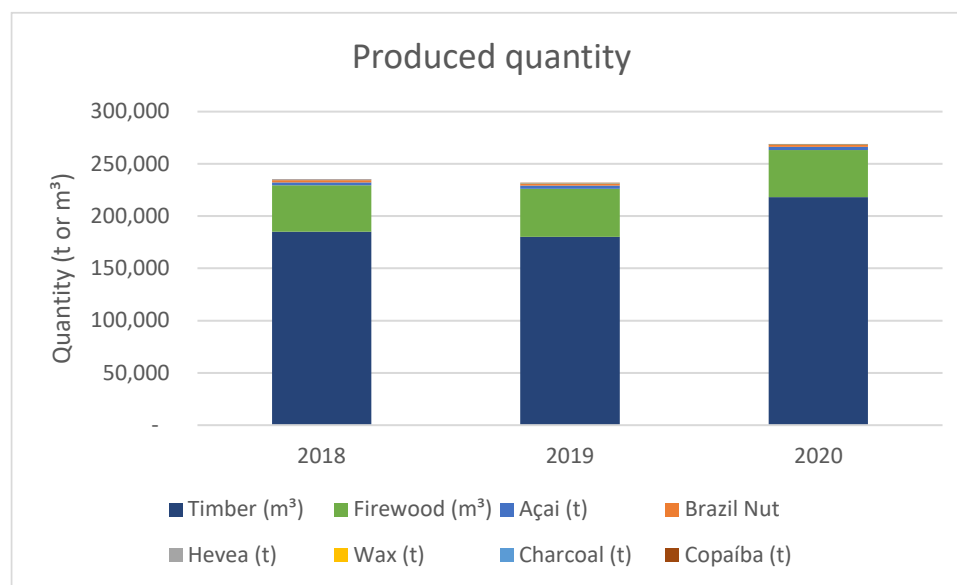
According to the VCS PD, the main land-uses between the years 1999 to 2013 that promoted or stimulated deforestation in the project region, frequently followed this order of events:

1. Highways, access roads, navigable rivers, and infrastructure projects reach remote forested areas;
2. Illegal timber logging seeks the most valuable commercial species;
3. Deforestation for livestock production.

Usually, deforestation in the region involves spatially overlapping activities: firstly, extraction of commercially valuable tree species for sale to timber companies. The final step is the slash-and-burn deforestation of the area above for pasturelands and cattle ranching.

An analysis of agents and drivers of deforestation revealed that during the third monitoring period (01-January-2020 to 31-December-2021), the primary economic activities in the five municipalities of the reference region (Boca do Acre, Pauini, Manoel Urbano, Sena Madureira and Feijó) continued to be extraction of timber and non-timber forest products (NTFPs) and cattle ranching¹¹. The graphs of production of logged timber and cattle ranching in the municipalities of the reference region, according to available data during the monitoring period, are presented in the Figures below.

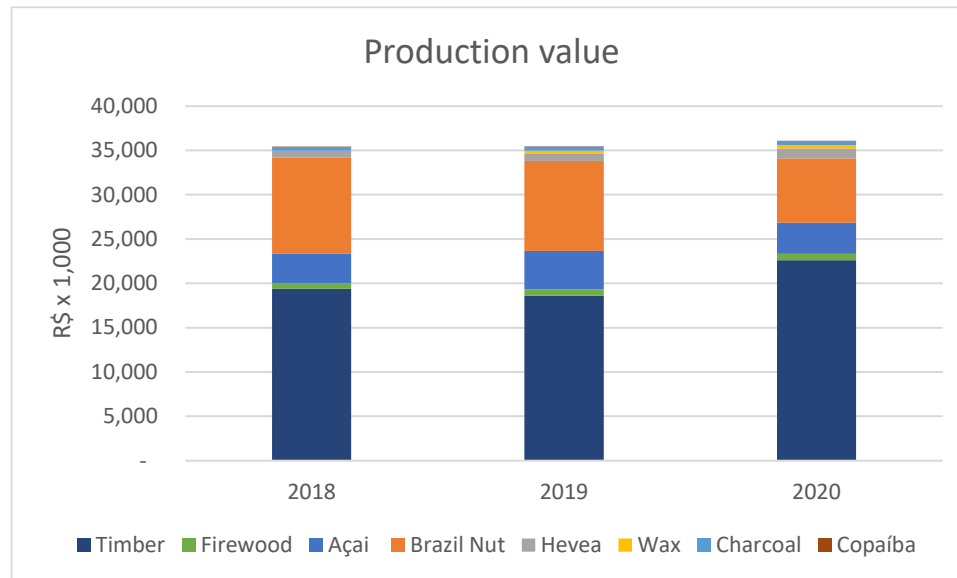
Figure 2. Extractive production in the municipalities of the Reference Region



According to Figure above, timber and firewood continued to be the largest contributors to the total amount of annual production when compared to all extractivism products in the municipalities where the reference region is located, surpassing 250,000 m³ in 2020. Timber showed an increase in the total value of production (R\$) during this period, and it also important to highlight that NTFPs have also increased its production value within the analyzed municipalities. The main NTFPs were Brazilian nuts and Açai, which are not considered elements of the deforestation dynamic; on the other hand, production of NTFP has been positively correlated with forest conservation.

¹¹ Instituto Brasileiro de Geografia e Estatística (IBGE). Available at: <<https://cidades.ibge.gov.br/>>. Last visited on 01-April-2022

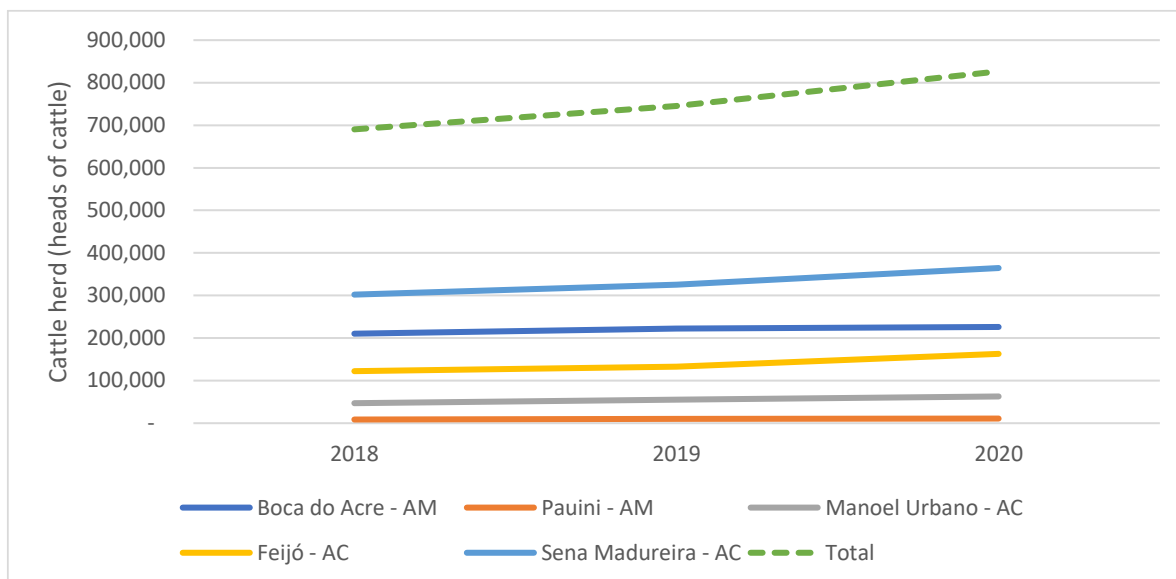
Figure 3. Extraction production values per product in the municipalities of the reference region during the 2018-2020 period



Furthermore, Figure below shows the increase of the cattle herd in the municipalities composing the reference region across the period 2018 - 2020¹². It is possible to note that this number increased 20% from 2018 to 2020, which means 135 thousand heads more. The municipality responsible for the largest cattle herd is Sena Madureira (in the State of Acre), which is located in the south of the project area, followed by Boca do Acre (in the State of Amazonas).

¹² The Brazilian Institute for Geography and Statistics (IBGE): <<http://www.ibge.gov.br/home/>>.

Figure 4. Cattle herd in the municipalities within the project boundaries



It is important to highlight that 2021 data was not available for any of the assessed parameters. However, it is expected to follow the upward trend presented in the previous years.

It is expected that agents and drivers of deforestation may increase as a result of a possible population growth in the reference region, which is also influenced by the prices of timber logs and livestock arroba, thus intensifying the demand to convert forested areas to productive areas in the region.

Looking now at the Reference Region, the actual classified deforestation during the monitoring period was of 11,318.04 ha, which corresponds to around 0.35%/year. Meanwhile, the predicted area in the baseline scenario that would be deforested within the reference region during this monitoring period from 2020 – 2021 would be 21,858.21 ha, meaning an annual average deforestation rate of 1.17% per year.

Comparing to what occurred during the 1999 – 2013 period (historical reference period), when the annual average deforestation rate within the reference region was of 0.25%, the deforestation rate increased around 40%, reaching around 0.35%/year. Therefore, an increase tendency in the deforestation rate in the region could be noted. This figure shows that Agro cortex activities in the region could help reducing the advancement of deforestation towards the project area. In fact, deforestation rate within the Agro cortex project area was around 98% lower than what occurred in the reference region. The map with the annual areas of deforestation within the reference region during the current monitoring period is showed below.

Figure 5. Deforestation in the Reference Region between 2019 and 2021

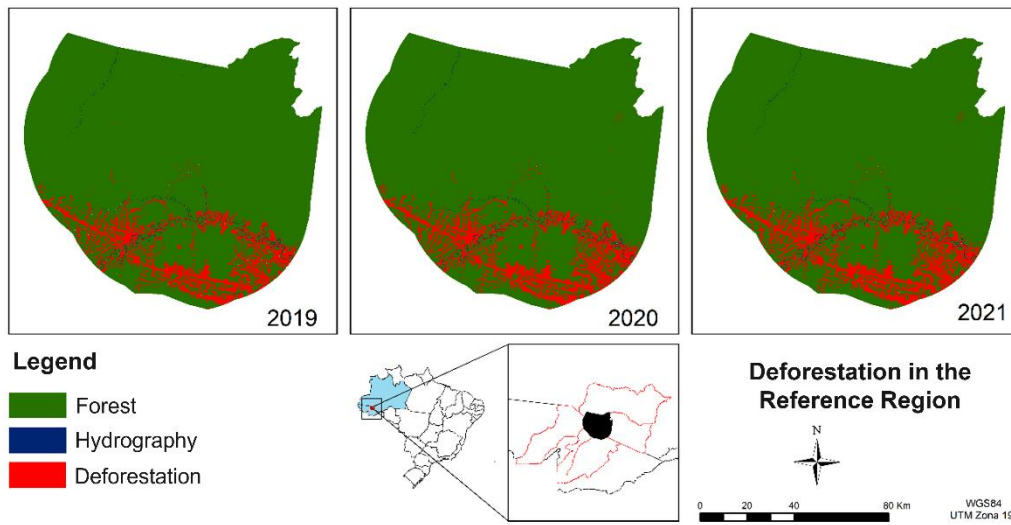


Figure 6. Accumulated deforestation in the reference region (RR) in 2020 indicating projected deforestation and deforestation occurred.

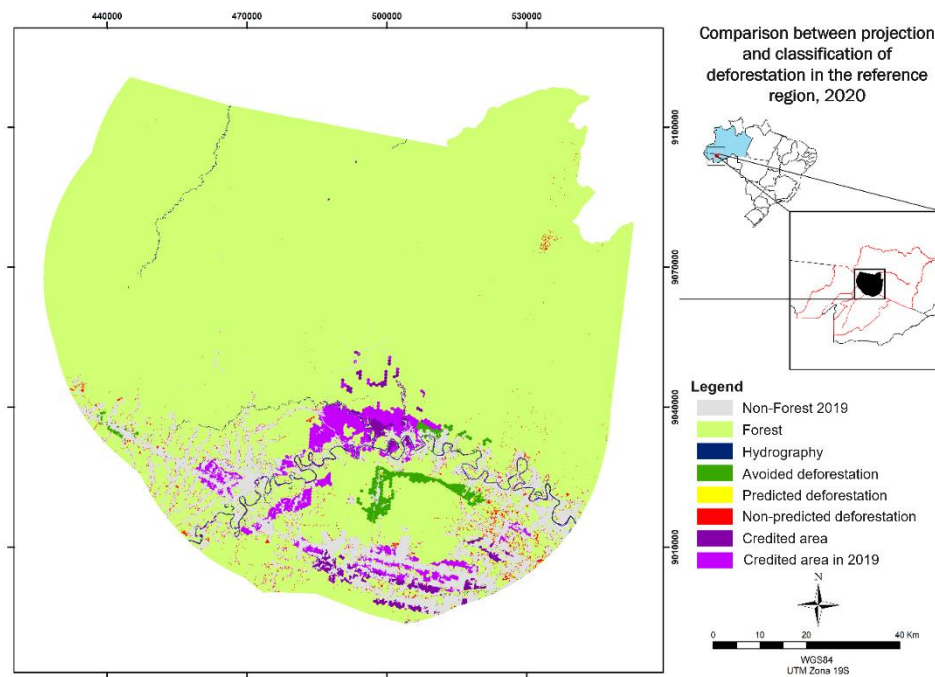
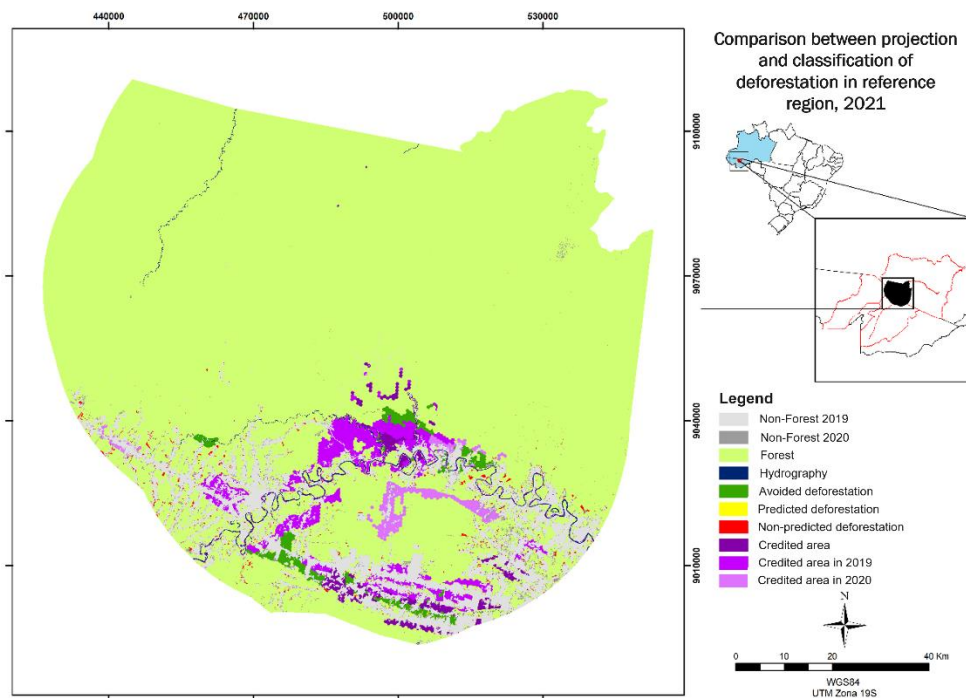


Figure 7. Accumulated deforestation in the reference region (RR) in 2021 indicating projected deforestation and deforestation occurred.



Social Carbon

This is the third Social Carbon Report, regarding Point 2. The project presented a great evolution from Point 0 to Point 1, going from 2.1 to 3.9 in the general performance. In comparison to the last monitoring period, during the Point 2, the project also presented a considerable evolution, improving the score in 4 of the 6 indicators and having a 4.7 score in the general performance. During this monitoring period, the project continued to contribute to the local development with partnerships with the government, universities, and cooperatives, offering donations of resources for local crafts, infrastructure, in addition to training and lectures to the communities and employees.

Furthermore, the project generates about 200 direct jobs and 100 to be generated by the multiplier effect, totaling 300 direct and indirect jobs, causing a very positive impact on the local economy of the municipality of Manoel Urbano / AC and surroundings. All workers, including outsourced workers, are hired in accordance with labor and social security legislation. Currently, of all the employees that Agrocortex employs in management and industry activities, 60% come from communities surrounding the project area. It is important to note that most of the municipalities in the reference region have a Very

Low Human Development Index (HDI), i.e., Pauini has a very poor positioning, as it placed 5538th of 5565 Brazilian municipalities, while Manoel Urbano in the 5186th.

During this monitoring period, as detailed in sections below, Agro cortex maintained the activities and actions conducted with the communities, and included new benefits as well, even though some planned activities were delayed or altered by the 2020's Covid-19 pandemic. The contact and conversations with the communities were specially affected, as the company decided to limit the social interactions to avoid spreading the virus in vulnerable areas.

3.2. Deviations

3.2.1. Methodology Deviations

Not applicable. The project has no methodology deviations.

3.2.2. Project Description Deviations

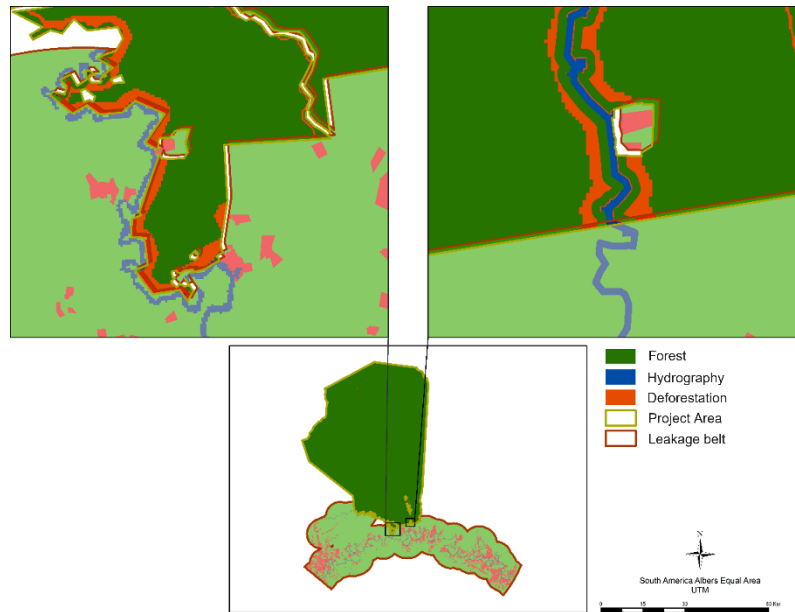
There were no Project Description Deviations during this monitoring period.

During the second monitoring period, the following deviations were applied:

According to the applied methodology VM0015 v1.1: “the project area shall include only land qualifying as “forest” for a minimum of 10 years prior to the project start date.” However, it was identified that the project area contained some hydrography areas, which were not excluded from the area qualified as forest for a minimum of 10 years prior to the project start date. Nevertheless, it is important to note that these hydrography areas were in fact excluded from the project area during the projection of future deforestation carried out in the VCS PD; and no deforestation occurred on hydrography areas during the first monitoring period. Thus, this situation did not impact baseline or project emissions, as the only modification was the size of the project area. Therefore, this deviation does not impact the applicability of the methodology, the additionality or the appropriateness of the baseline scenario.

Furthermore, it was also identified a little overlap between the project area and the leakage belt. The leakage belt delineation was corrected to exclude from it the project area limits. Similarly, this deviation does not impact the applicability of the methodology, the additionality or the appropriateness of the baseline scenario. The figure below shows the land use map in 2014, detailing the overlap between the project area and the leakage belt.

Figure 8. Overlapping areas between the project area and the leakage belt in 2014. It is also possible to observe that there are hydrography areas within the project area



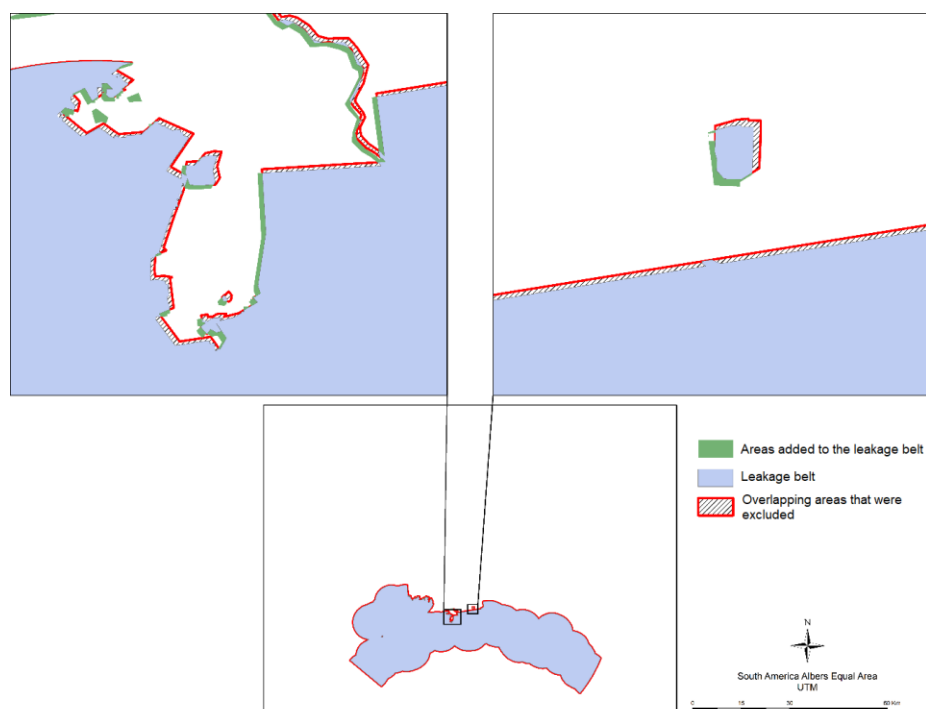
Therefore, the edition processes followed the procedures detailed below:

- Remove the hydrography areas from the project area (figure 8)
- Remove from the project area the overlapping areas with the leakage belt (figure 9)

Figure 9. Project area editing



Figure 10. Leakage belt area editing



After these editions in the project area and the leakage belt the new area values were:

- Project area – 186,067.04 ha (instead of 186,219.05).
- Leakage belt area – 127,972.41 ha (instead of 128,115.48 ha)

In addition, land-use change analyses were made through MapBiomass images, which is a new platform that produces maps through a pixel-by-pixel classification from Landsat satellites images. The entire process is done with extensive machine learning algorithms through the Google Earth Engine system that offers more detailed, precise and available information.

The mapping of land use dynamics in the reference region was based on the mapping produced by MapBiomass¹³, available in raster format.

MapBiomass is a multi-institutional initiative of the Emissions Estimation System Greenhouse Gases¹⁴ promoted by the Climate Observatory. The co-MapBiomass creation involves NGOs, universities, and technology companies. In MapBiomass, the image classification methodology uses for each year, all Landsat images available in each period (Landsat 5 [L5], Landsat [L7] and Landsat [L8] with a cloud cover less than or equal 50%. Thus, a representative mosaic of each year is generated by selecting cloudless pixels from the available images. For each pixel, metrics are extracted that describe its behavior during the year and can contain up to 105 layers of information. with an artificial intelligence classifier, Random Forest. The acquisition of Landsat

¹³ Mapbiomas website – Available at: <<http://mapbiomas.org/>>. Last visited on: 18/06/2020

¹⁴ SEEG website. Available at: <http://seeg.eco.br/en/> Last visited on 18/06/2020

images is done via Google Earth Engine, with sources from NASA (American Space Agency) and USGS (US Geological Survey).

The algorithm uses samples obtained by reference maps, generation of stable collections from previous MapBiomass series and direct collection by visual interpretation of Landsat images to classify as a single map per class. This classification then goes through the stages of the spatial filter, applying neighbourhood rules and temporal filters, in particular changes in coverage and use that are impossible or not allowed, to reduce spatial and temporal inconsistencies.

MapBiomass presents a higher temporal frequency than the official data from Prodes, and thus is recommended as image reference for regions with high cloud cover throughout the whole year.

According to the applied methodology, if remotely sensed data have become available from new and higher resolution sources during a monitoring period, these can only be used if the images based on interpretation of the new data overlap the images based on interpretation of the old data by at least 1 year and they cross calibrate to acceptable levels. Therefore, in order to verify the consistency between the different image classification methodologies, two land use maps of the same year (2013) were compared, using the new MapBiomass classification, and the classification supervised by Maximum Likelihood, used during for the baseline projection. The maps were overlapped, and a confusion matrix was generated and calculated in order to quantify the errors of omission and commission. The MapBiomass resulted in more precise and conservative values for deforestation. The values generated by the confusion matrix are showed below. It is possible to note that deforestation values for 2013 classified by Mapbiomas were more accurate and conservative than the old classification method.

Figure 11. Compatibility of the classification of land use used in the last monitored period with the data used in this current monitoring period.

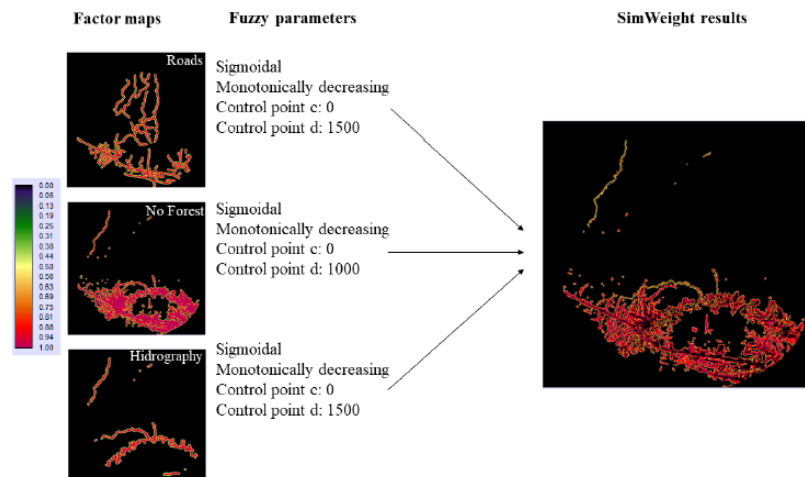
		Maximum Likelihood classification – 2013 (ha)				
		Forest	Hydrography	Deforestation	Total	Accuracy
MapBiomass 2013 (ha)	Forest	1,038,717.13	1,486.85	10,438.87	1,050,642.85	98.86%
	Hydrography	218.60	2,523.08.90	620.53	3,362.21	75.04%
	Deforestation	7,425.09	299.52	47,403.64	55,128.25	85.99%
	Total	1,046,360.82	4,309.45	58,463.04	1,108,920.00	
	Accuracy	99.27%	58.55%	81.08%		

In addition, the VCS PD, in the Section 2.4 – Baseline Scenario, had a writing error in the description of the projection method for simulating deforestation. It is important to highlight that this writing error did not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario, because the calculations and projections of future deforestation were not impacted. Moreover, this section of the VCS PD was not enough detailed with all the steps carried out during the mapping analysis, and therefore, this is better summarized below.

In order to simulate the landscape, land use/ land cover (LU/LC) maps from the years 1999 to 2006 were used in the calibration phase. The confirmation year for the model calibration was 2013.

Furthermore, the factor maps used to create the deforestation risk map are presented below.

Figure 12. Factor maps utilized to create the deforestation risk map



Several risk maps models were produced for the selection of the most accurate deforestation risk map, based on different combinations of factor maps and modeling assumptions. A total of 10 different risk maps were created using different GIS methods, and the most accurate one – the Test 3 with a kappa index of 0.9672 – was selected to project the future deforestation in the baseline scenario. The tests are shown in the Table below. In addition, the kappa index achieved for the Test 3 was detailed in the Figure below.

Figure 13. Deforestation projection models tested for the project activity. Each line corresponds to a model and was evaluated by the Kappa index

Teste ID	Control point:	Factor maps				Kappa for 2013			Note
		C	R	H	NF	Markov chain + automates	LCM/MLP	LCM/SimW	
1	c		500	500	100	0.5325	-	-	MCE (Weight) - Roads (0.2583) / Hydrography (0.6370) / No Forest (0.1047)
	d		3000	3000	1000				
2	c	4000	0	0		0.5974	-	-	MCE (Weight) - Community (0.1047) / Roads (0.2583) / Hydrography (0.6370)
	d	8500	1500	1500					
3	c		0	0	0	-	0.8351	0.9672	Adinonal LCM input: Elevation model
	d		1500	1500	1000				
4	c		0	0	0	-	0.8346	-	Adinonal LCM input: Elevation model+Basis road
	d		1500	1500	1000				
5	c	4000	0	0	0	-	0.7796	-	Adinonal LCM input: Elevation model+Basis road
	d	8500	1500	1500	1000				
6	c	0	0	0		-	0.7268	-	Adinonal LCM input: Elevation model
	d	500	500	200					
7	c	0	0	0		-	0.9672	*	Adinonal LCM input: Elevation model
	d	1000	500	500					
8	c	500	100	100		-	0.748	*	Adinonal LCM input: Elevation model
	d	5000	1000	1000					
9	c	1000	500	500		-	0.7199	0.7015	Adinonal LCM input: Elevation model
	d	5000	5000	5000					
10	c	1000	500	500		-	0.7191	0.7015	Adinonal LCM input: Elevation model
	d	10000	5000	5000					

Figure 14. Kappa index achieved for the Model 3, comparing the simulated scenario and the real one for the year of 2013, reaching an overall value of 0.9672

Using 2013_new (columns) v.s. landcov_predict_2013 (rows)

(Created: 8/16/2020 11:22:31 PM)

Pixel Cross-tabulation

Category	1	2	Total
1	11590674	0	11590674
2	44511	697641	742152
Total	11635185	697641	12332826

Chi-square = 11548808.0000, df = 1, P-Level = 0.0000, Cramer's V = 0.9677

Proportional Cross-tabulation

Category	1	2	Total
1	0.9398	0.0000	0.9398
2	0.0036	0.0566	0.0602
Total	0.9434	0.0566	1.0000

Kappa Index of Agreement (KIA)

1) Using landcov_predict_2013 as the reference image

Category	KIA
1	1.0000
2	0.9364

2) Using 2013_new as the reference image

Category	KIA
1	0.9364
2	1.0000

Overall Kappa: 0.9672

3.3. Grouped Projects

Not applicable. This is not a grouped project.

3.4. Safeguards

Safeguards are described in section 2.

4. DATA AND PARAMETERS

4.1. Data and Parameters Available at Validation

Data / Parameter	CF
Data unit	tC/tdm
Description	Default value of carbon fraction in biomass
Source of data	Values from the literature (e.g. IPCC 2003. Good practice guidance for land use, land-use change and forestry. Kanagawa: IGES,

	2003. Available at: < http://www.ipcc-nggip.iges.or.jp/public/gpplulucf/gpplulucf.html >).
Value applied	0.5
Justification of choice of data or description of measurement methods and procedures applied	The default value was used.
Purpose of Data	This parameter was used to calculate the baseline, project and leakage emissions from deforestation occurred in the baseline and project scenarios. Provides an estimate of the carbon content of the vegetation biomass within the project reference region.
Comments	If new and more accurate carbon fraction data become available, these can be used to estimate the net anthropogenic GHG emission reduction of the subsequent fixed baseline period.

Data / Parameter	<i>ab_{icl}</i>			
Data unit	Mg/ha			
Description	Average biomass stock per hectare in the above-ground biomass pool of initial forest classes icl in Mg/ha			
Source of data	Average values for the above-ground biomass were taken from the following study: SALIMON,C.I; PUTZ, F.E.; MENEZES-FILHO, L.; ANDERSON,A.; SILVEIRA, M.; FOSTER BROWN, I.; OLIVEIRA, L.C. Estimating state-wide biomass carbon stocks for a REDD plan in Acre, Brazil. 2011, Forest Ecology and Management , 262, p. 555–560, 2011.			
Value applied	Above-ground biomass <i>ab_{icl}</i> (Mg/ha)			
	Vegetation	Reference Region	Project Area	Leakage Belt
	Open tropical rainforest with bamboo	257.82	274.20	291.73
	Open tropical rainforest with palm trees	245.98	119.16	349.44
	Open alluvial rainforest with palm trees	218.50	193.83	243.17

	Dense tropical rainforest	323.88	-	-
	Secondary vegetation	37.00	-	53.45
Justification of choice of data or description of measurement methods and procedures applied	Following a literature search, the above-ground biomass values of this study was used as they were determined to accurately represent the values of the vegetation within the project reference region. In addition, the results from this study were also compared with Nogueira et al. (2008)¹⁵ and Saatchi et al. (2007)¹⁶, presenting very similar conclusions. The average biomass stock per hectare was calculated for each project boundary (reference region, project area and leakage belt) and for each vegetation group using weighted average, considering discounts for uncertainties.			
Purpose of Data	This parameter was used to calculate the baseline, project and leakage emissions from deforestation occurred in the baseline and project scenarios. Provides an average of the biomass stock per hectare in the above-ground biomass within the project reference region.			
Comments	If new and more accurate biomass stock data become available, these can be used to estimate the net anthropogenic GHG emission reduction of the subsequent fixed baseline period.			

Data / Parameter	<i>bb_{icl}</i>
Data unit	Mg/ha
Description	Average biomass stock per hectare in the below-ground biomass pool of initial forest classes icl in Mg/ha
Source of data	Average values for the below-ground biomass were taken from the applied methodology VM0015 v1.1, which estimates a root-to-shoot ratio of 0.24 for tropical rainforest having above ground biomass values above 125 tons/ha, and 0.20 for values below 125 tons/ha.
Value applied	Below-ground biomass <i>bb_{icl}</i> (Mg/ha)

¹⁵ NOGUEIRA, E. M. **Densidade de Madeira e Alometria de Árvores em Florestas do 'Arco do Desmatamento'**: Implicações para Biomassa e Emissão de Carbono a partir de Mudanças de Uso da Terra na Amazônia Brasileira. 2008. 151 f. Doctor Thesis - Curso de Ciências de Florestas Tropicais, INPA, Manaus, 2008.

¹⁶ SAATCHI, S.S.; HOUGHTON, R.A.; ALVALÁ, R.C.S.; SOARES J.V.; YU, Y. Distribution of aboveground live biomass in the amazon basin. **Global Change Biology**, v.13, p. 816-837, 2007

	Vegetation	Reference Region	Project Area	Leakage Belt
	Open tropical rainforest with bamboo	61.88	65.81	70.01
	Open tropical rainforest with palm trees	59.04	28.60	83.87
	Open alluvial rainforest with palm trees	52.44	37.78	49.62
	Dense tropical rainforest	77.73	-	-
	Secondary vegetation	7.40	-	10.69
Justification of choice of data or description of measurement methods and procedures applied	Following a literature search, the below-ground biomass values of the applied methodology were used as they were determined to accurately represent the values of the vegetation within the project reference region. The average biomass stock per hectare was calculated for each project boundary (reference region, project area and leakage belt) and for each vegetation group using weighted average, considering discounts for uncertainties.			
Purpose of Data	This parameter was used to calculate the baseline, project and leakage emissions from deforestation occurred in the baseline and project scenarios. Provides an average of the biomass stock per hectare in the below-ground biomass within the project reference region.			
Comments	If new and more accurate biomass stock data become available, these can be used to estimate the net anthropogenic GHG emission reduction of the subsequent fixed baseline period.			

Data / Parameter	C_{totfcl}
Data unit	tCO ₂ e/ha
Description	Average carbon stock per hectare in anthropic areas in equilibrium of post-deforestation class fcl in tCO ₂ e/ha
Source of data	Long-term average carbon stocks per hectare of post-deforestation LU/LC classes present in the reference region were taken from the following study: FEARNside, Philip M. Amazonian deforestation and global warming: carbon stocks in vegetation

	replacing Brazil's Amazon forest. Forest Ecology And Management , Manaus, v. 80, p.21-34, 1996.
Value applied	46.93
Justification of choice of data or description of measurement methods and procedures applied	Fearnside (1996) is one of the most recognized studies for the Brazilian Amazon about long term carbon stocks in deforested areas.
Purpose of Data	This parameter was used to calculate the baseline emissions from deforestation occurred in the baseline scenario. Provides an average of the post-deforestation carbon stock per hectare within the project reference region.
Comments	If new and more accurate biomass stock data become available, these can be used to estimate the net anthropogenic GHG emission reduction of the subsequent fixed baseline period.

Data / Parameter	D_m
Data unit	g/cm ³
Description	Mean wood density
Source of data	NOGUEIRA, E. M. Densidade de Madeira e Alometria de Árvores em Florestas do 'Arco do Desmatamento' : Implicações para Biomassa e Emissão de Carbono a partir de Mudanças de Uso da Terra na Amazônia Brasileira. 2008. 151 f. Doctor Thesis - Curso de Ciências de Florestas Tropicais, INPA, Manaus, 2008.
Value applied	0.583
Justification of choice of data or description of measurement methods and procedures applied	The mean wood density presented in Nogueira (2008) was obtained from southern and southwestern portions of the Brazilian Amazon, where the project region is located.
Purpose of Data	This parameter was used to calculate project emissions from logging activities occurred in the project scenario due to sustainable forest management. Carbon stock decrease due to planned logging activities were calculated through multiplying the harvested volume by the mean wood density. Carbon stock increase due to natural regeneration after periodical harvest cycle can be calculated through multiplying the mean annual increment by the mean wood density.
Comments	Nogueira (2008) defined wood density as "specific gravity" or "basic specific gravity". This is the ratio between the dry mass and the volume of green wood.

	If new and more accurate wood density data become available, these can be used to estimate project emissions of the subsequent fixed baseline period.
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Data / Parameter	D_j												
Data unit	g/cm ³												
Description	Mean wood density of species j												
Source of data	SERVIÇO FLORESTAL BRASILEIRO. Fichas Tecnológicas das Madeiras da FLONA Jamari. Available at: < http://www.florestal.gov.br/documentos/concessoes-florestais/concessoes-florestais-florestas-sob-concessao/flona-do-jamari/edital/192-fichas-tecnologicas/file >. Last visit on: 30-March-2022 OLIVEIRA, Luiz Rogério. Plano de Manejo Florestal Sustentado 2ª Revisão - Consolidado: Fazenda Seringal Novo Macapá. Rio Branco: Batisflor Florestal Ltda, 2017. 225 p.												
Value applied	<table><tr><th colspan="3">Commercial Groups</th></tr><tr><th>Timber commercial Group</th><th>Characteristics</th><th>Average wood density (g/cm³)</th></tr><tr><td>High density woods and Mahogany</td><td>High density woods, with the potential to become long-lived wood products</td><td>0.77</td></tr><tr><td>White woods</td><td>Low density woods, mainly destined for construction (short-lived wood products)</td><td>0.54</td></tr></table>	Commercial Groups			Timber commercial Group	Characteristics	Average wood density (g/cm ³)	High density woods and Mahogany	High density woods, with the potential to become long-lived wood products	0.77	White woods	Low density woods, mainly destined for construction (short-lived wood products)	0.54
Commercial Groups													
Timber commercial Group	Characteristics	Average wood density (g/cm ³)											
High density woods and Mahogany	High density woods, with the potential to become long-lived wood products	0.77											
White woods	Low density woods, mainly destined for construction (short-lived wood products)	0.54											
Justification of choice of data or description of measurement methods and procedures applied	Agrocortex divides timber production in commercial groups, which have different rates of commercialization and wood densities. These groups were classified in two larger groups, based on their properties and characteristics. The wood density presented by the cited study was obtained by the Brazilian Forest Service Forest Products Laboratory, which analyzed wood properties from different Brazilian Amazon species, where the project region is located.												
Purpose of Data	This parameter was used to calculate project emissions due to harvested wood products carbon pool in the project scenario. Carbon stock per hectare of extracted biomass by class of wood product were calculated through multiplying the timber volume per												

	product class by the wood density of species belonging to a specific class of wood products.
Comments	If new and more accurate wood density data become available, these can be used to estimate project emissions of the subsequent fixed baseline period.

Data / Parameter	EI
Data unit	%
Description	Ex ante estimated effectiveness index
Source of data	OLIVEIRA, Luiz Rogério. Plano de Manejo Florestal Sustentado 2ª Revisão - Consolidado : Fazenda Seringal Novo Macapá. Rio Branco: Batisflor Florestal Ltda, 2017. 225 p. Forest Stewardship Council (FSC) Certification for Forest Management (FSC-C121950) and Chain of Custody (FSC-C127203) for Agrocorrex SFMP activities.
Value applied	95
Justification of choice of data or description of measurement methods and procedures applied	The calculation of the effectiveness index was estimated on the efficiency in reducing deforestation within the project area due to Agrocorrex REDD Project activities.
Purpose of Data	This parameter was used to calculate project emissions in the baseline scenario. Provides an ex ante estimation of the carbon stock changes due to unavoidable unplanned deforestation within the project area, based on the effectiveness of the proposed project activities to reduce the deforestation.
Comments	Ex post monitoring of the project area shall be done to determine deforestation rate and the project emissions. This parameter will be updated at each renewal of fixed baseline period.

Data / Parameter	DLF
Data unit	%
Description	Displacement Leakage Factor
Source of data	OLIVEIRA, Luiz Rogério. Plano de Manejo Florestal Sustentado 2ª Revisão - Consolidado : Fazenda Seringal Novo Macapá. Rio Branco: Batisflor Florestal Ltda, 2017. 225 p. Forest Stewardship Council (FSC) Certification for Forest Management (FSC-C121950) and Chain of Custody (FSC-C127203) for Agrocorrex SFMP activities. SOCIALCARBON Indicators for REDD+SFMP Projects

Value applied	5
Justification of choice of data or description of measurement methods and procedures applied	The <i>DLF</i> was estimated as 5%, which is considered as a conservative estimate based on the referenced literature and taking into account the project situation, where AgroCortex SFMP+FSC+REDD+SOCIALCARBON project activities are estimated to benefit a large part of the population in the region.
Purpose of Data	This parameter was used to calculate leakage emissions in the baseline scenario due to activity displacement leakage, providing an <i>ex ante</i> estimation of the decrease in carbon stocks and increase in GHG emissions. This value was calculated based on the percent of deforestation expected to be displaced outside the project boundary due to the implementation of the AUD project activity.
Comments	<i>Ex post</i> monitoring of the leakage belt shall be done to determine deforestation rate outside the project area and consequently, the leakage emissions and carbon stock decrease. This parameter will be updated at each renewal of fixed baseline period.

Data / Parameter	$EBBBSLPA_t$
Data unit	tCO ₂ e
Description	Sum of (or total) baseline non-CO ₂ emissions from forest fire at year <i>t</i> in the project area
Source of data	Remote sensing data and GIS; Supervisor information.
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	If forest fires occur, these non-CO ₂ emissions will be subject to monitoring and accounting, when significant.
Purpose of Data	This parameter was used to calculate <i>non</i> -CO ₂ emissions due to forest fires within the project area in the baseline scenario, providing an <i>ex ante</i> estimation.
Comments	Non-CO ₂ emissions from fires used to clear forests in the baseline scenario were omitted in this project. Therefore, $EBBBSLPA_t$ equals to zero. <i>Ex post</i> monitoring of forest fires and non-CO ₂ emissions shall be done to determine GHG emissions within the project area (when the forest fire is significant).

	This parameter will be updated at each renewal of fixed baseline period.
Data / Parameter	$\Delta CBSLLK_t$
Data unit	tCO ₂ e
Description	Annual carbon stock changes in leakage management areas in the baseline case at year <i>t</i>
Source of data	Planned interventions proposed by Agrocorrex REDD Project; Remote sensing and GIS
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	Leakage prevention activities generating a decrease in carbon stocks should be estimated <i>ex ante</i> and accounted. The leakage prevention measures proposed by the present project do not include decrease in carbon stocks due to activities implemented in the leakage management area.
Purpose of Data	This parameter was used to calculate leakage emissions in the baseline scenario due to leakage prevention measures. It provides an <i>ex ante</i> estimation of the decrease in carbon stocks due to the activities implemented in the leakage management area.
Comments	<i>Ex post</i> monitoring of the leakage management area shall be done to determine the carbon stock decrease and the leakage emissions. This parameter will be updated at each renewal of fixed baseline period.

4.2. Data and Parameters Monitored

Data / Parameter	$ACPA_{icl,t}$
Data unit	Hectare
Description	Annual area of initial forest classes <i>icl</i> within the Project Area affected by catastrophic events at year <i>t</i>
Source of data	Remote sensing data and GIS, Agrocorrex management team and other field data.
Description of measurement methods and procedures to be applied	In addition to remote sensing data and GIS, which can identify the area affected by catastrophic events, the measurement of this parameter was also based in the below national database:

	INMET¹⁷ INPE¹⁸ Moreover, periodic reports from local Agro cortex management team, also confirmed the data obtained from remote sensing and GIS measurement.
Frequency of monitoring/recording	At each time a significant catastrophic event occurs
Value monitored	0 (no significant catastrophic event occurred)
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS. Furthermore, the following sources were also monitored to confirm the data obtained from remote sensing and GIS: INMET INPE Periodic reports from Agro cortex management team
Purpose of the data	This parameter was used to calculate project emissions in the project scenario. Provides an <i>ex post</i> estimation of initial forest classes (<i>icl</i>) areas affected by catastrophic events within the project area.
Calculation method	Remote sensing and GIS
Comments	Decreases in carbon stocks and increases in GHG emissions (e.g. in case of forest fires) due to natural disturbances (such as hurricanes, earthquakes, volcanic eruptions, tsunamis, flooding, drought, fires, tornados or winter storms) or man-made events, including those over which the project proponent has no control (such as acts of terrorism or war), are subject to monitoring and must be accounted under the project scenario, when significant.

¹⁷ INMET. National Meteorology Institute. Automatic Station – Graphics. Available at: < <https://tempo.inmet.gov.br/>>. Last visit on: 01-April-2022

¹⁸ INPE. Brazilian National Space Research Institute catalogue. Available at: < <https://queimadas.dgi.inpe.br/queimadas/portal/risco-de-fogo-meteorologia>>. Last visit on: 01-April-2022

Data / Parameter	$AUFPA_{icl,t}$
Data unit	Hectare
Description	Annual area of initial forest classes <i>icl</i> within the Project Area affected by forest fires at year <i>t</i>
Source of data	Remote sensing data and GIS, Supervisor information and other field data.
Description of measurement methods and procedures to be applied	In addition to remote sensing data and GIS, which can identify the area affected by forest fires, the measurement of this parameter was also based in the below national database: INMET ¹⁹ INPE ²⁰ Moreover, periodic reports from local Agro cortex management team also confirmed the data obtained from remote sensing and GIS measurement.
Frequency of monitoring/recording	Annually
Value monitored	0
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS. Furthermore, the following sources were also monitored to confirm the data obtained from remote sensing and GIS: INMET INPE Periodic reports from Agro cortex management team
Purpose of the data	This parameter was used to calculate project emissions in the project scenario. Provides an <i>ex post</i> estimation of initial forest classes (<i>icl</i>) areas affected by forest fires within the project area.
Calculation method	Remote sensing and GIS
Comments	Decreases in carbon stocks and increases in GHG emissions (e.g. in case of forest fires) due to natural disturbances (such as hurricanes, earthquakes, volcanic eruptions, tsunamis, flooding, drought, fires, tornados or winter storms) or man-made events, including those over which the project proponent has no control (such as acts of terrorism or war), are subject to monitoring and must be accounted under the project scenario, when significant.

¹⁹ INMET. National Meteorology Institute. Automatic Station – Graphics. Available at: < <https://tempo.inmet.gov.br/>>. Last visit on: 01-April-2022

²⁰ INPE. Brazilian National Space Research Institute catalogue. Available at: < <https://queimadas.dgi.inpe.br/queimadas/portal/risco-de-fogo-meteorologia>>. Last visit on: 01-April-2022.

	No forest fire was used by Agrocortex for conducting planned deforestation or timber harvesting activities. However, there were around 53.86 ha of unplanned deforestation within the project area during the monitored period, which conversion of forest to non-forest may have involved fires. The effect of fire on carbon emissions is counted in the estimation of carbon stock changes in the parameter $\Delta CUDdPA_t$; therefore, CO₂ emissions from forest fires were ignored to avoid double counting. However, non-CO₂ emissions (CH₄ and N₂O) from forest fires must be counted in the project scenario, when they are significant. In order to be conservative, it was assumed that all unplanned deforestation within the project area involved fire. Therefore, non-CO₂ emissions from forest fires were quantified and deducted from emission reductions, and considered in parameter EBBPSPat.
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Data / Parameter	$ABSLLK_{icl,t}$				
Data unit	Hectare				
Description	Annual area of deforestation of initial forest classes <i>icl</i> within the leakage belt at year <i>t</i>				
Source of data	Remote sensing and GIS.				
Description of measurement methods and procedures to be applied	Deforestation in the leakage belt area can be considered activity displacement leakage. Activity data for the leakage belt area was determined using the same methods applied to monitoring deforestation activity data in the project area.				
Frequency of monitoring/recording	Annually				
Value monitored	Annual average deforestation in the leakage belt during the monitoring period per forest class, in hectares:				
	Year	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	Secondary vegetation
	2020	995.64	12.45	1,104.92	293.77
	2021	304.26	2.99	718.81	104.34
	Total	1,299.90	15.44	1,823.73	398.11

Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing.
Purpose of the data	This parameter was used to calculate leakage emissions in the project scenario. Provides the <i>ex post</i> value of the deforested area within the leakage belt.
Calculation method	Analysis of satellite images and maps.
Comments	Where evidence can be collected that deforestation in the leakage belt is attributable to deforestation agents that are not linked to the project area, the detected deforestation may not be attributed to the project activity and therefore, not considered leakage.

Data / Parameter	$ABSLPA_{ic,t}$			
Data unit	Hectare			
Description	Annual area of deforestation of initial forest classes <i>ic</i> in the project area at year <i>t</i>			
Source of data	Field reports; Annual post-harvesting report; Remote sensing and GIS.			
Description of measurement methods and procedures to be applied	Forest cover change due to deforestation was monitored through assessment of classified satellite imagery covering the project area.			
Frequency of monitoring/recording	Annually			
Value monitored	Annual average deforestation in the project area during the monitoring period per forest class, in hectares:			
	Year	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees
	2020	92.66	8.85	1.63
	2021	58.61	5.09	3.57
	Total	151.28	13.95	5.20
Monitoring equipment	Remote sensing and GIS.			
QA/QC procedures to be applied	Best practices in remote sensing.			

Purpose of the data	This parameter was used to calculate baseline emissions and project emissions in the project scenario. Provides the <i>ex post</i> value of the deforested area per forest class within the project area.
Calculation method	Analysis of satellite images and maps.
Comments	N/A

Data / Parameter	$ABSLRR_{icl,t}$					
Data unit	Hectare					
Description	Annual area of deforestation of initial forest classes <i>icl</i> in the reference region at year <i>t</i>					
Source of data	Remote sensing and GIS.					
Description of measurement methods and procedures to be applied	Forest cover change due to deforestation was monitored through assessment of classified satellite imagery covering the project area.					
Frequency of monitoring/recording	Annually					
Value monitored	Annual average deforestation in the reference region during the monitoring period per forest class, in hectares:					
	Year	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	Dense Tropical Rainforest	Secondary Vegetation
	2020	5,302.24	625.85	1,379.51	0.00	550.99
	2021	1,947.19	456.25	847.29	0.81	207.91
	Total	7,249.43	1,082.10	2,226.80	0.81	758.90
Monitoring equipment	Remote sensing and GIS.					
QA/QC procedures to be applied	Best practices in remote sensing.					
Purpose of the data	This parameter was used to calculate baseline emissions in the project scenario. Provides the <i>ex post</i> value of the deforested area per forest class within the reference region.					
Calculation method	Analysis of satellite images and maps.					

Comments	N/A			
Data / Parameter	$APDPA_{icl,t}$			
Data unit	Hectare			
Description	Areas of planned deforestation in forest class <i>icl</i> at year <i>t</i> in the project area			
Source of data	Annual operational plan; Annual post-harvesting report; Remote sensing and GIS.			
Description of measurement methods and procedures to be applied	The planned deforestation activities in the project area that resulted in carbon stock decrease were subject to monitoring. Agro cortex management team records such information according to procedures established in its sustainable forest management plan.			
Frequency of monitoring/recording	Annually			
Value monitored	Year	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees
	2020	56.37	3.11	1.35
	2021	51.63	1.24	1.24
	Total	108.01	4.35	2.59
Monitoring equipment	Remote sensing and GIS Agro cortex Management team, based on the Sustainable Forest Management Plan for Fazenda Seringal Novo Macapá			
QA/QC procedures to be applied	Best practices in remote sensing. Internal audit of the SFMP.			
Purpose of the data	This parameter was used to calculate project emissions in the project scenario. Provides the <i>ex post</i> value of the decrease in carbon stocks due to planned deforestation in the project area.			
Calculation method	Emissions from deforestation at each forest class are quantified by multiplying the detected area of forest loss by the average forest carbon stock per unit area.			
Comments	Values above represent the annual planned deforestation per forest class during this monitoring period.			

	Planned deforestation mainly includes implementation of the forest management infrastructure, such as opening of main and secondary roads, skidding trails, and timber yards in each annual production unit within the project area.
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Data / Parameter	APLPA _{icl,t}																			
Data unit	Hectare																			
Description	Areas of planned logging activities in forest class <i>icl</i> at year <i>t</i> in the project area																			
Source of data	Annual operational plan; Annual post-harvesting report; Remote sensing and GIS.																			
Description of measurement methods and procedures to be applied	The planned logging activities in the project area that resulted in carbon stock increase or decrease shall be subjected to monitoring, when significant.																			
Frequency of monitoring/recording	Annually																			
Value monitored	<table><tr><th>Year</th><th>Open Tropical Rainforest with bamboo</th><th>Open Tropical Rainforest with palm trees</th><th>Open Alluvial Rainforest with palm trees</th></tr><tr><td>2020</td><td>5,040.23</td><td>0.00</td><td>0.00</td></tr><tr><td>2021</td><td>5,507.21</td><td>0.00</td><td>0.00</td></tr><tr><td>Total</td><td>10,547.44</td><td>0.00</td><td>0.00</td></tr></table>				Year	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	2020	5,040.23	0.00	0.00	2021	5,507.21	0.00	0.00	Total	10,547.44	0.00	0.00
Year	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees																	
2020	5,040.23	0.00	0.00																	
2021	5,507.21	0.00	0.00																	
Total	10,547.44	0.00	0.00																	
Monitoring equipment	Remote sensing and GIS Agrocortex Management team, based on the Sustainable Forest Management Plan for Fazenda Seringal Novo Macapá																			
QA/QC procedures to be applied	Best practices in remote sensing. Internal audit of the SFMP.																			
Purpose of the data	This parameter was used to calculate project emissions in the project scenario. Provides the <i>ex post</i> value of the increase or decrease in carbon stocks due to planned logging activities in the project area.																			
Calculation method	Carbon stock decrease from planned logging activities at each forest class are quantified by multiplying the detected area subject																			

	to logging by the harvested timber volume intensity, and then by the mean wood density. Carbon stock increase from planned logging activities at each forest class are quantified by multiplying the detected area subject to logging by the mean annual increment due to natural regeneration of managed forests, and then by the mean wood density.
Comments	According to the sustainable forest management plan²¹, 175,707.55 ha are subject to sustainable forest management plan (SFMP). The adopted rotation cycle is 30 years, thus each annual productive unit (APU) has around 5,856.92 hectares. The SFMP provides guidance to Agrocorrex management team in order to harvest forest products/by-products in a manner consistent with the conservation of the local ecosystem.

Data / Parameter	$APFPA_{icl,t}$
Data unit	Hectare
Description	Areas of planned fuel-wood collection and charcoal production activities in forest class <i>icl</i> at year <i>t</i> in the project area
Source of data	Annual operational plan; Annual post-harvesting report; Remote sensing and GIS; Other SFMP documents.
Description of measurement methods and procedures to be applied	No production of fuel wood or charcoal occurred within the project area during this monitoring period.
Frequency of monitoring/recording	Annually
Value monitored	0 (no production of fuel wood or charcoal occurred)
Monitoring equipment	Remote sensing and GIS Planned interventions proposed by Agrocorrex REDD Project
QA/QC procedures to be applied	Best practices in remote sensing. Internal audit of the SFMP.

²¹ OLIVEIRA, Luiz Rogério. **Plano de Manejo Florestal Sustentado 2ª Revisão - Consolidado**: Fazenda Seringal Novo Macapá. Rio Branco: Batisflor Florestal Ltda, 2017. 225 p.

Purpose of the data	This parameter was used to calculate project emissions in the project scenario. Provides the <i>ex post</i> value of the increase or decrease in carbon stocks due to planned fuel-wood collection and charcoal production activities in the project area.
Calculation method	Emissions at each forest class are quantified by multiplying the detected area subject to fuel wood collection or charcoal production by the harvested volume intensity, and then by the mean wood density.
Comments	N/A

Data / Parameter	$\Delta CPAdPA_t$										
Data unit	tCO _{2e}										
Description	Total decrease in carbon stock due to all planned activities at year <i>t</i> in the project area										
Source of data	Annual operational plan; Annual post-harvesting report; Remote sensing and GIS; Other SFMP documents.										
Description of measurement methods and procedures to be applied	The planned activities in the project area that resulted in carbon stock decrease shall be subjected to monitoring, when significant.										
Frequency of monitoring/recording	Annually										
Value monitored		<table><tr><th>Year</th><th>$\Delta CPAdPA_t$ (tCO_{2e})</th></tr><tr><td>2020</td><td>76,729.71</td></tr><tr><td>2021</td><td>93,372.20</td></tr><tr><td>Total</td><td>170,101.91</td></tr></table>	Year	$\Delta CPAdPA_t$ (tCO _{2e})	2020	76,729.71	2021	93,372.20	Total	170,101.91	
Year	$\Delta CPAdPA_t$ (tCO _{2e})										
2020	76,729.71										
2021	93,372.20										
Total	170,101.91										
Monitoring equipment	Remote sensing and GIS										
QA/QC procedures to be applied	Best practices in remote sensing. Internal audit of the SFMP.										
Purpose of the data	This parameter was used to calculate project emissions in the project scenario. Provides the <i>ex post</i> value of the decrease in carbon stocks due to planned activities in the project area.										
Calculation method	This parameter is the sum of: carbon stock decrease due to planned deforestation, carbon stock decrease due to planned logging activities, and carbon stock decrease due to planned fuel-wood and charcoal activities.										

Comments	No production of fuel wood or charcoal occurred within the project area during this monitoring period. Value above represents the annual decrease in carbon stocks due to all planned activities within the project area.
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Data / Parameter	$\Delta CPAiPA_t$										
Data unit	tCO ₂ e										
Description	Total increase in carbon stock due to all planned activities at year t in the project area										
Source of data	Annual operational plan; Annual post-harvesting report; Remote sensing and GIS; Permanent plots monitoring reports; Other SFMP related documents.										
Description of measurement methods and procedures to be applied	The planned activities in the project area that resulted in carbon stock increase shall be subjected to monitoring, when significant.										
Frequency of monitoring/recording	Annually										
Value monitored		<table><tr><th>Year</th><th>$\Delta CPAiPA_t$ (tCO₂e)</th></tr><tr><td>2020</td><td>30,640.38</td></tr><tr><td>2021</td><td>35,273.34</td></tr><tr><td>Total</td><td>65,913.72</td></tr></table>	Year	$\Delta CPAiPA_t$ (tCO ₂ e)	2020	30,640.38	2021	35,273.34	Total	65,913.72	
Year	$\Delta CPAiPA_t$ (tCO ₂ e)										
2020	30,640.38										
2021	35,273.34										
Total	65,913.72										
Monitoring equipment	Remote sensing and GIS										
QA/QC procedures to be applied	Best practices in remote sensing. Internal audit of the SFMP.										
Purpose of the data	This parameter was used to calculate project emissions in the project scenario. Provides the <i>ex post</i> value of the increase in carbon stocks due to planned activities in the project area, which could reduce the decrease in carbon stocks in the project area.										
Calculation method	Carbon stock increase from planned logging activities at each forest class are quantified by multiplying the detected area subject to logging by the mean annual increment due to natural regeneration of managed forests, and then by the mean wood density.										

	Due to the periodical harvesting, the projected increase in carbon stocks of each forest class in the project scenario is estimated by assuming that the maximum carbon stock is the long term average carbon stock (the average of a production cycle). Therefore, once a class reaches this level of carbon stock, no more carbon stock increase can be attributed to it.
Comments	No production of fuel wood or charcoal occurred within the project area during this monitoring period. In addition, there are no secondary forests or degraded forests within the project area that have the potential to grow and accumulate significant carbon stocks. A sustainable forest management plan (SFMP) was developed for the Project Area, which has been carried out by Agrocortex management team since 2014. Forests that will be subject to planned logging activities under the project scenario have the potential to grow and accumulate significant carbon stocks after the periodical harvest cycle due to natural regeneration. Value above represents the annual increase in carbon stocks due to all planned activities within the project area.

Data / Parameter	$\Delta CADLK_t$										
Data unit	tCO _{2e}										
Description	Total decrease in carbon stocks due to displaced deforestation at year t										
Source of data	Remote sensing and GIS.										
Description of measurement methods and procedures to be applied	Deforestation in the leakage belt area can be considered activity displacement leakage. Activity data for the leakage belt area will be determined using the same methods applied to monitoring deforestation activity data in the project area.										
Frequency of monitoring/recording	Annually										
Value monitored		<table><tr><th>Year</th><th>$\Delta CADLK_t$ (tCO_{2e})</th></tr><tr><td>2020</td><td>0.00</td></tr><tr><td>2021</td><td>0.00</td></tr><tr><td>Total</td><td>0.00</td></tr></table>	Year	$\Delta CADLK_t$ (tCO _{2e})	2020	0.00	2021	0.00	Total	0.00	
Year	$\Delta CADLK_t$ (tCO _{2e})										
2020	0.00										
2021	0.00										
Total	0.00										
Monitoring equipment	Remote sensing and GIS.										
QA/QC procedures to be applied	Best practices in remote sensing.										

Purpose of the data	This parameter was used to calculate leakage emissions in the project scenario. Provides the <i>ex post</i> value of the decrease in carbon stocks due to displaced deforestation in the leakage belt.
Calculation method	Emissions from deforestation at each forest class are quantified by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	Where evidence can be collected that deforestation in the leakage belt is attributable to deforestation agents that are not linked to the project area, the detected deforestation may not be attributed to the project activity and therefore, not considered leakage. The GIS analysis conducted during this monitoring period led to the conclusion that the increase in deforestation in the south of the Reference Region was not associated with the project activity; and that there was no relation between the observed patterns of deforestation in the Leakage Belt with the present REDD project.

Data / Parameter	$\Delta CPSLK_t$																															
Data unit	tCO _{2e}																															
Description	Annual carbon stock change in leakage management areas in the project case at year <i>t</i>																															
Source of data	Activities report related to leakage prevention measures proposed by Agro cortex REDD Project; SOCIALCARBON Reports; Field assessment; Remote sensing and GIS																															
Description of measurement methods and procedures to be applied	The planned activities in leakage management areas that resulted in carbon stock decrease shall be subjected to monitoring, when significant.																															
Frequency of monitoring/recording	Annually																															
Value monitored	<table><tr><th rowspan="4">Project year</th><th colspan="4">Carbon stock changes in leakage management area in the project case</th></tr><tr><th>ID_{fcl}</th><th>1</th><th>annual</th><th>cumulative</th></tr><tr><th>APSLK_{fcl,t}</th><th>C_{totfcl,t}</th><th>$\Delta CPSLK_t$</th><th>$\Delta CPSLK$</th></tr><tr><th>ha</th><th>tCO_{2e}/ha</th><th>tCO_{2e}</th><th>tCO_{2e}</th></tr><tr><td>2020</td><td>17.19</td><td>52.03</td><td>894.40</td><td>894.40</td></tr><tr><td>2021</td><td>6.99</td><td>60.70</td><td>424.30</td><td>1,318.70</td></tr></table>					Project year	Carbon stock changes in leakage management area in the project case				ID _{fcl}	1	annual	cumulative	APSLK _{fcl,t}	C _{totfcl,t}	$\Delta CPSLK_t$	$\Delta CPSLK$	ha	tCO _{2e} /ha	tCO _{2e}	tCO _{2e}	2020	17.19	52.03	894.40	894.40	2021	6.99	60.70	424.30	1,318.70
Project year	Carbon stock changes in leakage management area in the project case																															
	ID _{fcl}	1	annual	cumulative																												
	APSLK _{fcl,t}	C _{totfcl,t}	$\Delta CPSLK_t$	$\Delta CPSLK$																												
	ha	tCO _{2e} /ha	tCO _{2e}	tCO _{2e}																												
2020	17.19	52.03	894.40	894.40																												
2021	6.99	60.70	424.30	1,318.70																												
Monitoring equipment	Remote sensing and GIS																															

QA/QC procedures to be applied	Best practices in remote sensing. FSC annual reports.
Purpose of the data	This parameter was used to calculate leakage emissions in the project scenario. Provides the <i>ex post</i> value of the change in carbon stocks due to leakage prevention measures in the leakage management area.
Calculation method	Emissions from deforestation are quantified by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	Leakage prevention measures proposed by the present project do not include decrease in carbon stocks due to activities implemented in the leakage management area.

Data / Parameter	$\Delta CUDdPA_t$										
Data unit	tCO ₂ e										
Description	Total actual carbon stock change due to unavaoided unplanned deforestation at year t in the project area										
Source of data	Remote sensing and GIS Supervisor reports.										
Description of measurement methods and procedures to be applied	Forest cover change due to unplanned deforestation was monitored through assessment of classified satellite imagery covering the project area.										
Frequency of monitoring/recording	Annually										
Value monitored		<table><tr><th>Year</th><th>$\Delta CUDdPA_t$ (tCO₂e)</th></tr><tr><td>2020</td><td>27,331.42</td></tr><tr><td>2021</td><td>7,381.12</td></tr><tr><td>Total</td><td>34,712.53</td></tr></table>	Year	$\Delta CUDdPA_t$ (tCO ₂ e)	2020	27,331.42	2021	7,381.12	Total	34,712.53	
Year	$\Delta CUDdPA_t$ (tCO ₂ e)										
2020	27,331.42										
2021	7,381.12										
Total	34,712.53										
Monitoring equipment	Remote sensing and GIS										
QA/QC procedures to be applied	Best practices in remote sensing.										
Purpose of the data	This parameter was used to calculate project emissions in the project scenario. Provides the <i>ex post</i> value of the change in carbon stocks due to unavaoided unplanned deforestation within the project area.										

Calculation method	Emissions from deforestation at each forest class are quantified by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	N/A

Data / Parameter	EBBPSPA _t										
Data unit	tCO ₂ e										
Description	Sum of (or total) actual non-CO ₂ emissions from forest fire at year <i>t</i> in the project area										
Source of data	Remote sensing data and GIS Supervisor reports.										
Description of measurement methods and procedures to be applied	If forest fires occur, these non-CO ₂ emissions are subjected to monitoring and accounting, when significant. In addition to remote sensing data and GIS, which can identify the area affected by forest fire, periodic reports from area supervisors, who live inside the project area, confirmed the data obtained.										
Frequency of monitoring/recording	Annually										
Value monitored		<table><tr><th>Year</th><th>EBBPSPA_t (tCO₂e)</th></tr><tr><td>2020</td><td>638.57</td></tr><tr><td>2021</td><td>157.27</td></tr><tr><td>Total</td><td>792.84</td></tr></table>	Year	EBBPSPA _t (tCO ₂ e)	2020	638.57	2021	157.27	Total	792.84	
Year	EBBPSPA _t (tCO ₂ e)										
2020	638.57										
2021	157.27										
Total	792.84										
Monitoring equipment	Remote sensing and GIS										
QA/QC procedures to be applied	Best practices in remote sensing and GIS.										
Purpose of the data	This parameter was used to calculate <i>non</i> -CO ₂ emissions due to forest fires within the project area in the project scenario, providing an <i>ex post</i> project emissions value.										
Calculation method	If forest fires occur, these non-CO ₂ emissions will be subject to monitoring and accounting, when significant.										
Comments	No forest fire was used by Agrocortex for carrying out planned deforestation or timber harvesting activities. However, there were around 53.86 ha of unplanned deforestation within the project area during the monitored period, which conversion of forest to non-forest could have involved fires. It was conservatively assumed that all unplanned deforestation within the project area involved fire and all above ground biomass was burnt. Therefore,										

	non-CO ₂ emissions from forest fires were quantified and deducted from emission reductions.								
Data / Parameter	<i>EgLK_t</i>								
Data unit	tCO ₂ e								
Description	Emissions from grazing animals in leakage management areas at year <i>t</i> .								
Source of data	Activities report related to leakage prevention measures proposed by Agro cortex REDD Project; SOCIALCARBON Reports; Field assessment; Remote sensing data and GIS.								
Description of measurement methods and procedures to be applied	GHG emissions from grazing animals in leakage management areas (i.e. enteric fermentation or manure management) were subjected to monitoring, when significant.								
Frequency of monitoring/recording	Annually								
Value monitored	<table border="1"> <thead> <tr> <th>Year</th><th><i>EgLK_t</i> (tCO₂e)</th></tr> </thead> <tbody> <tr> <td>2020</td><td>17,685.10</td></tr> <tr> <td>2021</td><td>17,685.10</td></tr> <tr> <td>Total</td><td>35,370.19</td></tr> </tbody> </table>	Year	<i>EgLK_t</i> (tCO ₂ e)	2020	17,685.10	2021	17,685.10	Total	35,370.19
Year	<i>EgLK_t</i> (tCO ₂ e)								
2020	17,685.10								
2021	17,685.10								
Total	35,370.19								
Monitoring equipment	Remote sensing and GIS								
QA/QC procedures to be applied	Best practices in remote sensing and GIS. Field assessment data FSC annual reports.								
Purpose of the data	This parameter was used to calculate GHG leakage emissions from activities implemented in the leakage management area in the project scenario, providing an <i>ex post</i> value.								
Calculation method	Described in the methodology (VM0015, v1.1), section 8.1.2: <i>Ex ante</i> estimation of CH ₄ and N ₂ O emissions from grazing animals.								
Comments	Activities from grazing animals that resulted in GHG emissions occurred in the leakage management area during this monitoring period were carried out.								

Data / Parameter	$EADLK_t$
Data unit	tCO ₂ e
Description	Total <i>ex post</i> increase in GHG emissions due to displaced forest fires at year <i>t</i> .
Source of data	Remote sensing data and GIS.
Description of measurement methods and procedures to be applied	Forest fires in the leakage belt area can be considered activity displacement leakage. GHG emissions due displaced forest fires shall be subjected to monitoring, when significant.
Frequency of monitoring/recording	Annually
Value monitored	0.00 (no significant forest fires in the leakage belt area occurred during this monitoring period)
Monitoring equipment	Remote sensing and GIS
QA/QC procedures to be applied	Best practices in remote sensing and GIS.
Purpose of the data	This parameter was used to calculate leakage emissions in the project scenario. Provides the <i>ex post</i> value of the increase in GHG emissions due to displaced forest fires in the leakage belt.
Calculation method	Emissions from deforestation at each forest class are estimated by multiplying the detected area of forest loss by the average forest carbon stock per unit area.
Comments	No significant forest fires in the leakage belt area occurred during this monitoring period. Where evidence can be collected that deforestation in the leakage belt is attributable to deforestation agents that are not linked to the project area, the detected deforestation may not be attributed to the project activity and therefore, not considered leakage.

Data / Parameter	$H_{icl,t}$
Data unit	m ³ /ha
Description	Harvesting intensity of timber in forest class <i>icl</i> at year <i>t</i> in the project area due to planned logging activities (i.e., sustainable forest management plan).
Source of data	Sustainable forest management activity reports, such as the annual operational plan and the annual post-harvesting report.

Description of measurement methods and procedures to be applied	Forest inventory and measurements of wood logs by Agro cortex management team. Agro cortex controls all the harvested timber from the forest management area through a software. Harvesting intensity followed procedures described in the Sustainable Forest Management Plan for Fazenda Seringal Novo Macapá.										
Frequency of monitoring/recording	Annually										
Value monitored		<table><tr><th>Year</th><th>H_{licl,t} (m³/ha)</th></tr><tr><td>2020</td><td>3.16</td></tr><tr><td>2021</td><td>4.38</td></tr><tr><td>Average</td><td>3.80</td></tr></table>	Year	H _{licl,t} (m³/ha)	2020	3.16	2021	4.38	Average	3.80	
Year	H _{licl,t} (m³/ha)										
2020	3.16										
2021	4.38										
Average	3.80										
Monitoring equipment	The same equipment applied in the forest inventory. Each harvested timber log is measured by Agro cortex management team and stored in a collector, which is linked to the SFMP software.										
QA/QC procedures to be applied	Control procedures applied to forest inventory. FSC Certification. SFMP internal audit. Logging authorization from the Brazilian Environmental Agency ²² .										
Purpose of the data	This parameter was used to calculate project emissions in the project scenario. Provides the <i>ex post</i> value of the harvested timber volume due to planned logging activities in the project area.										
Calculation method	This parameter was calculated through the annual timber inventory, which is carried out before harvesting and contains the timber volume from each APU. After harvesting operations, each harvested timber log is measured (diameter and height) by Agro cortex employees and stored in a collector, which automatically calculate the timber volume through the following equation: $\ln V = -9,41417 + 0,97524 \times \ln (D^2 \times H)$ Where, D = Diameter H = Height Carbon stock decrease from planned logging activities at each forest class are quantified by multiplying the detected area subject to logging by the harvested timber volume intensity (added to logging damage factor), and then by the mean wood density.										

²² The responsible environmental agency in this case is the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - IBAMA.

Comments	A sustainable forest management plan (SFMP) was developed and has been executed by Agro cortex management team since 2014.
Data / Parameter	Logging damage factor (LDF)
Data unit	m ³ /m ³ of harvested timber
Description	The logging damage factor (LDF) is a representation of the quantity of emissions that will ultimately arise per unit of extracted timber (m ³). These emissions arise from the non-commercial portion of the felled trees (the branched and stump) and trees incidentally killed during felling.
Source of data	SFMP related documentation, such as forestry inventory, harvesting management plans and post-harvest assessment reports. Feldpausch et al. When big trees fall: Damage and carbon export by reduced impact logging in southern Amazonia. Forest Ecology and Management 219 (2005) 199–215
Description of measurement methods and procedures to be applied	The emissions resulting directly from logging are calculated by estimating the emissions resulting from dead wood created in each logging gap measured divided by the volume of wood created, adding skidder trails damage. According to Feldpausch et al (2005), Table 6 pag 209, the mean Coarse woody debris returned to the soil as necromass following logging and damage in: (1) tree felling gap formation (trees killed by tree-fall), (2) residual canopy from the felled tree, (3) road, (4) deck construction (whole trees plowed to the ground) and (5) skid maneuvering during logging, is about 6.9 Mg C/ha. According to section 4.3 (pg 212) from this same study, this represents 2.4 times the carbon taken off site in logs. However, the MR already takes into account as planned deforestation the roads and decks constructions, which represent around 16% of the total damage. Therefore, the LDF is $2.4 * (1-0,159) = 2.0174$.
Frequency of monitoring/recording	Annually
Value monitored	2.0174
Monitoring equipment	The same equipment applied in the forest inventory.
QA/QC procedures to be applied	Control procedures applied to forest inventory. SFMP internal audit. FSC Reports. Permanent plots monitoring report regarding the APUs harvested within the SFMP

Purpose of the data	This parameter was used to calculate project emissions from logging activities occurred in the project scenario due to sustainable forest management, specifically for the calculation of the carbon stock decrease due to planned logging activities in the project area.
Calculation method	This parameter is added to the harvested timber volume intensity in order to calculate carbon stock decrease from planned logging activities at each forest class.
Comments	If no monitoring data is available, SFMP data shall be used. If new and more accurate harvest intensity data become available, these can be used to estimate project emissions

Data / Parameter	<i>LTF_w</i>
Data unit	%
Description	Fraction of wood products that are considered permanent (i.e. carbon is stored for 100 years or more).
Source of data	Sustainable forest management activity reports, such as the annual operational plan and the annual post-harvesting report. Financial reports may also be utilized to calculate this parameter.
Description of measurement methods and procedures to be applied	Forest inventory and measurements of harvested wood logs by Agro cortex management team. Agro cortex controls all the harvested timber from the forest management area through the SFMP software. Agro cortex divides timber production in commercial groups, which have different rates of commercialization. Each group has a specific durability and lifetime, which mainly depends on the quality and density of the wood.
Frequency of monitoring/recording	Annually
Value monitored	0
Monitoring equipment	The same equipment applied in the forest inventory.
QA/QC procedures to be applied	Control procedures applied to forest inventory. SFMP internal audit. FSC Reports.
Purpose of the data	This parameter was used to calculate project emissions in the project scenario, specifically for calculations of harvested wood products carbon pool.

Calculation method	This parameter was calculated through the percentage of final wood products that are considered permanent (long lifetime).
Comments	This value is a conservative estimate based on Agro cortex's operations of the SFMP. Such data indicates long lifetime wood products are not produced as part of forest operations.

Data / Parameter	MAI_{icl}
Data unit	m ³ /ha/year
Description	Mean annual increment at each forest class due to natural regeneration of managed forests following planned sustainable logging activities
Source of data	Field measurements in sample plots; BRASIL. Conselho Nacional do Meio Ambiente (CONAMA). Resolution 406, dated 02/02/2009. Diário Oficial [da] República Federativa do Brasil , Brasília, DF, 06 fev. 2009. This Resolution establishes technical parameters to be adopted in the preparation, presentation, technical evaluation and execution of a Sustainable Forest Management Plan - SFMP for logging purposes, for native forests and their succession forms in the Amazon biome.
Description of measurement methods and procedures to be applied	Forests that were subject to planned logging activities under the project scenario have the potential to grow and accumulate significant carbon stocks after the periodical harvest cycle due to natural regeneration. This parameter was calculated through the annual monitoring of permanent plots following planned sustainable logging activities.
Frequency of monitoring/recording	Annually
Value monitored	0.86
Monitoring equipment	The same equipment applied in the forest inventory.
QA/QC procedures to be applied	Control procedures applied to forest inventory. SFMP internal audit. FSC Reports.
Purpose of the data	This parameter was used to calculate project emissions from logging activities occurred in the project scenario due to sustainable forest management, specifically for the calculation of the carbon stock increase due to natural regeneration of managed forests after planned sustainable logging activities.

Calculation method	Carbon stock increase from previously planned logging areas within each forest class is estimated via the increase in DBH assessed in measured trees within permanent plots. It is calculated through the annual measurement of the diameter of all remaining trees located within permanent plots following planned sustainable logging activities. The diameter is a good parameter to estimate the mean annual increment due to natural regeneration.
Comments	A SFMP was developed and is executed by Agro cortex management team since 2014. If new and more accurate harvest intensity data become available, these can be used to estimate project emissions

Data / Parameter	MTF_w
Data unit	%
Description	Fraction of wood products that are retired between 3 and 100 years.
Source of data	Sustainable forest management activity reports, such as the annual operational plan and the annual post-harvesting report. Financial reports may also be utilized to calculate this parameter.
Description of measurement methods and procedures to be applied	Forest inventory and measurements of harvested wood logs by Agro cortex management team. Agro cortex controls all the harvested timber from the forest management area through the SFMP software. Agro cortex divides timber production in commercial groups, which have different rates of commercialization. Each group has a specific durability and lifetime, which mainly depends on the quality and density of the wood.
Frequency of monitoring/recording	Annually
Value monitored	95
Monitoring equipment	The same equipment applied in the forest inventory.
QA/QC procedures to be applied	Control procedures applied to forest inventory. SFMP internal audit. FSC Reports.
Purpose of the data	This parameter was used to calculate project emissions in the project scenario, specifically for calculations of harvested wood products carbon pool.

Calculation method	This parameter was calculated through the percentage of final wood products that have an expected lifetime between 3 to 100 years.
Comments	This value was calculated with data on the operation of the SFMP during this monitoring period.

Data / Parameter	RF_t
Data unit	%
Description	Risk factor used to calculate VCS buffer credits
Source of data	VCS Non-Permanence Risk Report from Agro cortex REDD Project, Remote sensing data and GIS, Supervisor information Literature data.
Description of measurement methods and procedures to be applied	All sources of data from the VCS Non-Permanence Risk Report were used to measure the various risk factors.
Frequency of monitoring/recording	Annually
Value monitored	10
Monitoring equipment	Remote sensing and GIS.
QA/QC procedures to be applied	Best practices in remote sensing and GIS.
Purpose of the data	This parameter represents the non-permanence risk rating of the project during the current monitoring period, which was used to determine the number of buffer credits that shall be deposited into the AFOLU pooled buffer account.
Calculation method	This parameter was calculated using the AFOLU Non-Permanence Risk Tool. All the risk factors described in the VCS Non-Permanence Risk Report were assessed based on the current monitoring period.
Comments	N/A

Data / Parameter	STF_w
Data unit	%

Description	Fraction of wood products and waste that will be emitted to the atmosphere within 3 years.
Source of data	Sustainable forest management activity reports, such as the annual operational plan and the annual post-harvesting report. Financial reports may also be utilized to calculate this parameter.
Description of measurement methods and procedures to be applied	Forest inventory and measurements of harvested wood logs by Agro cortex employees. Agro cortex controls all the harvested timber from the forest management area through the SFMP software. Agro cortex divides timber production in commercial groups, which have different rates of commercialization. Each group has a specific durability and lifetime, which mainly depends on the quality and density of the wood.
Frequency of monitoring/recording	Annually
Value monitored	5
Monitoring equipment	The same equipment applied in the forest inventory.
QA/QC procedures to be applied	Control procedures applied to forest inventory. SFMP internal audit. FSC Reports.
Purpose of the data	This parameter was used to calculate project emissions in the project scenario, specifically for calculations of harvested wood products carbon pool.
Calculation method	This parameter was calculated through the percentage of final wood products that have an expected lifetime below 3 years.
Comments	This value was calculated with data on the operation of the SFMP during this monitoring period.

Data / Parameter	$VEX_{w,j,fc,t}$
Data unit	m ³
Description	Volume of timber for product class w , of species j , extracted from within forest class fc at time t
Source of data	Sustainable forest management activity reports, such as the annual operational plan and the annual post-harvesting report. Financial reports may also be utilized to calculate this parameter.

Description of measurement methods and procedures to be applied	Forest inventory and measurements of wood logs by Agro cortex management team. Agro cortex controls all the harvested timber from the forest management area through a SFMP software. Agro cortex divides timber production in commercial groups, which have different rates of commercialization.																		
Frequency of monitoring/recording	Annually																		
Value monitored	<table><tr><th colspan="3">Commercial Groups</th></tr><tr><th colspan="3">VEX_{w,j,icl,t} (m³)</th></tr><tr><th>Timber commercial Groups</th><th>2020</th><th>2021</th></tr><tr><td>High density woods and Mahogany</td><td>9,035.40</td><td>13,256.13</td></tr><tr><td>White woods</td><td>321.57</td><td>940.62</td></tr><tr><td>Total</td><td>9,356.96</td><td>14,196.75</td></tr></table>	Commercial Groups			VEX _{w,j,icl,t} (m³)			Timber commercial Groups	2020	2021	High density woods and Mahogany	9,035.40	13,256.13	White woods	321.57	940.62	Total	9,356.96	14,196.75
Commercial Groups																			
VEX _{w,j,icl,t} (m³)																			
Timber commercial Groups	2020	2021																	
High density woods and Mahogany	9,035.40	13,256.13																	
White woods	321.57	940.62																	
Total	9,356.96	14,196.75																	
Monitoring equipment	The same equipment applied in the forest inventory. Each harvested timber log is measured by Agro cortex employees and stored in a collector, which is linked to the SFMP software.																		
QA/QC procedures to be applied	Control procedures applied to forest inventory. FSC Certification. SFMP internal audit. Logging authorization from the Brazilian Environmental Agency ²³ .																		
Purpose of the data	This parameter was used to calculate project emissions in the project scenario, specifically for calculations of harvested wood products carbon pool. Provides the <i>ex post</i> value of the final wood products volume per product class due to planned logging activities in the project area.																		
Calculation method	This parameter was calculated based on the production of timber per commercial group. A volumetric efficiency coefficient of 40% ²⁴ was utilized to calculate the parameter $VEX_{w,j,fcl,t}$, in order to convert the volume of timber harvested into volume of final wood products.																		
Comments	This value was calculated with data on the operation of the SFMP during this monitoring period.																		

²³ The responsible environmental agency in this case is the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - IBAMA.

²⁴ According to Agro cortex internal data.

4.3. Data Monitored and SOCIALCARBON

Indicator	Women Inclusion
Data unit	Not applicable
Description	Evaluates initiatives implemented by the company to promote women inclusion in the community activities.
Source of data	Questionnaire, interviews with communities, reports, among others.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if there are campaigns aiming to promote women inclusion in the community activities.
Comments	Although there are women employed by the company, most of them perform only administrative activities. In addition, during this monitoring period, due the COVID-19 pandemic, Agro cortex couldn't promote any activities related to women empowerment.

Indicator	Expansion of community activities
Data unit	Not applicable
Description	Evaluates whether the community activities implemented by the company extend to all affected communities.

Source of data	Questionnaire, interviews with communities, reports, among others
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if there are activities that reach the communities affected by the project.
Comments	The initiatives reach up to eight communities.

Indicator	Associations and Cooperatives
Data unit	Not applicable
Description	Evaluates whether communities residing in/around the project area are involved in associations or cooperatives.
Source of data	Questionnaires; interviews with communities; meeting minutes; attendance lists; association records.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.

Purpose of the data	This parameter was used to check if the communities residing in/around the project area are involved in associations or cooperatives.
Comments	The association or cooperative is regularly attended and formally registered; however, there are no recognized leaders within the community.

Indicator	Conflict management
Data unit	Not applicable
Description	Evaluates the company's procedures to identify and deal with conflicts in the surrounding communities, as well as the actions that are being taken so that they do not recur.
Source of data	Questionnaire, procedures, interviews with communities, reports, among others
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if conflicts were identified, treated, and monitored.
Comments	In addition to the previous scenario, all conflicts identified are being treated and monitored. Efforts were carried out to ensure that they will not be repeated.

Indicator	Public health
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Data unit	Not applicable
Description	Evaluates the company's actions to mitigate the impacts of its activities related to the public health of surrounding communities.
Source of data	Questionnaire, interviews with communities, reports, among others.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if the company promotes any action to mitigate the impacts of its activities related to the public health of surrounding communities.
Comments	In addition to the previous scenario, the company monitors public health problems in the communities affected by the project.

Indicator	Community education and training
Data unit	Not applicable
Description	Evaluates the relevant education and training programs implemented as a project activity, including additional programs to the stakeholders and broader community.
Source of data	Questionnaire, interviews with communities, reports, among others.

Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if the company offers an education/training activity for the communities and/or employees.
Comments	The company offers an education / training activity in TWO of the following areas: - alternative income sources (e.g. collecting Brazil nuts) - education (e.g. literacy) - sustainable forest management

Indicator	Alternative income sources
Data unit	Not applicable
Description	Evaluates whether the project created alternative sources of income generation for the communities living within/surrounding the project area.
Source of data	Questionnaire, interviews with communities and project proponent, reports, among others.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was

	sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if the project generates any alternative income sources for the local communities.
Comments	The project generates three alternative income sources for the local communities.

Indicator	Carbon credit benefits
Data unit	Not applicable
Description	Evaluates whether proceeds from the sale of carbon credits was distributed to carbon project improvements or activities that benefit the local community.
Source of data	Reports, documents, and registries from project proponent.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if the sale of carbon credits was distributed to carbon project improvements or activities that benefit the local community.
Comments	Between 80 and 100% of the income generated by carbon credit sales was distributed to the carbon project or in the community development.

Indicator	Securing of funds
Data unit	Not applicable
Description	Evaluates the project proponent's participation in requests for proposals/ programs to secure funds. Also monitors whether project participants were successful, and whether the funds raised are creating activities for communities resident in/around the project area.
Source of data	Reports, documents, and registries from project proponent.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if the project owner search for proposals and/or programs to secure funds..
Comments	As well as the previous scenario, at least one of the initiatives undertaken is financially self-sufficient, not requiring any further funding to continue.

Indicator	Land Tenure
Data unit	Not applicable
Description	Evaluates the existence of conflicts due to land tenure, as well as whether actions are being taken to manage the issue.

Source of data	Reports, documents, and registries from project proponent.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if there was any conflict due to land tenure inside the project area as well as the actions that are being taken to manage these possible conflicts.
Comments	There were no conflicts inside the project area due to land tenure.

Indicator	Social and environmental investments
Data unit	Not applicable
Description	Evaluates the socio-environmental investments in the different areas: education; alternative income generation; environment; sport and infrastructure.
Source of data	Interviews with communities and project proponent, reports, among others.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview.

	For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if the company promotes any socio-environmental investments in different areas, such as: education, alternative income generation, environment, sport and infrastructure.
Comments	The company has social-environmental actions for four of the following topics: - education; - alternative income generation; - environment; - sport; - infrastructure.

Indicator	Quality control
Data unit	Not applicable
Description	Evaluates the quality control of the management plan operation.
Source of data	Reports, documents, and registries from project proponent.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if there is a quality control management plan operation.

Comments	There is a quality control team, and the problems are identified and solved.
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Indicator	Non-timber forest products (NTFPs)
Data unit	Not applicable
Description	Evaluates the sustainable use of natural resources by communities in/around the project area for income generation.
Source of data	Interviews with communities and project proponent, reports, among others.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	Non-timber forest products are traded in/around the project area, with sustainable practices in use.
Comments	Not applicable.

Indicator	Biodiversity monitoring
Data unit	Not applicable
Description	Evaluates whether the company has actions to identify and monitor the local fauna and flora.
Source of data	Reports, documents, and registries from project proponent.

Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if the company has actions to identify and monitor the local fauna and flora.
Comments	There is monitoring and identification of fauna AND flora.

Indicator	Impact on remaining flora
Data unit	Not applicable
Description	Evaluates the company actions to monitor the impact on the remaining flora.
Source of data	Reports, documents, and registries from project proponent.
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check if the company has actions to monitor the impact on the remaining flora.

Comments	In addition to the previous scenario, the company has measures / initiatives to reduce its impact on the remaining flora.
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Indicator	Buffer reduction
Data unit	Not applicable
Description	Measures the progression of the buffer in the current monitoring period compared to VCS PD and Monitoring Report.
Source of data	VCS PD and Monitoring Report
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check the progression of the buffer in the current monitoring period.
Comments	The buffer reduced by 0 to 5% compared to the previous monitoring period (or compared to the PD).

Indicator	Stakeholder consultation
Data unit	Not applicable
Description	Evaluates the methodology used for the stakeholder consultation regarding the carbon project.
Source of data	Interviews with communities and project proponent, reports, among others.

Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.
Purpose of the data	This parameter was used to check the methodology used for the stakeholder consultation regarding the carbon project.
Comments	During the time period analyzed, the company conducted a stakeholder consultation regarding the carbon project and all comments were registered. However this was not a formal stakeholder consultation.

Indicator	Project performance
Data unit	Not applicable
Description	Evaluates project performance in relation to verified emissions reductions.
Source of data	VCS PD and Monitoring Report
Description of methods to collect information and procedures to be applied	The Ecológica Assessoria team conducts an interview with the Agro cortex personnel and applies a questionnaire, aimed to indirectly obtain information regarding the six SOCIALCARBON Standard resources. Moreover, the Ecológica Assessoria team collects the evidence provided by Agro cortex. Then, a cross-check is made in order to guarantee that all documentation was sent and complies with the information provided during the interview. For more Information, please verify section 6.1 below.

Purpose of the data	This parameter was used to evaluate the project performance in relation to verified emission reductions.
Comments	Excellent: More than 95% of carbon credits predicted for the period were generated.

4.4. Monitoring Plan

The monitoring plan was performed as planned on the VCS PD. Monitoring was performed by the project proponent and outsourced to third parties having sufficient capacities to perform the monitoring tasks.

For all aspects of project monitoring, Agro cortex ensured that data collection, processing, analysis, management and archiving were conducted in accordance with the established monitoring plan. The authority for the registration, monitoring, measurement and reporting is *Mr. Marcos Preto*, the CEO of Agro cortex. The operational and managerial structure used for the monitoring plan is described on the table below:

Table 4. Type of Monitoring and Party Responsible for Monitoring

Variables monitored	Responsible	Frequency
Monitoring Deforestation and Project Emissions	Agro cortex together with Ecológica Assessoria and Uezu Planejamento Ambiental	Prior to verification
Monitoring of non-CO ₂ emissions from forest fires	Agro cortex together with Ecológica Assessoria and Uezu Planejamento Ambiental	Prior to verification
Monitoring of Leakage	Agro cortex together with Ecológica Assessoria and Uezu Planejamento Ambiental	Prior to verification
Monitoring of Natural Disturbance and catastrophic events	Agro cortex together with Ecológica Assessoria and Uezu Planejamento Ambiental	When a natural event occurs

Internal auditing and non-conformities were managed according to Agro cortex internal procedures. Agro cortex manages forest resources according to a Sustainable Forest Management Plan developed by third party experts and performed by its management team with significant experience in forest management. Such plan has procedures to identify and assess non-conformities and risks. The plan also establishes procedures for the regular training of Agro cortex staff. Ecológica Assessoria has also supported Agro cortex on the management of this VCS REDD Project.

Carbon stock changes due to planned deforestation were monitored by Agro cortex management team according to procedures set on their sustainable forest management plan, which included information on the amount of wood harvested and the total forest area affected by harvesting operations during the monitoring period.

Deforestation and related project emissions were monitored through periodic assessment of classified satellite imagery covering the project area. Uezu Planejamento Ambiental has supported the Project Proponent for such activity. For the present monitoring period, land-use change analyses were made through MapBiomass images, which is a new platform that produces maps through a pixel-by-pixel classification from Landsat satellites images.

Automatic classification was used for images cropped from the reference area, employing the cluster method from Google Earth Engine software. Automatic classification is necessarily followed by interpretation and refinement by analysts, in order to match the automatic results with the reality of the landscape. Using the same methodology as employed in the VCS PD, the process of accumulating “Non Forest” areas was adopted, in such a way that areas classified as “Non Forest” in one year were necessarily included in the same category in the following year.

Classification was first conducted for the whole Reference Region and subsequently cropped to the Leakage Belt and Project Area.

In order to compare the projection and the classification, GIS software was used to combine the land-use file from the projection of baseline deforestation with the classification obtained from satellite images in the current monitoring phase. In this way, a hybrid file was generated which allowed a “projection x classification” matrix to be created, which indicated the accumulated deforestation dynamics from 2020-2021, compared to the scenario stipulated in the VCS PD.

Based on the results obtained, the following matrix was developed for identification of the deforestation dynamics in a given period:

Table 5. Matrix for the identification of LULC change during comparison of projection versus classification

PROJECTION	CLASSIFICATION	WHAT OCCURRED	TABLE APPLIED
Non-Forest	Forest	The deforestation predicted in the VCS PD was avoided	Avoided deforestation
Forest	Forest	The forest was conserved as predicted	Forest
Non-forest	Non-forest	Deforestation occurred where it had been predicted	Predicted deforestation
Forest	Non-forest	Deforestation occurred where it had not been predicted	Non-predicted deforestation

Given the data obtained by combining these files, analysis of two aspects for project monitoring was possible: quantitative aspects relating to the total avoided deforestation area in the monitored period and the consequent generation of Verified Carbon Units (VCUs) credits; and qualitative aspects relating to the spatial distribution of these areas.

The data relating to generation of VCUs in the area during the monitoring period can be inferred from a numerical comparison of the projected and classified deforestation within the Project Area, regardless of spatial distribution.

In fact, the analysis of the spatial distribution of deforestation and the comparison with what was projected is fundamental to evaluating the deforestation patterns during the monitoring period. It allows the identification of concentration of activity in certain regions, construction of roads or possible changes in the dynamics of deforestation agents, drawing attention to necessary project adjustments.

In the case of the Reference Region and the Leakage Belt, the emphasis was put upon spatial analysis in order to understand the dynamics surrounding the Project Area and analyze possible changes in the observed deforestation patterns and possible relationships with the Project Area. Turning to the Project Area, it was analyzed spatially as well as numerically, in order to calculate the avoided deforestation in the period eligible for the generation of VCUs.

The SOCIAL CARBON Report shall be developed together with the Monitoring Report, preferably referring to the same monitoring period. Agro cortex is responsible for organizing activities and evidence for verification with the help of Ecológica Assessoria, which is responsible for completing the report and monitoring the audit.

Data for the SOCIALCARBON Report must be collected as per the Template and Guidance for Submission of new SOCIALCARBON Indicators for the Indicators for REDD + SFMP Projects available at the SOCIALCARBON website²⁵.

5. QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1. Baseline Emissions

The total average biomass stock per hectare (Mg ha^{-1}) was converted to tCO_2e using the following equations:

$$C_{\text{bicl}} = ab \times CF \times 44 / 12$$

²⁵ Available at <
https://static1.squarespace.com/static/6161c89d030b89374bec0b70/t/618a268beb78197f4e78ba15/1636443793807/Templ ate_Submission_of_new_indicators_REDD%2BSFMP_v1.2_EN11.pdf>

Where,

Cab_{icl}	Average carbon stock per hectare in the above-ground biomass carbon pool of initial forest class icl ; tCO _{2e} ha ⁻¹
ab	Average biomass stock per hectare in the above-ground biomass pool of initial forest class icl ; Mg ha ⁻¹
CF	Default value of carbon fraction in biomass
44/12	Ratio converting C to CO _{2e}

$$Cbb_{icl} = bb \times CF \times 44 / 12$$

Where,

Cbb_{icl}	Average carbon stock per hectare in the below-ground biomass carbon pool of initial forest class icl ; tCO _{2e} ha ⁻¹
bb	Average biomass stock per hectare in the below-ground biomass pool of initial forest class icl ; Mg ha ⁻¹
CF	Default value of carbon fraction in biomass
44/12	Ratio converting C to CO _{2e}

The total baseline carbon stock change in the project area at year t is calculated as follows:

$$\Delta CBSLPA_t = \Delta CabBSLPA_{icl,t} + \Delta CbbBSLPA_{icl,t}$$

Where,

$\Delta CBSLPA_t$	Total baseline carbon stock changes in the project area at year t ; tCO _{2e}
$\Delta CabBSLPA_{icl,t}$	Total baseline carbon stock change for the above-ground biomass pool in the project area for initial forest class at year t ; tCO _{2e}
$\Delta CbbBSLPA_{icl,t}$	Total baseline carbon stock change for the below-ground biomass pool in the project area for initial forest class at year t ; tCO _{2e}

$$\Delta CabBSLPA_{icl,t} = ABSLPA_{icl,t} \times \Delta Cab_{icl}$$

Where,

$\Delta CabBSLPA_{icl,t}$	Total baseline carbon stock change for the above-ground biomass pool in the project area for initial forest class at year t ; tCO _{2e}
$ABSLPA_{icl,t}$	Area of initial forest class icl deforested at time t within the project area in the baseline case; ha

ΔCab_{icl} Average carbon stock change factor per hectare in the above-ground biomass carbon pool of initial forest class *icl*; tCO₂e ha⁻¹

$$\Delta CbbBSLPA_{icl,t} = ABSLPA_{icl,t} \times \Delta Cbb_{icl}$$

Where,

$\Delta CbbBSLPA_{icl,t}$ Total baseline carbon stock change for the below-ground biomass pool in the project area for initial forest class at year *t*; tCO₂e

$ABSLPA_{icl,t}$ Area of initial forest class *icl* deforested at time *t* within the project area in the baseline case; ha

ΔCbb_{icl} Average carbon stock change factor per hectare in the below-ground biomass carbon pool of category *icl*; tCO₂e ha⁻¹

Carbon stocks

Project carbon stocks were calculated on the basis of biomass values from the study presented in tables below. An average of biomass values (above ground) from Salimon *et al.* (2011)²⁶ was utilized, which was a study conducted in the State of Acre that covered all the forest types in the State. The cited study obtained these values via inventoried wood volumes and allometric equations, using data from Amazonian regions.

Salimon *et al.* (2011)'s estimates of the above-ground biomass within the Brazilian State of Acre were mainly based on a remote sensing methodology carried out by Saatchi *et al.* (2007) and Nogueira *et al.* (2008), through the utilization of sophisticated methods to estimate biomass through remote sensing. Those three literature estimates of the above-ground biomass presented very similar results for the State of Acre.

The average biomass stock per hectare was calculated for each project boundary (reference region, project area and leakage belt) and for each vegetation group using weighted average. More details and the map of the different forest classes within the reference region, project area and leakage belt can be found in Appendix II.

Below ground biomass values were estimated to be 24% of the above ground biomass, according to the applied methodology VM0015 v1.1 (root-to-shoot ratio of 0.24 for tropical rainforest having above ground biomass values above 125 tons/ha, and 0.20 for values below 125 tons/ha).

Table 6. Biomass values used for the “forest” classes within the reference region

REFERENCE REGION			
Vegetation	Above-ground Biomass (Mg/ha)	Below-ground Biomass (Mg/ha)	Total biomass (Mg/ha)
Open tropical rainforest with bamboo	257.82	61.88	319.70

²⁶ SALIMON,C.I.; PUTZ, F.E.; MENEZES-FILHO, L.; ANDERSON,A.; SILVEIRA, M.; FOSTER BROWN, I.; OLIVEIRA, L.C. Estimating state-wide biomass carbon stocks for a REDD plan in Acre, Brazil. 2011, *Forest Ecology and Management*, 262, p. 555–560, 2011.

Open tropical rainforest with palm trees	245.98	59.04	305.01
Open alluvial rainforest with palm trees	218.50	52.44	270.94
Dense tropical rainforest	323.88	77.73	401.61
Secondary vegetation	37.00	7.40	44.40

Table 7. Biomass values used for the “forest” classes within the project area

PROJECT AREA			
Vegetation	Above-ground Biomass (Mg/ha)	Below-ground Biomass (Mg/ha)	Total biomass (Mg/ha)
Open tropical rainforest with bamboo + Lowland dense tropical rainforest	274.20	65.81	340.01
Open tropical rainforest with palm trees + bamboo	234.30	56.23	290.53
Open alluvial rainforest with palm trees + Dense alluvial tropical rainforest	218.50	52.44	270.94

Table 8. Biomass values used for the “forest” classes within the leakage belt

LEAKAGE BELT			
Vegetation	Above-ground Biomass (Mg/ha)	Below-ground Biomass (Mg/ha)	Total biomass (Mg/ha)
Open tropical rainforest with bamboo	256.59	61.58	318.17
Open tropical rainforest with palm trees	234.30	56.23	290.53
Open alluvial rainforest with palm trees	218.50	52.44	270.94
Secondary vegetation	37.00	7.40	44.40

In order to convert biomass into carbon, and carbon into carbon-dioxide, the conversion factors defined below were used.

Table 9. Biomass to CO₂ conversion factors²⁷

Conversion Factors	
Biomass to Carbon	0.5

²⁷ IPCC, 2003. Good practice guidance for land use, land-use change and forestry. Kanagawa: IGES, 2003. Available at: <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html>

C to CO ₂	44/12
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Table 10. Average CO₂ per hectare of initial forest classes icl existing in the reference region

REFERENCE REGION			
Vegetation	Aboveground biomass <i>Cab_{icl}</i> (tCO ₂ e/ha)	Belowground biomass <i>Cbb_{icl}</i> (tCO ₂ e/ha)	Total <i>Ctot_{icl}</i> (tCO ₂ e/ha)
Open tropical rainforest with bamboo	472.67	113.44	586.12
Open tropical rainforest with palm trees	450.96	108.23	559.19
Open alluvial rainforest with palm trees	400.58	80.12	480.70
Dense tropical rainforest	593.79	142.51	736.29
Secondary vegetation	67.83	13.57	81.40

Table 11. Average CO₂ per hectare of initial forest classes icl existing in the project area

PROJECT AREA			
Vegetation	Aboveground biomass <i>Cab_{icl}</i> (tCO ₂ e/ha)	Belowground biomass <i>Cbb_{icl}</i> (tCO ₂ e/ha)	Total <i>Ctot_{icl}</i> (tCO ₂ e/ha)
Open tropical rainforest with bamboo + Lowland dense tropical rainforest	502.70	120.65	623.35
Open tropical rainforest with palm trees + bamboo	429.55	103.09	532.64
Open alluvial rainforest with palm trees + Dense alluvial tropical rainforest	400.58	80.12	480.70

Table 12. Average CO₂ per hectare of initial forest classes icl existing in the leakage belt

LEAKAGE BELT			
Vegetation	Aboveground biomass <i>Cab_{icl}</i> (tCO ₂ e/ha)	Belowground biomass <i>Cbb_{icl}</i> (tCO ₂ e/ha)	Total <i>Ctot_{icl}</i> (tCO ₂ e/ha)
Open tropical rainforest with bamboo	470.41	112.90	583.31
Open tropical rainforest with palm trees	429.55	103.09	532.64
Open alluvial rainforest with palm trees	400.58	80.12	480.70

Secondary vegetation	67.83	13.57	81.40
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Average carbon stocks of post-deforestation classes

Fearnside (1996)²⁸ is one of the most recognized studies for the Brazilian Amazon about long term carbon stocks in deforested areas. This study constructed a Markov matrix of annual transition probabilities to estimate landscape composition and to project future changes in the Brazilian Amazon. The average carbon stock value of non-forest vegetation in anthropic areas in equilibrium (post-deforestation class) was defined as 12.8 tC/ha, or 46.93 tCO₂e/ha.

The use of Fearnside value for non-forest vegetation carbon stocks in equilibrium is conservative because it is based on several land-use types in the Amazon, including agriculture, pasturelands and secondary vegetation. Meanwhile, based on the Brazilian Government data available in the 3rd National GHG Inventory, the weighted average for carbon stocks in other land uses (mainly agriculture and pasturelands) was 32.99 tCO₂e. Therefore, the most conservative value between these two data was used.

Table 13. Long-term (20-years) average carbon stocks per hectare of post-deforestation LU/LC classes present in the reference region

Post deforestation class <i>fcl</i>	
Name	Non forest
ID _{fcl}	1
<i>C_{totfcl}</i>	
tCO ₂ e/ha	
46.93	

Uncertainty assessment

According to the applied methodology, if the uncertainty of the total average carbon stock is less than 10% of the average value, the average carbon stock value can be used. Otherwise, the lower boundary of the 90% confidence interval must be considered in the calculations if the class is an initial forest class in the project area or a final non-forest class in the leakage belt, and the higher boundary of the 90% confidence interval if the class is an initial forest class in the leakage belt or a final non-forest class in the project area.

Salimon *et al.* (2011) present uncertainties as one standard deviation of the mean. Thus, confidence interval of this method was around 68.27%. This was converted to a confidence interval of 90% by multiplying the standard deviation by the value of 1.64²⁹.

28 FEARNSIDE, Philip M.. Amazonian deforestation and global warming: carbon stocks in vegetation replacing Brazil's Amazon forest. Forest Ecology And Management, Manaus, v. 80, p.21-34, 1996. Available at: <[http://www1.uwindsor.ca/ees/system/files/Reference 4 - Amazonian deforestation and global warming- carbon stocks in.pdf](http://www1.uwindsor.ca/ees/system/files/Reference%204%20-%20Amazonian%20deforestation%20and%20global%20warming%20-%20carbon%20stocks%20in.pdf)>. Last visit on: April 13th. 2015.

29 SOUZA, A. M. Intervalos de Confiança. Departamento de Estatística - PPGEMQ / PPGEF – UFSM. 2008. Available at: <<http://w3.ufsm.br/adriano/aulas/ic/tintconf.pdf>>. Last visited on: 12/03/2018.

Therefore, Tables 26 and 27 below present carbon stocks per hectare of initial forest classes *ic/* existing in the project area and leakage belt, uncertainties at confidence interval of 90%, and final values after discounts for uncertainties.

The resulting changes in carbon stock for initial forest classes for the project area and leakage belt are shown in Tables below.

Table 14. Carbon stocks per hectare of initial forest classes icl existing in the project area and leakage belt

Initial forest class <i>icl</i>																								
Boundari es	Average carbon stock 90% CI																							
	Name	Open tropical rainforest with bamboo					Name	Open tropical rainforest with palm trees					Name	Open alluvial rainforest with palm trees					Name	Secondary vegetation				
	ID _{icl}	1					ID _{icl}	2					ID _{icl}	3					ID _{icl}	5				
	Cab _{icl}		Cbb _{icl}		Ctot _{icl}		Cab _{icl}		Cbb _{icl}		Ctot _{icl}		Cab _{icl}		Cbb _{icl}		Ctot _{icl}		Cab _{icl}		Cbb _{icl}		Ctot _{icl}	
	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI	C stock	±90% CI
	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha
Project Area	502.70	45.23	120.65	10.85	623.35	56.08	429.55	211.09	103.09	50.66	532.64	261.75	400.58	45.23	80.12	10.85	480.70	56.08	-	-	-	-	-	-
Leakage Belt	470.41	64.42	112.90	15.46	583.31	79.87	429.55	211.09	103.09	50.66	532.64	261.75	400.58	45.23	80.12	10.85	480.70	56.08	67.83	30.16	13.57	6.03	81.40	36.19

Table 15. Carbon stocks per hectare of initial forest classes icl existing in the project area and leakage belt after discounts for uncertainties

	Initial forest class <i>icl</i>																												
	Boundar les	Average carbon stock 90% CI																											
		Name	Open tropical rainforest with bamboo						Name	Open tropical rainforest with palm trees						Name	Open alluvial rainforest with palm trees						Name	Secondary vegetation					
		ID _{icl}	1						ID _{icl}	2						ID _{icl}	3						ID _{icl}	5					
		Cab _{icl}		Cbb _{icl}		Ctot _{icl}		Cab _{icl}		Cbb _{icl}		Ctot _{icl}		Cab _{icl}		Cbb _{icl}		Ctot _{icl}		Cab _{icl}		Cbb _{icl}		Ctot _{icl}					
		C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change	C stock	C stock change				
		tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha	tCO ₂ e /ha			
Initial forest class	Project Area	502.70	502.70	120.65	120.65	623.35	623.35	429.55	218.46	103.09	52.43	532.64	270.89	400.58	355.36	80.12	69.26	480.70	424.62	-	-	-	-	-	-				
Final forest class		502.70	502.70	120.65	120.65	623.35	623.35	429.55	640.64	103.09	153.75	532.64	794.39	400.58	445.81	80.12	90.97	480.70	536.78	-	-	-	-	-	-				
Initial forest class	Leakage Belt	470.41	534.83	112.90	128.36	583.31	663.19	429.55	640.64	103.09	153.75	532.64	794.39	400.58	445.81	80.12	90.97	480.70	536.78	67.83	97.99	13.57	19.60	81.40	117.59				
Final forest class		470.41	406.00	112.90	97.44	583.31	503.44	429.55	218.46	103.09	52.43	532.64	270.89	400.58	355.36	80.12	69.26	480.70	424.62	67.83	37.68	13.57	7.54	81.40	45.21				

Table 16. Baseline carbon stock change in the Reference Region

Carbon stock change in the above-ground biomass per initial forest class <i>icl</i>						Total carbon stock change in the above-ground biomass of initial forest class in the reference region	
ID _{cl}	1	2	3	4	5	$\Delta\text{CabBSLRR}_{icl,t}$	$\Delta\text{CabBSLRR}_{icl}$
Name	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	Dense Tropical Rainforest	Secondary vegetation	annual	cumulative
Project year	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	4,290,970	505,257	40,429	0	0	4,836,656	4,836,656
2021	4,693,579	396,445	298,414	0	332	5,388,769	10,225,426

Carbon stock change in the below-ground biomass per initial forest class <i>icl</i>						Total carbon stock change in the below-ground biomass of initial forest class in the reference region	
ID _{cl}	1	2	3	4	5	$\Delta\text{CbbBSLRR}_{icl,t}$	$\Delta\text{CbbBSLRR}_{icl}$
Name	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	Dense Tropical Rainforest	Secondary vegetation	annual	cumulative
Project year	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	493,659	45,553	26,384	0	2,663	568,259	568,259
2021	606,305	55,067	32,352	0	2,670	696,395	1,264,654

Carbon stock changes in above-ground biomass per post-deforestation zone z		Total carbon stock change of post deforestation zones in the reference region	
ID _{lz}	1	$\Delta\text{CBSLRR}_{z,t}$	ΔCBSLRR_z
Name	Non-forest	annual	cumulative
Project year	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	200,322	200,322	200,322
2021	248,660	248,660	448,982

Total net carbon stock change in the reference region	
ΔCBSLRR_t	ΔCBSLRR
annual	cumulative
tCO ₂ e	tCO ₂ e
5,204,594	5,204,594
5,836,504	11,041,098

Table 17. Baseline carbon stock change in the project area

Carbon stock change in the above-ground biomass per initial forest class <i>icl</i>				Total carbon stock change in the above-ground biomass of initial forest class in the project area	
ID _{cl}	1	2	3	$\Delta C_{abBSLPA_{icl,t}}$	$\Delta C_{abBSLPA_{icl}}$
Name	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	annual	cumulative
Project year	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}
2020	477,020	10,267	0	487,287	3,478,270
2021	565,738	15,834	0	581,572	4,059,842

Carbon stock change in the below-ground biomass per initial forest class <i>icl</i>				Total carbon stock change in the below-ground biomass of initial forest class in the project area	
ID _{cl}	1	2	3	$\Delta C_{bbBSLPA_{icl,t}}$	$\Delta C_{bbBSLPA_{icl}}$
Name	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	annual	cumulative
Project year	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}
2020	80,505	2,770	166	83,440	83,440
2021	94,083	3,150	166	97,398	180,838

Carbon stock changes in above-ground biomass per post-deforestation zone <i>z</i>		Total carbon stock change of post deforestation zones in the project area	
ID _z	1	$\Delta C_{BSLPA_{z,t}}$	ΔC_{BSLPA_z}
Name	Non-forest	annual	cumulative
Project year	tCO _{2e}	tCO _{2e}	tCO _{2e}
2020	29,235	29,235	29,235
2021	33,909	33,909	63,143

Total net carbon stock change in the project area	
ΔC_{BSLPA_t}	ΔC_{BSLPA}
annual	cumulative
tCO _{2e}	tCO _{2e}
541,493	541,493
645,061	1,186,554

Table 18. Baseline carbon stock change in the Leakage Belt

Carbon stock change in the above-ground biomass per initial forest class <i>icl</i>					Total carbon stock change in the above-ground biomass of initial forest class in the leakage belt	
ID _{cl}	1	2	3	5	$\Delta C_{abBSLLK_{icl,t}}$	$\Delta C_{abBSLLK_{icl}}$
Name	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	Secondary vegetation	annual	cumulative
Project year	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}
2020	2,513,266	0	80,008	0	2,593,274	11,009,956
2021	609,612	513	332,107	0	942,231	11,952,187

Carbon stock change in the below-ground biomass per initial forest class <i>icl</i>					Total carbon stock change in the below-ground biomass of initial forest class in the leakage belt	
ID _{cl}	1	2	3	5	$\Delta C_{bbBSLLK_{icl,t}}$	$\Delta C_{bbBSLLK_{icl}}$
Name	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	Secondary vegetation	annual	cumulative
Project year	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}
2020	199,722	18,126	38,450	974	257,272	257,272
2021	214,352	18,138	45,227	974	278,692	535,963

Carbon stock changes in above-ground biomass per post-deforestation zone <i>z</i>		Total carbon stock change of post deforestation zones in the leakage belt	
ID _{iz}	1	$\Delta C_{totBSLLK_{z,t}}$	$\Delta C_{totBSLLK_z}$
Name	Non-forest	annual	cumulative
Project year	tCO _{2e}	tCO _{2e}	tCO _{2e}
2020	77,831	77,831	77,831
2021	100,728	100,728	178,559

Total net carbon stock change in the leakage belt	
$\Delta C_{totBSLLK_t}$	$\Delta C_{totBSLLK}$
annual	cumulative
tCO _{2e}	tCO _{2e}
2,772,715	2,772,715
1,120,195	3,892,910

5.2. Project Emissions

The FSC-certified sustainable forest management plan implemented by Agro cortex in 2014 within the project area aims to harvest forest products/by-products in a manner consistent with the conservation of the local ecosystem. This type of economic activity enables the harvesting of an economically feasible volume of forest products, however allowing the regeneration of the natural stock in accordance with the growth and recovery rates of the biome.

Therefore, the present REDD project includes planned deforestation and planned logging activities within the project area. These carbon stock changes are estimated *ex ante* and shall be measured *ex post*.

Planned deforestation mainly includes implementation of infrastructure, such as opening of main and secondary roads, skidding trails³⁰, and timber yards in each annual production unit – APU (*Unidade de Produção Anual*, in portuguese) within the project area, estimated to be around 1% of each APU. According to the sustainable forest management plan³¹, 175,707.55 ha (92.4% of total property area) are subject to SFMP. The adopted rotation cycle is 30 years, thus each annual productive unit (APU) has around 5,856.92 hectares.

The location of areas to be protected and the allocation of infrastructures within each APU are planned based on an aerial survey, such as the Light Detection and Ranging (LIDAR) tool, which has a high-resolution of 1.5m. These data allow generating the Digital Terrain Model and the Digital Drainage Model. From these models, it is possible to generate level curves and to identify PPAs according to legislation. With the aforementioned models and the spatial distribution of the selected trees for cutting, Agro cortex plans the infrastructure construction in each APU within the project area, such as opening of main and secondary roads, skidding trails, and timber yards.

The construction of the infrastructure is carried out in accordance with techniques provided by the Tropical Forest Institute (*Instituto Floresta Tropical* - IFT), an NGO that promotes the adoption of good practices sustainable in forest management plans, contributing to the conservation of natural resources and improving the life quality of the population³².

30 According to the SFMP implemented by Agro cortex, all skidding trails are planned to minimize damages to the forest, extracting trees from the felling site without damaging other trees, only affecting sub-forest areas using low impact techniques. According to Holmes et al. (2002) less than 10% of skidding trails from reduced impact logging (RIL) forest management systems caused soil degradation and consequently clearings in the forest, while 100% of trails in conventional management areas are affected. It is expected that the FSC-certified SFMP implemented by Agro cortex would reduce this damage in a more significant way when compared to simple RIL-forest management.

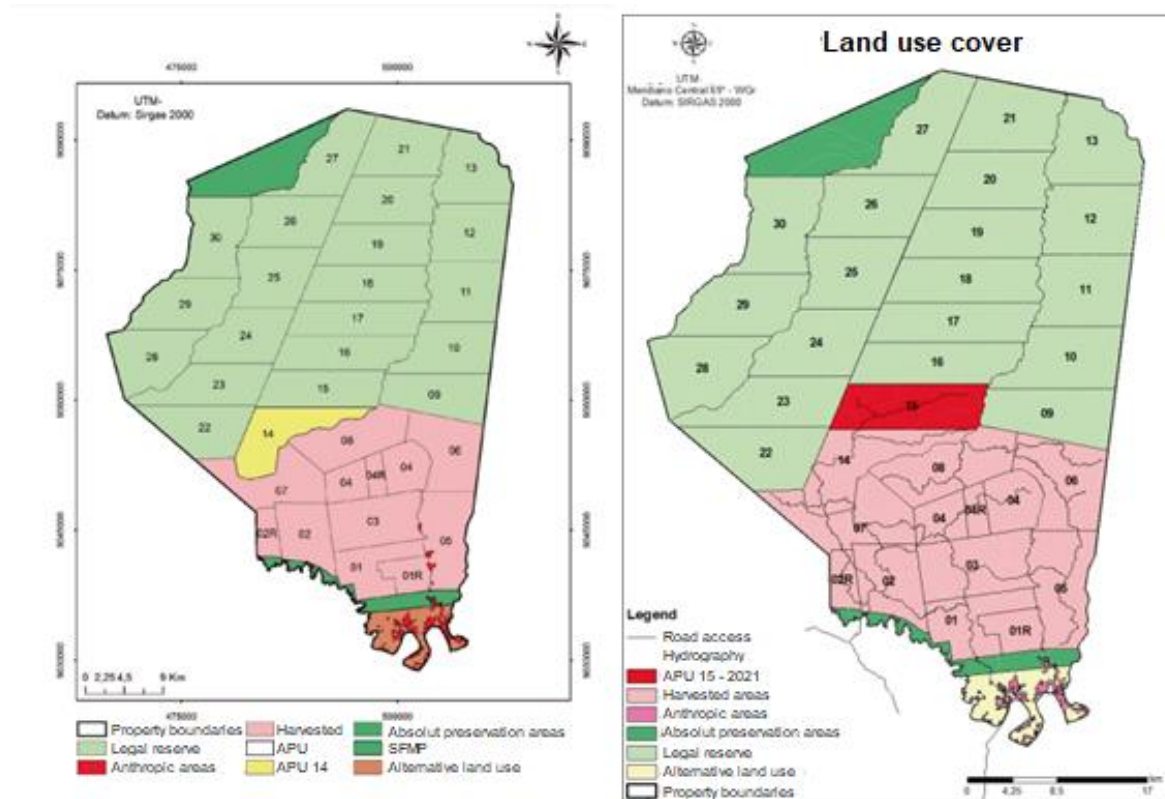
HOLMES, T.P.; BLATE, G.M.; ZWEDE, J.C.; PEREIRA JUNIOR, R.L BARRETO, P.; BOLTZ, F. Custos e benefícios financeiros da exploração de impacto reduzido em comparação à exploração florestal convencional na Amazônia Oriental. Belém: Fundação Floresta Tropical, 2002, 66p., 2ª edição.

31 OLIVEIRA, Luiz Rogério. Plano de Manejo Florestal Sustentado 2ª Revisão - Consolidado: Fazenda Seringal Novo Macapá. Rio Branco: Batisflor Florestal Ltda, 2017. 225 p.

32 Available at: <<http://ift.org.br/>>. Last visited on: 01-April-2022

The location of each APU and protection areas within the Agrocorrex property area, which will be subject to planned deforestation and planned logging activities during the project crediting period, is detailed in the Figure below.

Figure 15. Location of each APU within the Sustainable Forest Management Plan area



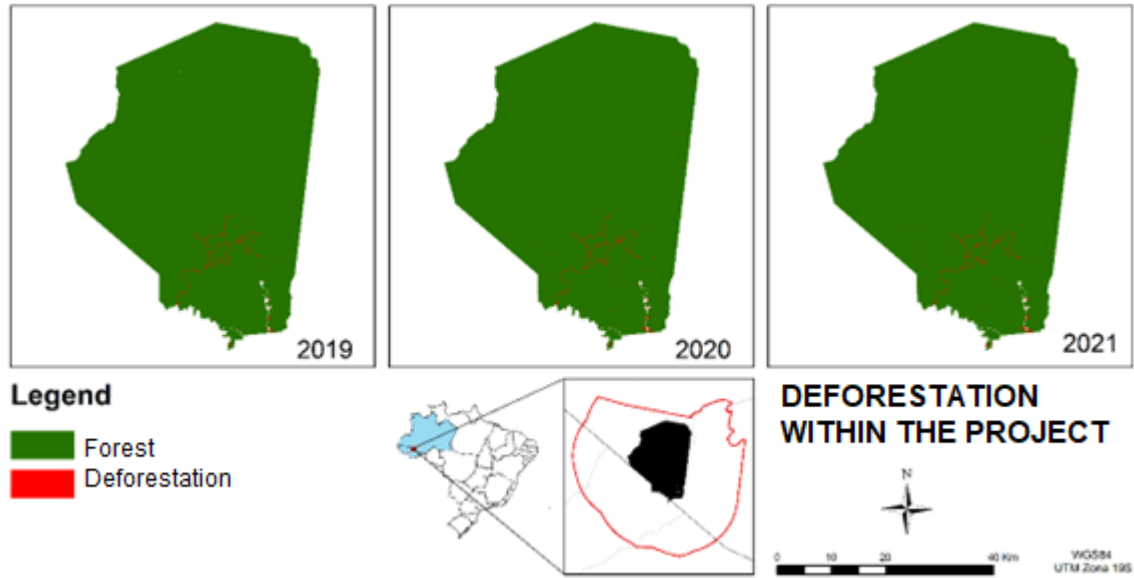
The GIS mapping carried out showed that most of the deforestation that took place during the third monitoring period within the project area resulted from SFMP planned activities. During the current monitoring period, two APUs were harvested, according to Table below.

Table 19. Annual Productive Units (APU) harvested at each year of the monitoring period

Annual Productive Unit (APU)	Year
APU 14	2020
APU 15	2021

The map with the annual areas of deforestation within the project area during the current monitoring period is showed below. It is possible to analyze that most annual deforested areas correspond to planned access roads and timber yards part of the Sustainable Forest Management Plan (SFMP).

Figure 16. Annual deforestation in the Project Area between 2019 and 2021



The *ex post* carbon stock decrease due to planned deforestation in the project area was calculated using the following equation:

$$\Delta CPDdPA_t = \sum_{icl=1}^{icl} (APDPA_{icl,t} \times \Delta Ct_{tot,icl})$$

Where,

$\Delta CPDdPA_t$ Total decrease in carbon stock due to planned deforestation at year t in the project area; tCO₂e

$APDPA_{icl,t}$ Areas of planned deforestation in forest class icl at year t in the project area; ha

$\Delta Ct_{tot,icl}$ Average carbon stock change of all accounted carbon pools in forest class icl at time t ; tCO₂e/ha

However, some unplanned deforestation occurred in the southern border of the project area, corresponding to a total of 53.86 ha during the monitoring period. The *ex post* carbon stock decrease due to unplanned deforestation in the project area was calculated using the following equation:

$$\Delta CUDdPA_t = \sum_{icl=1}^{icl} (AUDPA_{icl,t} \times \Delta Ct_{tot,icl})$$

Where,

$\Delta CPUDdPA_t$ Total *ex post* actual carbon stock change due to unavoidable unplanned deforestation at year t in the project area; tCO₂e

$AUDPA_{icl,t}$ Areas of unplanned deforestation in forest class *icl* at year *t* in the project area; ha

$\Delta Ct_{ot_{icl}}$ Average carbon stock change of all accounted carbon pools in forest class *icl* at time *t*; tCO₂e/ha

Therefore, the annual deforestation values (both planned and unplanned) within the Project Area during the current monitoring period can be seen in the Table 20 below.

Table 20. Annual deforestation, cumulative deforestation and R in the project area during the monitoring period

Year	Open Tropical Rainforest with bamboo	Open Tropical Rainforest with palm trees	Open Alluvial Rainforest with palm trees	Total forest area (ha)	No forest in PA (ha)	Annual Deforestation (ha)	Cumulative deforestation (ha)	R: annual rate of forest cover change
2020	171,642.28	9,515.14	4,125.01	185,282.42	936.63	103.15	103.15	0.06%
2021	171,583.66	9,511.66	4,121.44	185,216.76	1,002.29	65.66	168.80	0.04%
Initial Forest area (year of 2013) (ha)							186,067.04	
Final Forest area (year of 2021) (ha)							185,216.76	
Total deforestation in the project area (2020-2021 period) (ha)							168.80	
Average annual deforestation rate (2020-2021 period)							0.04%/year	

As can be seen in the table above, the project area displayed an annual average deforestation rate of 0.04% per year during the 2020 – 2021 period (applying R: annual rate of change of forest cover³³).

According to the baseline scenario, the predicted area that would be deforested within the project area during this monitoring period from 2020 - 2021 would be of 2,193.79 ha, which would mean an annual average deforestation rate of 0.67% per year. Comparing to the actual classified deforestation area during the same analyzed period, the present REDD project avoided 2,024.99 ha of deforestation, which can be seen in table below.

Table 21. Comparison between the simulated and classified deforestation area within the project area during the 2020-2021 period

Cumulative deforestation during the 2020-2021 period	Area (ha)
Simulated deforestation area (baseline scenario)	2,193.79
Classified deforestation area (project scenario)	170.42
Credit area	2,023.37

³³ Puyravaud, J.-P. (2003), "Standardizing the calculation of the annual rate of deforestation." Forest Ecology and Management, 177: 593-596

The comparison between these two scenarios is displayed in Figure 9 below, showing the conservation of forest areas and the consequent emission reduction provided by the REDD mechanism in the project area. The baseline scenario (solid blue line), which was calculated through the deforestation projected in the VCS PD, was compared to the project scenario (dashed red line). The area between these two lines is exactly the avoided deforestation area by this REDD project over monitored period.

Figure 17. REDD credit area formed by the comparison between the baseline and project scenarios

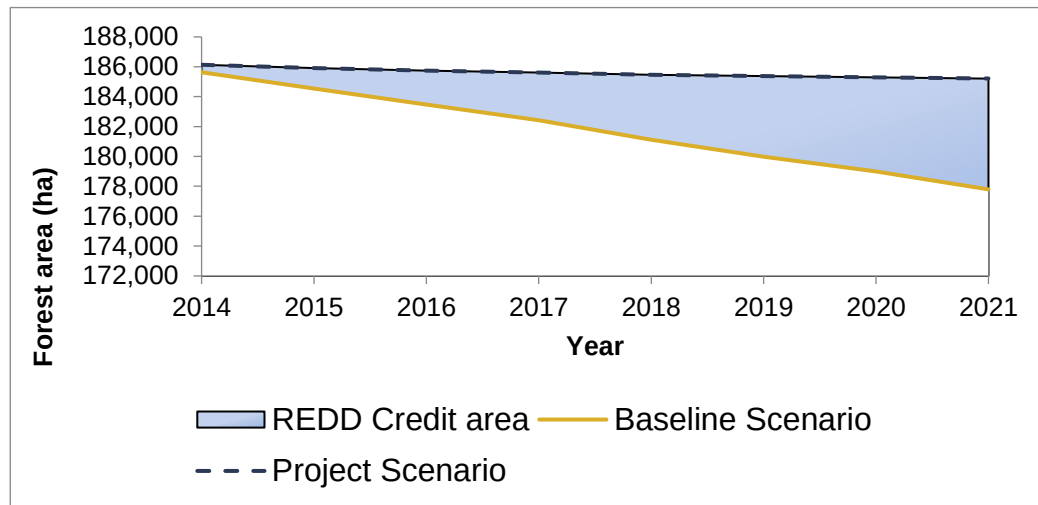


Figure 18. Accumulated deforestation in the project area in 2020 indicating projected deforestation and deforestation that occurred.

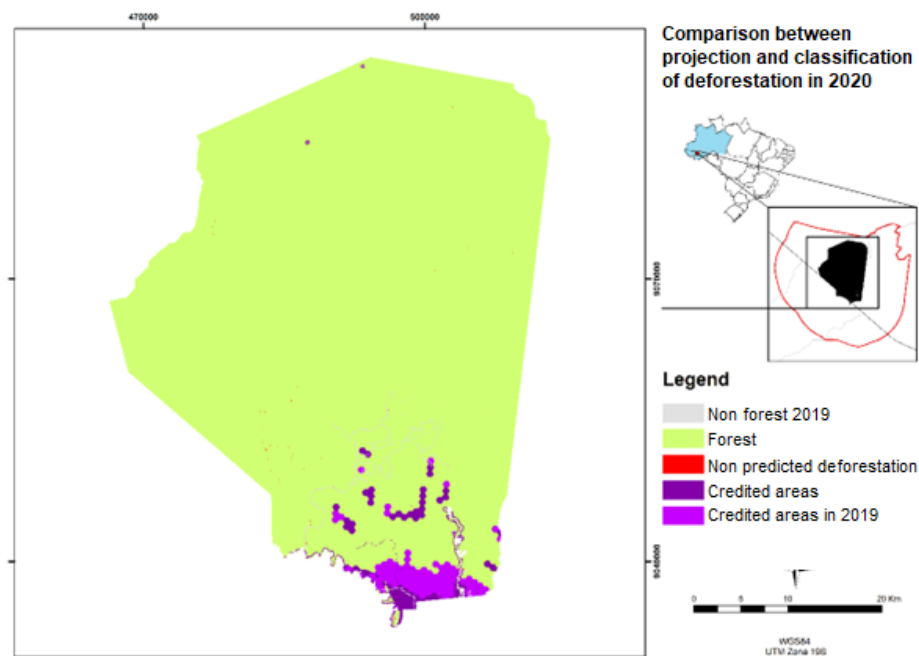
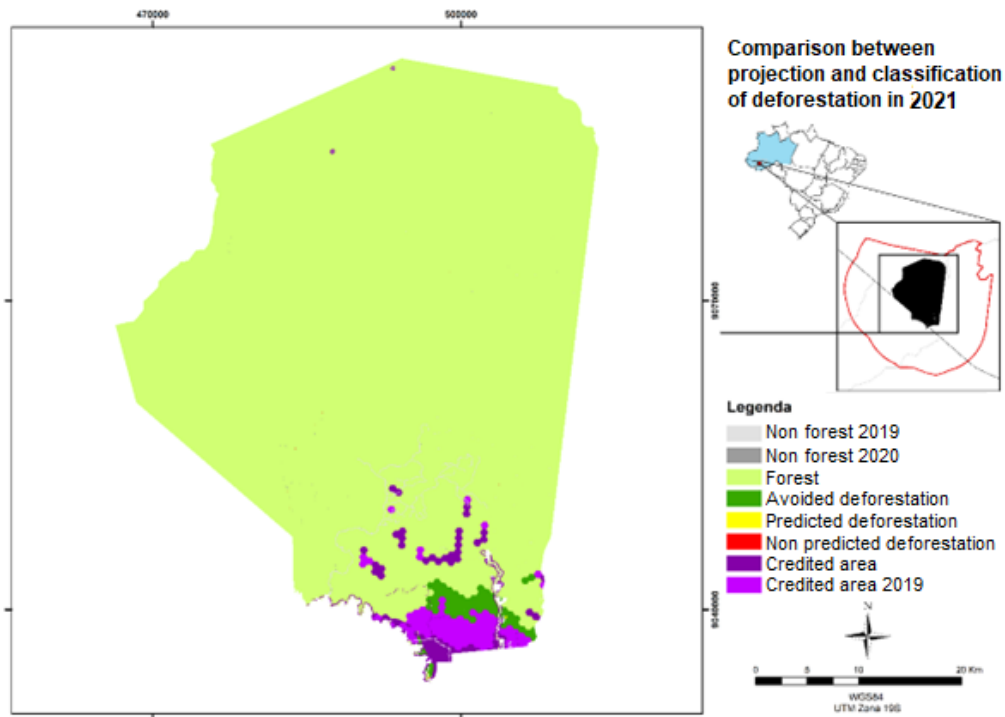


Figure 19. Accumulated deforestation in the project area in 2021 indicating projected deforestation and deforestation that occurred.



The GIS mapping carried out showed that almost all deforestation that took place during this monitoring period within the project area resulted from SFMP planned activities. As per Figures presented above, it is possible to analyze that most annual deforested areas correspond to planned access roads and timber yards part of the Sustainable Forest Management Plan (SFMP).

Therefore, the total carbon stock decreases due to planned and unplanned deforestation in the project area could be calculated, as depicted in Table below.

Table 22. Ex post carbon stock decrease due to planned and unplanned deforestation in the project area

Project year t	Areas of planned deforestation x Carbon stock change (decrease) in the project area						Total carbon stock decrease due to planned deforestation		Areas of unplanned deforestation x Carbon stock change (decrease) in the project area						Total carbon stock decrease due to unplanned deforestation		Total carbon stock decrease due to planned and unplanned deforestation in the project area	
	ID _{cl} = 1 Open tropical rainforest with bamboo		ID _{cl} = 2 Open tropical rainforest with palm trees		ID _{cl} = 3 Open alluvial rainforest with palm trees		annual	cumulative	ID _{cl} = 1 Open tropical rainforest with bamboo		ID _{cl} = 2 Open tropical rainforest with palm trees		ID _{cl} = 3 Open alluvial rainforest with palm trees		annual	cumulative	annual	cumulative
	APDPA _{cl,t}	Ctot _{cl,t}	APDPA _{cl,t}	Ctot _{cl,t}	APDPA _{cl,t}	Ctot _{cl,t}	ΔCPDdPA _t	ΔCPDdPA	AUDPA _{cl,t}	Ctot _{cl,t}	AUDPA _{cl,t}	Ctot _{cl,t}	AUDPA _{cl,t}	Ctot _{cl,t}	ΔCUDdPA _t	ΔCUDdPA		
	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	tCO ₂ e	tCO ₂ e	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	56.37	623.35	3.11	794.39	1.35	536.78	38,337.74	38,337.74	36.29	623.35	5.74	794.39	0.28	536.78	27,331.42	27,331.42	65,669.16	65,669.16
2021	51.63	623.35	2.85	794.39	1.24	536.78	35,116.25	73,453.99	6.98	623.35	2.24	794.39	2.33	536.78	7,381.12	34,712.53	42,497.37	108,166.52

Planned logging operations are carried out following a Reduced Impact Logging (RIL) system combined with other improved forest management techniques, including: planning of management activities, selection of best locations for infrastructure construction, directional felling, utilization of advanced technologies, tracking record of wood logs, reforestation activities, among others; which are essential practices to minimize the damage caused to the forest.

The maximum cutting level adopted by Agro cortex is 25.8 m³/ha, which is 14% lower than the legal harvesting volume allowed by Law. However, due to conservation measures, the actual logging intensity carried out by Agro cortex during this monitoring period was around 3.80 m³/ha.

At least 10% of the remaining trees per species in the effective exploration area are guaranteed, respecting the minimum limit of preservation of at least 3 trees per species per 100 ha, in each subdivision of the plot. For vulnerable species, those figures are stricter: 15% of the remaining trees per species in the effective exploration area shall be guaranteed, and at least 4 trees per species per 100 ha shall be preserved. Moreover, at least 20% of the remaining Mahogany trees in the effective exploration area shall be preserved, respecting the minimum limit of preservation of at least 5 trees per 100 ha, in each subdivision of the plot. Moreover, trees shall have minimum diameter of 50cm for felling, and 60cm for Mahogany. Furthermore, according to the Brazilian Forest Code, trees located within permanent preservation areas (PPA), i.e. at the borders of waterways or springs, shall be comprehensively preserved.

In the project scenario, emissions due to planned logging activities results from timber harvesting and also from damages to vegetation during the directional tree felling, which generate forest residues (branches, remains of logs and other damaged trees during the tree felling). According to the revised literature³⁴, it is estimated that 2 m³ of forest residues is generated for each m³ of log harvested through sustainable forest management. Thus, GHG emissions from logging activities include the volume of harvested timber plus the logging damage factor, as follows.

$$\Delta CLd_{icl,t} = (HI_{icl,t} + LDF) \times D_m \times CF \times 44 / 12$$

Where,

$\Delta CLd_{icl,t}$	Average carbon stock decrease due to logging activities in forest class <i>icl</i> at time <i>t</i> ; tCO ₂ e/ha
$HI_{icl,t}$	Harvesting intensity of timber in forest class <i>icl</i> at year <i>t</i> in the project area due to planned logging activities (i.e., sustainable forest management plan); m ³ /ha
LDF	Logging damage factor; m ³ /ha
D_m	Mean wood density; g/cm ³
CF	Default value of carbon fraction in biomass; tC t ⁻¹ d.m.

³⁴ Feldpausch et al. When big trees fall: Damage and carbon export by reduced impact logging in southern Amazonia. Forest Ecology and Management 219 (2005) 199–215.

44/12

Ratio of molecular weight of CO₂ to carbon; dimensionless

In addition, Agro cortex core activity is the sustainable forest management plan, therefore harvested wood products are a significant carbon pool under the project scenario. Carbon stocks in wood products are those stocks that become wood products pool at the time of deforestation. They are divided in three fractions, as follows:

1. Short-term wood products: wood products and waste that would decay within 3 years; all carbon shall be assumed to be lost immediately;
2. Medium-term wood products: wood products that are retired between 3 and 100 years; for this group of wood products, a 20-year linear decay function shall be applied;
3. Long-term wood products: wood products that are considered permanent (i.e. carbon is stored for 100 years or more); it may be assumed that no carbon is released.

Agro cortex divides timber production in four commercial groups. These groups were classified in two larger groups, based on their properties and characteristics, as described on Table below. According to the SFMP, 95% of the Commercial Group 2 category are destined for the production of durable wood products such as decks, tables, doors, etc. (which have potential to become long-lived wood products), and 5% for construction, which are short-lived wood products.

Table 23. Commercial timber groups produced by Agro cortex

Commercial Groups				
Group	Characteristics	Lifetime category	% of total harvested and commercialized wood	Average wood density (g/cm ³)
Group 1, 50% of Group 2, Group 4	High density woods and Mahogany	Medium-term and Long-term	95%	0.77
50% of Group 2, Group 3	White wood (low density wood)	Short-term	5%	0.54

Accounting for carbon stocks in wood products was carried out utilizing the Method 1 described in the applied Methodology: Direct Volume Extraction Estimation. This Method was applied because timber harvest plans specifying the harvest intensity per forest class in terms of volume extracted per hectare are available for the Project area. Furthermore, the proportion of carbon stock stored in each fraction of wood products was obtained from specific studies. The Method 1 contains the following steps:

Step 1: Calculate the biomass carbon of the commercial volume extracted since the project start date and in the process of logging activities as follows:

$$CXB_{w,icl,t} = \frac{1}{ABSLPA_{icl,t}} * \left(\sum_{i=1}^I \sum_{j=1}^J (VEX_{w,j,icl,t} * D_j * CF_j * \frac{44}{12}) \right)$$

Where,

$CXB_{w,icl,t}$	Mean carbon stock per hectare of extracted biomass carbon by class of wood product w from forest class icl at time t ; tCO ₂ e/ha
icl	1, 2, 3, ... icl initial pre-deforestation forest classes; dimensionless
w	1, 2, 3 ... w wood product class (sawn-wood, wood-based panels, other industrial roundwood, paper and paper board, and other); dimensionless
t	1, 2, 3... t years, a year of the project crediting period; dimensionless
t^*	the year at which the area $ABSLPA_{icl,t}$ is deforested in the baseline case; dimensionless
j	1, 2, 3 ... j tree species; dimensionless
$ABSLPA_{icl,t}$	Area of forest class icl deforested at year t^* ; ha
$VEX_{w,j,fcl,t}$	Volume of timber for product class w , of species j , extracted from within forest class fcl at time t ; m ³
D_j	Mean wood density of species j ; t d.m.m ⁻³
CF_j	Carbon fraction of biomass for tree species j ; tC t ⁻¹ d.m.
44/12	Ratio of molecular weight of CO ₂ to carbon; dimensionless

A volumetric efficiency coefficient of 59%³⁵ was utilized to calculate the parameter $VEX_{w,j,fcl,t}$, in order to convert the volume of timber harvested into volume of final wood products.

Step 2: Calculate the carbon stock in the wood products carbon pool extracted from the biomass at time t .

$$Cwp_{icl,t} = \sum_{w=1}^W CXB_{w,icl,t} * (1 - STF_w)$$

Where,

$Cwp_{icl,t}$	Carbon stock in the wood products carbon pool in initial forest class icl at time t ; tCO ₂ e/ha
STF_w	Fraction of wood products and waste that will be emitted to the atmosphere within 3 years; all carbon shall be assumed to be lost immediately; dimensionless

Step 3: Calculate the biomass carbon extracted at time t that becomes the medium-term wood products at the time of harvesting.

³⁵ According to Agrocortex internal data.

$$Cwp_{mt,icl,t} = Cwp_{icl,t} - (Cwp_{icl,t} * (1 - STF_w) * (1 - LTF_w))$$

Where,

$Cwp_{mt,icl,t}$ Carbon stock in the medium-term wood products carbon pool at the time of deforestation t of the initial forest class icl ; tCO₂e/ha

LTF_w Fraction of wood products that are considered permanent (i.e. carbon is stored for 100 years or more); it may be assumed no carbon is released

Step 4: Calculate the biomass carbon extracted at time t that becomes the long-term wood products at the time of harvesting.

$$Cwp_{lt,icl,t} = Cwp_{icl,t} - (Cwp_{icl,t} * (1 - STF_w) * (1 - MTF_w))$$

Where,

$Cwp_{lt,icl,t}$ Carbon stock in the long-term wood products carbon pool at the time of deforestation t of the initial forest class icl ; tCO₂e/ha

MTF_w Fraction of wood products that are retired between 3 and 100 years; for this group of wood products, a 20-year linear decay function shall be applied

Based on calculations above, the average carbon stock factor for harvested wood products carbon pool in the initial forest class icl applicable at time t is reported in Table below.

Table 24. Carbon stock factors for initial forest classes (icl) for harvested wood products carbon pool (Method 1)

Year after timber harvest		$\Delta Cwp_{cl,t}$ (tCO ₂ e/ha)		
		Short-lived	Medium-lived	Long-lived
1	2014	0	0.02	1.13
2	2015	0	0.07	2.17
3	2016	0	0.12	2.88
4	2017	0	0.14	4.43
5	2018	0	0.15	3.56
6	2019	0	0.16	3.80
7	2020	0	0.16	2.40
8	2021	0	0.17	3.22

The average carbon stock per hectare in the harvested wood products carbon pool of initial forest class icl at time t (ΔCwp_t) is calculated as follows:

$$\Delta Cwp_t = \sum_{icl=1}^{icl} (Cwp_{mt,icl,t} + Cwp_{lt,icl,t})$$

Therefore, the *ex post* carbon stock decrease due to planned logging activities in the project area was calculated using the following equation:

$$\Delta CPLdPA_t = \sum_{icl=1}^{icl} (APLPA_{icl,t} \times \Delta CLd_{icl,t}) - \left(\sum_{icl=1}^{icl} APLPA_{icl,t} \right) \times \Delta Cwp_t$$

Where,

$\Delta CPLdPA_t$	Total decrease in carbon stock due to planned logging activities at year <i>t</i> in the project area; tCO ₂ e
$APLPA_{icl,t}$	Areas of planned logging activities in forest class <i>icl</i> at year <i>t</i> in the project area; ha
$\Delta CLd_{icl,t}$	Average carbon stock decrease due to logging activities in forest class <i>icl</i> at time <i>t</i> ; tCO ₂ e/ha
ΔCwp_t	Average carbon stock per hectare in the harvested wood products carbon pool at time <i>t</i> ; tCO ₂ e/ha

Thus, Table below presents the *ex post* carbon stock decrease due to planned logging activities in the project area.

Table 25. Ex post actual carbon stock decrease due to planned logging activities in the project area

Project year <i>t</i>	Areas of planned logging activities x Carbon stock change (decrease) in the project area						Wood products		Total carbon stock decrease due to planned logging activities	
	ID _{cl} = 1 Open tropical rainforest with bamboo		ID _{cl} = 2 Open tropical rainforest with palm trees		ID _{cl} = 3 Open alluvial rainforest with palm trees		annual	cumulative	annual	cumulative
	$APLPA_{icl,t}$	$\Delta CLd_{icl,t}$	$APLPA_{icl,t}$	$\Delta CLd_{icl,t}$	$APLPA_{icl,t}$	$\Delta CLd_{icl,t}$	ΔCwp_t	ΔCwp	$\Delta CPLdPA_t$	$\Delta CPLdPA$
	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	5,040.23	10.18	0.00	0.00	0.00	0.00	12,908.88	12,908.88	38,391.97	38,391.97
2021	5,507.21	14.13	0.00	0.00	0.00	0.00	19,583.01	32,491.89	58,255.95	96,647.92

Fossil fuel emissions from sustainable forest management activities are likely to be less than 5% of the total GHG emissions reductions benefits generated by the present project. Considering that emissions from deforestation and forest degradation would be much higher than those associated with timber harvesting, the emissions from fossil fuel during transport and machinery use can be considered *de-minimis*. In addition, according to VCS AFOLU Requirements, fossil fuel emissions from transport and machinery use in REDD project activities can be considered *de minimis*.

No production of fuel wood or charcoal occurred within the project area during the monitoring period.

Thus, Table below presents the total *ex post* carbon stock decrease due to planned activities in the project area.

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

Project year <i>t</i>	Total carbon stock decrease due to planned deforestation		Total carbon stock decrease due to planned logging activities		Total carbon stock decrease due to planned fuel-wood and charcoal activities		Total carbon stock decrease due to planned activities	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta CPDdPA_t$	$\Delta CPDdPA$	$\Delta CPLdPA_t$	$\Delta CPLdPA$	$\Delta CPFdPA_t$	$\Delta CPFdPA$	$\Delta CPAAdPA_t$	$\Delta CPAAdPA$
	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}	tCO _{2e}
2020	38,337.74	38,337.74	38,391.97	38,391.97	0.00	0.00	76,729.71	76,729.71
2021	35,116.25	73,453.99	58,255.95	96,647.92	0.00	0.00	93,372.20	170,101.91

Forests that were subject to planned logging activities under the project scenario have the potential to grow and accumulate significant carbon stocks after the periodical harvest cycle due to natural regeneration. The mean annual increment of managed forests in Brazil is estimated to be 0.86 m³/ha/year³⁶.

Due to the periodical harvesting, the projected increase in carbon stocks of each forest class in the project case is estimated by assuming that the maximum carbon stock is the long term average carbon stock (the average of a production cycle). Therefore, once a class reaches this level of carbon stock, no more carbon stock increase can be attributed to it.

Table below provides an *ex post* carbon stock increase following planned logging activities in the project area, which is calculated as follows:

$$\Delta CPLiPA_t = \sum_{icl=1}^{icl} (APLPA_{icl,t} \times \Delta CLi_{icl,t})$$

Where,

$\Delta CPLiPA_t$ Total increase in carbon stock due to planned logging activities at year *t* in the project area; tCO_{2e}

$APLPA_{icl,t}$ Areas of planned logging activities in forest class *icl* at year *t* in the project area; ha

36 BRASIL. Conselho Nacional do Meio Ambiente (CONAMA). Estabelece parâmetros técnicos a serem adotados na elaboração, apresentação, avaliação técnica e execução de Plano de Manejo Florestal Sustentável - PMFS com fins madeireiros, para florestas nativas e suas formas de sucessão no bioma Amazônia. Resolução nº. 406, de 02 de fevereiro de 2009. Diário Oficial [da] República Federativa do Brasil, Brasília, DF, 06 feb. 2009.

$\Delta CL_{icl,t}$

Average carbon stock increase due to sustainable logging activities in forest class *icl* at time *t*; tCO₂e/ha

Table 27. Ex post carbon stock increase following planned logging activities in the project area

Project year <i>t</i>	Areas of planned logging activities x Carbon stock change (increase up to maximum long-term average)						Total carbon stock increase due to planned logging activities	
	ID _{cl} = 1 Open tropical rainforest with bamboo		ID _{cl} = 2 Open tropical rainforest with palm trees		ID _{cl} = 3 Open alluvial rainforest with palm trees		annual	cumulative
	APLPA _{icl,t}	$\Delta CL_{icl,t}$	APLPA _{icl,t}	$\Delta CL_{icl,t}$	APLPA _{icl,t}	$\Delta CL_{icl,t}$	$\Delta CPLIPA_t$	$\Delta CPLIPA$
	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	tCO ₂ e	tCO ₂ e
2020	5,040.23	0.92	0.00	0.00	0.00	0.00	30,640.38	30,640.38
2021	5,507.21	0.92	0.00	0.00	0.00	0.00	35,273.34	65,913.72

Neither planned protection of secondary/degraded forests without harvest nor production of fuel-wood and charcoal are expected to occur within the project area under the project scenario. Thus, carbon stock increase due to growth without harvest or due to planned fuel-wood and charcoal activities were not monitored. However, if any of these activities is implemented in the future, a measurement of the carbon stock changes will be carried out. According to the applied methodology, if the project activity generates a significant change in carbon stocks due to these activities, the carbon stock change shall be measured *ex post*. However, if the decrease is not significant, it shall not be accounted, and *ex post* monitoring is not required.

Therefore, the total *ex post* carbon stock increase due to planned activities in the project area is detailed in Table below.

Table 28. Total ex post carbon stock increase due to planned activities in the project area

Project year <i>t</i>	Total carbon stock increase due to growth without harvest		Total carbon stock increase due to planned logging activities		Total carbon stock increase due to planned fuel-wood and charcoal activities		Total carbon stock increase due to planned activities	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta CPNiPA_t$	$\Delta CPNiPA$	$\Delta CPLIPA_t$	$\Delta CPLIPA$	$\Delta CPFIPA_t$	$\Delta CPFIPA$	$\Delta CPAIPA_t$	$\Delta CPAIPA$
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	0.00	0.00	30,640.38	30,640.38	0.00	0.00	30,640.38	30,640.38
2021	0.00	0.00	35,273.34	65,913.72	0.00	0.00	35,273.34	65,913.72

The calculation of the ex post net carbon stock change in the project area under the project scenario ($\Delta CPSPA_t$) is described as follows.

$$\Delta CPSPA_t = \Delta CPAdPA_t + \Delta CUDdPA_t - \Delta CPAiPA_t$$

Where,

$\Delta CPSPA_t$	Sum of ex post actual carbon stock changes in the project area at year t; tCO ₂ e
$\Delta CPAdPA_t$	Total decrease in carbon stock due to all planned activities at year t in the project area; tCO ₂ e
$\Delta CUDdPA_t$	Total ex post actual carbon stock change due to unavoidable unplanned deforestation at year t in the project area; tCO ₂ e
$\Delta CPAiPA_t$	Total increase in carbon stock due to all planned activities at year t in the project area; tCO ₂ e

Ex post carbon stock change in the project area under the project scenario is shown below.

Table 29. Ex post net carbon stock change in the project area under the project scenario

Project year t	Total carbon stock decrease due to planned activities		Total carbon stock increase due to planned activities		Total carbon stock decrease due to unavoidable unplanned deforestation		Total carbon stock change in the project case	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta CPAdPA_t$	$\Delta CPAdPA$	$\Delta CPAiPA_t$	$\Delta CPAiPA$	$\Delta CUDdPA_t$	$\Delta CUDdPA$	$\Delta CPSPA_t$	$\Delta CPSPA$
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	76,729.71	76,729.71	30,640.38	30,640.38	27,331.42	27,331.42	73,420.75	73,420.75
2021	93,372.20	170,101.91	35,273.34	65,913.72	7,381.12	34,712.53	65,479.98	138,900.73

No forest fire was used by Agrocortex for carrying out planned deforestation or timber harvesting activities. However, there were around 53.86 ha of unplanned deforestation within the project area during the monitored period, which conversion of forest to non-forest could have involved fires.

The effect of fire on carbon emissions is counted in the estimation of carbon stock changes in the parameter $\Delta CUDdPA_t$; therefore CO₂ emissions from forest fires were ignored to avoid double counting. However, non-CO₂ emissions (CH₄ and N₂O) from forest fires must be counted in the project scenario, when they are significant.

It was conservatively assumed that all unplanned deforestation within the project area involved fire and all above ground biomass was burnt. Therefore, non-CO₂ emissions from forest fires were quantified and deducted from emission reductions, as follows:

$$EBB_{tot_{icl,t}} = EBB_{N_2O_{icl,t}} + EBB_{CH_4_{icl,t}}$$

Where,

$EBB_{tot,icl,t}$	Total GHG emission from biomass burning in forest class <i>icl</i> at year <i>t</i> ; tCO ₂ e/ha
$EBBN_2O_{icl,t}$	N ₂ O emission from biomass burning in forest class <i>icl</i> at year <i>t</i> ; tCO ₂ e/ha
$EBBCH_{4,icl,t}$	CH ₄ emission from biomass burning in forest class <i>icl</i> at year <i>t</i> ; tCO ₂ e/ha

$$EBBN_2O_{icl,t} = EBBCO_{2,icl,t} * 12/44 * NCR * ER_{N2O} * 44/28 * GWP_{N2O}$$

Where,

$EBBCO_{2,icl,t}$	Per hectare CO ₂ emission from biomass burning in slash and burn in forest class <i>icl</i> at year <i>t</i> ; tCO ₂ e/ha
NCR	Nitrogen to Carbon Ratio (IPCC default value = 0.01); dimensionless
ER_{N2O}	Emission ratio for N ₂ O (IPCC default value = 0.007)
GWP_{N2O}	Global Warming Potential for N ₂ O ³⁷

$$EBBCH_{4,icl,t} = EBBCO_{2,icl,t} * 12/44 * ER_{CH4} * 16/12 * GWP_{CH4}$$

Where,

$EBBCO_{2,icl,t}$	Per hectare CO ₂ emission from biomass burning in slash and burn in forest class <i>icl</i> at year <i>t</i> ; tCO ₂ e/ha
ER_{CH4}	Emission ratio for CH ₄ (IPCC default value = 0.012)
GWP_{CH4}	Global Warming Potential for CH ₄ ³⁸

$$EBBCO_{2,icl,t} = F_{burnt,icl} * \sum_{p=1}^P (C_{p,icl,t} * P_{burnt,p,icl} * CE_{p,icl})$$

Where,

$EBBCO_{2,icl,t}$	Per hectare CO ₂ emission from biomass burning in the forest class <i>icl</i> at year <i>t</i> ; tCO ₂ e/ha
$F_{burnt,icl}$	Proportion of forest area burned during the historical reference period in the forest class <i>icl</i> ; %

³⁷ According to the VCS Standard, the six Kyoto Protocol greenhouse gases and ozone-depleting substances shall be converted using 100 year global warming potentials derived from the IPCC's Fifth Assessment Report. GWP for N₂O = 265. Available at: < <https://www.ipcc.ch/assessment-report/ar5/>>. Last visited on: 30-March-2022.

³⁸ According to the VCS Standard, the six Kyoto Protocol greenhouse gases and ozone-depleting substances shall be converted using 100 year global warming potentials derived from the IPCC's Fourth Assessment Report. GWP for CH₄ = 28. Available at: < <https://www.ipcc.ch/assessment-report/ar5/>>. Last visited on: 30-March-2022

$C_{p,icl,t}$	Average carbon stock per hectare in the carbon pool p burnt in the forest class icl at year t ; tCO ₂ e/ha
$P_{burnt,p,icl}$	Average proportion of mass burnt in the carbon pool p in the forest class icl ; % (conservatively assumed as 100%)
$CE_{p,icl}$	Average combustion efficiency of the carbon pool p in the forest class icl ; dimensionless (IPCC default of 0.5 was used)
p	Carbon pool that could burn, in the project case, above-ground biomass

Thus, the total actual non-CO₂ emissions from forest fire at year t in the project area ($EBBPSPA_t$) are calculated as follows.

$$EBBPSPA_t = ABSLPA_{icl,t} * EBBtot_{icl,t}$$

Where,

$EBBPSPA_t$	Total actual non-CO ₂ emissions from forest fire at year t in the project area; tCO ₂ e/ha
$ABSLPA_{icl,t}$	Annual area of deforestation of initial forest classes icl in the project area at year t ; ha
$EBBtot_{icl,t}$	Total GHG emission from biomass burning in forest class icl at year t ; tCO ₂ e/ha

Table 30. Total ex post emissions of GHG due to forest fires in the project area

Project year t	Emissions of non-CO ₂ gases from forest fires in the project area						Total ex post emissions of GHG due to forest fires in the project area	
	ID _{cl} = 1 Open Tropical Rainforest with bamboo		ID _{cl} = 2 Open Tropical with palm tree		ID _{cl} = 3 Open Alluvial Rainforest with palm tree		annual	cumulative
	AUDPA _{icl,t}	EBBPSPA _{icl,t}	AUDPA _{icl,t}	EBBPSPA _{icl,t}	AUDPA _{icl,t}	EBBPSPA _{icl,t}	EBBPSPA _t	EBBPSPA
	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	ha	tCO ₂ e/ha	tCO ₂ e	tCO ₂ e
3rd MR 2020	36.29	16.38	5.74	7.12	0.28	11.58	638.57	638.57
2021	6.98	16.38	2.24	7.12	2.33	11.58	157.27	795.84

Total ex post project emissions for the project area

The ex post carbon stock changes and non-CO₂ emissions in the Project area during the monitoring period is summarized in Table below.

Table 31. Total ex post estimated actual net changes in carbon stocks and emissions of GHG gases in the project area

Project year t	Total ex post carbon stock decrease due to planned activities		Total ex post carbon stock increase due to planned activities		Total ex post carbon stock decrease due to unavoided unplanned deforestation		Total ex post carbon stock change		Total ex post estimated actual non- CO ₂ emissions from forest fires in the project area	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	ΔCPAdPA_t	ΔCPAdPA	ΔCPAiPA_t	ΔCPAiPA	ΔCUDdPA_t	ΔCUDdPA	ΔCPSPA_t	ΔCPSPA	EBBPSPA_t	EBBPSPA
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	76,729.71	76,729.71	30,640.38	30,640.38	27,331.42	27,331.42	73,420.75	73,420.75	638.57	638.57
2021	93,372.20	170,101.91	35,273.34	65,913.72	7,381.12	34,712.53	65,479.98	138,900.73	157.27	795.84

5.3. Leakage

According to the applied methodology, two sources of leakage are considered: a) decrease in carbon stocks and increase in GHG emissions associated with leakage prevention measures; and b) decrease in carbon stocks and increase in GHG emissions associated with activity displacement leakage.

Ex post estimation of decrease in carbon stocks and increase in GHG emissions due to leakage prevention measures

To reduce the risk of activity displacement leakage, baseline deforestation agents could participate in activities within the project area and leakage management area that together will replace baseline income, product generation and livelihood of the agents as much as possible, so that deforestation will be reduced and the risk of displacement minimized. As such, a reduction in carbon stocks and/or an increase in GHG emissions may occur compared to the baseline case. If this decrease in carbon stock or increase in GHG emission is significant, it must be accounted and *ex post* monitoring will be required.

In order to calculate the net carbon stock changes that the planned leakage prevention measures are expected to occasion during the monitoring period, the projected carbon stocks shall be estimated in the leakage management area under the baseline case and project scenario.

$$\Delta CLPMLK_t = \Delta CPSLK_t - \Delta CBSLLK_t$$

Where,

$\Delta CLPMLK_t$	Carbon stock decrease due to leakage prevention measures at year t ; tCO ₂ e
$\Delta CBSLLK_t$	Annual carbon stock changes in leakage management areas in the baseline case at year t ; tCO ₂ e
$\Delta CPSLK_t$	Annual carbon stock change in leakage management areas in the project case; tCO ₂ e

If the net sum of carbon stock changes within a monitoring period is more than zero, leakage prevention measures are not causing any carbon stock decrease. The net increase shall conservatively be ignored in the calculation of net GHG emission reductions of the project activity. Nevertheless, if the net sum is negative, it must be accounted if significant.

According to the planned interventions carried out by Agro cortex REDD Project in the baseline case, no decrease in carbon stocks due to activities implemented in the leakage management area were identified, thus $\Delta CBSLLK = 0$. However, during the current monitoring period, there were carbon stock changes within the leakage management area due to deforestation of regenerated forests. Therefore, the *ex post* carbon stock change in leakage management areas in the project case ($\Delta CPSLK_t$) was calculated as follows. The annual values are detailed in the Table below.

$$\Delta\text{CPSLK}_t = \text{APSLK}_{fcl,t} * \Delta\text{Ctot}_{icl}$$

Where,

ΔCPSLK_t	Annual carbon stock change in leakage management areas in the project case; tCO ₂ e
$\text{APSLK}_{fcl,t}$	Annual area of class fcl with decreasing carbon stock in leakage management areas in the project case at year t; ha
ΔCtot_{icl}	Average carbon stock change of all accounted carbon pools in forest class icl at time t; tCO ₂ e/ha

Table 32. Ex post carbon stock change in leakage management areas in the project case

Project year	Carbon stock changes in leakage management area in the project case			
	ID _{fcl}	1	annual	cumulative
	APSLK _{fcl,t}	Ctot _{fcl,t}	ΔCPSLK_t	ΔCPSLK
	ha	tCO ₂ e/ha	tCO ₂ e	tCO ₂ e
2020	17.19	52.03	894.40	894.40
2021	6.99	60.70	424.30	1,318.70

The Table below shows that the net sum of carbon stock changes within the leakage management area during the current monitoring period is less than zero, i.e., leakage prevention measures are causing carbon stock decrease and therefore, are included as leakage emissions.

Table 33. Ex post estimated net carbon stock change in leakage management areas

Project year	Total carbon stock change in the baseline case		Total carbon stock change in the project case		Net carbon stock change due to leakage prevention measures	
	annual ΔCBSLLK_t tCO ₂ e	cumulative ΔCBSLLK tCO ₂ e	annual ΔCPSLK_t tCO ₂ e	cumulative ΔCPSLK tCO ₂ e	annual ΔCLPMLK_t tCO ₂ e	cumulative ΔCLPMLK tCO ₂ e
2020	0.00	0.00	894.40	894.40	894.40	894.40
2021	0.00	0.00	424.30	1,318.70	424.30	1,318.70

Furthermore, leakage prevention measures carried out by the present project during the current monitoring period did not include agricultural intensification, fertilization, fodder production and/or other measures to enhance cropland and grazing land areas. However, the communities living within the leakage management area implement cattle raising activities and therefore, emissions from grazing animals in leakage management areas (EgLK_t) should be accounted, which calculation is detailed below.

$$EgLK_t = ECH_{4ferm_t} + ECH_{4man_t} + EN_{2Oman_t}$$

Where,

$EgLK_t$ Emissions from grazing animals in leakage management areas at year t ; tCO₂e/year

ECH_{4ferm_t} CH₄ emissions from enteric fermentation in leakage management areas at year t ; tCO₂e/year

ECH_{4man_t} CH₄ emissions from manure management in leakage management areas year t ; tCO₂e/year

EN_{2Oman_t} N₂O emissions from manure management in leakage management areas at year t ; tCO₂e/year

t 1, 2, 3, ... T years of the project crediting period; dimensionless

The values adopted to calculate the $EgLK_t$ parameter are available below:

Table 34. Parameters used for the ex post estimation of GHG emissions from grazing activities

Parameter	Values used for calculations	Unit	Description
EF1	56	kg CH ₄ head-1 yr-1	Enteric CH ₄ emission factor for the livestock group
EF2	1	kg CH ₄ head-1 yr-1	Manure management CH ₄ emission factor for the livestock group
EF3	0.02	kg N ₂ O-N (kg N-1) head-1 yr-1	Emission factor for N ₂ O emissions from manure management for the livestock group
EF4	0.01	kg N ₂ O-N (kg NH ₃ -N and NO _x -N emitted)-1 head-1 yr-1	Emission factor for N ₂ O emissions from atmospheric deposition of forage-sourced nitrogen on soils and water surfaces
DBI	-	kg d.m. head-1 day-1	Daily biomass intake
Nex	0.36	kg N head-1 yr-1	Annual average N excretion per livestock head
Fracgas	0.3	kg NH ₃ -N and NO _x -N emitted (Kg N)-1	Fraction of managed livestock manure nitrogen that volatilizes as NH ₃ and NO _x in the manure management phase

Therefore, the total *ex post* estimated carbon stock changes and increases in GHG emissions due to leakage prevention measures during this monitoring period is calculated as follows.

Table 35. Ex post estimation of leakage emissions above the baseline from grazing animals in leakage management areas

Project year	annual	annual	annual	annual	annual	annual	annual	annual	annual	cumulative
	Afforage ha	Pforage kgd.m.yr	Population Nr Heads	ECH4fermt tCO ₂ e	ECH4mant tCO ₂ e	EdirN2Omant tCO ₂ e	EindN2Omant tCO ₂ e	EN2Omant tCO ₂ e	EgLkt tCO ₂ e	EgLKt tCO ₂ e
2020	0.00	0.00	11,057.00	17,337.38	309.60	33.15	4.97	38.12	17,685.10	17,685.10
2021	0.00	0.00	11,057.00	17,337.38	309.60	33.15	4.97	38.12	17,685.10	35,370.19

$$ELPMLK_t = EgLK_t + \Delta CLPMLK_t$$

Where,

$ELPMLK_t$ Annual total increase in GHG emissions due to leakage prevention measures at year t ; tCO₂e

Table 36. Ex post estimated total emissions above the baseline from leakage prevention activities

Project year	Carbon stock decrease due to leakage prevention measures		Total ex post GHG emissions from increased grazing activities		Total ex post increase in GHG emissions due to leakage prevention measures	
	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta CLPMLK_t$	$\Delta CLPMLK$	EgLK _t	EgLK	ELPMLK _t	ELPMLK
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	894.40	894.40	17,685.10	17,685.10	18,579.49	18,579.49
2021	424.30	1,318.70	17,685.10	35,370.19	18,109.40	36,688.89

Ex post decrease in carbon stocks and increase in GHG emissions due to activity displacement leakage

Activities that cause deforestation within the project area in the baseline case could be displaced outside the project boundary due to the implementation of the AUD project activity. A greater decrease in carbon stocks within the leakage belt during the project scenario than those predicted *ex ante* would indicate displacement of deforestation activities due to the project.

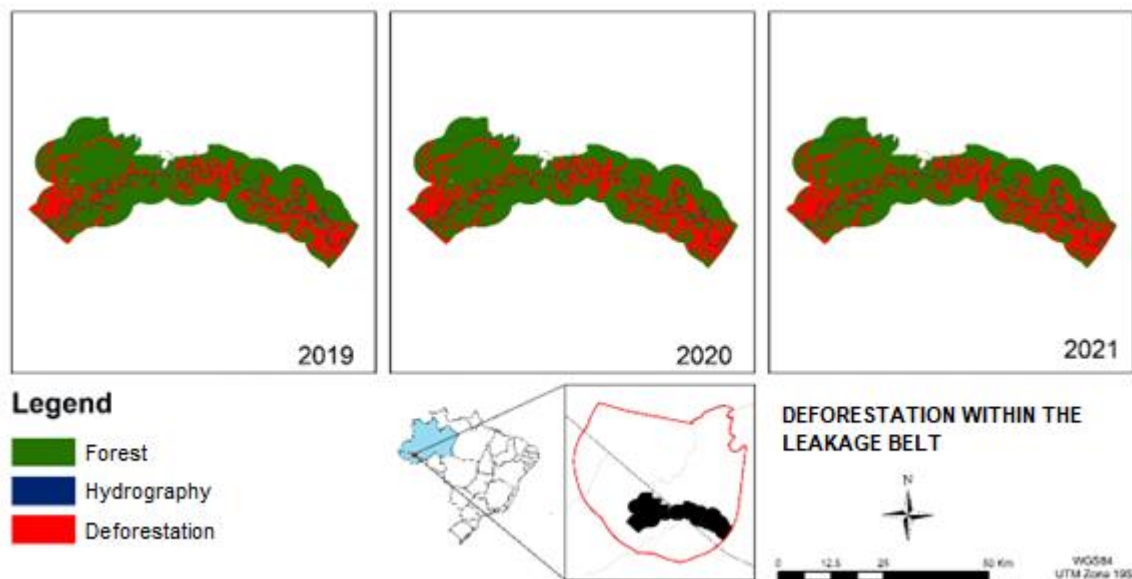
It is important to note that activity data for the leakage belt area was determined using the same methods applied to monitoring deforestation activity data in the project area. Leakage due to displacement activity was monitored by mapping forest cover change in the leakage belt.

As defined in the VCS Methodology VM0015 v1.1, if carbon stocks in the leakage belt area decrease more during project implementation than projected in the baseline case, this will be an indication that leakage due to displacement of baseline activities has occurred. Where strong evidence can be collected that deforestation in the leakage belt is attributable to deforestation agents that are not linked to the project area, the detected deforestation may not be attributed to the project activity and considered leakage.

The Leakage Belt (LK) presented the highest deforestation rate during this monitored period. From 2020 to 2021, there was an accumulated deforestation of 3,537.18 ha during this period at an annual rate of 1.31%/year.

It is observed that pressure comes from the South of the Reference Region along the BR-364 highway and the Purus River. Furthermore, it appears to originate from outside the latter, influencing the dynamics of land-use change in the Leakage Belt. Figure below shows the annual deforested areas within the leakage belt during the monitoring period.

Figure 20. Deforestation in the Leakage Belt between 2019 and 2021

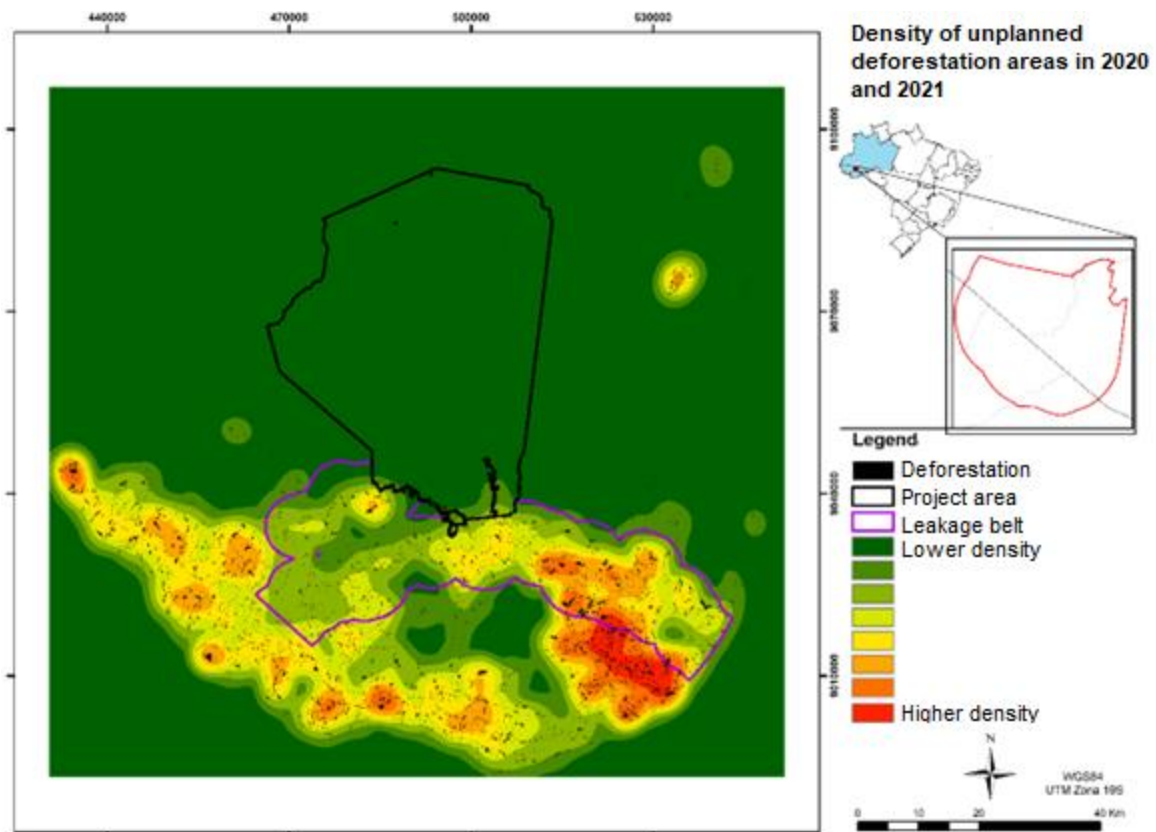


In addition, the increase of the non-forest class occurred at the extreme boundaries of the leakage belt and far from the project area: from one side occurred the expansion of the municipality of Manoel Urbano in the State of Acre, and the increase of roads that connect the city to new opened areas. At the other side, along the Purus River in the state of Amazonas, the increase of the non-forest class resulted from the expansion of the municipality of Sena Madureira. Deforestation was concentrated along the Purus River, according to the historical occupation pattern in the region.

According to PRODES³⁹ data, the municipalities of Manoel Urbano and Sena Madureira showed a deforestation rate increase during the monitoring period (2020-2021). Manoel Urbano presented an increase rate between 2019-2020 of 0.44%, while in Sena Madureira, the increase was of about 0.32%.

During the current monitoring period within the leakage belt, it can be noticed that the main focus of deforestation was the Sena Madureira Deforestation, in the eastern border of the LK. The deforestation occurred in the middle region of the LK presented the lowest density of those areas and corresponds to the part that encompasses the community and the leakage management area (LMA), which is the closest region to the Agro cortex project area.

Figure 21. Density of areas with unplanned deforestation in 2020 and 2021.



³⁹ PRODES Project - Brazilian Amazon Forest Monitoring through Satellite. Instituto Nacional de Pesquisas

Espaciais (INPE). Increase rate 2019/2020 Available at: < <http://www.dpi.inpe.br/prodesdigital/prodesmunicipal.php> >. Last visited on 29-March-2022.

Figure 22. Accumulated deforestation in the leakage belt in 2020 indicating projected deforestation and deforestation occurred.

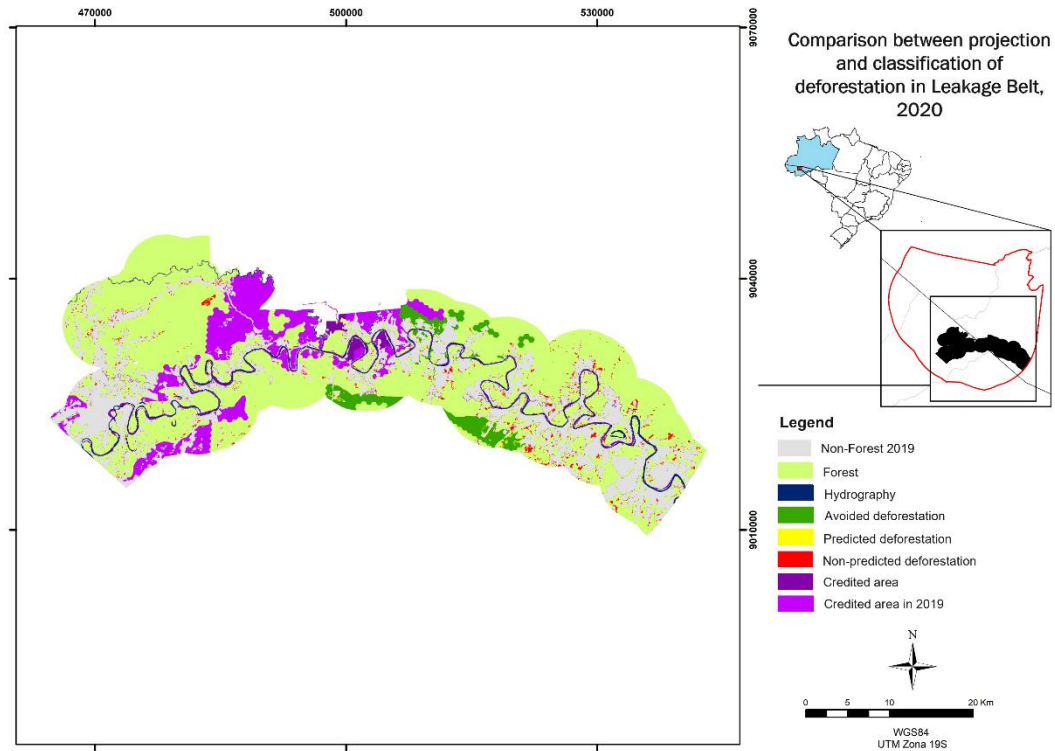
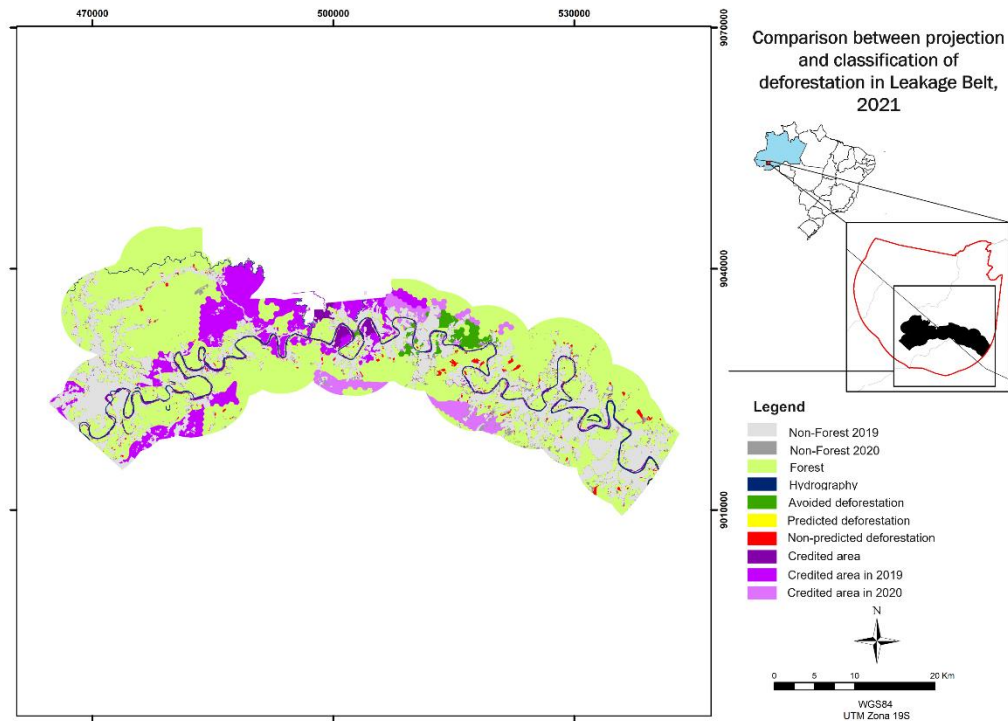


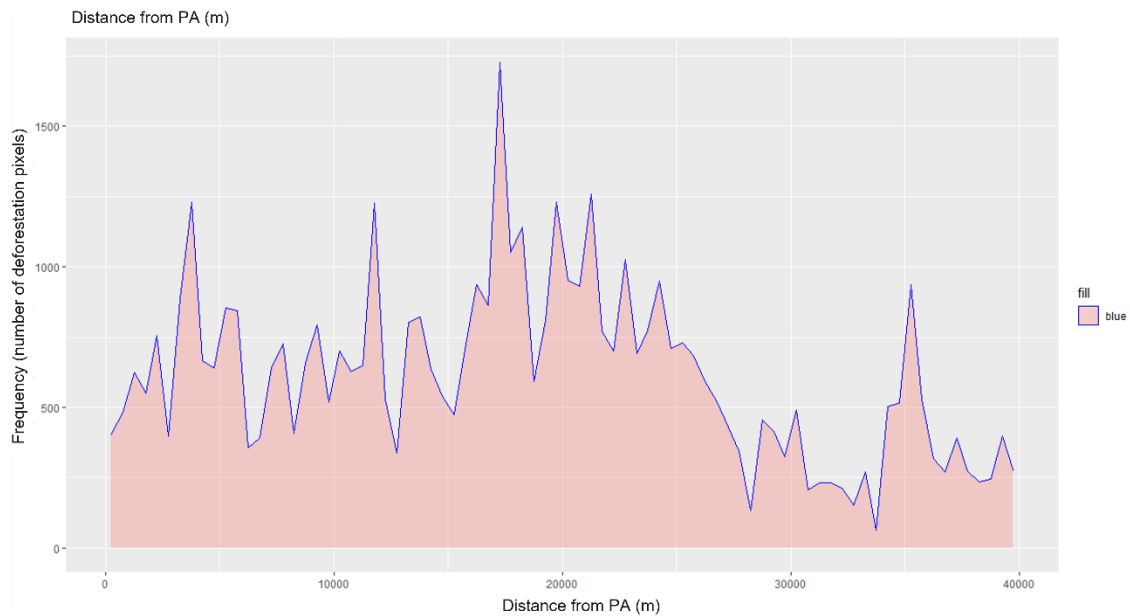
Figure 23. Accumulated deforestation in the leakage belt in 2021 indicating projected deforestation and deforestation occurred.



According to the GIS analysis, the focus of deforestation located at the LK extremity – far from the project area and the leakage management area - presented the highest densities of deforestation rates during the monitoring period. This is a positive indication that social activities involving the local community contributed to environmental education and alternative livelihood projects encompassing generation of income from SFMP. Combined with the increased surveillance against deforestation agents in the region, these social activities developed by Agro cortex REDD Project may have contributed in part to reduce the deforestation rate within the middle region of the LK, where the leakage management area is located.

The deforestation within the leakage belt did not occur due to the displacement of deforestation from the project area. In addition to the density map that shows where deforestation predominantly occurred within the leakage belt (Figure 20 above), the Figure below shows the distribution of deforestation in relation to the distance from the project area. This graph shows that a large part of the deforestation in the monitoring period occurred more than 10km far from the project area.

Figure 24. Distribution of deforestation pixels in the leakage belt, considering their distance from the project area



Therefore, observing the deforestation patterns in the Leakage Belt, the GIS analysis led to the conclusion that the deforestation in the south of the Leakage Belt is not associated with the project activity; and that there was no relation between the observed patterns of deforestation in the Leakage Belt with the present REDD project.

Thus, leakage emissions due to activity displacement, which is calculated as the difference between the *ex ante* and the *ex post* assessments, was defined as zero, as detailed in the Table 37 below.

Table 37. Total net carbon stock change in the leakage belt

Project year	Total ex ante net baseline carbon stock change		Total ex post net actual carbon stock change		Total ex post leakage	
	$\Delta\text{CBSLLKt}$ annual	ΔCBSLLK cumulative	$\Delta\text{CBSLLKt}$ annual	ΔCBSLLK cumulative	$\Delta\text{CBSLLKt}$ annual	ΔCBSLLK cumulative
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	2,772,715	10,486,649	1,145,773	1,145,773	0	0
2021	1,120,195	11,606,844	578,646	1,724,419	0	0

However, to reduce the risk of activity displacement leakage, baseline deforestation agents may participate in activities within the project area and leakage management area, so that deforestation will be reduced, and the risk of displacement minimized.

Emissions from forest fires were not included in the baseline scenario; therefore, monitoring of increases in GHG emissions within leakage belt ($EADLK_t$) is not necessary.

Ex post estimation of total leakage

The result of all sources of leakage is calculated as follows:

$$\Delta CLK_t = \Delta CLPMLK_t + \Delta CADLK_t$$

Where:

ΔCLK_t Total decrease in carbon stocks within the leakage belt at year t ; tCO₂e

$\Delta CLPMLK_t$ Carbon stock decrease due to leakage prevention measures at year t ; tCO₂e

$\Delta CADLK_t$ Total decrease in carbon stocks due to displaced deforestation at year t ; tCO₂e

$$ELK_t = EgLK_t + EADLK_t$$

Where:

ELK_t Sum of *ex post* leakage emissions at year t ; tCO₂e

$EgLK_t$ Emissions from grazing animals in leakage management areas at year t ; tCO₂e

$EADLK_t$ Total *ex post* increase in GHG emissions due to displaced forest fires at year t ; tCO₂e

In addition, methane emissions resulting from the decomposition of wood residues that were generated during the timber processing in Agro cortex industry were calculated. A small part of the wood residues is burned in a boiler located inside the industry; however, the largest part has been piled up since 2014, which results in methane emissions from anaerobic decomposition.

Calculations were made according to methodology AMS-III.F.: Avoidance of methane emissions through composting - Version 12.0⁴⁰ and the Methodological Tool 04 - Emissions from solid waste disposal sites - Version 08.⁴¹

The results of all *ex post* estimations of leakage are summarized in the table below. Therefore, such emissions were discounted due to leakage during this monitoring period. The calculated values of ΔCLK_t and ELK_t in the present project are shown in the table below.

⁴⁰ AMS-III.F.: Avoidance of methane emissions through composting – Version 12.0. Available at: <
<https://cdm.unfccc.int/methodologies/DB/NZ83KB7YHBIAT7HL2U1PCNAOCHPUQYX>>

⁴¹ Methodological Tool 04 – Emissions from solid waste disposal sites – Version 08. Available at: <
<https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v8.0.pdf>>

Table 38. Total ex post estimated leakage

Project year	Total ex post GHG emissions from increased grazing activities		Total ex post increase in GHG emissions due to displaced forest fires		Total ex post GHG emissions from decomposition of wood residues in the industry		Total ex post decrease in carbon stocks due to displaced deforestation		Carbon stock decrease due to leakage prevention measures		Total net carbon stock change due to leakage		Total net increase in emissions due to leakage	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	EgLK _t tCO ₂ e	EgLK tCO ₂ e	EADLK _t tCO ₂ e	EADLK tCO ₂ e	annual tCO ₂ e	cumulative tCO ₂ e	ΔCADLK _t tCO ₂ e	ΔCADLK tCO ₂ e	ΔCLPMLK _t tCO ₂ e	ΔCLPMLK tCO ₂ e	ΔCLK _t tCO ₂ e	ΔCLK tCO ₂ e	ELK _t tCO ₂ e	ELK tCO ₂ e
2020	17,685.10	17,685.10	0.00	0.00	5,032.69	5,032.69	0.00	0.00	894.40	894.40	894.40	894.40	22,717.78	22,717.78
2021	17,685.10	35,370.19	0.00	0.00	5,393.36	10,426.04	0.00	0.00	424.30	1,318.70	424.30	1,318.70	23,078.45	45,796.24

5.4. Net GHG emission reductions and removals

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

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

Where:

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

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

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

$\Delta CPSPA_t$ Sum of ex post estimated actual carbon stock changes in the project area at year t ; tCO₂e

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

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

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

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

ELK_t Sum of ex post estimated leakage emissions at year t ; tCO₂e

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

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

$$VCU_t = \Delta REDD_t - VBC_t$$

$$VBC_t = (\Delta CBSLPA_t - \Delta CPSPA_t) \times RF_t$$

Where:

VCU_t	Number of Verified Carbon Units that can be traded at time t ; tCO ₂ e Note: If $VCU_t < 0$ no credits (VCUs) will be awarded to the proponents of the AUD project activity.
$\Delta REDD_t$	<i>Ex post</i> estimated net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t ; tCO ₂ e
VBC_t	Number of Buffer Credits deposited in the VCS Buffer at time t ; tCO ₂ e
$\Delta CBSLPA_t$	Sum of baseline carbon stock changes in the project area at year t ; tCO ₂ e
$\Delta CPSPA_t$	Sum of <i>ex post</i> carbon stock changes in the project area at year t ; tCO ₂ e ha ⁻¹
RF_t	Risk factor used to calculate VCS buffer credits; %
t	1, 2, 3 ... T , a year of the proposed project crediting period; dimensionless.

The RF_t was estimated using the most recent version of the *VCS-approved AFOLU Non-Permanence Risk Tool* and the resulting value of RF_t for the present REDD project during the current monitoring period was 10%.

The specific summary of GHG reductions and removals in the Agro cortex REDD project during the current monitoring period is included in Table 39 below. The latter table includes estimates of GHG emissions reduction ($REDD_t$), calculations of buffer and leakage, and the resulting calculation of tradable Verified Carbon Units (VCU_t).

Table 39. Ex post estimated net anthropogenic GHG emissions reductions and VCU

Project year	Baseline carbon stock changes		Baseline GHG emissions from biomass burning		Ex post project carbon stock changes		Ex post project GHG emissions from biomass burning		Ex post leakage carbon stock changes		Ex post leakage GHG emissions		Ex post net anthropogenic GHG emission reductions		Ex post VCUs tradable		Ex post buffer credits	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	ΔCBSLPA_t	ΔCBSLPA	EBBBSLPA_t	EBBBSLPA	ΔCPSPA_t	ΔCPSPA	EBBPSPA_t	EBBPSPA	ΔCLK_t	ΔCLK	ELK_t	ELK	ΔREDD_t	ΔREDD	VCU_t	VCU	VBC_t	VBC
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
2020	541,493	541,493	0	0	73,421	73,421	639	639	894	894	22,718	22,718	443,821	443,821	397,013	397,013	46,807	46,807
2021	645,061	1,186,554	0	0	65,480	138,901	157	796	424	1,319	23,078	45,796	555,921	999,742	497,962	894,975	57,958	104,765

In addition, the net GHG emission reductions and removals in the Agrocortex REDD Project are summarized in the Table 40, which follows.

Table 40. Net GHG emissions reductions and removals in the Agrocortex REDD Project 3rd monitoring period

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)	Buffer pool allocation	VCUs eligible for issuance
2020	541,493	74,059	23,612	443,821	46,807	397,013
2021	645,061	65,637	23,503	555,921	57,958	497,962
Total	1,186,554	139,697	47,115	999,742	104,765	894,975
Total number of monitoring years	2	2	2	2	2	2
Average annual ERs	593,277	69,848	23,557	499,871	52,383	447,488

6. SOCIALCARBON RESULTS

6.1 Results

6.1.1 Social Resource

Indicator	Women inclusion					
Description	Evaluates initiatives implemented by the company to promote women inclusion in the community activities. Campaigns: Punctual actions that do not have continuity, such as lectures, women's inclusion week, among others. Program: Set of continuous actions to promote women inclusion in the community activities, offering equal opportunities of access to goods and services for all.					
Situation	In 2017 Agrocorrex established a partnership with the government that is still occurring during this monitoring period. This partnership is to donate wood residues to the Artisans association, stimulating the production of handicrafts. The program helps 40 artisans, indirectly benefiting 250 families⁴². During the monitoring period, due the COVID-19 pandemic, Agrocorrex couldn't develop any solid action related to women empowerment. The company's staff is composed by 124 employees on the industry, 13 of them are women. However, the main activity performed by these women employed are related to the administrative department, as shown in the evidences.					
There are no initiatives related to women inclusion.	There are plans to implement actions to promote women inclusion in the community activities.	There are campaigns aiming to promote women inclusion in the community activities.	There are monitored programs to promote women inclusion in the community activities.	In addition to the previous scenario, there are positive results related to women inclusion in the communities.	There is no barrier and women are fully integrated into the community.	
Score	3 (three)					
Prospects	Develop a program to empower women and valorize children and adolescents, with a cycle of lectures.					

⁴² Available at <<https://agencia.ac.gov.br/governo-e-agrocorrex-fecham-parceria-para-apoiar-artesaos/>>

Indicator	Expansion of community activities
Description	Evaluates whether the community activities implemented by the company extend to all affected communities.
Situation	Comments: According to the Socio Environmental diagnosis held by Agro cortex⁴³, there are communities from 10 localities, totalizing 95 families affected by the project and 177 people. Agro cortex is in constant communication with the local government, signing partnerships to benefit the community: - Partnership with the State of Acre's government⁴⁴ to reduce bureaucracy and expand the production and generation of income and work. It generates 350 direct and indirect jobs; - Partnership with the government to donate wood residues for the Artisans Association, stimulating the production of handicrafts. The program helps 40 artisans, indirectly benefiting 250 families. - Partnership with the government to promote repairs in public infrastructure and objects when needed, such as on hoses used in activities of the Secretary of Construction and Public Services of Acre government. - Partnership with DER Acre – Departamento de Estradas de Rodagem, Infraestrutura Hidroviária e Aeroportuária do Acre (Department of Highways, Waterway and Airport Infrastructure of Acre): donation of forest residues. During the period of research and interviews with the local communities for the elaboration of the socio-environmental diagnosis, Agro cortex promoted some activities with children of a local public school in the Itaúba community. In addition, during the monitored period, Agro cortex donated wood and wood residues to some residents of Manuel Urbano's city, supporting the construction of a vegetable garden. According to the social impact studies, the subsistence farming is one of the most significant activities of the local communities: 83% of the communities have the subsistence agriculture as a source of their families food and 17% do not cultivate for their own consumption. The Sustainable Forest Management Plan with FSC incorporates alternative income into the community. During the analyzed period, according to the Agro cortex, 50% of the activities were developed with the local community and 50% were developed with outsourced labor coming from the northern region as well, but not exactly from the local communities.

⁴³ DIAGNÓSTICO SOCIOAMBIENTAL 2020.

⁴⁴ Available at <<https://agencia.ac.gov.br/governo-do-acre-consolida-parceria-com-o-setor-produtivo/>>

Agrocortex offered first aid and reduced impact logging trainings to the community. Furthermore, the local commerce is stimulated with the purchase of local products whenever possible. Agrocortex also donated food and a wheelchair for residents of the local communities. In addition, the company donate wood residues to help the construction of a dog kennel for a local NGO which helps homeless dogs. In order to conduct the socio environmental diagnosis in 2020, local meetings were made with ten local communities affected by the project: Oriental, Santa Penha, Oriente, São Salvador, Boca do Macapá, Macapá, Alegria e Itaúba.					
There are no social activities to the surrounding community.	There are social activities that reach at least one community.	There are social activities that reach up to three communities.	There are activities that reach up to five communities.	There are activities that reach up to eight communities.	Social activities reach 100% of the communities affected by the project.
Score	5 (five)				
Prospects	There are currently no foreseen improvements.				

Indicator	Associations and Cooperatives				
Description	Evaluates whether communities residing in/around the project area are involved in associations or cooperatives. Association: Group of two or more people who organize themselves to defend their common interests, without financial ends and existing as a legal entity. Cooperative: Organization consisting of at least twenty private individuals acting cooperatively and mutually assisting each other, with democratic, participatory management, with common economic and social goals, of which the legal and doctrinal aspects are independent of those of other organizations and societies.				
Situation	Employees and local community have associated with: - Artisans Association - SINTIACRE – Sindicato dos Trabalhadores Industriários do Acre (Union of industrial workers in Acre) - SINDUSMAD – Sindicato da Indústria Madeireira do Estado do Acre (Union of the timber industry of the State of Acre)				
Absence of associations and cooperatives; individual	Attempts to form associations or cooperatives have been made,	An association or cooperative is regularly attended and formally registered;	An association or cooperative is regularly attended and formally registered, and	In addition to the previous scenario, there is a formally registered, regularly	In addition to the previous scenario, the association/ cooperative is independent

action predominates.	meetings are informal.	however, there are no recognized leaders within the community.	there are recognized leaders from the community.	attended association or cooperative that is generating positive results for the community (e.g. objectives have been achieved).	(not in need of external support).
Score	3 (three)				
Prospects	There are currently no foreseen improvements.				

6.1.2 Human Resource

Indicator	Conflict management				
Description	Evaluates the company's procedures to identify and deal with conflicts in the surrounding communities, as well as the actions that are being taken so that they do not recur.				
Situation	The company maintains the regularization process of the surrounding communities and invasion areas. Although there was no conflict with the community during the period, a illegal invasion and deforestation of 56 ha happened inside the project area. The project owner has taken all the appropriate measures to resolve this problem, such as a incident report, and continue to monitor the area to identified any adverse situation in order to prevent it from occurring a conflict like this one in the future again.				
There are no actions related to conflict management.	There are actions related to conflict management however they are informal.	There are procedures to identify AND deal with conflicts.	In addition to the previous scenario, all conflicts identified are being treated and monitored. Efforts were carried out to ensure that they will not be repeated.	In addition to the previous scenario, the company has preventive actions to prevent the emergence of new conflicts, e.g. the company provides a team to gather opinions and solve conflicts.	In addition to the previous scenario, the local community is satisfied with community activities.

Score	4 (four)
Prospects	Regularization of the surrounding communities and their lands.

Indicator	Public health
Description	Evaluates the company's actions to mitigate the impacts of its activities related to the public health of surrounding communities.
Situation	The company offered lectures on domestic violence and first aid training for the surrounding communities and employees. In addition, during the COVID-19 pandemic, Agro cortex followed up on cases of COVID-19 among its employees. A vaccination campaign against flu was also promoted.

There are no actions related to public health.	There are isolated initiatives, which have little impact, in the public health area, for example: distribution of information pamphlets.	There are lectures OR campaigns to create awareness in the communities and prevent themes related to public health (e.g. prostitution, violence against women, alcohol abuse, drug use, among others).	There are lectures AND campaigns to create awareness in the communities and prevent themes related to public health (e.g. prostitution, violence against women, alcohol abuse, drug use, among others).	In addition to the previous scenario, the company monitors public health problems in the communities affected by the project.	In addition to the previous scenario, there are actions to solve the public health problems.
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Score	5 (five)
Prospects	Include other themes of public health in lectures and campaigns.

Indicator	Community education and training
Description	Evaluates the relevant education and training programs implemented as a project activity, including additional programs to the stakeholders and broader community.

Situation	Comments:				
	Agrocortex offers the “Jovem Aprendiz” (young apprentice) initiative, project that creates job opportunities for the young people at risk and vulnerability situations. The program is an alternative income source for the young adults of the region, offering jobs inside the company and a chance to learn, in practice, about sustainable management, FSC, forest conservation, etc. During the monitoring period, the following trainings and lectures were held, to employees and community: • Planning and construction techniques for yards, roads, bridges, culverts and forest management infrastructure. • Special tree cutting techniques and safe forestry handling. • Planning and dragging techniques in forestry handling. • Training in the use of GPS equipment. • First aid training. • Formation of a fire brigade. • Training in combat forest fires. • Clarification lecture on labor legislation. • Lecture to clarify forest management and the legislation related to the management. • Use and handling of data collector. • Lecture on the importance of conservation of threatened species of fauna and flora and its monitoring procedure. • Lecture on Agrocortex’s High Conservation Values and chain of custody presentation. • CIPA training on workplace security				
There are no education and training activities.	There are no education and training activities, however the company promotes lectures on different themes.	The company offers an education / training activity in ONE of the following areas: - alternative income sources (e.g. collecting Brazil nuts) - education (e.g. literacy) - sustainable forest management	The company offers an education / training activity in TWO of the following areas: - alternative income sources (e.g. collecting Brazil nuts) - education (e.g. literacy) - sustainable forest management	The company offers an education / training activity in the following areas: - alternative income sources (e.g. collecting Brazil nuts) - education (e.g. literacy) - sustainable forest management	In addition to the previous scenario, the company simulates entrepreneurship (e.g. support, lectures, microloans among others).
Score	4 (four)				

Prospects	There are currently no foreseen improvements.
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6.1.3 Financial Resource

Indicator	Alternative income sources				
Description	Evaluates whether the project created alternative sources of income generation for the communities living within/surrounding the project area.				
Situation	The company hires community members to work in the Sustainable Forest Management Plan with FSC. Agrocorrex is Manoel Urbano's largest employer and one of the largest in the State of Acre. Agrocorrex also has the "Jovem Aprendiz" (young apprentice) initiative, project that creates job opportunities for the young people at risk and vulnerability situations. Also, with the donation of wood and wood residues to some residents of Manuel Urbano's city, Agrocorrex supported the construction of a vegetable garden. According to the social impact studies, the subsistence farming is one of the most significant activities of the local communities: 83% of the communities have the subsistence agriculture as a source of their families food and 17% do not cultivate for their own consumption.				
The project does not generate any alternative income sources for the local communities.	The project generates one alternative income source for the local communities.	The project generates two alternative income sources for the local communities.	The project generates three alternative income sources for the local communities.	The project generates four alternative income sources for the local communities.	The project generates more than five alternative income sources for the local communities.
Score	4 (four)				
Prospects	The company will start to acquire native seeds from the community to produce seedlings in its nursery.				

Indicator	Carbon credit benefits
Description	Evaluates whether proceeds from the sale of carbon credits was distributed to carbon project improvements or activities that benefit the local community.
Situation	100% of all credit sales are invested in Agrocorrex's operation and social and environmental benefits. Carbon credits are important to maintain important

activities, such as: payment of wages, maintenance of operations, social and environmental initiatives and benefits, donations in partnership with the State and municipality's government, land demarcation process for each family within the rural property Fazenda Seringal Novo Macapá, geoprocessing techniques to locate the selected trees for cutting, and plan the infrastructure construction in each annual production unit, purchase of local commerce products, production of native tree seedlings in two tree nurseries and plantation in harvested areas inside the SFMP, fauna monitoring to evaluate the impacts of the SFMP on the local fauna, FSC certifications, carbon project costs, among others. Furthermore, the project generates about 350 direct and indirect jobs, causing a very positive impact on the local economy of the municipality of Manoel Urbano-AC, and surroundings. All workers, including outsourced workers, are hired in accordance with labor and social security legislation. All revenues from carbon credit sales are invested in Agrocoortex's operation and social and environmental benefits. Between 2020 and 2021, a total of 1,784,573 tCO2e credits were sold to national and international companies, resulting in revenues of R\$ 42,813,553, which were fully integrated into the company's working capital used to maintain the activities listed above. Moreover, carbon credits are also important to help in the maintenance of FSC certification, as it is very difficult to compete with illegal logging in Brazil.						
The income generated by carbon credit sales was not distributed to the carbon project or in the community, or there are no organized controls of the allocation of proceeds.	Less than 20% of the income generated by carbon credit sales was distributed to the carbon project or in the community development.	Between 20 and 40% of the income generated by carbon credit sales was distributed to the carbon project or in the community development.	Between 40 and 60% of the income generated by carbon credit sales was distributed to the carbon project or in the community development.	Between 60 and 80% of the income generated by carbon credit sales was distributed to the carbon project or in the community development.	Between 80 and 100% of the income generated by carbon credit sales was distributed to the carbon project or in the community development.	
Score	6 (six)					
Prospects	There are currently no foreseen improvements.					

Indicator	Securing of funds
Description	Evaluates the project proponent's participation in requests for proposals/ programs to secure funds. Also monitors whether project participants were

	successful, and whether the funds raised are creating activities for communities resident in/around the project area.				
Situation	The project is subscribed and accepted in the Compromisso com o Clima Platform being evaluated the best forest project, and sales and negotiations have already been concluded. Furthermore, during this monitoring period, Agrocortex received four awards due the success of the project.				
The project proponent does not take any action to secure funds.	The project proponent participates in programs/ requests for proposal; however no funding has been secured so far.	The project proponent participates in programs/ requests for proposal, and has secured funding, and initiatives have been put into practice. However, the latter were inactive or nonexistent in the period analysed.	The project proponent participates in programs/ requests for proposal, and has secured funding, and initiatives have been put into practice. In the period analysed at least one initiative is operating.	The project proponent participates in programs/ requests for proposal, and has secured funding, and initiatives have been put into practice. In the period analysed, more than one initiative is operating, however the latter are not self-sustaining (they require funding to continue).	As well as the previous scenario, at least one of the initiatives undertaken is financially self-sufficient, not requiring any further funding to continue.
Score	6 (six)				
Prospects	There are currently no foreseen improvements.				

6.1.4 Natural Resource

Indicator	Land tenure
Description	Evaluates the existence of conflicts due to land tenure, as well as whether actions are being taken to manage the issue.
Situation	There was illegal deforestation of 56 ha within the project area during this monitoring period. The project owner has taken all the appropriate measures to

	resolve this problem, such as a incident, and monitors the area to identify any adverse situation, in order to mitigate new conflicts. In addition, a Work Plan and Term of Commitment with IBAMA were carried out to identify the deforested areas.				
There are protests in the project area due to problems with land tenure.	The company has conflicts related to land tenure, and has no actions addressed to solve them.	The company has conflicts related to land tenure and started a dialogue to solve them.	The company has conflicts due to land tenure and is in the process of solving them.	Part of land tenure proceedings has been concluded and the owners already have the terms of concession and the legal land title as well as right to use those localities.	All land tenure proceedings are concluded and the owners already have the terms of concession and the legal land title as well as right to use those localities. Beyond that, the company monitors the management plan area to avoid new land occupation.
Score	6 (six)				
Prospects	The company will continue to monitor the area to prevent new illegal invasions.				

Indicator	Social and environmental investments
Description	Evaluates the socio-environmental investments in the different areas: education; alternative income generation; environment; sport and infrastructure.
Situation	<u>Education</u> - Agrocortex offered workplace security, first aid and fire trainings for the community. The company has agreements with universities such as the Federal University of Acre (UFAC), Unicamp and Federal University of Lavra. It is an important partnership to exchange experiences, mutual assistance and to promote knowledge and education for society. <u>Alternative income</u> - The company established a partnership to donate wood residues to the Artisans association, stimulating the production of handicrafts, in addition to the creation of job opportunities for the young adult and adult population under the “Jovem Aprendiz” (young apprentice) program and in the SFMP itself.

	Infrastructure - Loan of machinery to the municipality of Manoel Urbano to repair streets and highways in the region; Partnership with DERAcree to donate forest residues to repair roads and highways in the region for the local communities. Environment - In 2017 Agro cortex has built a nursery and do its monitoring and planting until now.				
There are no actions related to socio-environmental investments.	The company has social-environmental actions for at least one of the following topics: - education; - alternative income generation; - environment; - sport; - infrastructure.	The company has social-environmental actions for two of the following topics: - education; - alternative income generation; - environment; - sport; - infrastructure.	The company has social-environmental actions for three of the following topics: - education; - alternative income generation; - environment; - sport; - infrastructure.	The company has social-environmental actions for four of the following topics: - education; - alternative income generation; - environment; - sport; - infrastructure.	The company has social-environmental actions for all of the following topics: - education; - alternative income generation; - environment; - sport; - infrastructure.
Score	5 (five)				
Prospects	There are currently no foreseen improvements.				

Indicator	Quality control				
Description	Evaluates the quality control of the management plan operation.				
Situation	During this monitoring period, two external companies were hired to conduct the internal audit before the third-party audit of the FSC certification and IBAMA to guarantee the SFMP quality. The FSC/Imaflora certification provides the confirmation that the company accomplishes a sustainable and responsible forest management. In addition, during this monitoring period, Agro cortex has done a Forest Inventory.				
There are no actions to ensure quality control of the management plan operations.	There are plans to implement quality control actions of the management plan operation.	There is quality control actions of the management plan operation in place, however failures exist (e.g.	There is quality control actions of the management plan operation in place, however failures exist (e.g. the team can	There is quality control actions of the management plan operation in place, however failures exist (e.g.	There is a quality control team, and the problems are identified and solved.

		the team can only identify problems of low difficulty).	identify problems of low and moderate difficulty).	the team can identify problems of low, moderate and high difficulty).	
Score	6 (six)				
Prospects	There are currently no foreseen improvements.				

6.1.5 Biodiversity/Technology Resource

Indicator	Non-timber forest products (NTFPs)				
Description	Evaluates the sustainable use of natural resources by communities in/around the project area for income generation. “NTFPs are biological resources or products from flora – which are not wood – obtained from forests for subsistence or for trade. They can come from native, primary or secondary forest, planted forest or agro-forestry systems. NTFPs include a wide range of products including medicinal plants, fibres, resins, latex varieties, oils, rubbers, fruits, nuts, seasonings, dyes, rattan, bamboo, etc.” (Brazilian Forest Service, 2013). Sustainable practices are taken to include the following: - Low-impact practices; - Exploitation/ collection practices of each NTFP that are compatible with their productivity levels and without affecting their regeneration and/or conservation of each utilized species.				
Situation	Non-timber forest products are used mainly for subsistence purposes.				
Non-timber forest products are used exclusively for subsistence purposes.	Non-timber forest products are traded in/around the project area, however without sustainable practices.	Non-timber forest products are traded in/around the project area, with sustainable practices in use.	As well as the previous scenario, there are studies and plans with the community in order to determine the available volumes, use, distribution, regeneration and conservation of non-timber	As well as the previous scenario, there are partnerships to exploit the business potential of non-timber forest products in/around the project area.	As well as the previous scenario: There is equitable distribution of the benefits of non-timber forest products. Or there are facilities to add value to non-timber forest products

			forest products.		in/around the project area.
Score	1 (one)				
Prospects	There are currently no foreseen improvements.				

Indicator	Biodiversity monitoring				
Description	Evaluates whether the company has actions to identify and monitor the local fauna and flora.				
Situation	Flora monitoring is made through the Impact Assessment Report on Permanent Plots, made in 2020 and 2021, and the Forest Inventories, made annually. Fauna is monitored through the Fauna Report, last edition made in November of 2020. This Fauna Report registered 345 bird species and 34 mammals from a total of 573 species of birds and 60 species of mammals with high probability of existence in the region, according to secondary data collected. Regarding the species that were registered, 3 birds and 8 mammals are nationally and/or globally endangered, such as the Pacarana (<i>Diomys branickii</i>), the Jaguar (<i>Panthera onca</i>), the Goeldi's Marmoset (<i>Callimico goeldii</i>), the Black-billed Toucan (<i>Tamphastus vitellinus culmitanus</i>) and the Blue-headed Maracana (<i>Primolius couloni</i>).				
There is no process of identification and monitoring of fauna and flora, nor cataloguing of timber.	There are plans to implement identification and monitoring fauna and flora.	There is monitoring and identification of fauna AND flora.	There is monitoring and identification of fauna AND flora annually.	In addition to the previous scenario, there is botanical collection of flora and herbarium.	In addition to the previous scenario, there is a catalogue of identified woods (xiloteca).
Score	3 (three)				
Prospects	There are currently no foreseen improvements.				

Indicator	Impact on remaining flora
Description	Evaluates the company actions to monitor the impact on the remaining flora.

Situation	The company developed an Impact assessment report on permanent plots, which comply with the requirements of the PNMS, to evaluate the conditions of the remaining flora in 2020 and in 2021. The reports analyzed the floristic composition, diversity, and structure of the forest of tree individuals inventoried in the 20 plots installed. The study of 2020 analyzed 17 plots installed and identified 49 families, 133 species and inventoried and identified 1468 trees. Each year are installed 4 UPAs, and, of the 17 plots mentioned, many were amendments to the measured plots. In other hand, the study realized in 2021 analyzed 4 plots installed in the UPA 15, and identified 44 families, 126 species and inventoried and identified 969 trees..The forest appears to have few tree individuals of commercial value. During the monitored period, the two nurseries that were constructed were still in operation. Agro cortex continued to plant the seedlings in some areas and to monitor the nurseries. Agro cortex monitored the flora and the impact of the project on the remaining flora through the annual monitoring reports. In addition, the company promotes lectures and workshops to teach and raise awareness among its employees about court, drag and roads practices in order to have a low impact on the remaining flora.					
	There are no actions related to monitoring the impacts on the remaining flora.	There are plans to implement impact monitoring on the remaining flora.	The company is monitoring the impact on the remaining flora by one of the following operations: . Court . Drag . Road	The company is monitoring the impact on the remaining flora by two of the following operations: . Court . Drag . Road	The company is monitoring the impact on the remaining flora by all of the following operations: . Court . Drag . Road	In addition to the previous scenario, the company has measures / initiatives to reduce its impact on the remaining flora.
	Score					5 (five)
	Prospects					Expand planting activities, with different species in enrichment and restoring plantations, and the production of seedlings from several native species.

6.1.6 Carbon Resource

Indicator	Buffer reduction
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Description	Measures the progression of the buffer in the current monitoring period compared to VCS PD and Monitoring Report.				
Situation	In the current monitoring period, the buffer was 10%.				
The buffer is higher in the current monitoring than in any other monitoring period (or compared to the PD).	The buffer reduced by 0 to 5% compared to the previous monitoring period (or compared to the PD).	The buffer reduced by up to 10% compared to the previous monitoring period (or compared to the PD).	The buffer reduced by up to 15% compared to the previous monitoring period (or compared to the PD).	The buffer reduced by up to 20% compared to the previous monitoring period (or compared to the PD).	The buffer reduced by more than 20% compared to the previous monitoring period (or compared to the PD). Or The buffer is currently at the minimum V-C-S requirement.
Score	6 (six)				
Prospects	There are currently no foreseen improvements.				

Indicator	Stakeholder consultation					
Description	Evaluates the methodology used for the stakeholder consultation regarding the carbon project.					
Situation	A local stakeholder consultation was held in 2020 (Socio Environmental Diagnosis). Agrocortex team understands that the best identified procedure to collect opinions and comments from stakeholders was through physical meetings with employees and community leaderships. During the current monitored period, in 2020, during the interviews for the socio environmental diagnosis elaboration, Agrocortex promoted a stakeholder consultation among the 8 communities affected by the project and registered the residents considerations. Periodic meetings are held with the local government of Manoel Urbano. In addition, FSC holds annual meetings at the city to collect information about the project, without the participation of Agrocortex representants.					

	Although there was no formal stakeholder consultation regarding the carbon project during this monitoring period, the company aims to have a good relationship with its stakeholders. Public summary reports are sent annually to all Stakeholders through e-mail, not only as part of the FSC certification but also to be in touch with the stakeholders to made them up to date about the project situation and steps; feedback requests are also made through email or phone. The email comunidades@agrocortex.com and the redd@agrocortex.com are also an open channel for communication with the local stakeholders.				
During the time period analyzed, the company did not conduct a stakeholder consultation regarding the carbon project.	During the time period analyzed, the company conducted an informal stakeholder consultation regarding the carbon project.	During the time period analyzed, the company conducted a formal stakeholder consultation regarding the carbon project and all comments were registered.	During the time period analyzed, the company conducted a formal stakeholder consultation regarding the carbon project and all comments were registered. At least one of the suggestions was addressed.	In addition to scenario 4, the company conducted systematic stakeholder consultation surveys.	In addition to scenario 5, the company has organized planning to implement stakeholder suggestions.
Score	2 (two)				
Prospects	Conduct a formal Local Stakeholder Consultation Meeting and formalize Stakeholder's comments to facilitate the implementation of suggestions.				

Indicator	Project performance
Description	Evaluates project performance in relation to verified emissions reductions. Project performance = Units verified in the Monitoring Report corresponding to the SCR period/ Estimate of emissions reductions in the VCS PD.
Situation	Comparing the 3rd monitoring period (from 01-January-2020 to 31-December-2021) and the VCS PD estimates: Net anthropogenic GHG emission reductions verified in the Monitoring Report: 999,742 Net anthropogenic GHG emission reductions estimate in the VCS PD: 880,079. Project performance: 113% The Project performance was excellent, with the generation of carbon credits very close to the estimated in the VCS PD.

Not successful: 0% of carbon credits predicted for the period were generated.	Very Low: 1% to 25% of carbon credits predicted for the period were generated.	Low: 26% to 50% of carbon credits predicted for the period were generated.	Reasonable: 51% to 75% of carbon credits predicted for the period were generated.	Good: 76% to 95% of carbon credits predicted for the period were generated.	Excellent: More than 95% of carbon credits predicted for the period were generated.
Score	6 (six)				
Prospects	There are currently no foreseen improvements.				

6.2 Analysis of Results

6.2.1 Current Performance

Resource	Critical	Satisfactory	Sustainable	Average Score	Performance
Social	0.0%	66.7%	33.3%	3.7	Satisfactory
Human	0.0%	66.7%	33.3%	4.3	Satisfactory
Financial	0.0%	33.3%	66.7%	5.3	Sustainable
Natural	0.0%	0.0%	100%	5.7	Sustainable
Biodiversity/Tech	33.3%	33.3%	33.3%	3.0	Satisfactory
Carbon	33.3%	0.0%	66.7%	4.7	Satisfactory
General	11%	33%	56%	4.4	Satisfactory

6.2.2 Historical Performance

Social	Point Zero	Point One	Point Two
	1.3	3.0	3.7

In Point Zero, there were few actions focused on local communities, such as monitoring of social impacts and promotion of a training activity in sustainable forest management to the local residents. During the current monitoring period, partnerships with the local government were made to expand employment opportunities for the local community, in addition to donations of resources for local crafts and production. The employment of woman was also stimulated with donations to artisans and the hiring of women from the community to manufacture the company's uniforms.

Furthermore, Agro cortex promoted the donation of food and materials of basic necessity to the members of the local communities, such as a wheelchair.

Human	Point Zero	Point One	Point Two
	2.3	4.3	4.3

In the past monitoring period, Agro cortex developed lectures on domestic violence, first aid courses, fire training, etc to employees and local community.

During this monitoring period, besides not being able to do actions about the theme of women empowerment and domestic violence, the company was able to maintain all the courses and lectures to the employers and communities members.

Job opportunities and forest management trainings were also offered. In addition, they had a progress in the regularization activities of land ownership with the local community in comparison to the last monitoring period.

Financial	Point Zero	Point One	Point Two
	1.7	4.3	5.3

The company is still the largest employer in the region and offers employment opportunities to the local communities. In comparison to Point One, the company sold more carbon credits and invested its profit in the development and maintenance of the project, in addition to benefits to the community. The project has also participated in requests for proposals and was accepted in one.

Furthermore, Agro cortex demonstrates to have an efficient control of their expenses and investments.

Natural	Point Zero	Point One	Point Two
	2.7	4.3	5.7

Comparing to the Point One, Agro cortex has a great advance in the process of the regularization of communities' land title. The company continued to do a cycle of lectures and training for employees and the local community. In addition, the company has partnership with federal universities to promote actions related to education.

The "Jovem Aprendiz" program still occurs and helps the employment generation in the region.

Comparing to Point One, Agro cortex still realizes both internal and external audits to maintain the quality control of the SFMP activities. The company has the FSC/Imaflora certification, providing the confirmation that is in accomplishing with a sustainable and responsible forest management.

Biodiversity	Point Zero	Point One	Point Two
	1.7	3.3	3.0

Comparing to Point One, Agro cortex didn't has any significant advance regarding the alternatives to expand the exploration of non-timber forest products. However, the company still implements the impact assessment due to SFMP activities and continues to conduct the monitoring of fauna and flora within the project area. It is also expanding production in its nursery, seeking to enrich exploited and native species. The Flora catalogue can be considered an improvement over Point zero and Point one.

The score of this resource has decreased mostly because of the non existence of actions regarding the sustainable use of Non-timber forest products and the absence of effectiveness actions in order to mitigate and prevent the project impacts on the remaining flora.

Carbon	Point Zero	Point One	Point Two
	2.7	4.0	4.7

In comparison of the last monitoring periods, Carbon resource had one of the best performances of the current Report due to Project Performance indicator, exceeding the expectations of the VCS PD. As a result of the stakeholder consultation held in 2017, the best identified procedure to collect opinions and comments from stakeholders was through physical meetings with employees and community leaderships. In the current monitoring period, a local, but not formal, stakeholder consultation was held in 2020 during the interviews for the elaboration of the Socio Environmental diagnosis.

Comparing to Point One, Agro cortex didn't held a lot of periodic meetings with the local government and the community mostly due the COVID-19 pandemic.

Public summary reports are sent annually to all Stakeholders through e-mail.

There was a great advance compared to the last report, much due to the progress of the project and commitment of the company.

General	Point Zero	Point One	Point Two
	2.1	3.9	4.4

In comparison to the last monitoring periods, Agro cortex carbon project had one of the best performances due to the improvements that the project owner has done.

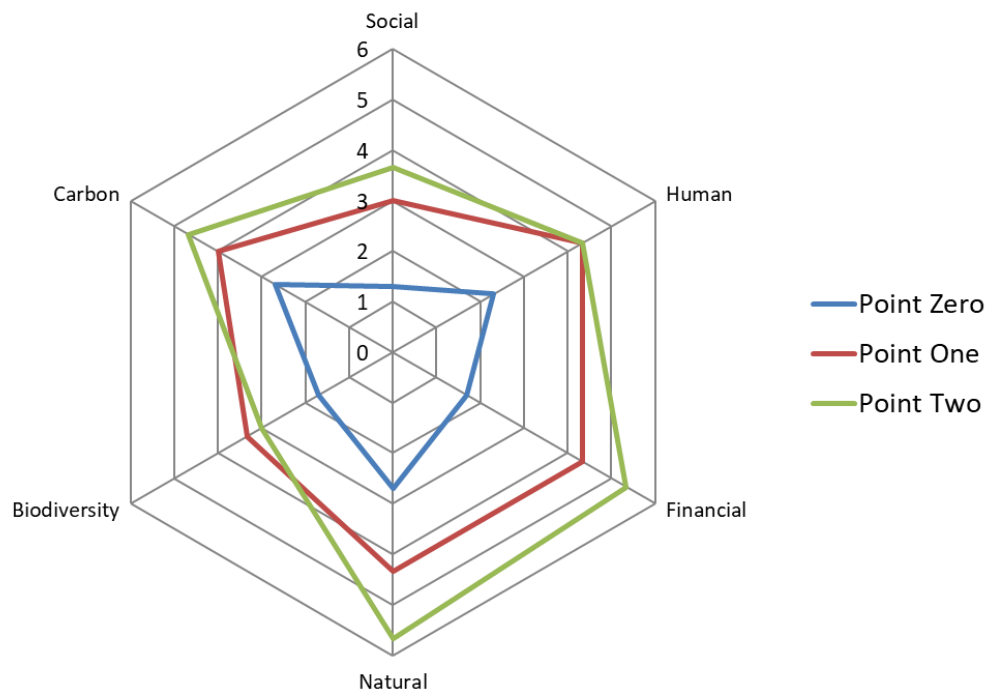
Although there was no action focused on the women empowerment, the company has done donations to contribute to the communities' development, such as donations of wood residues, food and objects of basic needs.

In addition, there were no conflicts inside the project area during this monitoring period. Despite having an illegal invasion resulting in unplanned deforestation, the procedures were well conducted by the project owner.

Agrocortex continues to have a high-quality control of the project, as well as fauna and flora monitoring.

Despite not having performed a formal stakeholder consultation, the project always seeks to be in contact with its stakeholders.

6.2.3 Performance Hexagon



6.3 Prospect Status

6.3.1 Achieved Prospects

Human Resource	
Indicator	Conflict management
Prospect	Regularization of the surrounding communities and minimize invasion.
Details	During this monitoring period, Agro cortex carried out efforts to solve the land conflicts in the surrounding area and implemented actions to the regularization of these lands and minimize invasion. Agro cortex mapped the lands of each family and hired a lawyer to conduct all the regularization process of the lands.

Natural Resource	
Indicator	Land tenure
Prospect	The company would like to start the land tenure regularization procedure with the communities
Details	During this monitoring period Agro cortex hired a lawyer to conduct all the land tenure regularization process of the communities lands.

Carbon Resource	
Indicator	Stakeholder consultation
Prospect	Conduct another Stakeholder Consultation Meeting and formalize Stakeholder's comments to facilitate the implementation of suggestions.
Details	During this monitoring, in 2020, Agro cortex promoted a stakeholder consultation during the interviews to the Socio Environmental Diagnosis elaboration and the company registered the community's members comments and suggestions.

6.3.2 Not Achieved Prospects

Social Resource	
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Indicator	Women inclusion
Prospect	Develop a program to empower women and valorize children and adolescents, with a cycle of lectures.
Details	Due the COVID-19 pandemic, Agro cortex couldn't develop actions with the communities nor the employers related to women empowerment. The company pretends to develop the program during the nest monitoring period.

Human Resource	
Indicator	Public health
Prospect	Include other themes of public health in lectures and campaigns
Details	Due the COVID-19 pandemic, Agro cortex couldn't develop more actions with the communities nor the employers related to other themes of public health in lectures and campaigns. The company pretends to develop these actions in the future.

Financial Resource	
Indicator	Alternative income sources
Prospect	The company will start to acquire native seeds from the community to produce seedlings in its nursery.
Details	During this monitoring period, Agro cortex didn't acquire any native seeds from the community. On the other hand, the company supported the generation of alternative income sources through the wood and wood residues donation that allowed the residents in the construction of a vegetable garden, in which they can cultivate both for subsistence and selling.

6.3.3 Identified Prospects

Social Resource	
Indicator	Women inclusion
Responsible	Marcos Preto
Timescale	2024

It was noted that Agro cortex has the potential to promote more actions and investments related to the women inclusion among the activities of the industry as well as the management.

In order to do that, the company could adopt a internal political focusing on the admission of women in a specific period of time as goals that Agro cortex wanted to achieve. In addition, the company could promote more actions such as lectures or trainings that focus on the women residents of the community and of those who work at the company. These actions can be focused on technical activities, women empowerment, and miscellaneous subjects. Agro cortex could also do a public consultation among the women who lives in the local communities and those who work at the company to know what subjects they think is more relevant.

Human Resource	
Indicator	Conflict management
Responsible	Marcos Preto
Timescale	2024

During the monitoring period it was not observed the existence of conflict inside the project area. However, due the illegal invasion that happened, it is important that the project owner continue to monitor the area to avoid that a situation like this happened again in the future. In order to the a more effective monitoring, the company could do a analysis to identify the areas that have a high potential to be illegally invaded and contract its own team to monitor these areas to avoid new possible conflicts.

Financial Resource	
Indicator	Carbon credit benefits
Responsible	Marcos Preto
Timescale	2024

Regarding the Carbon credit benefits indicator, it was clearly noted that all the income from the sale of carbon credits was used in social and environmental actions in order to allow that the Agro cortex Carbon project continues to exist. However, the control of the income destination can be improved. Agro cortex could do a registry about how much money are going to each social and environmental action they are promoting. Thereby, Agro cortex will have a more detailed registry about the destination of the income from your carbon credit sales.

Natural Resource	
Indicator	Land tenure
Responsible	Marcos Preto
Timescale	2024

During the monitoring period it was not observed the existence of conflict inside the project area due to land tenure. However, due the illegal invasion that happened, it is important that the project owner continue to monitor the area to avoid that a situation like this happened again in the future. In order to the a more effective monitoring, the company could do a analysis to identify the areas that have a high potential to be illegally invaded and contract its own team to monitor these areas to avoid new possible conflicts due to land tenure.

Biodiversity/Technology Resource	
Indicator	Impact on remaining flora
Responsible	Marcos Preto
Timescale	2024

Although the company promotes the elaboration of annuals monitoring reports regarding the impact of the project on the remaining flora, it was noted that Agrocortex can improve its action to mitigate its impacts more efficiently.

The company could adopt a reforestation plan to mitigate its impacts as well as the expansion of the planting of different species in the project area.

Carbon Resource	
Indicator	Stakeholder consultation
Responsible	Marcos Preto
Timescale	2024

During this monitoring period Agro cortex didn't promote a formal local stakeholder consultation. Therefore, it is important that, for the next monitoring, the company promotes a formal local stakeholder consultation with those who are impacted and affected by the Agro cortex carbon project. With this formal stakeholder consultation, Agro cortex will be able to identify not only the perception of their stakeholders, but also improvement points that perhaps, without this consultation, the company on it own, wouldn't be able to identify.

In addition, a formal stakeholder consultation allows a more valuable relationship between the company and their stakeholders.

APPENDIX I – PROJECT AREA CONTOUR COORDINATES

Project Area Contour Coordinates											
UTM 19L, Datum WGS84											
Point	X	Y	Point	X	Y	Point	X	Y	Point	X	Y
1	497572.79	9036841.97	268	503153.60	9042237.99	535	488400.14	9040803.03	802	503153.14	9042178.05
2	497707.38	9036830.75	269	503153.14	9042229.16	536	488397.91	9040799.64	803	503185.37	9042151.20
3	497813.94	9036836.36	270	503153.14	9042237.99	537	488248.61	9040572.71	804	503237.68	9042107.60
4	497948.53	9036645.68	271	503153.60	9042237.99	538	488232.53	9040548.26	805	503281.24	9042073.72
5	498043.87	9036583.99	272	511826.19	9087206.05	539	488216.26	9040519.49	806	503292.53	9042070.49
6	498116.78	9036612.03	273	512159.68	9086960.66	540	488145.37	9040394.06	807	503292.69	9042065.72
7	498245.76	9036527.91	274	512807.77	9086954.37	541	488108.72	9040407.63	808	503296.70	9042065.72
8	498357.93	9036365.28	275	513018.56	9086293.69	542	487964.34	9040461.10	809	503296.70	9042046.88
9	498543.00	9036365.28	276	512980.81	9086016.83	543	487817.37	9040400.44	810	503288.90	9042037.66
10	498711.24	9036314.80	277	513023.76	9085804.44	544	487610.43	9040315.04	811	503261.88	9042030.16
11	498795.36	9036269.94	278	513094.07	9085456.82	545	487541.96	9040286.78	812	503189.28	9041996.28
12	498851.44	9036090.48	279	513395.36	9084919.63	546	487516.06	9040295.73	813	503165.08	9041947.88
13	498918.74	9036051.22	280	513358.46	9084617.94	547	487173.21	9040414.17	814	503213.48	9041899.48
14	498918.74	9035978.31	281	513240.19	9083651.31	548	487209.75	9040464.41	815	503261.88	9041889.80
15	498789.75	9035759.60	282	508748.87	9047024.50	549	487226.85	9040487.92	816	503309.39	9041896.13
16	498733.67	9035681.08	283	508087.89	9045661.42	550	487297.04	9040537.47	817	503369.01	9041881.46
17	498784.15	9035596.96	284	507759.13	9043731.58	551	487454.80	9040648.83	818	503417.23	9041869.60
18	498868.27	9035501.62	285	508062.27	9043261.92	552	487354.23	9040782.92	819	503417.81	9041869.45
19	498812.19	9035355.81	286	508147.66	9042732.50	553	487246.96	9040776.21	820	503419.69	9041868.88
20	498789.75	9035243.65	287	507964.07	9042083.52	554	487300.60	9040970.65	821	503421.52	9041868.19
21	498896.31	9035120.27	288	507946.99	9041613.87	555	487073.28	9041242.89	822	503423.31	9041867.38
22	499002.86	9035052.97	289	508016.04	9041233.08	556	487244.19	9041402.12	823	503425.04	9041866.46
23	499120.25	9034950.90	290	508005.41	9041233.08	557	487091.36	9041470.89	824	503426.71	9041865.42
24	499121.01	9034940.24	291	508005.41	9041261.79	558	487028.27	9041448.18	825	503428.31	9041864.28
25	497637.57	9034940.24	292	507976.70	9041261.79	559	487007.86	9041457.66	826	503429.82	9041863.04
26	497637.57	9034198.52	293	507976.70	9041204.37	560	486928.19	9041382.12	827	503431.26	9041861.69
27	497504.44	9033589.93	294	508005.41	9041204.37	561	486847.19	9041482.12	828	503432.60	9041860.26
28	497528.53	9033509.65	295	508005.41	9041175.66	562	486744.20	9041452.12	829	503433.85	9041858.75
29	497531.20	9033500.74	296	508026.45	9041175.66	563	486735.16	9041424.21	830	503434.99	9041857.15
30	497524.71	9033499.06	297	508087.89	9040836.51	564	486731.51	9041382.84	831	503436.03	9041855.49
31	497440.18	9033455.29	298	507861.60	9040341.54	565	486742.40	9041301.17	832	503436.95	9041853.76
32	497468.23	9033422.55	299	507895.76	9040145.14	566	486707.01	9041203.16	833	503437.76	9041851.97
33	497468.23	9033394.80	300	508066.54	9039931.66	567	486705.37	9041197.75	834	503438.46	9041850.13
34	497476.80	9033394.80	301	507972.61	9039590.09	568	486709.60	9041175.66	835	503439.03	9041848.26
35	497324.67	9033320.42	302	507712.17	9039239.99	569	486712.20	9041162.12	836	503439.47	9041846.35
36	497300.62	9033308.66	303	507549.92	9038906.96	570	486689.53	9041145.71	837	503439.80	9041844.41
37	497295.96	9033306.39	304	507268.13	9038667.87	571	486687.95	9041140.54	838	503439.99	9041842.46
38	497256.82	9033287.25	305	507144.31	9038240.91	572	486685.23	9041105.15	839	503440.05	9041840.50
39	497247.10	9033285.56	306	507246.78	9037788.34	573	486615.22	9041066.52	840	503440.00	9041838.64
40	497076.97	9033255.97	307	507383.41	9037378.46	574	486606.28	9041061.58	841	503439.33	9041827.72
41	497105.54	9033290.89	308	507122.97	9036934.42	575	486609.53	9041075.08	842	503558.71	9041840.92
42	497020.05	9033294.61	309	506542.31	9036823.41	576	486613.23	9041090.47	843	503615.91	9041819.47
43	496982.87	9033287.17	310	506478.26	9036533.08	577	486577.98	9041064.95	844	503657.31	9041836.03
44	496934.55	9033261.15	311	506485.92	9036467.95	578	486491.20	9041002.12	845	503669.95	9041836.03
45	496880.12	9033267.20	312	506488.74	9036468.23	579	486471.67	9040973.64	846	503669.95	9041841.08
46	496878.36	9033295.29	313	506481.15	9036461.72	580	486395.20	9040862.12	847	503710.94	9041857.48
47	496804.85	9033287.12	314	503843.01	9036204.45	581	486373.68	9040915.92	848	503711.88	9041857.86
48	496810.30	9033205.45	315	503728.38	9036193.28	582	486331.20	9041022.12	849	503716.13	9041858.33
49	496838.86	9033206.51	316	499063.95	9035739.02	583	486174.20	9041062.12	850	503716.40	9041859.34
50	496842.84	9033193.46	317	499116.28	9035006.43	584	486020.20	9041202.12	851	503809.32	9041845.37
51	496792.36	9033158.19	318	499081.38	9035052.97	585	485884.20	9041202.12	852	503823.87	9041988.72
52	496808.93	9033120.76	319	498929.96	9035165.13	586	485883.20	9041052.12	853	503831.02	9042008.77
53	496862.39	9033069.04	320	498851.44	9035260.47	587	486013.20	9040862.12	854	503838.36	9042096.76
54	496905.74	9033118.44	321	498840.23	9035350.20	588	485907.42	9040815.32	855	503841.73	9042137.18
55	496975.44	9033075.30	322	498913.13	9035473.58	589	485900.20	9040812.12	856	503842.20	9042142.93
56	496990.13	9033078.97	323	498890.70	9035529.66	590	485687.00	9040875.76	857	503860.49	9042229.57
57	497034.91	9033090.17	324	498800.97	9035664.26	591	485632.20	9040892.12	858	503892.31	9042266.70
58	497005.18	9033138.49	325	498823.40	9035720.34	592	485417.20	9040782.12	859	503899.64	9042266.70
59	496980.53	9033181.63	326	498918.74	9035866.15	593	485227.20	9040532.12	860	503899.64	9042275.25
60	497061.67	9033050.26	327	498986.04	9036073.65	594	485233.70	9040428.22	861	503899.86	9042275.51
61	497089.21	9033005.66	328	498868.27	9036281.15	595	485237.20	9040372.12	862	503908.71	9042295.41
62	497008.85	9032888.21	329	498772.93	9036398.92	596	485089.41	9040335.41	863	503928.35	9042295.41
63	497002.05	9032878.28	330	498514.95	9036410.14	597	485076.20	9040332.12	864	503928.35	9042324.12
64	496983.51	9032906.70	331	498408.40	9036443.79	598	484944.20	9040402.12	865	503957.07	9042324.12
65	496980.13	9032911.88	332	498301.85	9036578.39	599	484944.20	9040582.12	866	503957.07	9042378.01
66	496927.34	9032992.84	333	498167.25	9036673.72	600	484875.20	9040792.12	867	503960.28	9042381.55
67	496922.71	9032999.93	334	498077.52	9036701.76	601	484802.20	9040842.12	868	503985.78	9042381.55
68	496908.61	9033021.55	335	497982.18	9036690.55	602	484757.21	9040962.12	869	503985.78	9042409.60
69	496901.4										

99	496841.13	9034794.37	366	494414.10	9037490.99	633	473467.02	9073887.44	900	507740.08	9041035.20
100	496932.03	9034794.37	367	494413.59	9037492.11	634	474211.26	9074911.96	901	507755.34	9040988.85
101	497068.39	9034794.37	368	494373.88	9037578.15	635	475066.51	9074991.57	902	507809.45	9040985.75
102	497125.20	9034868.22	369	494381.62	9037640.07	636	475481.78	9075561.29	903	507868.05	9041055.87
103	497102.48	9035004.58	370	494392.89	9037730.26	637	475737.04	9076637.61	904	507858.41	9041126.01
104	497119.56	9035049.60	371	494400.69	9037792.70	638	475894.76	9077591.94	905	507817.57	904118.23
105	497164.97	9035169.34	372	494125.81	9037886.56	639	475928.67	9078437.75	906	507783.82	9041099.17
106	497079.75	9035180.70	373	494157.81	9037927.71	640	476158.88	9079438.57	907	504436.79	9041109.91
107	497045.74	9035175.60	374	494172.74	9037946.90	641	476147.02	9079782.60	908	504428.52	9041209.15
108	496966.12	9035163.66	375	494281.24	9037986.88	642	476469.25	9080341.93	909	504337.55	9041200.88
109	496880.90	9035072.76	376	494300.13	9037993.83	643	476108.25	9080741.93	910	504300.58	9041144.00
110	496843.56	9035074.25	377	494276.26	9038091.94	644	476102.86	9081116.85	911	504246.09	9041141.41
111	496768.08	9035083.85	378	494274.77	9038098.06	645	475674.25	9081651.93	912	504153.17	9041152.56
112	496767.67	9035077.29	379	494239.79	9038241.90	646	475773.21	9082842.14	913	504091.32	9041149.47
113	496738.86	9035078.44	380	494194.04	9038257.97	647	475692.62	9083266.28	914	504064.08	9041161.16
114	496716.14	9034947.76	381	494058.98	9038305.43	648	476055.25	9084431.91	915	504058.78	9041074.82
115	496719.40	9034936.58	382	493991.72	9038329.06	649	475644.71	9085235.60	916	504030.50	9040970.42
116	496705.25	9034929.66	383	493917.97	9038346.33	650	491931.83	9085231.60	917	503933.86	9040862.63
117	496546.14	9035030.43	384	493879.27	9038418.39	651	494213.96	9085555.16	918	503926.03	9040848.54
118	496841.14	9035399.18	385	493649.58	9038311.86	652	494251.44	9085548.23	919	503842.86	9040812.90
119	496750.44	9035444.53	386	493633.69	9038304.49	653	494437.34	9085513.84	920	503818.84	9040810.26
120	496658.00	9035490.75	387	493620.87	9038298.55	654	494816.29	9085443.76	921	503762.19	9040907.39
121	496549.46	9035545.02	388	493455.36	9038221.79	655	504521.78	9085452.73	922	503822.42	9040950.41
122	496543.16	9035548.17	389	493234.11	9038228.49	656	509484.11	9090735.41	923	503839.63	9041062.27
123	496492.04	9035573.73	390	493200.94	9038291.75	657	509496.02	9090384.01	924	503813.82	9041242.96
124	496485.73	9035576.88	391	493104.06	9038476.49	658	509460.56	9090271.46	925	503812.16	9041244.02
125	496463.32	9035588.09	392	493089.96	9038503.38	659	509626.35	909106.16	926	503813.73	9041253.66
126	496438.87	9035600.32	393	493019.89	9038618.78	660	509838.14	9089969.11	927	503801.70	9041250.67
127	496348.48	9035531.74	394	492984.09	9038671.74	661	510021.90	9089744.86	928	503719.17	9041303.20
128	496332.29	9035519.46	395	492903.08	9038811.18	662	510246.16	9089654.53	929	503584.16	9041196.61
129	496319.77	9035509.96	396	492879.50	9038850.01	663	510786.55	9089523.72	930	503511.63	9041178.59
130	496256.59	9035462.04	397	492874.37	9038858.47	664	511247.51	9089202.91	931	503509.99	9041201.63
131	496244.44	9035452.82	398	492862.00	9038878.83	665	511638.40	9088586.21	932	503489.67	9041226.47
132	496061.36	9035448.75	399	492827.59	9038964.86	666	511755.20	9088090.99	933	503457.45	9041202.31
133	495975.23	9035446.83	400	492794.96	9039046.45	667	511712.93	9087558.42	934	503448.82	9041195.83
134	495942.74	9035446.11	401	492473.14	9039033.04	668	511826.19	9087206.05	935	503424.56	9041204.39
135	495922.03	9035462.04	402	492479.45	9039022.28	669	502519.23	9045829.83	936	503448.31	9041166.39
136	495768.42	9035580.20	403	492496.28	9038993.57	670	502498.13	9045783.42	937	503451.39	9041162.54
137	495573.26	9035485.77	404	492501.11	9038985.32	671	502434.99	9045787.05	938	503402.42	9041157.10
138	495560.58	9035479.63	405	492513.11	9038964.86	672	502431.31	9045636.40	939	503323.36	9041148.32
139	495548.04	9035490.75	406	492529.94	9038936.15	673	502427.53	9045628.10	940	503309.68	9041118.23
140	495314.86	9035697.43	407	492587.12	9038838.61	674	502430.19	9045590.88	941	503300.16	9041097.27
141	495288.90	9035720.44	408	492558.54	9038832.59	675	502427.84	9045494.65	942	503280.33	9041053.67
142	495265.58	9035741.11	409	492501.11	9038820.50	676	502439.21	9045494.00	943	503324.52	9041047.35
143	495286.15	9035761.68	410	492357.56	9038790.28	677	502439.44	9045493.98	944	503340.57	9041045.06
144	495312.51	9035788.04	411	492332.35	9038784.97	678	502441.39	9045493.79	945	503374.98	9041093.43
145	495440.29	9035749.15	412	492321.86	9038774.48	679	502443.33	9045493.47	946	503452.43	9040993.43
146	495466.71	9035741.11	413	492164.73	9038617.36	680	502445.24	9045493.03	947	503473.53	9040993.43
147	495500.24	9035848.38	414	492150.33	9038649.03	681	502447.12	9045492.46	948	503490.10	9040980.49
148	495429.70	9035930.67	415	492131.21	9038691.11	682	502447.30	9045492.40	949	503542.01	9040960.39
149	495419.78	9035942.25	416	492151.32	9038818.49	683	502555.91	9045417.20	950	503542.64	9040960.14
150	495429.70	9035946.31	417	491896.55	9039033.04	684	502536.40	9045395.52	951	503544.43	9040959.33
151	495439.07	9035950.14	418	491798.25	9039000.27	685	502431.30	9045434.38	952	503546.16	9040958.41
152	495458.42	9035958.05	419	491695.42	9038965.99	686	502426.37	9045434.66	953	503547.83	9040957.37
153	495567.28	9036002.59	420	491635.08	9038758.15	687	502426.08	9045422.86	954	503549.42	9040956.23
154	495601.97	9035936.10	421	491621.29	9038764.28	688	502441.76	9045239.61	955	503550.94	9040954.99
155	495624.61	9035892.71	422	491582.34	9038781.59	689	502470.87	9045055.59	956	503552.38	9040953.65
156	495630.69	9035881.07	423	491574.73	9038784.97	690	502545.05	9044947.13	957	503553.72	9040952.22
157	495639.59	9035864.00	424	491576.46	9038821.30	691	502660.14	9044821.80	958	503554.96	9040950.70
158	495647.74	9035848.38	425	491577.83	9038850.01	692	502636.76	9044823.15	959	503555.68	9040949.70
159	495676.13	9035864.00	426	491580.57	9038907.44	693	502666.13	9044862.51	960	503555.68	9040912.83
160	495716.82	9035886.38	427	491581.44	9038925.76	694	502451.75	9044784.34	961	503546.49	9040889.59
161	495728.33	9035892.71	428	491553.63	9038931.85	695	502518.49	9044681.65	962	503495.45	9040838.55
162	495745.53	9035902.17	429	491533.97	9038936.15	696	502529.23	9044737.52	963	503495.45	9040778.32
163	495781.83	9035922.13	430	491521.93	9038938.78	697	502597.33	9044775.98	964	503572.89	9040700.88
164	495775.49	9036036.27	431	491383.10	9038969.15	698	502670.99	9044785.87	965	503607.31	9040649.25
165	495775.12	9036042.82	432	491366.89	9038972.70	699	502729.23	9044782.53	966	503608.62	9040646.62
166	495835.46	9036042.82	433	491269.68	9039348.15	700	502730.02	9044795.46	967	503641.72	9040580.42
167	495860.38	9036016.43	434	491383.46	9039575.71	701	502784.81	9044782.23	968	503658.93	9040494.37
168	495868.76	9036007.56	435	491383.66	9039576.10	702	502802.59	9044893.79	969	503712.52	9040429.30
169	495889.09	9035986.03	436	491323.31	9039723.60	703	502802.92	9045035.94	970	503706.53	9040400.10
170	495895.88	9035978.85	437	491323.31	9039891.22	704	502730.13	9045078.48	971	503714.95	9040336.97
171	495899.86	9035974.63	438	491189.22	9039985.08	705	502728.62	9045079.43	972	503756.02	9040341.86
172	495881.92	9035975.91	439	491193.95	9040055.90	706	502727.02	9045080.57	973	503778.54	9040344.54
173	495831.67	9035978.42	440	491201.60	9040170.75	707	502725.50	9045081.81	974	503791.77	9040362.18
174	495831.67	9035978.85	441	491202.63	9040186.22	708	502724.07	9045083.15	975	503788.70	9040371.41
175	495830.93	9035978.85	442	490947.86	9040534.85	709	502722.73	9045084.59	976	503894.98	9040393.70
176	495830.80	9035978.47	443	490760.13	9040528.15	710	502721.48	9045086.10	977	503931.44	9040446.63
177	495827.47	9035978.63	444	490750.30	9040515.29	711	502720.34	9045087.70	978	503951.49	9040451.35
178	495825.35	9035961.72	445	490694.70	9040442.58	712	502719.30	9045089.36	979	503953.29	9040478.34

204	496090.07	9036591.27	471	490056.16	9039495.65	738	503095.72	9043099.34	1005	494681.64	9037753.11
205	495887.89	9036581.79	472	490020.64	9039537.43	739	503124.43	9043099.34	1006	494683.60	9037753.18
206	495832.11	9036579.18	473	489942.18	9039629.74	740	503124.43	9043070.63	1007	494685.56	9037753.12
207	495829.28	9036581.79	474	490062.86	9039897.92	741	503153.14	9043070.63	1008	494687.51	9037752.92
208	495774.24	9036632.59	475	490062.86	9040033.34	742	503153.14	9043128.05	1009	494689.45	9037752.61
209	495767.07	9036639.22	476	490062.86	9040132.58	743	503124.43	9043128.05	1010	494691.36	9037752.16
210	495657.79	9036740.09	477	489955.59	9040213.03	744	503124.43	9043214.19	1011	494693.24	9037751.59
211	495483.48	9036559.06	478	489885.19	9040461.10	745	503101.47	9043214.19	1012	494695.08	9037750.90
212	495322.57	9036612.70	479	489916.55	9040486.58	746	503089.79	9043307.37	1013	494696.86	9037750.09
213	495255.30	9036581.79	480	489917.07	9040487.00	747	502975.40	9043325.48	1014	494698.60	9037749.17
214	495200.01	9036556.39	481	489931.79	9040498.97	748	502934.07	9043300.91	1015	494700.26	9037748.14
215	495192.81	9036553.08	482	489992.47	9040548.26	749	502913.71	9043228.93	1016	494701.86	9037746.99
216	495142.59	9036530.01	483	490000.98	9040551.83	750	502967.39	9043195.05	1017	494703.38	9037745.75
217	495130.32	9036524.37	484	490200.31	9040635.42	751	502980.87	9043173.87	1018	494704.06	9037745.11
218	495085.16	9036503.62	485	490280.76	9040776.21	752	502980.87	9043156.76	1019	494730.10	9037795.33
219	495074.50	9036498.72	486	490220.42	9040963.94	753	502952.16	9043156.76	1020	494707.19	9037955.04
220	495034.27	9036565.77	487	490118.05	9040957.34	754	503187.19	9042962.64	1021	494629.66	9037938.39
221	495065.17	9036581.79	488	490031.91	9040951.78	755	503213.28	9042911.72	1022	495444.55	9037758.97
222	495113.88	9036607.04	489	490012.58	9040950.53	756	503268.76	9042908.53	1023	495444.55	9037701.55
223	495120.55	9036610.50	490	490009.53	9040945.96	757	503271.95	9042915.41	1024	495601.97	9037701.55
224	495171.30	9036636.82	491	490003.20	9040936.46	758	503260.85	9042972.53	1025	495601.97	9037672.84
225	495215.29	9036659.63	492	489990.39	9040917.25	759	503203.91	9042996.99	1026	495659.40	9037672.84
226	495113.88	9036717.38	493	489974.49	9040893.40	760	503187.19	9042962.64	1027	495659.40	9037787.68
227	495099.88	9036725.35	494	489971.25	9040888.54	761	503088.83	9042902.31	1028	495573.26	9037787.68
228	495056.45	9036750.08	495	489917.07	9040807.26	762	503096.30	9042791.33	1029	495573.26	9037758.97
229	495049.46	9036754.06	496	489894.69	9040773.69	763	503163.98	9042822.75	1030	495544.55	9037758.97
230	494970.32	9036799.13	497	489888.35	9040764.19	764	503168.74	9042900.15	1031	504000.16	9037205.83
231	494948.62	9036811.49	498	489876.68	9040746.69	765	503110.93	9042910.53	1032	503833.07	9037169.71
232	494811.10	9036889.80	499	489865.08	9040729.28	766	503088.83	9042902.31	1033	503833.07	9037156.03
233	495217.37	9036914.87	500	489847.97	9040752.09	767	503870.93	9042553.82	1034	503833.07	9037107.19
234	496101.28	9037016.47	501	489824.85	9040782.92	768	503870.93	9042496.39	1035	503832.06	9037098.60
235	496193.18	9037027.04	502	489854.91	9040679.11	769	503899.64	9042496.39	1036	503812.22	9037098.60
236	497124.13	9037127.98	503	489871.23	9040931.34	770	503899.64	9042488.67	1037	503812.36	9037098.01
237	497398.93	9037178.46	504	489891.90	9040997.46	771	503861.60	9042496.28	1038	503812.68	9037096.07
238	497511.10	9037189.67	505	489824.38	9041004.00	772	503813.51	9042498.96	1039	503812.86	9037094.28
239	497628.87	9037150.42	506	489772.33	9041009.04	773	503813.51	9042525.11	1040	503819.93	9036995.48
240	497499.88	9037071.90	507	489684.06	9041017.58	774	503698.66	9042525.11	1041	503818.44	9036982.81
241	497483.06	9036970.96	508	489543.26	9041325.99	775	503698.66	9042553.82	1042	503821.97	9036966.91
242	497572.79	9036841.97	509	489502.57	9041305.64	776	503612.53	9042553.82	1043	503823.15	9036950.46
243	496121.38	9035905.97	510	489391.25	9041249.98	777	503612.53	9042525.11	1044	503823.16	9036950.30
244	496150.40	9035852.22	511	489382.35	9041245.53	778	503583.81	9042525.11	1045	503823.18	9036950.01
245	496301.47	9035853.93	512	489371.54	9041119.43	779	503583.81	9042467.68	1046	503823.94	9036936.56
246	496266.93	9035954.30	513	489362.24	9041010.87	780	503526.39	9042467.68	1047	503828.49	9036937.59
247	496121.38	9035905.97	514	489125.44	9040917.25	781	503497.68	9042467.68	1048	503832.37	9036920.11
248	495692.73	9035774.43	515	489103.17	9040908.45	782	503354.12	9042467.68	1049	503828.96	9036890.49
249	495726.73	9035626.64	516	489073.94	9040896.90	783	503354.12	9042525.11	1050	503826.53	9036890.63
250	495803.23	9035643.07	517	489062.68	9040866.07	784	503353.51	9042525.11	1051	503827.33	9036876.44
251	495855.67	9035619.21	518	489058.87	9040855.65	785	503272.50	9042430.31	1052	503823.55	9036843.67
252	495887.20	9035688.80	519	488983.10	9040648.27	786	503268.40	9042419.94	1053	503829.58	9036836.68
253	495748.38	9035802.47	520	488946.56	9040548.26	787	503242.98	9042415.70	1054	503832.34	9036787.78
254	495692.73	9035774.43	521	488940.59	9040493.69	788	503220.10	9042301.32	1055	503832.38	9036786.90
255	496441.58	9033759.51	522	488923.09	9040333.72	789	503220.96	9042300.03	1056	503832.50	9036782.28
256	496478.15	9033746.16	523	488986.90	9040200.78	790	503218.91	9042294.84	1057	504049.78	9036760.63
257	496478.02	9033752.18	524	489003.55	9040166.10	791	503176.59	9042279.73	1058	504051.71	9036791.92
258	496441.58	9033759.51	525	488894.38	9040212.89	792	503155.40	9042272.16	1059	504147.34	9036842.55
259	497120.17	9033430.83	526	488878.85	9040219.54	793	503154.04	9042246.27	1060	504166.42	9037014.30
260	497147.89	9033427.63	527	488862.75	9040226.44	794	503149.50	9042266.70	1061	504170.94	9037015.33
261	497172.39	9033446.69	528	488862.12	9040227.39	795	503124.43	9042266.70	1062	504169.39	9037041.08
262	497186.01	9033498.41	529	488842.46	9040256.88	796	503124.43	9042237.99	1063	504172.15	9037065.84
263	497158.82	9033533.97	530	488826.02	9040281.54	797	503095.72	9042237.99	1064	504180.42	9037189.89
264	497150.61	9033544.70	531	488823.32	9040285.60	798	503095.72	9042180.57	1065	504089.15	9037195.60
265	497066.21	9033482.08	532	488768.60	9040367.67	799	503124.43	9042180.57	1066	504086.39	9037208.61
266	497077.11	9033435.80	533	488742.07	9040407.47	800	503124.43	9042151.85	1067	504000.16	9037205.83
267	497120.17	9033430.83	534	488668.32	9040843.26	801	503153.14	9042151.85			

APPENDIX II – DEFINITION OF BIOMASS STOCKS

A total of 14 different forest phytophysiognomies were identified in the reference region, while 3 of them are present in the project area and 8 in the leakage belt.

These forest phytophysiognomies were grouped in accordance to their presence in each project spatial boundary (reference region, project area and leakage belt), according to the predominant category of each phytophysiognomy, following instructions from the Brazilian Institute for Geography and Statistics - IBGE.

Afterwards, biomass stocks were calculated through the weighted average between above ground biomass values for each phytophysiognomy, which were obtained from Salimon *et al.* (2011)⁴⁵, and the presence of each phytophysiognomy within each project boundary.

Table below details the presence of each phytophysiognomy within each project spatial boundary and the grouping method adopted according to the predominant forest class. These data were used to calculate the weighted average of biomass stocks in each grouped forest class. In addition, the figure 23 presents the forest classes existing at each project boundary, RR, LB and PA.

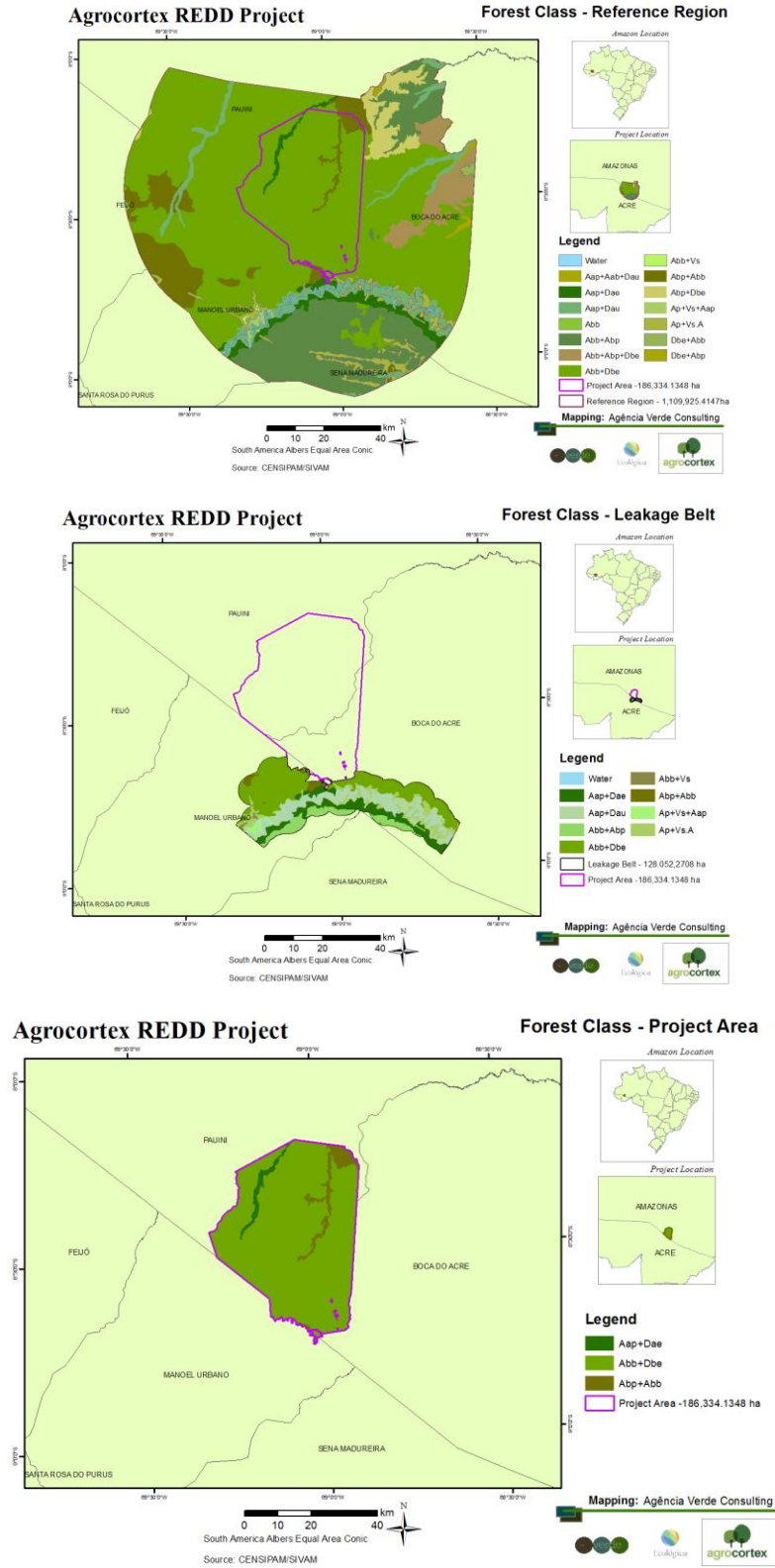
⁴⁵ SALIMON, C.I.; PUTZ, F.E.; MENEZES-FILHO, L.; ANDERSON, A.; SILVEIRA, M.; FOSTER BROWN, I.; OLIVEIRA, L.C. Estimating state-wide biomass carbon stocks for a REDD plan in Acre, Brazil. 2011, Forest Ecology and Management, 262, p. 555–560, 2011.

Table 41. Presence of each phytophysognomy within each project spatial boundary and the grouping method adopted according to the predominant forest class

				REFERENCE REGION			PROJECT AREA			LEAKAGE BELT		
Acronym	Vegetation classes (IBGE)	Grouped classes	Average above ground biomass (Mg ha ⁻¹)	Area of the vegetation class in the RR (ha)	% of the class in the grouped vegetation type	% of the class in the RR	Area of the vegetation class in the PA (ha)	% of the class in the grouped vegetation type	% of the vegetation class in the PA	Area of the vegetation class in the LK (ha)	% of the class in the grouped vegetation type	% of the vegetation class in the Leakage Belt
Abb	Floresta Ombrófila Aberta Terras Baixas com Bambu	Abb	192.80	362.16	0.04%	0.03%						
Abb+Abp	Floresta Ombrófila Aberta Terras Baixas com Bambu + Palmeiras		186.50	163,377.76	18.55%	14.72%				11,537.28	19%	9%
Abb+Abp+Dbe	Floresta Ombrófila Aberta Terras Baixas com Bambu + Palmeiras + Floresta Ombrófila Densa de terras Baixas com Dossel Emergente		274.90	41,426.30	4.70%	3.73%						
Abb+Dbe	Floresta Ombrófila Aberta Terras Baixas com Bambu + Floresta Ombrófila Densa de terras Baixas com Dossel Emergente		274.20	675,167.73	76.64%	60.83%	172,554.03	100%	93%	50,159.25	81%	39%
Abb+Vs	Floresta Ombrófila Aberta Terras Baixas com Bambu + Vegetação Secundária		114.90	625.84	0.07%	0.06%				526.94	1%	
Dbe	Floresta Ombrófila Densa de Terras Baixas com Dossel Emergente	Dbe	328.80	1,709.61	61.88%	0.15%						
Dbe+Abp	Floresta Ombrófila Densa de Terras Baixas com Dossel Emergente + Floresta		315.90	1,053.01	38.12%	0.09%						

	Ombrófila Aberta Terras Baixas com Palmeiras											
Aap+Aab+D au	Floresta Ombrófila Aberta Aluvial com Palmeiras + Bambu + Floresta Ombrófila Densa Aluvial com Dossel Uniforme	Aap	218.50	2,589.03	3.03%	0.23%						
Aap+Dae	Floresta Ombrófila Aberta Aluvial com Palmeiras + Floresta Ombrófila Densa Aluvial com Dossel Emergente		218.50	27,683.70	32.36%	2.49%	4,133.22	100%	2%	18,796.21	41%	15%
Aap+Dau	Floresta Ombrófila Aberta Aluvial com Palmeiras + Floresta Ombrófila Densa Aluvial com Dossel Uniforme		218.50	55,264.26	64.61%	4.98%				27,023.56	59%	21%
Abp+Abb	Floresta Ombrófila Aberta Terras Baixas com Palmeiras + Bambu	Abp	234.30	74,968.58	71.23%	6.75%	9,531.80	100%	5%	2,694.49	100%	2%
Abp+Dbe+A bb	Floresta Ombrófila Aberta Terras Baixas com Palmeiras + Floresta Ombrófila Densa de terras Baixas com Dossel Emergente + Bambu		274.90	30,275.41	28.77%	2.73%						
Ap+Vs.A	Pecuária + Vegetação Secundária	Ap	37.00	27,709.95	91.78%	2.50%				12,645.19	87%	10%
Ap+Vs+ Aap	Pecuária + Vegetação Secundária + Floresta Ombrófila Aberta Aluvial com Palmeiras		37.00	2,481.65	8.22%	0.22%				1,818.77	13%	1%

Figure 25. Forest classes existing at each project boundary, RR, LB and PA



APPENDIX III – METHODOLOGICAL PROCEDURES FOR LU/LC-CHANGE ANALYSIS

According to the applied methodology, in order to achieve a consistent time-series of LU/LC-change data over the crediting period, the detailed methodological procedures used in pre-processing, classification, post classification processing, and accuracy assessment of the remotely sensed data shall be carefully documented in the VCS PD. Therefore, the information below describes the methodological procedures applied during the current monitored period.

Data sources and pre-processing

The historic deforestation of the reference region should be analyzed through maps from MapBiomass (version 5.0, which was the last available version), available in raster format, which can be downloaded from the <http://mapbiomas.org/> website. MapBiomass is a multi-institutional initiative of the Greenhouse Gas Emissions Estimation System (SEEG - <http://seeg.eco.br/en/>) promoted by the Climate Observatory. MapBiomass co-creation involves NGO's, universities and technology companies.

Furthermore, at least two Landsat scenes per year should be necessary to compose the entire reference region (orbit/point: 002/066 and 003/66). The final mapping resolution should be 30m.

Table 42. Source of the remotely sense data used for historical reference period

Vector	Sensor	Resolution		Coverage (Km ²)	Acquisition date DD/MM/YY	Scene	
		Spatial (m)	Spectral (µm)			Path	Row
Satellite	Landsat TM	30	0.45 – 2.35	34,225	2020-2021	3	66
Satellite	Landsat TM	30	0.45 – 2.35	34,225	2020-2021	2	66

The forest dynamics data, the deforestation vectors and other base data from the studied region, which were used for the project's baseline construction, should be organized in a spatialized database. For this purpose, the software used in this baseline reassessment was the File Geodatabase format from ArcGIS 10.6. The files are stored in vector and matrix format (raster). In order to standardize spatial references, all data has been projected for the UTM and Datum WGS84, Zone 22S projection.

The MapBiomass methodology for land use classification uses 105 input variables, including the original Landsat bands, indexes, fractional and textural information derived from these bands, which are detailed in the table below.

			Reducer							
	band or index name	formula	median	median_dry	median_wet	amplitude	std Dev	min	Reference	
bands	blue	B1 (L5 e L7); B2 (L8)								
	green	B2 (L5 e L7); B3 (L8)								
	red	B3 (L5 e L7); B4 (L8)								
	nir	B4 (L5 e L7); B5 (L8)								
	swir1	B5 (L5 e L7); B6 (L8)								
	swir2	B7 (L5); B8 (L7); B7 (L8)								
	temp	B6 (L5 e L7); B10 (L8)								
index	ndvi	(nir - red)/(nir + red)								
	evi2	(2.5 * (nir - red)/(nir + 2.4 * red + 1)								
	cai	(swir2 / swir1)								
	ndwi	(nir - swir1)/(nir +								
		swir1)								
	gcvi	(nir / green - 1)								
		(-red*0.017 - nir*0.007 -								
	hall_cover	swir2*0.079 + 5.22)								
	pri	(blue - green)/(blue + green)								
	savi	(1 + L) * (nir - red)/(nir + red + 0,5)								
	textG	('median_green').entropy(ee.Kernel.square({radius: 5}))								
fraction	gv	fractional abundance of green vegetation within the pixel								
	npv	fractional abundance of non-photosynthetic vegetation within the pixel								
	soil	fractional abundance of soil within the pixel								
	cloud	fractional abundance of cloud within the pixel								
	shade	100 - (gv + npv + soil + cloud)								
	MEM index	gvs	gv / (gv + npv + soil + cloud)							
ndfi		(gvs - (npv + soil))/(gvs + (npv + soil))								
sefi		(gv+npv_s - soil)/(gv+npv_s + soil)								
wefi		((gv+npv) - (soil+shade)) / ((gv+npv) + (soil+shade))								
fns		((gv+shade) - soil) / ((gv+shade) + soil)								
slope		ALOS DSM: Global 30m								

Table 52. List, description and reference of bands, fractions and indexes available in the feature space⁴⁶

⁴⁶ Source: MapBiomass. Description of each column below.

Where,

Median - Median of the pixel values of the best mapping period defined by each biome.

Median_dry = median of the quartile of the lowest pixel NDVI values.

Median_wet = median of the quartile of the highest pixel NDVI values.

Amplitude = amplitude of variation of the index considering all the images of each year.

stdDev = standard deviation of all pixel values of all images of each year.

Min = lower annual value of the pixels of each band.

In addition, Landsat Images used in MapBiomass were accessible via Google Earth Engine, and most of them are composed by the Collection 1 Tier 1 from USGS. This is the highest quality Level-1 products suitable for pixel-level time series analysis. These images are radiometrically calibrated and orthorectified using ground control points (GCPs) and digital elevation model (DEM) data to correct for relief displacement.

Data classification and post-processing

The LU/LC classes defined for this project activity were: Forest, Non-Forest and Hydrography. In addition, the established LU/LC-change categories were:

- a) Forested areas that remains as forested areas (Conservation);
- b) Forest that are converted to non-forested areas (Deforestation); or
- c) Non-forested areas that remains as non-forested areas.

The image classification methodology for each year involves all Landsat images available for each period (Landsat 5 [L5], Landsat 7 [L7] and Landsat 8 [L8]) or other sensor available) with a cloud cover less than or equal to 50%. Thus, a representative mosaic of each year could be generated, selecting cloud free pixels from the available images. Metrics should be extracted for each pixel that describes its behavior during the year and could contain up to 105 layers of information. The mapping should be done with an artificial intelligence classifier, such as the Random Forest. The Landsat images acquisition could be made through Google Earth Engine, with data from NASA and USGS (U.S. Geological Survey).

The algorithm may use samples obtained by reference maps, stable collections from previous MapBiomass series and/or direct collection by visual interpretation of Landsat images in order to classify a single map per class. This classification should then go through spatial filter, applying neighborhood rules and temporal filters to reduce spatial and temporal inconsistencies. The software used in this baseline reassessment was the ArcGIS 10.6. In addition, high resolution images from Google Earth software (<https://earth.google.com/>) were also utilized to perform some LU/LC-change analysis.

Due to the pixel-based classification method and the long temporal series, the MapBiomass applies a chain of post-classification filters. The first post-classification action involves the application of temporal filters. Then, a spatial filter was applied followed by a gap fill filter. The application of these filters removes

classification noises. These post-classification procedures were implemented in the Google Earth Engine platform and are described below:

Gap Fill

The Gap fill is a temporal filter used to fill possible no-data values. In a long time series of severely cloud-affected regions, it is expected that no-data values may populate some of the resultant median composite pixels. In this filter, no-data values (“gaps”) are theoretically not allowed and are replaced by the temporally nearest valid classification

Spatial Filter

Spatial filter was applied to avoid unwanted modifications to the edges of the pixel groups (blobs), a spatial filter was built based on the “connectedPixelCount” function. This function locates connected components (neighbours) that share the same pixel value.

Temporal Filter

The temporal filter uses sequential classifications in a three-to-five-years unidirectional moving window to identify temporally non-permitted transitions. Based on generic rules (GR), the temporal filter inspects the central positions of three to five consecutive years, and if the extremities of the consecutive years are identical but the centre position is not, then the central pixels are reclassified to match its temporal neighbour class.

Frequency Filter

This filter takes into consideration the occurrence frequency throughout the entire time series. Thus, all class occurrence with less than given percentage of temporal persistence (eg. 3 years or fewer out of 33) are filtered out. This mechanism decreasing the number of false positives and preserving consolidated trajectories.

Incident Filter

An incident filter was applied to remove pixels that changed too many times in the 34 years of time span. All pixels that changed more than eight times and are connected to less than 6 pixels were replaced by the MODE value of that given pixel position in the stack of years.

Classification accuracy assessment

The MapBiomass results go through an accuracy evaluation, which remains in 95% for the entire Amazon Biome. However, to meet the particularities of the project’s region, an independent evaluation was carried out for the reference region.

Thus, in order to assess the accuracy of the maps produced by the MapBiomass methodology, a confusion matrix was generated calculating the percentages of user and producer correctness, as well as omission and commission errors.

A total of 210 random points was drawn on the reference region (70 points for each land use class – Forest, Non-Forest and Hydrography) and the degree of correctness of the classification was verified. High resolution images from Google Earth should also be used as reference, in which land use was visually possible at the drawn points.

The table below shows the final accuracy analysis carried out for each year and each land use class during the analyzed monitoring period.

Table 43. Summary of confusion matrices from the evaluation of MapBiomias from 2020 to 2021

Year	Producer accuracy			User accuracy		
	Forest	Hydrography	Deforestation	Forest	Hydrography	Deforestation
2020	98.53%	97.06%	90.54%	95.71%	94.29%	95.71%
2021	95.65%	98.53%	94.52%	94.23%	95.71%	98.57%