FLORESTAL SANTA MARIA PROJECT (FSM-REDD PROJECT) MONITORING REPORT

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The FSM farm is a rural property solely dedicated to sustainable management of natural forests located in the Municipality of Colniza, with a total area of 71,713.96 ha. A great amount of land-grabbers who conducted initial processes of illegal land occupation (by grabbing private farms) are still installed in the municipality. These land-grabbers have mechanisms to rapidly catching hold of lands and immediately exploiting local timber by means of clear-cutting the forests. The immediate timber revenues provide the necessary budget to implementing pasture and agriculture. On the other hand, some of these illegal invasions, when not contested by original landowners, can give the invader possession rights to claim such land to his/her ownership[1]. In this context, the common land-use practices are technically archaic and production scale does not reflect the real potential of land, resulting in low economic return for families, and inducing them to invade new areas in the region, as the only alternative of earning their subsistence from timber as an immediate source of income. This scenario induces the cycle of continuous land invasions and social conflicts, which causes damages to environment and communities in the region.

The FSM team is continuously negotiating with neighbors and public entities to enhance the vigilance mechanisms on the farm frontiers. The FSM farm is continuously avoiding invasions by means of vigilance bases. The FSM team is also currently making efforts to retrieve the FSC (Forest Stewardship Council) certification, to guarantee that sustainable forest management is being carried out according to the best practices. For the current monitoring period, it has been verified that the project area underwent deforestation in approximately 58 hectares, as a consequence of deforestation promoted by a neighbor, which overlapped the eastern FSM farm boundary.

The project activity is claiming total emission reductions of 6,076,632.0 tCO_2 for this verification period between 04 May, 2012 and 12 April, 2019, which corresponds to an average of 875,284.4 tCO_2 per year. These emission reductions are associated with the deforestation avoidance of 12,841 hectares along the verification period, with an average of 1,849.7 hectares protected per year.

[1] Characterizing steady land tenure, known in the Brazilian constitution as “usucapião” or “Uti Possidetis”: the acquisition of property by long possession without claim by others.

1.2 Sectoral Scope and Project Type

• Sectoral Scope: 14 - Agriculture Forestry and Other Land Use

• AFOLU – REDD - Avoiding Unplanned Deforestation and Degradation (AUDD)

• This is not a Grouped project.

1.3 Project Proponent

Organization name	Florestal Santa Maria S.A.
Contact person	Rubens Forbes Alves de Lima
Title	Landowner
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1.4 Other Entities Involved in the Project

Organization name	Ecologica Assessoria Ltda.
Role in the Project	Technical Advisory
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1.5 Project Start Date

Project start date: April 13th, 2009 (Date on which first money transfer was made to K2C consultancy and the participants started to work on the project development.) This document is available for consultation by auditors. All documents and records will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

1.6 Project Crediting Period

Start date: April 13th, 2009

End date: April 13th, 2039

Total number of years: 30 years

1.7 Project Location

Country: Brazil

State: Mato Grosso

Municipality: Colniza

Project boundary coordinates (meters; SAD69):

UTM 21

0237843	8972335
0233198	9004336
0252337	8987942
0271190	8988449
0269828	8972729

1.8 Title and Reference of Methodology

Approved VCS Methodology VM0007 Version 1.5

9 March 2015 REDD Methodology Module

“REDD+ Methodology Framework (REDD-MF)”

Sectoral Scope 14, from Avoided Deforestation Partners (ADP).

This REDD Methodology Framework provides guidance for constructing methodologies for REDD project activities compliant with the validation and verification requirements of the VCS. By using this document, a REDD methodology was constructed based on a set of pre-defined VCS-approved modules. The resulting methodology is VCS-approved without the requirement of a methodology validation.

1.9 Participation under other GHG Programs

Not applicable: the project is not engaged to other emissions trading program and the host country has not binding limits on GHG emissions.

The project neither has nor intends to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program. The VCS Program has a central project database, which lists each approved project. The VCS Project Database is the central storehouse of information on all projects validated to VCS criteria and all Verified Carbon Units issued under the program. Every VCU can be tracked from issuance to retirement in the database, allowing buyers to ensure every credit is real, additional, permanent, independently verified, uniquely numbered and fully traceable online. This project has not been registered in any other credited activity, and no VCUs have been assigned to the project area so far. Thus, any possibility of double counting of credits is eliminated.

The project has not been registered, and it is not seeking registration under any other GHG programs.

This project has not been rejected under any other GHG program.

1.10 Other Forms of Credit

Not applicable: the project is not involved in other Emission Trading Programs, other Binding Limits or other Forms of Environmental Credit.

1.11 Sustainable Development

This project activity promotes sustainable development by avoiding deforestation in the Project Area and promoting social benefits. The FSM REDD Project is committed to conduct social-environmental activities linked to the preservation of the forest stewardship and maintaining the integrity of the Santa Maria property. The model proposed by this project includes its replication in areas with a potential to receive REDD projects. The central idea is to multiply preserved areas in the surrounding region adopting sustainable practices, converting the region into a model for sustainable development and with the benefits of the income arising from the reduction in emissions.

The contribution to sustainable development is being monitored applying the SOCIALCARBON® Standard, which is based in six main pointers: Technology; Natural; Financial; Human; Social and Carbon Resources.

2 SAFEGUARDS

2.1 No Net Harm

Between 2000 and 2005, illegal occupation in the region, led by professional land-grabbers (mainly over private lands)[2], generated uncontrollable pressure over local landowners, becoming extremely threatening, given the lack of governmental infrastructure and law enforcement to preserve privately owned lands. The deforestation pressure in the State of Mato Grosso is mostly the result of illegal land-grabbing by invasion of private lands, using to such objective logging, slash-and-burning and cattle-ranching. However, other factors contributed to deforestation in the State of Mato Grosso. According to the Amazon Institute for Environmental Research (IPAM)[3], the causes of tropical deforestation are apparently the same in different regions of the planet and can directly be accounted for (a) conversion of forest areas into areas for agriculture and cattle breeding for the purpose of land possession or not; (b) timber extraction; and (c) land-clearance by fire. There also indirect causes such as (d) governmental subsidies and incentives to agriculture and cattle breeding; (e) investment policies in infrastructure projects; (f) illegality of land possession and ownership; (g) lack of state governance and law enforcement; and (h) market drivers, such as rising commodities prices. All of these patterns can be found in the Brazilian Amazon and specifically in the State of Mato Grosso.

The FSM farm is one of the few sites in the region that still preserves all native forest. Several illegal occupations in the FSM farm were eradicated and registered by local authorities and by the farm self-vigilance system. These invasions originated judicial prosecutions for repossession of land tenure. Thanks to an extensive self-vigilance system and landowner's investments and efforts, these invasions have not caused significant damage to original vegetation.

(i) According to research carried out by National Indian Foundation (FUNAI), villages and isolated native Brazilian were in regions outside the project area. Reserve areas were created for this purpose. Namely:

a. T.I. Escondido;

b. T.I. Arara do Rio Branco; and

2 Invasion of public lands was less prone to legal settlement, whereas private lands that were not deemed “productive” could be acquired by means of adverse possession (usucapião) and are more easily subject

3 IPAM. REDD in Brazil: An Amazonian approach (2012). Available at: https://ipam.org.br/wp-content/uploads/2015/12/redd_no_brasil_um_enfoque_amaz%C3%B4nico.pdf. Last visited on 03/11/2020.

c. T.I. Rio Pardo.

Key: T.I.: Territory of native Brazilians

(ii) The so-called Forest People, known in Acre and in Amazonas, are mostly the remaining rubber tappers from the rubber boom occurred at the beginning of last century. The woods from this region of Colniza, do not count on Pará rubber trees in a number which is commercially sustainable. This fact explains why there are no forest people in the place where the colonization Project was developed.

For these reasons, considering the low risk of cultural impact or conflict in the possession of the offered lots, during the 80’s and 90’s the National Institute for Colonization and Agrarian Reform (INCRA) and the Institute of Territories of the State of Mato Grosso (INTERMAT), chose part of this area to resettle new immigrants from other parts of the country. On the other hand, exactly for these people not being used and lacking knowledge of how to live with and manage the Amazon forest, is that the rampant deforestation began. They were seeking (a) easy profit with the sale from the wood (b) to create conditions for their own subsistence through agriculture/ livestock, without exploring from the forest the benefits which it could have provided them. This was the beginning of the invasions process and of total lack of control of the region, which resulted in the current environmental situation.

The FSM farm has 7 fixed vigilance points distributed all along the property, which control all entrances and boundaries of the farm. The portion southeast of the farm is the most critical in terms of invasion risks, as several roads and trails have been made to access farm boundaries passing through INCRA settlements. All vigilance points are provided with lodgings for guards, where at least one guard (contracted by the FSM farm) keeps in charge of a certain area of forest.

During this monitoring period, various meetings and consultations were held with the employees of FSM farm to explain the company’s proposition and enquire about their opinions. It became apparent that the workers were motivated to attend the meetings in order to be informed about the company's plans and proposals and the project.

An assessment of potential environmental and socio-economic risks of the Project was performed on October, 2020 as part of the design of the SOCIALCARBON Report – Point Zero. The main potential environmental and socio-economic risks that are evaluated as part of SOCIALCARBON certification are detailed in the table below:

Activity	Aspect	Impact	Effect		Comments/ Observation
			Beneficial	Adverse	
REDD: Carbon credit project	Conservation of Amazon Rainforest	Greenhouse Gas Emissions Reductions	X		Monitored by the Carbon resource: • Project performance.
REDD: Carbon credit project	Conservation of Amazon Rainforest	Monitoring and supervision to avoid deforestation of forest within the project area.	X		Monitored by the Biodiversity resource: • Biodiversity conservation.
REDD: Carbon credit project	Conservation of Amazon Rainforest	Conflict management with communities in the project area, due to land tenure issues		X	Monitored by the Carbon resource: • Stakeholder consultation Monitored by the Natural resource: • Land tenure.
REDD: Carbon credit project	Application of the Social Carbon methodology	Encouragement and investment in research on social, economic and environmental aspects in the project region.	X		Monitored by the Human resource: • Public Health • Community education Monitored by the Financial resource: • Securing of funds Monitored by the Natural resource: • Social and environmental investments Monitored by the Biodiversity resource: • Biodiversity research.
REDD carbon project	Uncertainties relating to standing forest in the future.	Non permanence of carbon: Time which carbon will remain stocked in live biomass, without being emitted into the atmosphere. Due to the uncertainties related to what		X	Monitored by the Carbon resource: • Buffer reduction.

		will happen to the forest in future, there is a risk of non-permanence of forest carbon.			
Sustainable forest management	Vehicle transport	Air Pollution, Noise and soil erosion		X	Monitored by the Human resource: • Conflict management.
Sustainable forest management	Presence of company/ workers on local communities	Conflicts between company/ workers and local communities		X	Monitored by the Human resource: • Conflict management.

Table 1. Main social, economic and environmental impacts of the FSM-REDD Project

The identified impacts were monitored through the indicators described on the last column of the table above. In the table below (Table 2), it is possible to observe the monitoring methods for each of the 18 socio-environmental indicators evaluated by the SOCIALCARBON Standard for the present project. At each monitoring period, SOCIALCARBON Standard proposes a historical analysis and promotes the continuous improvement of socio-environmental activities in the project, thus mitigating at least part of the impacts, ensuring a sustainable livelihood for the local community.

Resource	Indicator	Evaluation Methods
Social	**1. Women inclusion:** Evaluates initiatives implemented by the company to promote women inclusion in the community activities.	Questionnaire, interviews with communities, reports, among others.
	2. Expansion of community activities: Evaluates whether the community activities implemented by the company extend to all affected communities.	Questionnaire, interviews with communities, reports, among others
	3. Associations and Cooperatives: Evaluates whether communities residing in/around the project area are involved in associations or cooperatives	Questionnaires; interviews with communities; meeting minutes; attendance lists; association records.

Human	**4. Conflict management:** 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.	Questionnaire, procedures, interviews with communities, reports, among others.
	5. Public health: Evaluates the company's actions to mitigate the impacts of its activities related to the public health of surrounding communities.	Questionnaire, interviews with communities, reports, among others
	6. Community education and training: Evaluates the relevant education and training programs implemented as a project activity, including additional programs to the stakeholders and broader community.	Questionnaire, interviews with communities, reports, among others
Financial	**7. Alternative income sources:** Evaluates whether the project created alternative sources of income generation for the communities living within/surrounding the project area.	Questionnaire, interviews with communities
	8. Carbon credit benefits: Evaluates whether proceeds from the sale of carbon credits was distributed to carbon project improvements or activities that benefit the local community.	Questionnaire and/or control spreadsheets.
	9. Securing of funds: 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.	Questionnaire, requests for proposals, meetings with project proponent and project area supervisors; interviews with communities and program teachers/ trainers.
Natural	**10. Land tenure:** Evaluates the existence of conflicts due to land tenure, as well as whether actions are being taken to manage the issue.	Questionnaire, documents, meetings with project proponent and project area supervisors; interviews with communities.
	11. Social and environmental investments: Evaluates the socio-environmental investments	Questionnaire, documents, meetings with project

	in the different areas: education; alternative income generation; environment; sport and infrastructure.	proponent and project area supervisors; interviews with communities.
	12. Quality control: Evaluates the quality control of the management plan operation.	Reports, studies, documents, communication with project proponent, among others.
Biodiversity	**13. Non-timber forest products (NTFPs):** Evaluates the sustainable use of natural resources by communities in/around the project area for income generation.	Communication with project proponent/ environmental bodies working in the area.
	14. Biodiversity monitoring: Evaluates whether the company has actions to identify and monitor the local fauna and flora.	Reports, studies, documents, communication with project proponent, among others.
	15. Impact on remaining flora: Evaluates the company actions to monitor the impact on the remaining flora.	Technical reports on the management plan.
Carbon	**16. Buffer reduction:** Measures the progression of the buffer in the current monitoring period compared to VCS PD and Monitoring Report.	VCS PD and Monitoring Report.
	17. Stakeholder consultation: Evaluates the methodology used for the stakeholder consultation regarding the carbon project.	Informative letter, satisfaction questionnaire, occurrence book, etc.
	18. Project performance: Evaluates project performance in relation to verified emissions reductions.	VCS PD and Monitoring Report.

Table 2. Monitoring methods of SOCIALCARBON indicators for Florestal Santa Maria Project[4]

The following measures were planned by FSM to mitigate this risk:

- Regular meetings with neighboring farms located within the leakage management area explaining about the project;

[4] As established by the approved SOCIALCARBON methodology Indicators for REDD + SFMP, Version 1.2, available at: https://www.socialcarbon.org/wp-content/uploads/2012/11/Template_Submission_of_new_indicators_REDD+SFMP_v1.2_EN11.pdf. Last visited on February 19th, 2021.

- Establish procedures to monitor fauna;
- Establish and monitor time limits for harvest transportation to avoid disturbing locals during rest periods;
- Promote lectures and educational/health campaigns;

During this monitoring period there were no record of significant harms regarding the risks described above. FSM established procedures to monitor and report on environmental or socioeconomic impacts from its forest operations throughout the entire monitoring period. These risks will be monitored as part of the present monitoring report and also as part of the monitoring of the non-permanence risk, which is evaluated at each verification event. Nevertheless, from this monitoring period onwards, these risks will also be assessed by the SOCIALCARBON Standard.

2.2 Local Stakeholder Consultation

During the validation process, an explanatory letter was sent to major stakeholders asking their opinion about the project. Moreover, they were also invited to get to know and comment on the project through the communication channel (the project website). Furthermore, the stakeholders were informed that the period for requesting information and comments about the Project was 30 days from the receipt of the letter, and it could be done through the form for comments, which should be sent by email or via the website. As no answer was obtained within 30 days, it was assumed that stakeholders have no objections to the project activity.

The purpose of this local stakeholder consultation was:

- 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.

From the project validation onwards, two communication channels were created for the project. The online permanent communication channel with local stakeholders[5] was created to receive any comments or suggestions regarding the present REDD project. All comments received are documented and stored in digital format for up to two years. The local communication channel was created to establish an effective interaction with the residents of the region, it consists of a public summary of the management plan and activities of the

[5] Available at: http://www.florestalsantamaria.com.br/site/en/contato.php

project, containing the physical, electronic address and contact phone.. The SOCIALCARBON methodology also analyzes the frequency and methods used for addressing the outcomes of each local stakeholder consultation. There were messages sent through the online platform registered on this monitoring period, however, none were addressed specifically to the Florestal Santa Maria REDD Project, but to questions about carbon projects.

No stakeholder consultations were carried out during this monitoring period. However, the project owner often holds meetings with farm employees, where the carbon project and its benefits are discussed. Moreover, through the informal communication channel, the residents of the region contacted the housekeepers at the base of the project to request assistance such as transporting purchases and buying medicines, for example, and were promptly attended to.

2.3 AFOLU-Specific Safeguards

Local Stakeholder Identification and Background

According to VCS Standard version 4.0, the project proponent shall conduct a thorough assessment of the local stakeholders that will be impacted by the project, including:

<u>1.The process(es) used to identify local stakeholders likely impacted by the project and a list of such stakeholders:</u>

Stakeholders were identified through research and previous social activities developed by Florestal Santa Maria in the project area. The main stakeholders included Governmental agents, Environmental and Agricultural Agencies, private sector, universities, and mainly people from the community who live near the project area and in the city of Colniza. According to the social impact studies, there are rural and indigenous communities affected by project activities. It is important to note that environmental and social activities carried out by the project 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.

<u>2. Identification of any legal or customary tenure/access rights to territories and resources, including collective and/or conflicting rights, held by local stakeholders:</u>

The region has a history of invasions and irregular land occupations. However, since the beginning of Florestal Santa Maria's operations in the region, the property is in the name of a single owner. As a way to contain conflicts and social tension, the organization has seen an opportunity to combine environmental preservation in the region with job generation.

3. A description of the social, economic and cultural diversity within local stakeholder groups and the differences and interactions between the stakeholder groups;

As stated in item 1, project stakeholders involve from government agencies to the resident community near the project area. Thus, by applying different forms of consultation, it is considered that the project covers the social, economic and cultural diversity of the different stakeholders.

According to the Social Impact Assessment report carried out by Florestal Santa Maria, the local community is formed by the population adjacent to the project area and the inhabitants of the city of Colniza, which has approximately 40,000[6] residents, who live essentially from agriculture and cattle raising. A large part of the population has low educational level, mainly in the rural area, which has poor infrastructure, public transport and communication, access to water through artesian wells and the electricity network has only been offered since 2009. For these stakeholders, communication with the project team is informal, carried out through direct communication with the employees present at the bases.

For government agencies, private agencies and NGOs, the contact method for suggestions and complaints is concentrated on the communications channel opened on the project website. There was no stakeholder consultation meeting in this monitoring period, however, the communication channel remains open and did not record comments on suggestions or complaints in the period.

4. Any significant changes in the makeup of local stakeholders over time;

No changes were identified among the stakeholders involved with the project. Any future significant changes will be informed in this section.

5. The expected changes in well-being and other stakeholder characteristics under the baseline scenario, including changes to ecosystem services identified as important to local stakeholders;

The risks of the project were analyzed in this monitoring period, as detailed in Table 1, showing the positive and negative impacts of the project and how they are being monitored by the SOCIALCARBON Standard indicators. The project planning is focused on forest conservation and sustainable community development, using approved methodologies to monitor these advances. Communities are directly impacted, as there are actions aimed exclusively at them, such as expanding income sources, generated by hiring people from the community, as a way to empower and create community independence, besides that

[6] According to the Brazilian Institute of Geography and Statistics (2020). Available at: https://www.ibge.gov.br/cidades-e-estados/mt/colniza.html. Last visited on February 15th, 2021.

preventing illegal deforestation of property and directing resources to expand education, professionalization and environmental education actions.

Risks to Local Stakeholders

The main potential environmental and socio-economic risks for stakeholders were evaluated in the table below (Table 3) and as part of SOCIALCARBON certification from this monitoring period onwards.

As described above, Florestal Santa Maria management team has expertise and prior experience in implementing projects with community engagement within the project region, such as the construction of an elementary school, renovation of roadways, transportation of students, in addition to meetings with the community of Colniza - MT, which made it possible to identify the main difficulties of the communities and future projects to be developed in the region.

Aspect	Impact	Effect		Comments/ Observation
		Beneficial	Adverse	
Sustainable Forest Management Plan	Logging		X	Florestal Santa Maria works with the Sustainable Forest Management Plan, exploring a volume below that authorized by the Exploration License. Furthermore, sustainable management certifications (FSC) are guarantees of planned management that reduce impacts on the environment and communities. Despite the fact that the project has not had the FSC seal for a couple of years, project activities continue to be held under the guidelines of certification.
Sustainable Forest Management Plan	Reduced access to land due to expansion of exploration		X	There are no inhabitants within the project area, and therefore, the community is not and will not be affected by logging activities. In any case, the expansion of the exploration is not foreseen, and, if there is one, it will be communicated and implemented in order to avoid the removal of residents or limitation of access to land.
Resources	Withdrawal of natural,		X	The region where the population lives does not exceed the limits of the farm, and therefore, it is not and

	economic and intangible resources (water, food, alternative income, cultural events, etc.) from families			will not be affected by logging activities. The project's objective is to guarantee financial resources to maintain sustainable wood management and also to expand the socio-environmental benefits for the communities affected by the Project's activities. Thus, the use of SOCIALCARBON Standard is a guarantee that there will be no reduction in access and/or withdrawal of resources from impacted families.
Land access	Reduced access to traditional areas		X	The farm does not include communities' access regions, and therefore, they are not or will not be affected by the maintenance of activities. There are no plans to expand the management area.
Land use	Displacement of families due to project activity		X	Families have never been and will not be removed from the area surrounding the project. Florestal Santa Maria maintains a long-term relationship with local families, and one of the objectives of the carbon project is to expand social and environmental benefits.
Food Security	Withdrawal of land used for food production or income generation		X	The project area does not include communities' access regions, and therefore, they will not be affected by the maintenance of activities.
Climate change adaptation	Adaptations and impacts related to the climate crisis	X		The objective of the project is forest conservation, avoiding deforestation of the Amazon Forest. 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 communities.

Table 3. Risks to Local Stakeholders

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.

The project owner formally hired the local community, offered technical training, workplace security, first aid and fire training programs, in addition to providing education for children. Conflict management was monitored by SOCIALCARBON indicators, specifically Stakeholder consultation and Conflict management. Nevertheless, there was no record of conflicts during this monitoring period. The project owner's strategy to maintain land tenure and manage possible conflicts is to promote benefits to the community, through the generation of jobs and the establishment of good relationship with them. FSM also tried to create a partnership with the municipality of Colniza to offer technical courses, as a way to prevent young people from becoming squatters through vocational education, but the project did not proceed.

No community member has been or will be removed from their land. 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 at the time of validation. As described above, the project opened to stakeholders a communication and information channel about the REDD project. This communication channel addresses about:

- 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 process of VCS Program validation and verification.

Grievance redress and conflict management procedures, as well as benefit sharing mechanisms have been discussed in communication meetings with farm employees. Furthermore, a permanent communication channel 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.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The FSM team is continuously negotiating with neighbors and public entities to enhance the vigilance mechanisms on the farm frontiers. The implementation of these improved mechanisms is dependent on VCU benefits.

The FSM farm is continuously avoiding invasions by means of vigilance bases, as described in the VCS-PD. The FSM team is also currently making efforts to retrieve the FSC (Forest Stewardship Council) certification, to guarantee that sustainable forest management is being carried out according to the best practices.

For the current monitoring period, it has been verified that the project area underwent deforestation in approximately 58 hectares, as a consequence of deforestation promoted by a neighbor, which overlapped the eastern FSM farm boundary. It is noteworthy that the fact is not related to the deforestation pressures caused by professional land grabbers or other deforestation agents that aim to systematically invade rural properties to settle and spread deforestation through internal roads. On the contrary, the characteristic of the observed deforestation leads to the conclusion that it resulted from a planning error in forest suppression, with no intention of progressive deforestation within the Project Area. For the purpose of estimates, it has been evidenced that the deforested area corresponds to 3.4% of the estimated annual area of deforestation foreseen in the baseline for 2018 (year of occurrence of this deforestation). According to T-SIG (Tool for testing significance of GHG emissions in A / R CDM project activities), "*the sum of decreases in carbon pools and increases in emissions that may be neglected shall be less than 5% of the total decreases in carbon pools and increases in emissions, or less than 5% of net anthropogenic removals by sinks, whichever is lower*". Thus, this spot deforestation was negligible for calculation purposes, according to T-SIG.

The monitoring procedures also show that *ex post* deforestation inside the Leakage Belt has been far below that estimated *ex ante*, corresponding to 984 hectares in 2018, and 126 hectares in 2019.

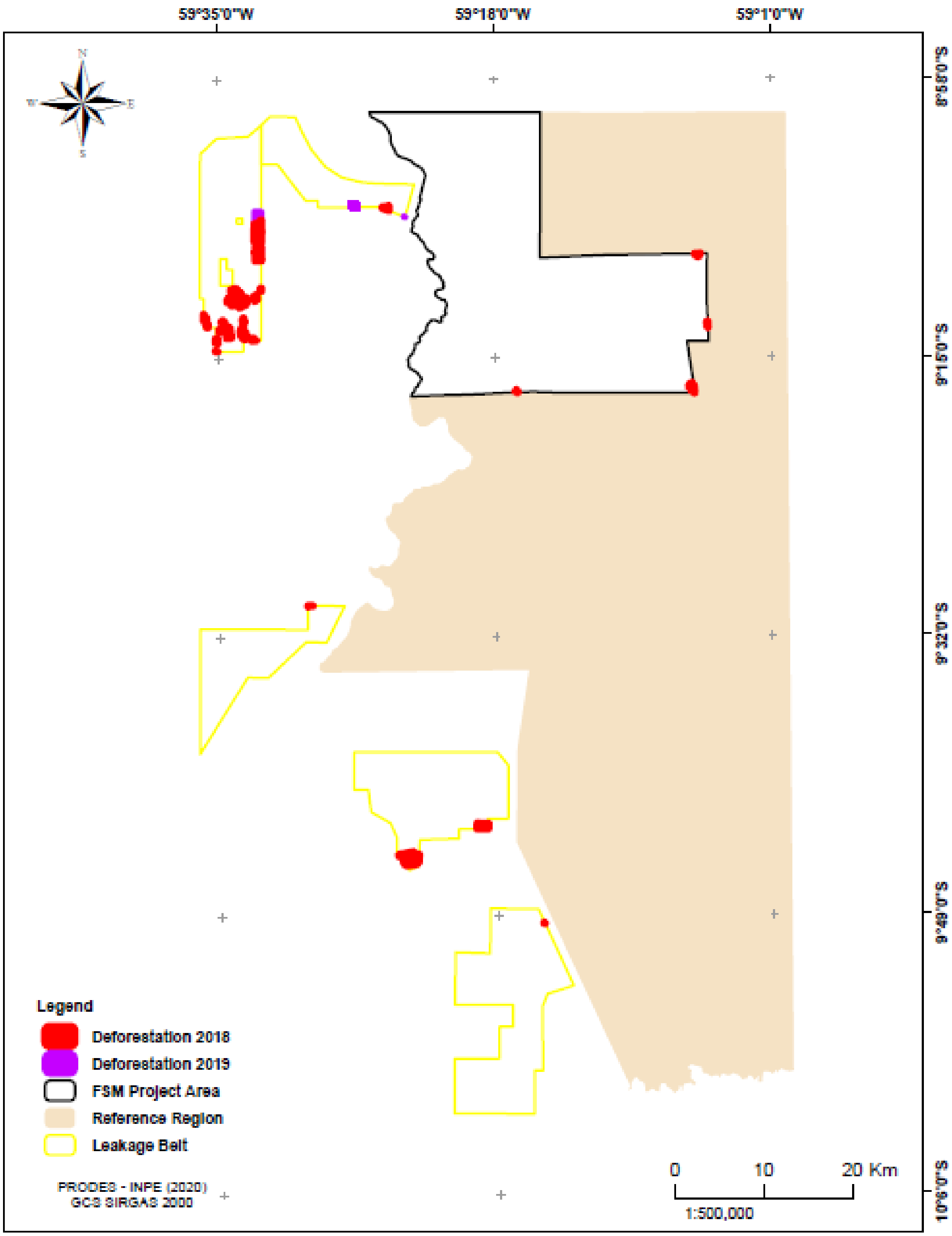


Figure 1. Deforestation occurred in the Project Area and Leakage Belt during the current monitoring period.

3.2 Deviations

3.2.1 Methodology Deviations

According to VCS rules, methodology deviations shall be reported in all subsequent verification reports. Therefore, this section describes all methodology deviations described in the validated VCS PD.

In the analysis of leakage outside the leakage belt, for calculating PROPIMM, the participatory rural appraisal (PRA) approach was replaced by local official data available from IBGE. This practice is justified by the fact that the IBGE and DataSus have a precise approach for accounting population locally, which allowed calculating the number of immigrants from 2012 to 2019 in the municipality of Colniza. The number of immigrants has been estimated assuming that the annual growth in the municipal population[7], excluding the difference between births[8] and deaths[9], reflects the exact number of immigrants according to official available data. According to the number of immigrants, we have inferred the proportion of deforestation attributed to immigrant agents.

As the country has a great variety of forest biomes in all its extension, TOTFOR considered only the Amazon Rainforest biome, instead of the whole Brazilian territory. This is a conservative approach. Thus, as a representation of the total area of Amazon Rainforest in Brazilian Territory, TOTFOR consisted of the total Amazon forest area (5.015.067,749 km²)[10] multiplied by the net preserved forest (97%)[11]. As TOTFOR was considered only for the Amazon biome, PROTFOR and MANFOR were evaluated solely for Brazilian Northern and Centre-West macro-regions.

3.2.2 Project Description Deviations

The areas exploited inside the FSM farm from 13rd April 2009 to 31st December 2011 (First Monitoring Period) and from 1st April 2017 to 12th April 2019 (Current Monitoring Period) were excluded from the calculation of VCU benefits. This is due to the fact that these areas were not certified by the FSC (Forest Stewardship Council) at the moment of timber harvest and,

[7] ftpftp.ibge.gov.brEstimativas_de_PopulacaoEstimativas_2012; ftpftp.ibge.gov.brEstimativas_de_PopulacaoEstimativas_2013; ftpftp.ibge.gov.brEstimativas_de_PopulacaoEstimativas_2014; ftpftp.ibge.gov.brEstimativas_de_PopulacaoEstimativas_2015; ftpftp.ibge.gov.brEstimativas_de_PopulacaoEstimativas_2016; ftpftp.ibge.gov.brEstimativas_de_PopulacaoEstimativas_2017; ftpftp.ibge.gov.brEstimativas_de_PopulacaoEstimativas_2018; ftpftp.ibge.gov.brEstimativas_de_PopulacaoEstimativas_2019

[8] http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sinasc/cnv/nvmt.def

[9] http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sim/cnv/obt10mt.def

[10] https://www.ibge.gov.br/geociencias/cartas-e-mapas/mapas-regionais/15819-amazonia-legal.html

[11] http://meioambiente.am.gov.br/unidade-de-conservacao/

consequently, were not eligible to the Project, according to M-MON v2.1. The documents showing the areas exploited within this time period are available for consultation by auditors and will be kept in a secure retrievable manner for at least two years after the end of the project crediting period. Thus, the baseline emissions and project emissions occurring inside these areas were not quantified for the present verification period. The project calculations have been designed to project deforestation firstly in all “Very High” risk deforestation areas, followed by “High” risk areas, and so on. The current total “Very High” risk area in the PA is 22,509.1 hectares, from which 5,549.98 hectares have been projected to be deforested in the First Monitoring Period. For the current monitoring period, 12,841.24 hectares have been projected for deforestation in PA. Thus, there are still 4,117.8 hectares to be deforested in the “Very High” risk areas, prior to beginning the projected deforestation in “High” risk areas. Thus, this deviation does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario.

NON-FSC AREAS EXCLUDED from 13rd April 2009 to 31st December 2011 (First Monitoring Period) - UPAs 23 and 24

		Stratum			
		Aluvial	**Encosta**	**FOB Densa Submontana**	**FOB Submontana Cipós e Palmeiras**
Deforestation risk class	5 (Very High)	1,151.8	247.0	4,050.2	2,796.3
	4 (High)	4.5	2.2	0.0	12.3
	3 (Medium)	0.6	0.0	0.0	2.1
	2 (Low)	0.0	0.0	0.0	0.0
	1 (Very Low)	0.0	0.0	0.0	0.0

NON-FSC AREAS EXCLUDED from 1st April 2017 to 12th April 2019 (2nd Monitoring Period) - UPAs 2012 (25), 2017 and 2018

		Stratum			
		Aluvial	**Encosta**	**FOB Densa Submontana**	**FOB Submontana Cipós e Palmeiras**
Deforestation risk class	5 (Very High)	312.8	879.3	847.3	1,399.7
	4 (High)	516.5	84.9	991.2	0.0
	3 (Medium)	0.0	0.0	378.8	0.0
	2 (Low)	0.0	0.0	0.0	0.0
	1 (Very Low)	0.0	0.0	0.0	0.0

For the calculation of the deforestation rate in the validated VCS-PD, the difference in deforested areas between the satellite images was systematically divided by 3, assuming that the interval between the images was 3 years. However, a detailed assessment of the calculations shows that the interval between the images does not correspond to 3 years. In this scenario, the intervals between the satellite images were adjusted, in order to obtain the exact interval to be considered in the deforestation rate calculations. Moreover, the deforestation rate has been decreased inside the Project Area, due to deduction of areas harvested without FSC certification during the monitoring period. This mathematical operation caused variation in the calculation of deforestation rate, which has changed from 2,104.9 ha/year (VCS-PD) to 1,850.1 ha/year (current Monitoring Period). The updated spreadsheet is available for evaluation by the auditors.

During development of this Monitoring Report, the audit team noted that the sum of parameters SLF_{ty} (Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product ty; dimensionless) and OF_{ty} (Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product ty; dimensionless) could not be more than 1 (i.e. 100%). In this case, given that SLF_{ty} is indicated to be 0.2 for sawnwood (default value, according to VCS Module VMD0005 REDD Methodological Module: Estimation Of Carbon Stocks In The Long-Term Wood Products Pool (CP-W)), thus OF_{ty} has been adjusted to 0.8 (current Monitoring Report), instead of 0.84 (VCS-PD).

The logging damage factor used has been set as 0.67 tC/m^3, being the most conservative default value, proposed in M-MON v2.1. This was also the most conservative value for logging damage factor in the VCS-PD.

Furthermore, according to VCS rules, project description deviations shall be reported in all subsequent verification reports. Therefore, this section also describes below all Project Description Deviations verified in the 1st monitoring report, which comprised the 2009 – 2012 period.

The areas exploited inside the FSM farm from 13th April 2009 to 31st December 2011 were excluded from the calculation of VCU benefits. This is due to the fact that these areas were not previously certified by the FSC (Forest Stewardship Council) and, consequently, were not eligible to the Project, according to M-MON v2.1. Thus, baseline emissions and project emissions occurring inside these areas were not quantified.

Moreover, the deduction factor (LF_{ME}) was adopted as 0.2 (since the First Monitoring Report) instead of 0.4 (VCS-PD), based on the fact that the forest biomass is considered to be less in Project Area than in the average of Amazon Biome. It is important to consider that the Market Leakage is not calculated only for the Reference Area, but for all Amazon Biome. The scientific literature demonstrates that the forest occurring inside the FSM region has less biomass than that observed in the average of Amazon Biome. Thus, it is expected that the areas to be deforested in the Amazon Biome in the project case, as a result of project leakage, are less than those that would be observed in the project region.

During development of this Monitoring Report, the project team has noted a mistake in the frequency of monitoring / recording of $A_{RRL,forest,t}$ (Remaining area of forest in RRL at time t), which was set to 5 years in the First Monitoring Report and VCS-PD. This frequency has then been corrected to every 10 years, since it is only applicable to the baseline renewal.

3.3 Grouped Projects

Not applicable: this is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	***CF***
Data unit	tC t d.m^{-1}
Description	Carbon fraction of dry matter in t Ct^{-1} d.m.
Source of data	Values from the literature (e.g. IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3) shall be used if available, otherwise default value of 0.47 t C t^{-1} d.m. can be used.
Value applied	0.47
Justification of choice of data or description of measurement methods and procedures applied	The default value was used to be more conservative.
Purpose of Data	• Calculation of baseline emissions; • Calculation of project emissions; • Calculation of leakage.
Comments	Where new species are encountered in the course of monitoring, new carbon fraction values must be sourced from the literature or otherwise use the default value.

Data / Parameter	***R***
Data unit	t root d.m.t^{-1} shoot d.m.
Description	Root to shoot ratio appropriate to species or forest type / biome; note that as defined here, root to shoot ratio is applied as belowground biomass per unit area: aboveground biomass per unit area (not on a per stem basis)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Ch. 4, AFOLU, pg. 4.49, Table 4-4.
Value applied	0.37
Justification of choice of data or description of	Local values are not known, and the IPCC factor is a conservative value.

measurement methods and procedures applied	
Purpose of Data	• Calculation of baseline emissions; • Calculation of project emissions; • Calculation of leakage.
Comments	Guidelines for Conservative Choice of Default Values: Global values may be selected from Table 4.4 (modified as given above) of the AFOLU Guidelines (IPCC 2006), by choosing a climatic zone and forest type that most closely matches the project circumstances.

Data / Parameter	***ln(Volume, m³) = -8.939 + 2.507*ln(DBH, cm)***
Data unit	$m^3.tree^{-1}$
Description	Allometric equation to estimation of aboveground merchantable volume of trees, in the range between 4.46-cm and 81.99-cm DBH.
Source of data	Peer-reviewed scientific article: NOGUEIRA, E.M.; FEARNSIDE, P.M.; NELSON, B.W.; BARBOSA, R.I.; KEIZER, E.W.H., 2008. Estimates of forest biomass in the Brazilian Amazon: New allometric equations and adjustments to biomass from wood-volume inventories. Forest Ecology and Management, 256(2008): 1853-1867.
Value applied	$\ln(\text{Volume, } m^3) = -8.939 + 2.507*\ln(\text{DBH, cm})$
Justification of choice of data or description of measurement methods and procedures applied	Peer-reviewed work performed in the region of FSM farm, with a similar vegetation typology. The statistical quality of model is in conformance with methodology requirements.
Purpose of Data	• Calculation of baseline emissions; • Calculation of project emissions; • Calculation of leakage.
Comments	The result of such equation must be converted to mass by multiplying it by the wood density.

Data / Parameter	***Volume, m³ = -0.4306 + 0.0011*(DBH, cm)²***
Data unit	$m^3.tree^{-1}$
Description	Allometric equation to estimation of aboveground merchantable volume of trees with DBH higher than 82 cm.

Source of data	Peer-reviewed scientific article: COLPINI, C.; TRAVAGIN, D.P.; SOARES, T.S.; SILVA, V.S.M. e, 2009. Determinação do volume, do fator de forma e da porcentagem de casca de árvores individuais em uma Floresta Ombrófila Aberta na região noroeste de Mato Grosso. Acta Amazonica, 39(1): 97-104.
Value applied	Volume, m^3 = -0.4306 + 0.0011*$(DBH, cm)^2$
Justification of choice of data or description of measurement methods and procedures applied	Peer-reviewed work performed in the region of FSM farm, with a similar vegetation typology. The statistical quality of model is in conformance with methodology requirements.
Purpose of Data	• Calculation of baseline emissions; • Calculation of project emissions; • Calculation of leakage.
Comments	The result of such equation must be converted to mass by multiplying it by the wood density.

Data / Parameter	***ln(Mass, kg) = -6.3789 – 0.877*ln(1/(DBH, cm)^2) + 2.151*ln(Height, m)***
Data unit	kg.tree^{-1}
Description	Allometric equation to estimation of total aboveground biomass of palms.
Source of data	Peer-reviewed scientific article: SALDARRIAGA, J.G., WEST, D.C., THARP, M.L., UHL, C., 1988. Long-term chronosequence of forest succession in the upper Rio Negro of Colombia and Venezuela. Journal of Ecology, 76: 938–958.
Value applied	ln(Mass, kg) = -6.3789 – 0.877*ln(1/(DBH, cm)^2) + 2.151*ln(Height, m)
Justification of choice of data or description of measurement methods and procedures applied	Peer-reviewed work. The statistical quality of model is in conformance with methodology requirements.
Purpose of Data	• Calculation of baseline emissions; • Calculation of project emissions; • Calculation of leakage.
Comments	The result of such equation must be divided by 1000 to obtain the biomass value in t.

4.2 Data and Parameters Monitored

In a conservative approach, the project proponent opted not to monitor forest degradation in the Reference Area and Project Area. According to previous studies for characterization of the Reference Area, illegal extraction of smaller trees for fuelwood and charcoal is not a usual practice in the FSM region. Moreover, the practice of illegal logging of smaller trees and forest degradation is expected to be pretty much more pronounced in non-protected areas, as those observed in the Reference Area, than in protected forest areas, as the FSM farm. As demonstrated in the VCS-PD, the FSM farm has a system for monitoring boundaries and for hindering any invasion that might endanger the forest. The only carbon loss inside the FSM farm is attributed to low-impact Sustainable Forest Management.

Data / Parameter	***Project Forest Cover Monitoring Map***
Data unit	N/A.
Description	Map showing the location of forest land within the project area at the beginning of each monitoring period. If within the Project Area some forest land is cleared, the benchmark map must show the deforested areas at each monitoring event.
Source of data	Remote sensing in combination with GPS data collected during ground truthing.
Description of measurement methods and procedures to be applied	The measurement methods and procedures applied are described in Approved VCS Module VMD0015 (Version 2.1) REDD Methodological Module: Methods for monitoring of greenhouse gas emissions and removals (M-MON), Sectoral Scope 14, pages 3 to 14.
Frequency of monitoring/recording	At least every 5 years or if verification occurs on a frequency of less than every 5 years, examination must occur prior to any verification event.
Value monitored	N/A.
Monitoring equipment	Remote sensing and GPS.
QA/QC procedures to be applied	The minimum map accuracy should be 90% for the classification of forest/non-forest in the remote sensing imagery. If the classification accuracy is less than 90% then the map is not acceptable for further analysis. More remote sensing data and ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.

Purpose of the data	• Calculation of baseline emissions; • Calculation of project emissions.
Calculation method	N/A.
Comments	N/A.

Data / Parameter	***Leakage Belt Forest Cover Monitoring Map***
Data unit	N/A.
Description	Map showing the location of forest land within the leakage belt area at the beginning of each monitoring period.
Source of data	Remote sensing in combination with GPS data collected during ground truthing.
Description of measurement methods and procedures to be applied	Map accuracy is 90%.
Frequency of monitoring/recording	At least every 5 years or if verification occurs on a frequency of less than every 5 years, examination must occur prior to any verification event.
Value monitored	N/A.
Monitoring equipment	Remote sensing and GPS.
QA/QC procedures to be applied	The minimum map accuracy should be 90% for the classification of forest/non-forest in the remote sensing imagery. If the classification accuracy is less than 90% then the map is not acceptable for further analysis. More remote sensing data and ground truthing data will be needed to produce a product that reaches the 90% minimum mapping accuracy.
Purpose of the data	Calculation of leakage emissions.
Calculation method	N/A.
Comments	N/A.

Data / Parameter	$A_{burn,i,t}$
Data unit	ha
Description	Area burnt in stratum *i* at time *t*

Source of data	Remote sensing data.
Description of measurement methods and procedures to be applied	It is considered that burning is a common practice in the region, and that all deforested area undergoes burning in a given moment.
Frequency of monitoring/recording	Areas burnt will be monitored every 5 years or if verification occurs on a frequency of less than every 5 years, examination will occur prior to any verification event.
Value monitored	**Year** / **PA** / **LB**: **2012** / 0 / 0 **2013** / 0 / 0 **2014** / 0 / 0 **2015** / 0 / 0 **2016** / 0 / 0 **2017** / 0 / 0 **2018** / 58 / 984 **2019** / 0 / 126
Monitoring equipment	Remote sensing and GPS.
QA/QC procedures to be applied	Best practices in remote sensing.
Purpose of the data	• Calculation of baseline emissions; • Calculation of project emissions.
Calculation method	N/A.
Comments	As burning of biomass is common practice in the region, it was considered that all the deforested areas were burnt – deforestation cycle includes burning. Deforestation in LB and PA has been detected only in years 2018 and 2019.

Year	PA	LB
2012	0	0
2013	0	0
2014	0	0
2015	0	0
2016	0	0
2017	0	0
2018	58	984
2019	0	126

Data / Parameter	$A_{DefPA,i,t}$
Data unit	ha
Description	Area of recorded deforestation in the project area in stratum *i* at time *t*
Source of data	Remote sensing imagery.

Description of measurement methods and procedures to be applied	Remote sensing tools.
Frequency of monitoring/recording	Monitored every 5 years or if verification occurs on a frequency of less than every 5 years, examination will occur prior to any verification event.
Value monitored	<table><tr><th>Year</th><th>$A_{DefPA,i,t}$</th></tr><tr><td>**2012**</td><td>0</td></tr><tr><td>**2013**</td><td>0</td></tr><tr><td>**2014**</td><td>0</td></tr><tr><td>**2015**</td><td>0</td></tr><tr><td>**2016**</td><td>0</td></tr><tr><td>**2017**</td><td>0</td></tr><tr><td>**2018**</td><td>58</td></tr><tr><td>**2019**</td><td>0</td></tr></table>
Monitoring equipment	Remote sensing and GPS.
QA/QC procedures to be applied	Best practices in remote sensing.
Purpose of the data	Calculation of project emissions.
Calculation method	Periodic analysis of the progression of deforested area in the Project Area.
Comments	For the current monitoring period, it has been verified that the project area underwent deforestation in approximately 58 hectares, as a consequence of deforestation promoted by a neighbor, which overlapped the eastern FSM farm boundary. It is noteworthy that the fact is not related to the deforestation pressures caused by professional land grabbers or other deforestation agents that aim to systematically invade rural properties to settle and spread deforestation through internal roads. On the contrary, the characteristic of the observed deforestation leads to the conclusion that it resulted from a planning error in forest suppression, with no intention of progressive deforestation within the Project Area.

Data / Parameter	$A_{DefLB,i,t}$
Data unit	ha
Description	Area of recorded deforestation in the leakage belt in stratum *i* at time *t*
Source of data	Remote sensing imagery.
Description of measurement methods and procedures to be applied	Periodic analysis of remote sensing imagery.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event.
Value monitored	Year: $A_{DefLB,i,t}$ 2012: 0 2013: 0 2014: 0 2015: 0 2016: 0 2017: 0 2018: 984 2019: 126
Monitoring equipment	Satellite imagery.
QA/QC procedures to be applied	Best practices in remote sensing.
Purpose of the data	Calculation of leakage emissions.
Calculation method	Periodic analysis of the progression of deforested area in the Leakage belt.
Comments	Deforestation inside the Leakage Belt has been far below that estimated *ex ante*, corresponding to 984 hectares in 2018, and 126 hectares in 2019.

Data / Parameter	$A_{RRL,forest,t}$

Data unit	ha
Description	Remaining area of forest in *RRL* at time *t*
Source of data	Remote sensing imagery.
Description of measurement methods and procedures to be applied	Periodic analysis of the progression of deforested area in *RRL*.
Frequency of monitoring/recording	Monitored every 10 years for baseline revision. This value will be presented at the time of baseline renewal.
Value monitored	To be determined in the 2nd baseline reassessment report.
Monitoring equipment	Remote sensing imagery.
QA/QC procedures to be applied	Best practices in remote sensing.
Purpose of the data	Calculation of baseline emissions (renewal).
Calculation method	Analysis of satellite images.
Comments	Monitored every 10 years for baseline renewal.

Data / Parameter	A_{sp}
Data unit	ha
Description	Area of sample plots in ha
Source of data	Recording and archiving of number and size of sample plots.
Description of measurement methods and procedures to be applied	Rectangular plots are obtained by means of stakes and metric tapes.
Frequency of monitoring/recording	At least every ten years for baseline renewal.
Value monitored	0.025
Monitoring equipment	GPS and measuring tape.
QA/QC procedures to be applied	GPS coordinates are double checked in the field.
Purpose of the data	Calculation of baseline emissions (renewal).

Calculation method	N/A.
Comments	Carbon stock estimation occurs only for determination or renewal of the baseline.

Data / Parameter	***N***
Data unit	Dimensionless
Description	Number of sample plots.
Source of data	Recording and archiving of number of sample points.
Description of measurement methods and procedures to be applied	Calculated with statistic equation.
Frequency of monitoring/recording	At least every ten years for baseline renewal.
Value monitored	128
Monitoring equipment	N/A.
QA/QC procedures to be applied	Standard statistic equation.
Purpose of the data	Calculation of baseline emissions (renewal).
Calculation method	Calculated using the following formula: $n = (t^2.CV^2)/(E\%^2+((t^2.CV^2)/N))$ Where: n = number of parcels sampled in each stratum (variable for each stratum) t = Student “t” value (2.262) CV = coefficient of variation (%) (variable for each stratum) E% = permissible sampling error (10%) N = number of parcels in total stratum area (variable for each stratum)
Comments	N/A.

Data / Parameter	***DBH***

Data unit	Cm
Description	Diameter at breast height of a tree in cm.
Source of data	Field measurements in sample plots.
Description of measurement methods and procedures to be applied	Measured 1.3m above ground. Measure all trees above some minimum DBH in the sample plots. The minimum DBH varies depending on tree species and climate; for instance, the minimum DBH may be as small as 2.5 cm or as high as 20m. Minimum DBH employed in inventories is held constant for the duration of the project.
Frequency of monitoring/recording	Monitoring must occur at least every ten years for baseline renewal. Where carbon stock enhancement is included, monitoring shall occur at least every five years.
Value monitored	N/A.
Monitoring equipment	Measuring tape.
QA/QC procedures to be applied	Standard quality control procedures for forest inventory including field data collection and data management were applied. The procedure of DBH measurement is already applied in national forest monitoring, and is available from published handbooks, and from the IPCC GPG LULUCF 2003. An example of handbook is MacDicken, K.G. (1997) A Guide to Monitoring Carbon Storage in Forestry and Agroforestry Projects. Winrock International Institute for Agricultural Development. 91 pp.
Purpose of the data	Calculation of baseline emissions (renewal).
Calculation method	Diameter (DBH) is calculated based on circumference at breast height (CBH) measurement, by means of the basic perimeter equation: DBH = CBH / π.
Comments	N/A.

Data / Parameter	***H***
Data unit	M
Description	Total height of tree.
Source of data	Field measurements in sample plots.
Description of measurement methods	Direct measurement by means of hypsometer.

and procedures to be applied	
Frequency of monitoring/recording	Monitoring must occur at least every ten years for baseline renewal. Where carbon stock enhancement is included, monitoring shall occur at least every five years.
Value monitored	N/A.
Monitoring equipment	Hypsometer / visual inspection.
QA/QC procedures to be applied	Experienced and trained field labor.
Purpose of the data	Calculation of baseline emissions (renewal).
Calculation method	N/A.
Comments	Direct measurement of height corresponding merchantable value. This parameter is only used in allometric equations of palms. For trees, this parameter is only applied for cross-checking of data obtained in the field. In this latter case, the measurement can be performed visually, after training.

Data / Parameter	$A_{DECKS,I,t}$
Data unit	ha
Description	Area of logging decks in stratum *i* at time *t*.
Source of data	Reported measurements such as post-harvest assessment reports, post-harvest maps that are based on field measurements, or Annual Operational Plans of the Sustainable Management Plan.
Description of measurement methods and procedures to be applied	Systematic sampling must take place to ensure all decks within the area logged are identified and a conservative estimate of area produced.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value monitored	<table><tr><th>Year</th><th>A_{DECKS}</th></tr><tr><td>2012</td><td>0</td></tr><tr><td>2013</td><td>0</td></tr><tr><td>2014</td><td>6.00</td></tr></table>

	2015 | 0 2016 | 9.05 2017 | 0 2018 | 0 2019 | 0
Monitoring equipment	According to the Annual Operational Plans of the Sustainable Management Plan.
QA/QC procedures to be applied	The measured area of logging decks in current logging gaps will be compared with those of previous logging gaps.
Purpose of the data	Calculation of project emissions.
Calculation method	Data obtained from annual FSM forest management.
Comments	N/A.

Data / Parameter	$A_{ROAD,i,t}$
Data unit	ha
Description	Area of roads in stratum *i* at time *t*.
Source of data	Reported measurements such as post-harvest assessment reports, post-harvest maps that are based on field measurements, or Annual Operational Plans of the Sustainable Management Plan.
Description of measurement methods and procedures to be applied	The area of roads created may be based on the length of roads multiplied by the average width of roads. The length of all roads created during selective logging must be measured through systematically sampling the entire area logged to produce a conservative estimate of the length of roads created. Sufficient number of measurements of road width shall be measured to achieve a precision of equal or less than 15% of the mean at the 95% confidence interval. Where different categories of roads exist, different average road widths should be used.

<table>
<tr><td>Frequency of monitoring/recording</td><td>Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event.</td></tr>
<tr><td>Value monitored</td><td>
<table>
<tr><th>Year</th><th>A_{ROAD}</th></tr>
<tr><td>2012</td><td>0</td></tr>
<tr><td>2013</td><td>0</td></tr>
<tr><td>2014</td><td>24.50</td></tr>
<tr><td>2015</td><td>0</td></tr>
<tr><td>2016</td><td>21.22</td></tr>
<tr><td>2017</td><td>0</td></tr>
<tr><td>2018</td><td>0</td></tr>
<tr><td>2019</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>According to the Annual Operational Plans of the Sustainable Management Plan.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The measured area of logging decks in current logging gaps will be compared with those of previous logging gaps.</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of project emissions.</td></tr>
<tr><td>Calculation method</td><td>Estimations of emissions from road creation shall be based on logging management plans or average width of roads and length of roads produced for logging in the farm.</td></tr>
<tr><td>Comments</td><td>Data obtained from annual FSM forest management.</td></tr>
</table>

Data / Parameter	L_{sk}
Data unit	m
Description	Length of skid trail *sk*.
Source of data	Reported measurements such as post-harvest assessment reports, post-harvest maps that are based on field measurements, or Annual Operational Plans of the Sustainable Management Plan.
Description of measurement methods and procedures to be applied	The length of skid trails may be estimated through using systematic sampling with a random start of the entire area logged or within a sampled known logged area within the project boundary to produce a conservative estimate of the

	length of skid trails created. The total length of all skid trails can be equal to the mean length of skid trails per unit area multiplied by the total area logged.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event.
Value monitored	**Year** / L_{SK}: 2012 – 0; 2013 – 0; 2014 – 105,694; 2015 – 0; 2016 – 166,729; 2017 – 0; 2018 – 0; 2019 – 0
Monitoring equipment	According to the Annual Operational Plans of the Sustainable Management Plan.
QA/QC procedures to be applied	The measured length of skid trails in current logging gaps will be compared with those of previous logging gaps.
Purpose of the data	Calculation of project emissions.
Calculation method	Estimations of emissions from skid trail creation shall be based on logging management plans or average length and number of skid trails produced due to logging in the farm.
Comments	Data obtained from annual FSM forest management.

Value monitored:

Year	L_{SK}
2012	0
2013	0
2014	105,694
2015	0
2016	166,729
2017	0
2018	0
2019	0

Data / Parameter	W_{SKID}
Data unit	m
Description	Mean width of skid trails.
Source of data	Reported measurements such as post-harvest assessment reports and post-harvest maps that are based on field measurements.

Description of measurement methods and procedures to be applied	The average width of skid trails created within a stratum *i* can be based on reported widths; a conservative estimate based on machinery used; or additional field measurements. Conservative estimate: Width edge of tires on largest skidder type * 140% is used, as the skidder type is known and used to create all skid trails.
Frequency of monitoring/recording	The estimated mean width of skid trails shall be monitored and updated prior to each verification report.
Value monitored	2,6 m * 1,4
Monitoring equipment	Data obtained from annual FSM forest management and reports.
QA/QC procedures to be applied	The measured length of skid trails in current logging gaps will be compared with those of previous logging gaps.
Purpose of the data	Calculation of project emissions.
Calculation method	Conservative estimate: Width edge of tires on largest skidder type * 140% is used, as the skidder type is known and used to create all skid trails.
Comments	It is assumed that all diameter trees are destroyed and therefore the aboveground and belowground tree biomass that is destroyed by the skidder conservatively equates to the maximum aboveground biomass carbon stock observed in all strata. Based on the overall area of skid trails related to the Project Area, the values estimated for emissions from skid trails are not significant according to T-SIG, as they represent much less than 5% of total emissions. Thus, the inclusion of these emissions in final calculations is indisputably conservative *per se*.

Data / Parameter	A_i
Data unit	ha
Description	Total area of stratum *i*.
Source of data	GPS delineation and remote sensing imagery.
Description of measurement methods and procedures to be applied	GPS delineation and remote sensing imagery.

Frequency of monitoring/recording	At a minimum every time the baseline is updated (at least every 10 years).
Value monitored	<table><tr><th>Stratum</th><th>Area (ha)</th></tr><tr><td>Aluvial</td><td>11,145.4</td></tr><tr><td>Encosta</td><td>8,074.8</td></tr><tr><td>FOB Densa Submontana</td><td>453.5</td></tr><tr><td>FOB Submontana Cipós e Palmeiras</td><td>38,362.5</td></tr></table> The areas exploited inside the FSM farm from 1st April 2017 to 12th April 2019 were excluded from the calculation of VCU benefits. This is due to the fact that these areas were not certified by the FSC (Forest Stewardship Council) at the moment of timber harvest and, consequently, were not eligible to the Project, according to M-MON v2.1. The documents showing the areas exploited within this time period are available for consultation by auditors and will be kept in a secure retrievable manner for at least two years after the end of the project crediting period. Thus, the baseline emissions and project emissions occurring inside these areas were not quantified for the present verification period.
Monitoring equipment	GPS and satellite image.
QA/QC procedures to be applied	GPS data is confirmed by field survey.
Purpose of the data	Calculation of project emissions.
Calculation method	Satellite image analysis.
Comments	Deforested area inside the Project Area is excluded from the project activity.

Data / Parameter	$V_{ex,i}$
Data unit	m^3
Description	The volume of timber in m^3 extracted from within the stratum (does not include slash left onsite), reported by wood product class and preferably species.

Source of data	Timber harvest records.
Description of measurement methods and procedures to be applied	Timber inventory, performed in FSM.
Frequency of monitoring/recording	Annually.
Value monitored	<table><tr><th>Year</th><th>V_{ex}</th></tr><tr><td>2012</td><td>0</td></tr><tr><td>2013</td><td>1,463.53</td></tr><tr><td>2014</td><td>0</td></tr><tr><td>2015</td><td>37,893.30</td></tr><tr><td>2016</td><td>26,210.46</td></tr><tr><td>2017</td><td>0</td></tr><tr><td>2018</td><td>0</td></tr><tr><td>2019</td><td>0</td></tr></table>
Monitoring equipment	The same equipment applied in forest inventory.
QA/QC procedures to be applied	The same control procedures applied to forest inventory.
Purpose of the data	Calculation of project emissions.
Calculation method	Timber inventory.
Comments	Note that this volume does not include logging slash left onsite. Data compilers should also make sure that extracted volumes reported are gross volumes removed (i.e. reported volume does not already discount for estimated wood waste, as is often the practice in harvest records). Assignment of volume extracted to wood product class(es), will be substantiated on the basis of records of timber sales.

Data / Parameter	$A_{BSL,PA,unplanned,t}$
Data unit	ha
Description	Annual area of unplanned baseline deforestation in the Project Area at year *t*

Source of data	Remote sensing imagery.
Description of measurement methods and procedures to be applied	Remote sensing imagery by PRODES.
Frequency of monitoring/recording	Annually.
Value monitored	**Year** / $A_{BSL,PA,unplanned,t}$: 2012: 0; 2013: 0; 2015: 0; 2016: 0; 2017: 0; 2018: 58; 2019: 0
Monitoring equipment	Satellite images by PRODES.
QA/QC procedures to be applied	PRODES results are crosschecked by satellite image verification.
Purpose of the data	Calculation of project emissions.
Calculation method	Periodic analysis of the progression of deforested area in the Project Area.
Comments	For the current monitoring period, it has been verified that the project area underwent deforestation in approximately 58 hectares, as a consequence of deforestation promoted by a neighbor, which overlapped the eastern FSM farm boundary. It is noteworthy that the fact is not related to the deforestation pressures caused by professional land grabbers or other deforestation agents that aim to systematically invade rural properties to settle and spread deforestation through internal roads. On the contrary, the characteristic of the observed deforestation leads to the conclusion that it resulted from a planning error in forest suppression, with no intention of progressive deforestation within the Project Area.

Value monitored:

Year	$A_{BSL,PA,unplanned,t}$
2012	0
2013	0
2015	0
2016	0
2017	0
2018	58
2019	0

Data / Parameter	$C_{BSL,i}$

Data unit	tCO_2-e ha^{-1}
Description	Carbon stock in all pools in the baseline in stratum *i*
Source of data	Field measurements in sample plots.
Description of measurement methods and procedures to be applied	Field measurements in sample plots and application of allometric equations, as described in “Field inventory of biomass” of this Monitoring Report.
Frequency of monitoring/recording	Monitoring must occur at least every ten years for baseline renewal.
Value monitored	N/A.
Monitoring equipment	The same cited for field measurements in sample plots.
QA/QC procedures to be applied	The same cited for field measurements in sample plots.
Purpose of the data	Calculation of baseline emissions.
Calculation method	Field measurements in sample plots and application of allometric equations, as described in “Field inventory of biomass” of this Monitoring Report.
Comments	N/A.

Data / Parameter	$C_{AB,tree,i}$
Data unit	tCO_2-e ha^{-1}
Description	Carbon stock in aboveground biomass in trees in the project case in stratum *i*
Source of data	Field measurements in sample plots.
Description of measurement methods and procedures to be applied	Field measurements in sample plots, application of allometric equations and multiplication of the merchantable volume by the BCEF (Biomass conversion and expansion factor: 1.66) for conversion of merchantable volume to total aboveground tree biomass, as described in “Field inventory of biomass” of this Monitoring Report.
Frequency of monitoring/recording	Monitoring must occur at least every ten years for baseline renewal.
Value monitored	N/A.
Monitoring equipment	The same cited for field measurements in sample plots.

QA/QC procedures to be applied	The same cited for field measurements in sample plots.
Purpose of the data	Calculation of baseline emissions.
Calculation method	Field measurements in sample plots, application of allometric equations and multiplication of the merchantable volume by the BCEF (Biomass conversion and expansion factor: 1.66) for conversion of merchantable volume to total aboveground tree biomass, as described in “Field inventory of biomass” of this Monitoring Report.
Comments	N/A.

Data / Parameter	$C_{BB,tree,i}$
Data unit	tCO_2-e ha^{-1}
Description	Carbon stock in belowground biomass in trees in the project case in stratum *i*
Source of data	Field measurements in sample plots.
Description of measurement methods and procedures to be applied	Field measurements in sample plots, application of allometric equations and multiplication of the total aboveground biomass by the root-shoot ratio (0.37) for calculation of total belowground tree biomass, as described in “Field inventory of biomass” of this Monitoring Report.
Frequency of monitoring/recording	Monitoring must occur at least every ten years for baseline renewal.
Value monitored	N/A.
Monitoring equipment	The same cited for field measurements in sample plots.
QA/QC procedures to be applied	The same cited for field measurements in sample plots.
Purpose of the data	Calculation of baseline emissions.
Calculation method	Field measurements in sample plots, application of allometric equations and multiplication of the total aboveground biomass by the root-shoot ratio (0.37) for calculation of total belowground tree biomass, as described in “Field inventory of biomass” of this Monitoring Report.
Comments	N/A.

Data / Parameter	$C_{WP,i}$
Data unit	tCO_2-e ha^{-1}
Description	Carbon stock in wood products in the project case in stratum *i*
Source of data	As described in “Wood products carbon pool in the project case” of this Monitoring Report.
Description of measurement methods and procedures to be applied	As described in “Wood products carbon pool in the project case” of this Monitoring Report.
Frequency of monitoring/recording	Annually.
Value monitored	2.24
Monitoring equipment	As described in “Wood products carbon pool in the project case” of this Monitoring Report.
QA/QC procedures to be applied	As described in “Wood products carbon pool in the project case” of this Monitoring Report.
Purpose of the data	Calculation of project emissions.
Calculation method	As described in “Wood products carbon pool in the project case” of this Monitoring Report.
Comments	N/A.

Data / Parameter	$E_{BiomassBurn,i,t}$
Data unit	tCO_2-e ha^{-1}
Description	Non-CO_2 emissions due to biomass burning in stratum *i* in year *t*
Source of data	As described in “Emissions from biomass burning in the baseline” of this Monitoring Report.
Description of measurement methods and procedures to be applied	As described in “Emissions from biomass burning in the baseline” of this Monitoring Report.
Frequency of monitoring/recording	Monitoring must occur at least every ten years for baseline renewal.

Value monitored	As described in "Emissions from biomass burning in the baseline" of this Monitoring Report.
Monitoring equipment	As described in "Emissions from biomass burning in the baseline" of this Monitoring Report.
QA/QC procedures to be applied	As described in "Emissions from biomass burning in the baseline" of this Monitoring Report.
Purpose of the data	Calculation of baseline emissions.
Calculation method	As described in "Emissions from biomass burning in the baseline" of this Monitoring Report.
Comments	N/A.

4.3 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, FSM 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. Rubens Forbes Alves Lima, the CEO of FSM.

Title and reference of the VCS methodology

Approved VCS Methodology VM0007 Version 1.5

9 March 2015 REDD Methodology Module

“REDD+ Methodology Framework (REDD-MF)”

Sectoral Scope 14, from Avoided Deforestation Partners (ADP).

Approved VCS Module VMD0015 - Version 2.1

REDD Methodological Module:

Methods for monitoring of GHG emissions and removals (M-MON)

Sectoral Scope 14

These methods aim at monitoring changes in land cover due to deforestation and carbon stock enhancement, and to calculate activity data for each of these categories of change. These methods are applied for monitoring Reference Area, Project Area and Leakage Belt.

In a conservative approach, the project proponent opted not to monitor forest degradation in the Reference Area and Project Area. According to previous studies for characterization of the Reference Area, illegal extraction of smaller trees for fuelwood and charcoal is not a usual practice in the FSM region. Moreover, the practice of illegal logging of smaller trees and forest degradation is expected to be pretty much more pronounced in non-protected areas, as those observed in the Reference Area, than in protected forest areas, as the FSM farm. As demonstrated in the VCS-PD, the FSM farm has a system for monitoring boundaries and for hindering any invasion that might endanger the forest. The only carbon loss inside the FSM farm is attributed to low-impact Sustainable Forest Management. The emissions occurring from Sustainable Forest Management (logging gaps, roads, and decks) will be continuously monitored and reported by the project proponent during the entire project period.

Revision of the baseline

a. Technical description of the monitoring task.

The baseline scenario will be monitored through an assessment of the driver variables and assumptions assumed by the satellite images to project deforestation expected in the baseline scenario. These parameters will be re-validated after each baseline renewal (10 years), based on the calculation of the verified post facto baseline deforestation (in hectares) of the past 10 year period – in comparison with other location not affected by the project activities. If deforestation is verified as 10% lower or 10% higher than originally predicted, the post facto carbon baseline shall be re-adjusted using the observed values of the driver variables.

The baseline of a REDD project activity is estimated ex ante. It will be monitored in a reference area (unplanned deforestation) for the purpose of periodically adjusting the baseline. Ex-ante baseline estimations are therefore used in both the ex-ante and ex-post estimation of net carbon stock changes and greenhouse gas emission reductions.

The baseline monitoring task will be done in accordance with the following module:

Approved VCS Module VMD0007

Version 1.0

REDD Methodological Module:

Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation (BL-UP)

Sectoral Scope 14

Data collected

The data collected are given on the following tables:

Data Unit / Parameter:	Any spatial feature included in the spatial model that is subject to changes over time (Factor Maps)
Data unit:	According to spatial feature selected
Description:	Factor Maps

Source of data:	Digital maps – Landsat5
Description of measurement methods and procedures to be applied:	Update of digital maps
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	Risk Maps
Data unit:	N/A
Description:	A Risk Map shows, for each pixel location, the risk, or "suitability", for deforestation as a numerical scale (e.g. from 0 = minimum risk to some upper limit representing the maximum).
Source of data:	Digital maps – Landsat5
Description of measurement methods and procedures to be applied:	Update of digital maps
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	Baseline deforestation Maps
Data unit:	N/A
Description:	Maps showing the location of deforested hectares in each year of the baseline period
Source of data:	Digital maps – Landsat5
Description of measurement methods and procedures to be applied:	Update of digital maps
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	AA_U
Data unit:	%

Description:	The accuracy assessment of the rate of unplanned deforestation (equals 90% or more)
Source of data:	Existing maps or models, expert consultation, literature
Description of measurement methods and procedures to be applied:	Multi-criteria analysis implemented in a Geographical Information System
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	*Correct*
Data unit:	Ha
Description:	Area correct due to observed change predicted as change
Source of data:	Spatial model of deforestation location
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	Err_A
Data unit:	Ha
Description:	Area of error due to observed change predicted as persistence
Source of data:	Spatial model of deforestation location
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	Err_B

Data unit:	ha
Description:	Area of error due to observed persistence predicted as change
Source of data:	Spatial model of deforestation location
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	*FOM*
Data unit:	N/A
Description:	Figure of Merit
Source of data:	Calculated using equation $FOM = CORRECT / (CORRECT + Err_A + Err_B)$
Description of measurement methods and procedures to be applied:	Described above
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	*LB*
Data unit:	Ha
Description:	Leakage belt area
Source of data:	GPS coordinates and/or remote sensing data
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Where leakage belt boundaries have not been derived using GPS on-the-ground measurements, quality control shall be carried out. A minimum of 30 locations on the leakage belt boundary, each separated by at least 1km, shall be visited. If a systematic bias is detected in the original boundaries and/or if >10% of

	locations differ by >50m, then the entire boundary shall be resurveyed. These directives come from the Approved VCS Module VMD0007 (Version 1.0) REDD Methodological Module: Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation (BL-UP), Sectoral Scope 14.
Any comment:	Shall be estimated at time zero, this estimate shall be used for *ex-ante* purposes

Data Unit / Parameter:	LSC_{RRL}
Data unit:	Ha
Description:	The area of *RRL* suitable for conversion from forest to an alternate land use
Source of data:	Remote sensing data
Description of measurement methods and procedures to be applied:	Calculated from the result of analysis of forest areas in the reference region for projection of location of deforestation with regard to constraints to deforestation (including elevation, climate, protected status etc.). Uses parameter $A_{RRL,forest,t}$ derived from M-MON
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	Monitored at least once every 10 years (when the baseline is revisited) Shall be estimated at time zero, this estimate shall be used for *ex-ante* purposes

Data Unit / Parameter:	*PA*
Data unit:	Ha
Description:	Unplanned deforestation project area
Source of data:	GPS coordinates and/or remote sensing data
Description of measurement methods and procedures to be applied:	Where project boundaries have not been derived using GPS on-the-ground, measurements quality control shall be carried out. A minimum of 30 locations on the project boundary, each separated by at least 1km, shall be visited. If a systematic bias is detected in the

	original boundaries and/or if >10% of locations differ by >50m, then the entire boundary shall be resurveyed. These directives come from the Approved VCS Module VMD0007 (Version 1.0) REDD Methodological Module: Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation (BL-UP), Sectoral Scope 14.
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	Shall be estimated at time zero, this estimate shall be used for ex-ante purposes. The areas exploited inside the FSM farm from 13rd April 2009 to 31st December 2011 and from 1st April 2017 to 12th April 2019 were excluded from the calculation of VCU benefits. This is due to the fact that these areas were not previously certified by the FSC (Forest Stewardship Council) and, consequently, were not eligible to the Project, according to M-MON v2.1. The documents showing the areas exploited within this time period are available for consultation by auditors and will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

Data Unit / Parameter:	P_{LK}
Data unit:	Dimensionless
Description:	Ratio of the area of the leakage belt to the total area of *RRD*
Source of data:	Leakage belt area and RRD area, determined by satellite imaging
Description of measurement methods and procedures to be applied:	Calculated from the result of remotely sensed data analysis
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	Shall be estimated at time zero, this estimate shall be used for ex-ante purposes

Data Unit / Parameter:	$P_{LSC,RRL}$
Data unit:	Dimensionless
Description:	Ratio of the parameter LSC_{RRL} to the area of *RRD*
Source of data:	LSC_{RRL} area and *RRD* area, determined by satellite imaging
Description of measurement methods and procedures to be applied:	Calculated from the result of remotely sensed data analysis
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	Shall be estimated at time zero, this estimate shall be used for ex-ante purposes

Data Unit / Parameter:	P_{PA}
Data unit:	Dimensionless
Description:	Ratio of the project area to the total area of *RRD*
Source of data:	Project area and *RRD* area, determined by satellite imaging
Description of measurement methods and procedures to be applied:	Calculated from the result of remotely sensed data analysis
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	Monitored at least every 10 years (when the baseline is revisited) Shall be estimated at time zero, this estimate shall be used for ex-ante purposes

Data Unit / Parameter:	P_{RRL}
Data unit:	Dimensionless
Description:	Ratio of the forest area in the *RRL* at the start of the historical reference period to the total area of *RRD*
Source of data:	Forest area in the *RRL* and *RRD*, determined by satellite imaging
Description of measurement methods and procedures to be applied:	Calculated from the result of remotely sensed data analysis

Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	Monitored at least every 10 years (when the baseline is revisited) Shall be estimated at time zero, this estimate shall be used for ex-ante purposes

Data Unit / Parameter:	*RRD*
Data unit:	Ha
Description:	Geographic boundaries of the reference area for projection of rate of deforestation
Source of data:	GPS coordinates and/or remote sensing data
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	*RRL*
Data unit:	Ha
Description:	Geographic boundaries of the reference area for projection of location of deforestation
Source of data:	GPS coordinates and/or remote sensing data
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	Best practices in remote sensing
Any comment:	-

Data Unit / Parameter:	T_{hrp}
Data unit:	Yr
Description:	Duration of the historical reference period in years

Source of data:	GPS coordinates and/or remote sensing data
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Updated every time the baseline is revisited (at least every 10 years)
QA/QC procedures to be applied:	N/A
Any comment:	Should be between 10 and 15 years

Monitoring of the actual carbon stock changes and greenhouse gas emissions

The implementation of the project activities will be monitored by the responsible group within FSM and will consist of large investments in policing the FSM, one monitoring base will be established in one of the already existing policing bases. All the bases communicate through radio every day to the main base.

The bases will be positioned in strategic points within the FSM and continuous monitoring activities with advanced remote sensing techniques will be implemented also satellite images and field studies will be used. The land use area monitoring will be done with remote sensing methods, using images of medium resolution, generated by INPE. Associated with this, the Environmental Monitoring Program aims at involving the communities in mapping the threatened areas; identifying the risks and threats to which these areas are subjected. The large-scale monitoring will be done through satellite images made available by INPE (PRODES).

All of this reliable data that is collected and documented will be used as a technical support tool for decision making in order to improve project outcomes, and to adapt the project according to the current needs and reality. These decisions will be made during the periodic meetings to review the Activity Plan. On these occasions, the design of the Monitoring Plan will be analyzed according to its efficiency in generating reliable feedback and all the necessary information. If any changes in the Monitoring Plan or management actions are identified, a corrective action will be designed and implemented.

According to Figure 5, the red dots represent the 7 bases already established by the project owner to work as monitoring points at FSM. All the bases have radio communication, and they communicate at least once a day. They are all equipped with motorcycles so they can easily move to other areas if needed.

As strategy for looking after the property and assure the project it was considered the following assumptions:

1-Avoid entry of outsiders:

1.1 Hunters

1.2 Fishermen

1.3 Intrusion

1.4 Prevention of invasion

1.5 Fire Prevention

1.6 Support the Work of Forest Stewardship Management Plan

2 - Consolidation of calm and peaceful possession

3-Cleaning of frontiers and its milestones

4-Internal organization of communication

On top of these issues, there is strategic plan with seven fixed bases located in strategic locations to meet the above assumptions, namely:

BASE 1 - SEDE

This base possesses the administrative office of the farm, main house (residence for Directors, Officers and invited guests), kitchen and dining hall.

This base is equipped with electricity (including a generator), satellite internet, fixed and mobile telephone (both by means of an external aerial) and a motorcycle.

BASE 2 – LINHA 12

This base possesses lodgment for collaborators, dining hall, toilets, one house for the fixed employee, building for storage and maintenance of machinery, and logging deck.

This base is equipped with electricity, mobile telephone (by means of an external aerial), and a motorcycle.

BASE 3 - ARIPUANÃ

This base possesses one house for the fixed employee, dining hall and kitchen for visitors.

This base is equipped with electricity (by means of a generator), mobile telephone (by means of an external aerial), and a motorcycle.

BASE 4 - ACAMPAMENTO

This operational base possesses three houses: two houses are lodgments with toilets and one house has a kitchen, dining hall, storage room, office, toilets and two bedrooms.

This base is equipped with electricity (by means of a generator), and a motorcycle.

BASE 6 – LINHA 6

This base possesses a house for the fixed employee.

This base is equipped with solar electricity, and mobile telephone (by means of an external aerial).

BASE 7 - PACUTINGA

This base possesses a house for the fixed employee.

This base is equipped with solar electricity, and mobile telephone (by means of an external aerial).

BASE 8 - MORERU

This base possesses a house for the fixed employee, with accommodation for 3 people. This base is in charge of the gate to the road Colniza / Moreru.

This base is equipped with solar electricity, mobile telephone (by means of an external aerial), and a motorcycle.

All bases communicate 24 hours, the Manager of BASE 1 is authorized for any decision making and action.

BASES 2, 3 and 4 report to BASE 1

BASES 6 and 7 report to BASE 8

To be able to receive the authorization to perform a sustainable management of the forest (so called AUTEX) the property was obligated to have a sustainable management plan in place and present it to the competent environmental agency SEMA / MT. The Management Plan is fully available to auditors.

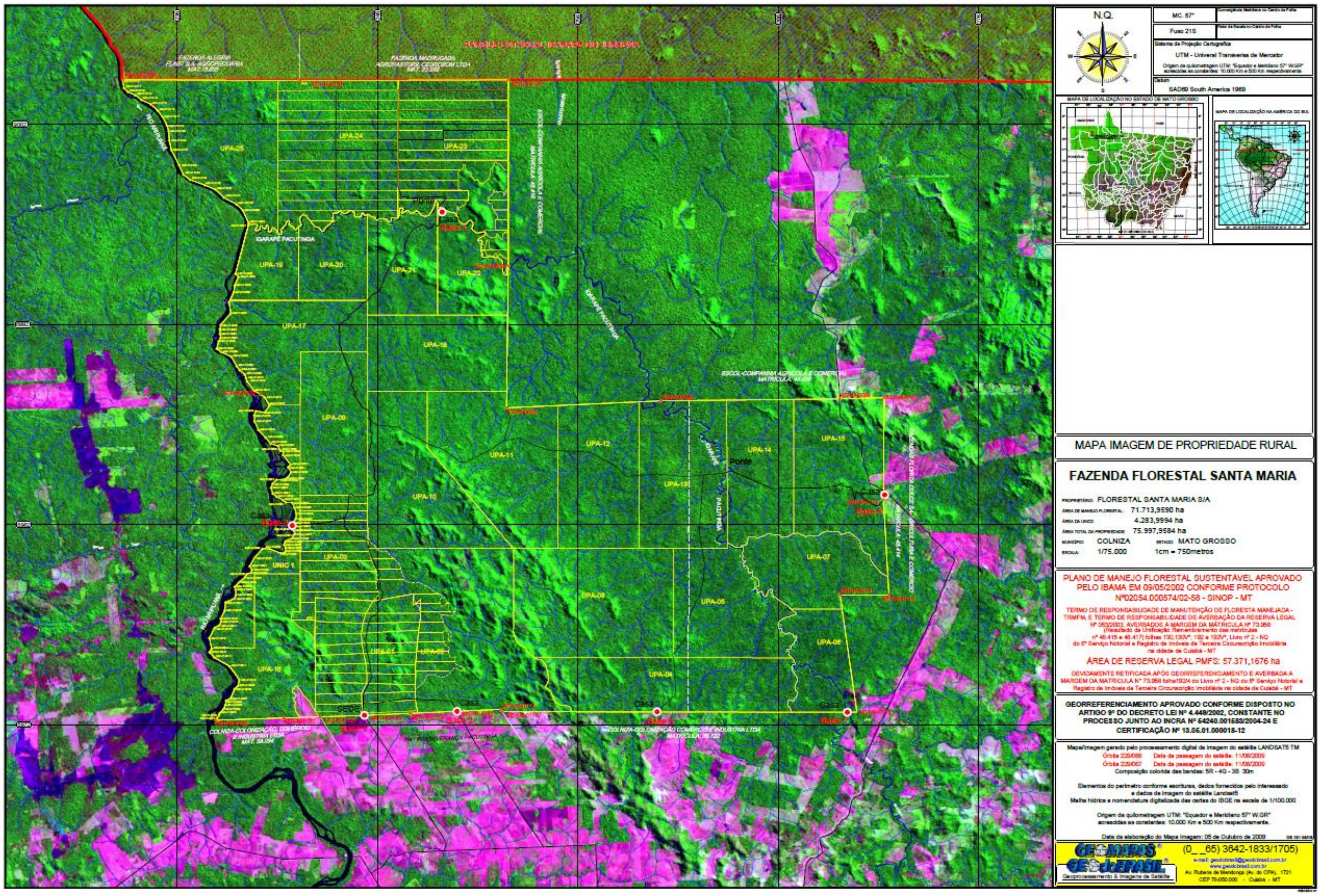


Figure 2. Distribution of the infrastructure for the project monitoring

All the parameters to be monitored are described on item 4.2 above.

Monitoring degradation due to selective logging of forest management areas

The calculation procedure for estimating net ex post emissions and removals related to selective logging activities in the project case will be equal to the summed emissions arising from selective logging operations.

The net emissions in the project case are estimated by combining:

- Emissions arising from logging gap: encompass emissions from felling timber tree and emissions from incidental damage caused by falling timber tree,
- Emissions from infrastructure: from constructing logging infrastructure for removal of timber, such as haul roads, skid trails and logging decks.

Emissions arising in the logging gap

In the project case, emissions occur as a direct result of the death of the timber tree and due to the death of trees killed when the timber tree is felled. The net emission in the project case is equal to the biomass of the wood extracted plus the logging damage factor multiplied by the extracted volume:

$$C_{LG} = \sum_{t=1}^{T}(C_{EXT,t} + (LDF * V_{EXT,t} * \frac{44}{12})) \quad (1)$$

Where:

C_{LG} Actual net project emissions arising in the logging gap at time *t*; tCO_2-e

$C_{EXT,t}$ Biomass carbon stock of timber extracted within the project boundary at time *t*; tCO_2-e

LDF Logging damage factor; tC m^{-3}

$V_{EXT,t}$ Volume extracted at time *t*; m^3

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

For ex-ante calculation of the total volume of wood extracted, it was assumed that wood extraction is always identical, independently on the type and biomass of strata. Thus, the volume of wood extracted is not dependent on strata biomass volume per hectare.

Emissions arising through logging infrastructure

The net emission in the project case is equal to the sum of emissions resulting from skid trails, roads, and logging decks created for selective logging operations.

The emissions from the creation of skid trails are estimated by multiplying the total length of skid trails created and a skid trail emission factor.

$$\Delta C_{SKID,t} = L_{SKID,t} * SK \quad (2)$$

Where:

$\Delta C_{SKID,t}$ Change in carbon stock resulting from skid trail creation at time *t*; tCO_2-e

$L_{SKID,t}$ Length of skid trails at time *t*; m

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

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

The calculation of *SK* is further explained in M-MON v2.1. For ex-post calculations of emissions arising from creation of skid trails, roads, and logging decks, it was conservatively assumed the emission equivalent to the stratum with the highest biomass (i.e. “Encosta” stratum). It is assumed that the machinery used to create the skid trail kills all aboveground and belowground tree biomass located within the path of the skid trail. This biomass becomes deadwood and is assumed to be immediately emitted.

The emission resulting from the creation of roads is determined by multiplying the area of roads created by the carbon stock. The emission from logging decks is determined by measuring the area of logging decks created in each logging gap, and the area is multiplied by the carbon stock. By merging equations 17 and 18 of M-MON V2.1 (page 17), the following equation was created for estimating the emissions from roads and logging decks:

$$\Delta C_{ROAD,t + DECKS,t} = (A_{ROAD,t} + A_{DECKS,t}) * C_{BSL}$$

Where:

$\Delta C_{ROAD,t + DECKS,t}$ Change in carbon stock resulting from logging road and deck creation at time *t*; tCO_2-e

$\Delta C_{ROAD,t}$ Area of roads at time *t*; ha

$\Delta C_{DECKS,t}$ Area of logging decks at time *t*; ha

C_{BSL} Carbon stock in aboveground and belowground tree biomass in the baseline case; tCO_2-e ha^{-1}

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

For conservativeness purposes, the biomass of the "Encosta" stratum is used in C_{BSL}, as it has the highest biomass value among all strata.

Based on the overall area of roads and logging decks related to the Project Area, the values estimated for emissions from roads and decks are not significant according to T-SIG, as they represent much less than 5% of total emissions. Thus, the inclusion of these emissions in final calculations is indisputably conservative *per se*.

Field inventory of biomass

The field inventory methodology is described in a Standard Operating Procedure (SOP), which is available for consultation by the auditors. This SOP was specifically designed to FSM carbon inventories, to be applied in the baseline assessment, as well as in the monitoring period. The field carbon inventory involved the installation of 18 permanent transects, composed by a total of 128 permanent plots. These permanent plots will be periodically assessed throughout the project duration.

The merchantable volume of trees is estimated by directly measuring the circumference at breast height (CBH). The data of CBH is converted in DBH (Diameter at Breast Height) and applied to allometric equations for estimation of merchantable stem volume. For application of allometric equations, trees were divided in two classes of DBH:

- DBH ranging from 4.46 cm to 81.99 cm: application of allometric equation from NOGUEIRA et al. (2008);
- DBH higher than 82.00 cm: application of allometric equation from COLPINI et al. (2009);

The total aboveground tree biomass was estimated by using a default biomass expansion factor (BEF). Palm tree data underwent application of a specific allometric equation by SALDARRIAGA et al. (1988) for direct estimation of total aboveground biomass. For estimation of belowground biomass, the aboveground sum of trees and palms biomass was multiplied by a default root-shoot ratio.

The field inventory SOP (available for consultation by the auditors) describes the guidelines for the following aspects:

- Procedures for allocation of transects and plots in the field;
- Documentation of coordinates of transects and plots;
- Standards for identification and signalization of transects and plots;
- Description of field inventory team;
- Standards for measurement of tree diameters under several conditions;
- Standards for measurement dynamics of the field inventory team;
- QA/QC procedures to guarantee the application of correct field procedures (annual training, evaluation and performance reporting);
- Items for annual evaluation of field inventory team;

- QA/QC procedures to guarantee that field data are within the range of tree dimensions required in the field inventory;
- QA/QC procedures to guarantee that there was no misunderstanding in data notation in the field;
- QA/QC procedures to guarantee reliability of data transfer;
- Model of data transfer error quantification and report;
- List of equipment and materials to be used in the field inventory.

After the annual evaluation of field inventory team, the team coordinator must produce an annual Evaluation Report for each field inventory technician. This Evaluation Report will be printed in two hardcopies: one for FSM records and other for the field inventory technician that was evaluated. This document will be the evidence of the annual evaluation of field inventory team.

Monitoring of leakage carbon stock changes and greenhouse gas emissions

For the leakage belt the net greenhouse gas emissions in the project case is equal to the sum of stock changes due to deforestation in the leakage belt:

$$\Delta C_{P,LB} = \sum_{t=1}^{t} \sum_{i=1}^{M} \Delta C_{P,DefLB,i,t} \qquad (4)$$

Where:

$\Delta C_{P,LB}$ Net greenhouse gas emissions in the leakage belt in the project case; *t* CO_2-e

$\Delta C_{P,DefLB,i,t}$ Net carbon stock change as a result of deforestation in the leakage belt the project case in stratum *i* at time *t*; t CO_2-e

i 1, 2, 3 …*M* strata in the project scenario

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

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

For the project area the net greenhouse gas emissions in the project case are equal to the sum of stock changes due to deforestation and degradation plus the total greenhouse gas emissions minus any eligible forest carbon stock enhancement:

$$\Delta C_P = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \left(\Delta C_{P,DefPA,i,t} + \Delta C_{P,Deg,i,t} + GHG_{P-E,i,t} - \Delta C_{P,Enh,i,t}\right) \tag{5}$$

ΔC_P Net greenhouse gas emissions within the project area under the project scenario; *t* CO_2-e

$\Delta C_{P,DefPA,i,t}$ Net carbon stock change as a result of deforestation in the project area in the project case in stratum *i* at time *t*; t CO_2-e

$\Delta C_{P,Deg,i,t}$ Net carbon stock change as a result of degradation in the project area in the project case in stratum *i* at time *t*; t CO_2-e

$GHG_{P-E,i,t}$ Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum *i* at time *t*; t CO_2-e

$\Delta C_{P,Enh,i,t}$ Net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline in stratum *i* at time *t*; t CO_2-e

i 1, 2, 3 …*M* strata in the project scenario

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

The net carbon stock change as a result of deforestation is equal to the area deforested multiplied by the emission per unit area.

$$\Delta C_{P,DefPA,i,t} = \sum_{n-1}^{U} \left(\Delta C_{DefPA,u,i,t} * \Delta C_{pools,P,Def,u,i,t}\right) \tag{6}$$

$$\Delta C_{P,DefLB,i,t} = \sum_{n-1}^{U} \left(\Delta C_{DefLB,u,i,t} * \Delta C_{pools,P,Def,u,i,t}\right) \tag{7}$$

Where:

$\Delta C_{P,DefPA,i,t}$ Net carbon stock change as a result of deforestation in the project case in the project area in stratum *i* at time *t*; t CO_2-e

$\Delta C_{P,DefLB,i,t}$ Net carbon stock change as a result of deforestation in the project case in the leakage belt in stratum *i* at time *t*; t CO_2-e

$\Delta_{DefPA,u,i,t}$ Area of recorded deforestation in the project area stratum *i* converted to land use *u* at time *t*; ha

$\Delta_{DefLB,u,i,t}$ Area of recorded deforestation in the leakage belt stratum *i* converted to land use *u* at time *t*; ha

$\Delta C_{pools,Def,u,i,t}$ Net carbon stock changes in all pools in the project case in land use *u*, in stratum *i* at time *t*; t CO_2-e

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

i 1, 2, 3 …*M* strata

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

The emission per unit area is equal to the difference between the stocks before and after deforestation minus any wood products created from timber extraction in the process of deforestation:

$$\Delta C_{pools,Def,i,t} = C_{BSL,i} - C_{P,post,i} - C_{wp,i} \qquad (8)$$

Where:

$\Delta C_{pools,Def,i,t}$ Net carbon stock changes in all pools as a result of deforestation in the project case in land use u in stratum *i* at time *t*; t CO_2-e

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

$C_{P,post,i}$ Carbon stock in all pools in post deforestation land use *u* in stratum *i*; t CO_2-e ha^{-1}

$C_{wp,i}$ Carbon stock sequestered in wood products from harvests in stratum *i*; t CO_2-e ha^{-1}

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

i 1, 2, 3 …*M* strata in the project scenario

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

For calculation of carbon stock sequestered in wood products, see the module "Estimation of carbon stocks and changes in carbon stocks in the harvested wood products carbon pool in REDD project activities" (CP-W).

Instead of tracking annual emissions through burning and/or decomposition, this methodology employs the simplifying assumption that all carbon stocks are emitted in the year deforested and that no stocks are permanently sequestered (beyond 100 years after deforestation). This assumption applies regardless of whether burning is employed as part of the forest conversion process or as part of post conversion land use activities.

For each post-deforestation land use (u) estimate the long-term carbon stock. Carbon stocks in the selected pools (must be the same as those used in the baseline modules) must be measured and estimated using the methods given in module CP-AB.

$$C_{post,u,i} = C_{AB\_tree,i} + C_{BB\_tree,i} + C_{AB\_non-tree,i} + C_{BB\_non-tree,i} + C_{DW,i} + C_{LI,i} + C_{SOC,PD-BSL,i} \quad (9)$$

Where:

$C_{post,u,i}$ Carbon stock in all pools in post-deforestation land use *u* in stratum *i* at time *t*; t CO_2-e

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

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

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

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

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

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

$C_{SOC,PD-BSL,i}$ Mean post-deforestation stock in soil organic carbon in the post deforestation stratum *i*; t CO_2-e ha^{-1}

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

i 1, 2, 3 …*M* strata in the project scenario

Carbon pools excluded from the project can be accounted as zero. Herbaceous non-tree vegetation is considered to be de minimis in all instances. For the determination which carbon pools must be included in the calculations as a minimum, use Tool T-SIG.

Monitoring areas undergoing carbon stock enhancement

It is conservative to assume that no carbon stock enhancement is occurring. The project elected to set $\Delta C_{P,Enh,I,t} = 0$ for the whole project area.

Organizational structure, responsibilities and competencies

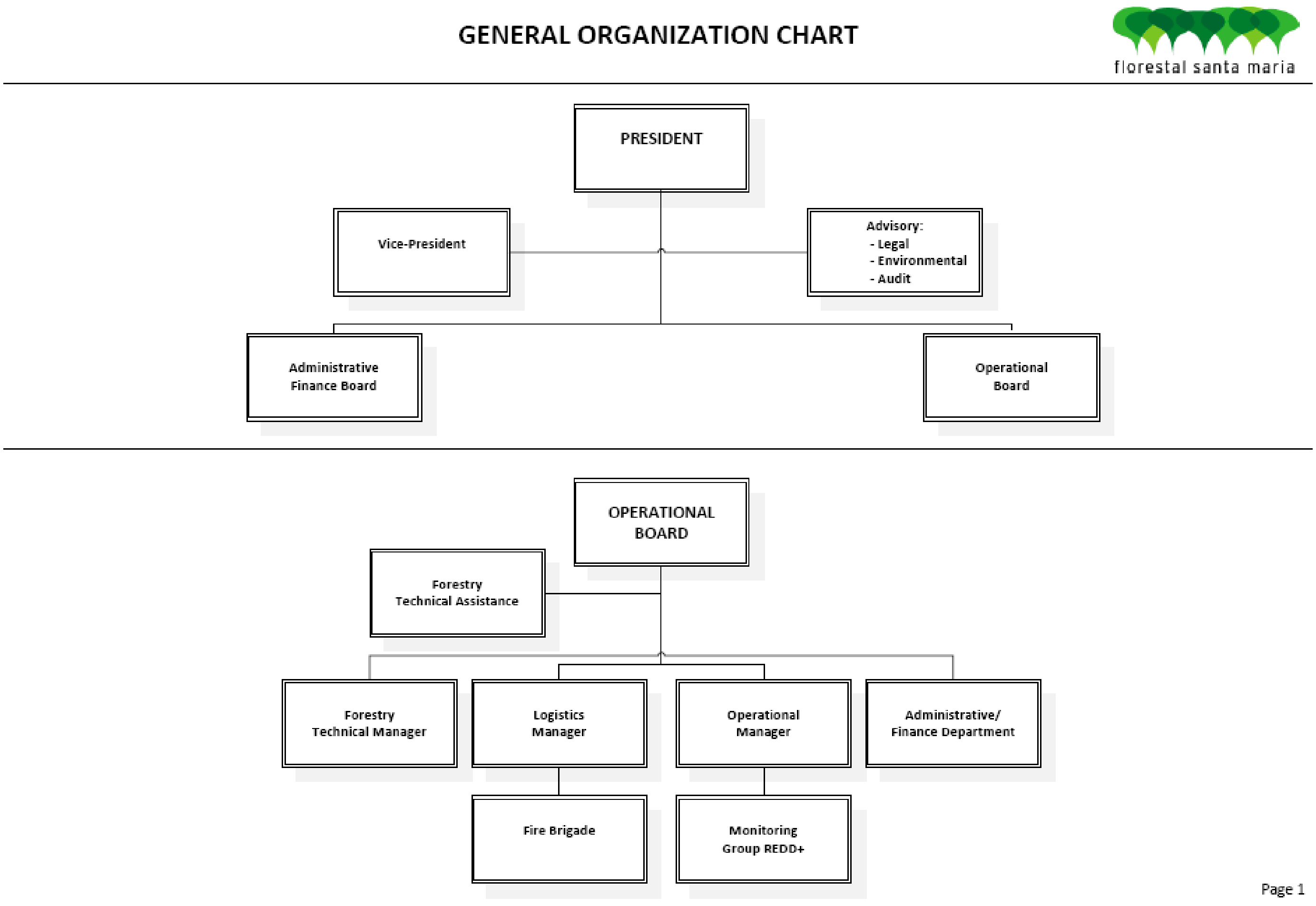
Ecológica Assessoria Ltda. and Florestal Santa Maria S.A. were responsible for the development of the current monitoring report. In order to ensure the operation of the monitoring activities during this period, the operational and managerial structure was established according to the table below.

Table 4. Type of Monitoring and Party Responsible for Monitoring

Variables to be monitored	Responsible	Frequency
Revision of the baseline	FSM and external institutions qualified for the GIS analysis and monitoring	Every 10 years
Monitoring Deforestation, actual carbon stock changes and GHG emissions	FSM and Ecológica Assessoria	Prior to each verification
Monitoring degradation due to selective logging of forest management areas	FSM and Ecológica Assessoria	Prior to each verification
Monitoring of leakage carbon stock changes and GHG emissions	FSM and Ecológica Assessoria	Prior to each verification
Field inventory of biomass	FSM	At least, every 10 years

Estimation of ex-post net carbon stock changes and GHG emissions	FSM and Ecológica Assessoria	Prior to each verification

Moreover, in order to ensure the operation of the monitoring activities, the operational and managerial structure of Florestal Santa Maria S.A. is detailed in the chart below, which shows the organization and responsibilities.



Methods for generating, recording, aggregating, collating and reporting data on monitored parameters

The parameters monitored on the project will be generated, recorded, aggregated and collated using the system that it is already in place at FSM.

All data sources and processing, classification and change detection procedures will be documented and stored in a dedicated long-term electronic archive maintained by FSM.

FSM keeps a digital copy of all documents generated during the development of the VCS PD and the subsequent baseline reports and monitoring periods. Ecológica Assessoria Ltda. will also keep all documents generated during the current monitoring period.

Given the extended time frame and the pace of production of updated versions of software and new hardware for storing data, electronic files will be updated periodically or converted to a format accessible to future software applications, as needed.

All maps and records generated during project implementation will be stored and made available to VCS verifiers at verification for inspection. In addition, any data collected from ground-truth points (including GPS coordinates, identified land-use class, and supporting photographic evidence) will be recorded and archived.

Monitored data will be kept for two years after the end of the crediting period or the last issuance of carbon credits for this project activity, whichever occurs later. For this purpose, the authority for the registration, monitoring, measurement and reporting is FSM. Furthermore, monitored parameters described in the section 4.2 above were monitored with the frequency described in the sub-section Organizational structure, responsibilities and competencies, above.

Quality Assurance/Quality Control

To ensure consistency and quality of results, spatial analysts carrying out the image processing, interpretation, and change detection procedures strictly adhered to the steps detailed in the Methodology and VCS PD. Project activities implemented within the project area were consistent with the management plans of the PD.

The implementation of the project activity was monitored by continuous monitoring activities using remote sensing techniques. Additionally, field data was also used. The land-use monitoring was carried out with remote sensing methods, using images generated by INPE

(PRODES)[12], which were subject to digital processing to perform the interpretation and classification of the land cover classes studied.

The management structure also relies on FSM employees to help monitor the area within the project area.

During the current monitoring period, the Florestal Santa Maria Project activity has also implemented the sustainability report following the SOCIALCARBON methodology, which was developed by Instituto Ecológica and focus on implementing environmental and social activities within the project area. This methodology follows the SOCIALCARBON Guidelines available at: http://www.socialcarbon.org/documents/.

In addition, the SOCIALCARBON Report corresponding to the current monitoring period will be available on the VCS Registry once the MR is issued.

Procedures for handling internal auditing and non-conformities

The procedures for handling internal auditing and non-conformities are established by the Operational Board of FSM under the approval of the President. All the necessary task-force and procedures will be in place to meet the highest levels of governance.

FSM manages forest resources according to a Sustainable Forest Management Plan approved by a State-level Environmental Agency, which developed by third party experts and performed by its management team with significant expertise 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 FSM staff.

During the current monitoring period, Ecológica Assessoria Ltda implemented a procedure to minimize the risk of error, obtaining reliable data on which to base the monitoring results, and thus, minimizing non-conformities. It included the revision of monitoring procedures set out in the methodological guidelines and; revision of the monitoring report prior to its delivery to the VVB, in order to confirm that the calculations, analysis and the conclusions are accurate and measured. If non-conformities exist during the internal or external auditing processes, the data should be reviewed, and the non-conformities addressed.

[12] Available at: http://www.obt.inpe.br/prodes/index.php.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

For conservative calculation purposes, only the areas under “Very High” and “High” deforestation risk classes were considered to be deforested in the baseline, which corresponds to a total deforestation of 86% of the Project Area over 30 years. Also for conservativeness purposes, the areas exploited inside the FSM farm from 13rd April 2009 to 31st December 2011, and from 1st April 2017 to 12th April 2019, were excluded from the calculation of VCU benefits. This is due to the fact that these areas were not certified by the FSC (Forest Stewardship Council) at the moment of timber harvest and, consequently, were not eligible to the Project, according to M-MON v2.1. The documents showing the areas exploited within this time period are available for consultation by auditors and will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

Estimation of annual areas of unplanned deforestation

The projected unplanned baseline deforestation in the project area is estimated as follows:

$$A_{BSL,PA,unplanned,t} = A_{BSL,RRD,unplanned,t} * P_{PA}$$

Where:

$A_{BSL,PA,unplanned,t}$ Projected area of unplanned baseline deforestation in the project area in year t; ha

$A_{BSL,RRD,unplanned,t}$ Projected area of unplanned baseline deforestation in the RRD in year t; ha

P_{PA} Ratio of the project area to the total area of RRD; dimensionless

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

Future deforestation is assumed to happen first at the pixel locations with the highest deforestation risk value. In the Deforestation Risk Map, the pixels with the highest risk value were successively selected whose area is equal to the area expected to be deforested in a given project year, proportionally for a given stratum occurring in the Project Area. Pixel selection procedure was repeated for each successive project year. All yearly baseline deforestation areas were compiled in one single table showing the expected Baseline Deforestation for the Project Duration (Table 5; Location Analysis). This procedure was repeated for each forest stratum occurring in the Project Area.

Table 5. Projection of annual baseline deforestation for the Project Area (Location Analysis), during project duration, for each stratum occurring in the Project Area

Annual baseline deforestation for the Project Area								Stratum FOB Dens
	Deforestation Risk Class					Total yearly area (ha/year)	Total accumulative area (ha)	
	5	4	3	2	1			
Year								
2012	0.0					0.0	0.0	
2013	0.0					0.0	0.0	
2014	0.0					0.0	0.0	
2015	0.0					0.0	0.0	
2016	0.0					0.0	0.0	
2017	0.0					0.0	0.0	
2018	0.0					0.0	0.0	
2019	0.0					0.0	0.0	

Annual baseline deforestation for the Project Area								Stratum Encosta
	Deforestation Risk Class					Total yearly area (ha/year)	Total accumulative area (ha)	
	5	4	3	2	1			
Year								
2012	6.1					6.1	6.1	
2013	9.2					9.2	15.2	
2014	9.2					9.2	24.4	
2015	9.2					9.2	33.6	
2016	9.2					9.2	42.8	
2017	9.2					9.2	51.9	
2018	9.2					9.2	61.1	
2019	2.6					2.6	63.7	

Annual baseline deforestation for the Project Area								Stratum Aluvial
	Deforestation Risk Class					Total yearly area (ha/year)	Total accumulative area (ha)	
	5	4	3	2	1			
Year								
2012	367.7					367.7	367.7	
2013	556.1					556.1	923.8	
2014	556.1					556.1	1,479.9	
2015	556.1					556.1	2,036.0	
2016	556.1					556.1	2,592.1	
2017	556.1					556.1	3,148.2	
2018	556.1					556.1	3,704.3	
2019	155.4					155.4	3,859.7	

Annual baseline deforestation for the Project Area								Stratum FOB Subn
	Deforestation Risk Class					Total yearly area (ha/year)	Total accumulative area (ha)	
	5	4	3	2	1			
Year								
2012	849.6					849.6	849.6	
2013	1284.9					1,284.9	2,134.4	
2014	1284.9					1,284.9	3,419.3	
2015	1284.9					1,284.9	4,704.2	
2016	1284.9					1,284.9	5,989.1	
2017	1284.9					1,284.9	7,273.9	
2018	1284.9					1,284.9	8,558.8	
2019	359.1					359.1	8,917.9	

Characterization of biomass in Project Area

The Project Area underwent a specific field inventory in 2010. The forest inventory was preceded by a local stratification by forest sub-types, as shown in Figure 4. Permanent sampling plots were installed in the field considering the minimal sampling for each stratum, in order to obtain a representative sample with maximum of 15% error[13].

The field inventory methodology is described in a Standard Operating Procedure (SOP), which is available for consultation by the auditors. This SOP was specifically designed to FSM carbon inventories, to be applied in the baseline assessment, as well as in the baseline renewal. The field carbon inventory involved the installation of 18 permanent transects, composed by a total of 128 permanent plots. The distribution of transects can be seen in Figure 4. The geographic coordinates of the permanent sampling plots are available for consultation by the auditors.

[13] According to "Approved VCS Module VMD0017 (Version 1.0) REDD Methodological Module: Estimation of uncertainty for REDD project activities (X-UNC), Sectoral Scope 14", the allowable uncertainty under this methodology is +/- 15% at the 95% confidence level. Where this precision level is met then no deduction should result for uncertainty.

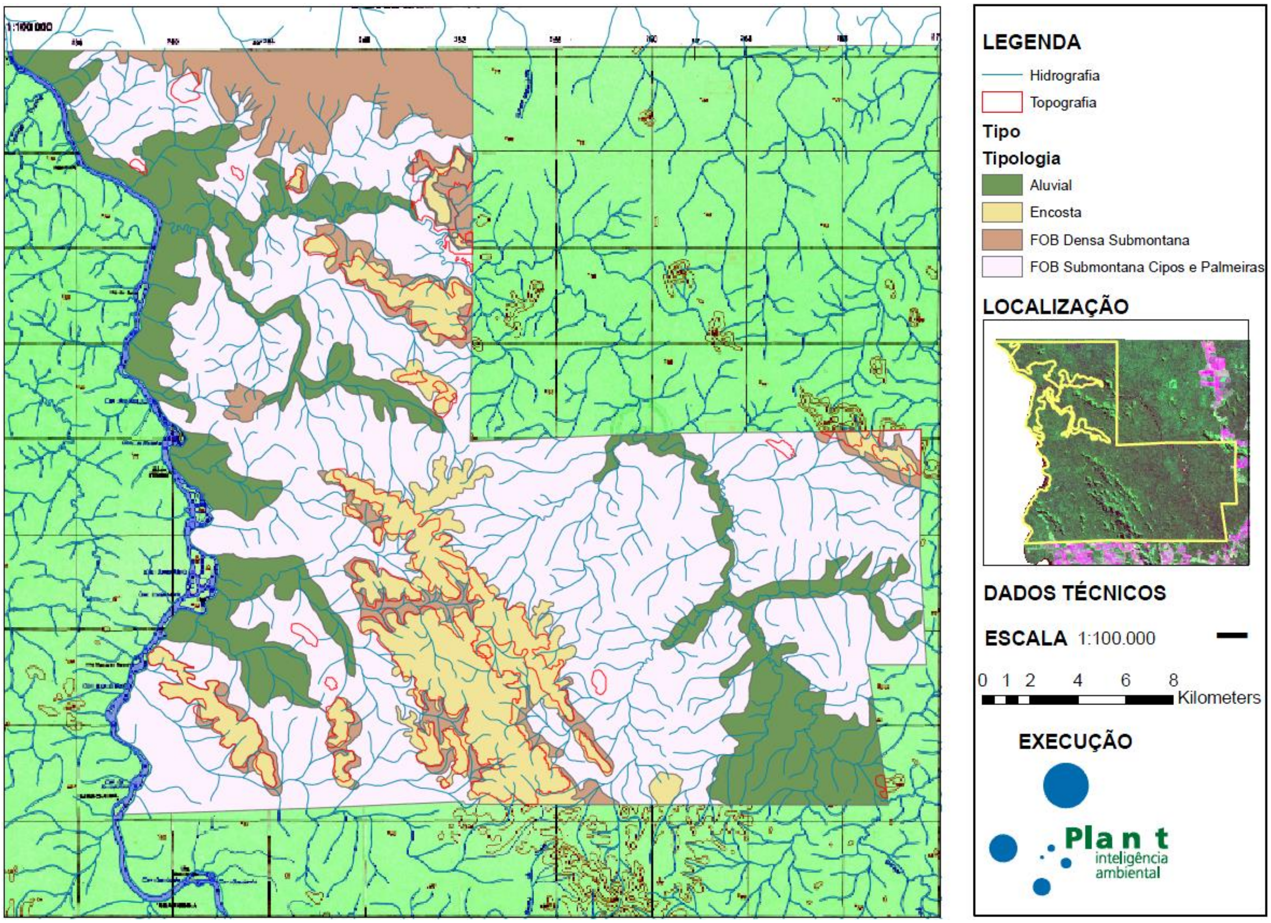


Figure 3. Thematic map of vegetation typologies (strata) and hydrography in FSM farm

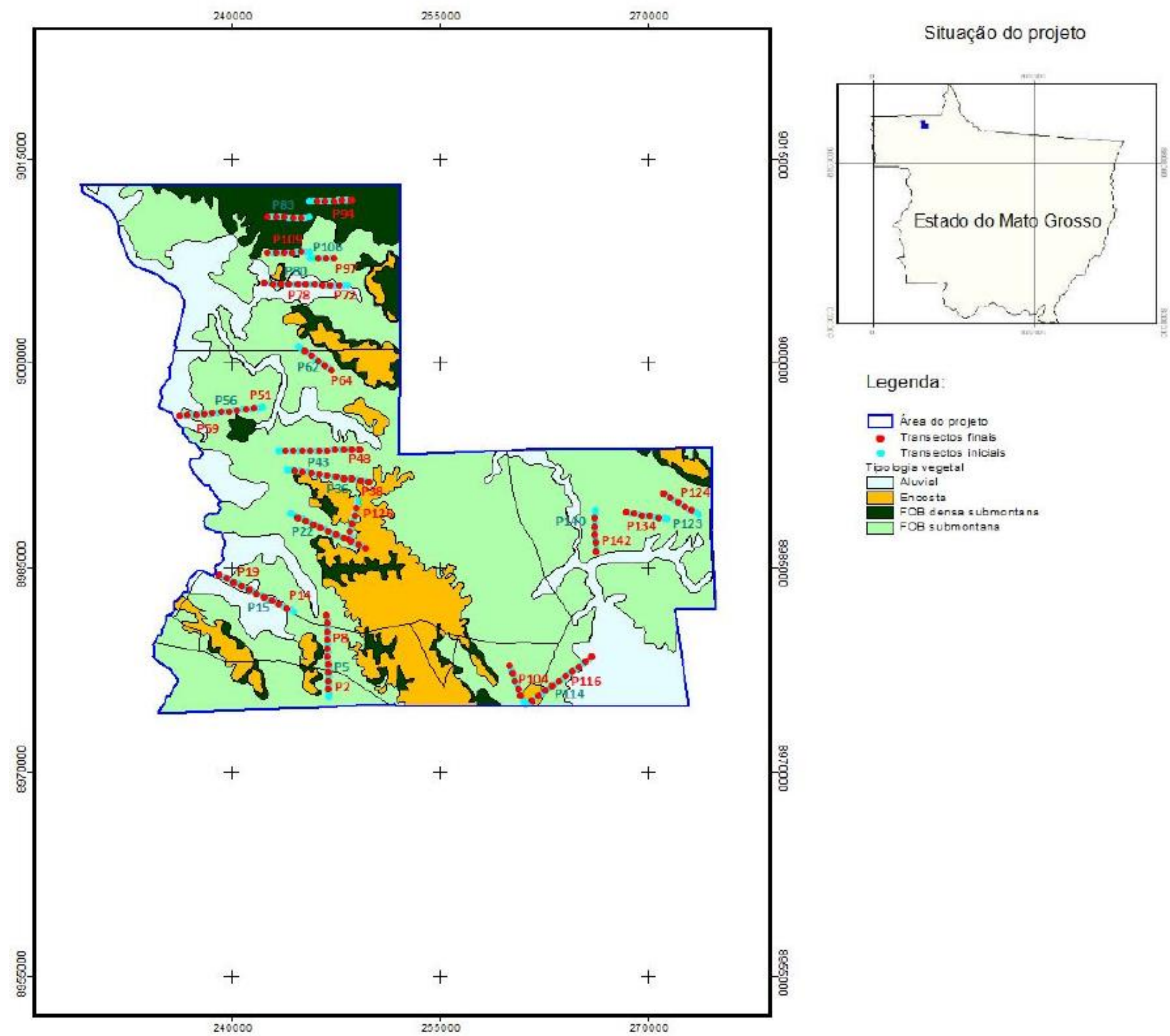


Figure 4. Distribution of permanent transects for the biomass carbon inventory in the Project Area

The merchantable volume of trees was estimated by directly measuring the circumference at breast height (CBH). The data of CBH is converted in DBH (Diameter at Breast Height) and applied to allometric equations for estimation of merchantable stem volume. For application of allometric equations, trees were divided in two classes of DBH:

- DBH ranging from 4.46 cm to 81.99 cm: application of allometric equation from NOGUEIRA et al. (2008) [14]. This equation was adjusted for estimating bole volume of trees with DBH ranging from 5 to 82 cm (excepting palm trees). This equation has been derived using DBH based on datasets that comprise more than 30 trees (i.e. 298 trees). The model was based on statistically significant regression and has an r^2 that is higher than 0.8 (i.e. r^2 = 0.971):

$$\ln(\text{Volume, m}^3) = -8.939 + 2.507 \cdot \ln(\text{DBH, cm})$$

- DBH higher than 82.00 cm: application of allometric equation from COLPINI et al. (2009) [15]. The COLPINI et al. (2009) Kopezky – Gehrhardt allometric equation was applied for estimating the merchantable volume of trees (excepting palm trees). This equation has been derived using DBH based on datasets that comprise more than 30 trees (i.e. 91 trees). This equation was based on statistically significant regression and has an r^2 that is higher than 0.8. According to COLPINI et al. (2009), the Kopezky – Gehrhardt model showed the best performance among single-entry models for estimation of volumes with bark in the same forest type observed in the FSM region. The Kopezky – Gehrhardt model, presented below, provided an r^2 of 0.928. Given that the allometric equation has been obtained for individuals having DBH higher than 82 cm (i.e. ranging from 15-cm to 135-cm DBH), the equation was applied for trees with DBH higher than this threshold inside the FSM farm.

$$\text{Volume, m}^3 = -0.4306 + 0.0011 \cdot (\text{DBH, cm})^2$$

Both equations correspond to a local forest-type specific model, whose data were collected in the same type of forest ("As", according to the official IBGE classification; Open Forest of South Amazon) at distances of about 120 km from the FSM farm.

COLPINI's model was adjusted for a forest fragment located at the municipality of Cotriguaçu (north-west region of the State of Mato Grosso) between latitudes 9°47' and 9°53' S and longitudes 58°13' and 58°19' W, with altitude varying between 100 and 150 m.

For NOGUEIRA's model, data collection was performed also in the municipality of Cotriguaçu and other two municipalities: Juruena and Carlinda, State of Mato Grosso. In NOGUEIRA et al. (2008), in South Amazon sampling sites, the vegetation was described as

[14] NOGUEIRA, E.M.; FEARNSIDE, P.M.; NELSON, B.W.; BARBOSA, R.I.; KEIZER, E.W.H., 2008. Estimates of forest biomass in the Brazilian Amazon: New allometric equations and adjustments to biomass from wood-volume inventories. Forest Ecology and Management, 256(2008): 1853-1867.

[15] COLPINI, C.; TRAVAGIN, D.P.; SOARES, T.S.; SILVA, V.S.M. e, 2009. Determinação do volume, do fator de forma e da porcentagem de casca de árvores individuais em uma Floresta Ombrófila Aberta na região noroeste de Mato Grosso. Acta Amazonica, 39(1): 97-104.

open forest, including the Carlinda site in the north-western portion of the State of Mato Grosso. Except for the Carlinda site, where evidence of previous disturbance was observed, all other plots were in primary forest, without invasion of pioneer trees or mortality associated with edges.

Note that this forest type specific equation does not include palm species and so a specific equation for this growth form was used. The equation used for estimation of total aboveground biomass in palm species was that presented by SALDARRIAGA et al. (1988)[16]:

$$\ln(\text{Mass, kg}) = -6.3789 - 0.877 \cdot \ln(1/(\text{DBH, cm})^2) + 2.151 \cdot \ln(\text{Height, m})$$

This is likely to be the most suitable equation available for estimation of palm aboveground biomass in the Amazon biome. This equation was also applied by NOGUEIRA et al. (2008) as the most suitable for the Amazon biome. The SALDARRIAGA's equation has an r^2 of 0.89 (above the minimum threshold required by the methodology, 0.80).

The results of the baseline field inventory are in conformance with the methodology accuracy requirements, as all biomass average estimations inside each stratum have an error below 15%, as shown in Table 6. The overall error of the biomass field inventory is estimated in 3.71%.

Table 6. Summary of the number of permanent plots in each stratum (n), as well as the estimates of sampling errors (E%) and coefficients of variation (CV) for each stratum

FOB Submontana Cipós e Palmeiras					**n**	
Plot area	2500	m2	t2	2.792241	**70**	(estimated)
Total area	425730000	m2	CV2	584.24	**70**	(measured)
N	170292		E%2	23.43		
t(69)	1.671					
E%	**4.84**					
CV	**24.17**					

Aluvial					**n**	
Plot area	2500	m2	t2	2.927521	**25**	(estimated)
Total area	131316000	m2	CV2	595.95	**25**	(measured)
N	52526.4		E%2	68.39		
t(24)	1.711					
E%	**8.27**					
CV	**24.41**					

[16] SALDARRIAGA, J.G., WEST, D.C., THARP, M.L., UHL, C., 1988. Long-term chronosequence of forest succession in the upper Rio Negro of Colombia and Venezuela. Journal of Ecology, 76: 938–958.

FOB Submontana Densa					n	
Plot area	2500	m2	t2	3.0276	**18**	(estimated)
Total area	67210000	m2	CV2	727.25	**18**	(measured)
N	26884		E%2	119.03		
t(17)	1.740					
E%	10.91					
CV	**26.97**					

Encosta					n	
Plot area	2500	m2	t2	3.101121	**15**	(estimated)
Total area	92883000	m2	CV2	711.53	**15**	(measured)
N	37153.2		E%2	142.32		
t(14)	1.761					
E%	11.93					
CV	**26.67**					

TOTAL INVENTORY					n	
Plot area	2500	m2	t2	2.7556	**128**	(estimated)
Total area	717000000	m2	CV2	640.58	128	(measured)
N	286800		E%2	13.76		
t(127)	1.660					
E%	3.71					
CV	**25.31**					

The merchantable aboveground biomass of trees measured in the field (“Merchantable (trees) (t/ha)”) and the total aboveground biomass of palms (“Palms (aboveground) (t/ha)”) are shown in Figure 5. For total aboveground tree biomass calculation (“Aboveground”; t/ha), merchantable biomass of trees was multiplied by a BCEF (Biomass conversion and expansion factor) for conversion of merchantable volume to total aboveground tree biomass equal to 1.66 [17]. The total aboveground biomass of palms (“Palms (aboveground) (t/ha)”) was directly provided by the allometric equation for palms (SALDARRIAGA et al. 1988). For estimating the belowground biomass per stratum (“Belowground”; t/ha), the aboveground component (“Aboveground (total) (t/ha)”) was multiplied by a root-shoot ratio of 0.37 [18].

For calculating the carbon pools (above and belowground) for each stratum, the total biomass of the total area of each stratum was multiplied by a CF (Carbon Fraction) in Dry Matter equal to 0.47 [19] (conversion from dry mass to tC) and by 44/12 (conversion from tC to tCO_2).

[17] Brown, S., A. J. R. Gillespie, and A. E. Lugo, 1989. Biomass estimation methods for tropical forests with applications to forest inventory data. Forest Science, 35:881-902. (Table 4; pg. 890; minimum value deducted from lowest limit.: 1.743 - 0.083 = 1.66)

[18] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Ch. 4, AFOLU, pg. 4.49, Table 4-4.

[19] Default value 0.47 tC t^{-1} d.m. (3_CP-B, pg. 9).

BCEF	R
1.66	0.37

			Biomass					
Stratum	Area (ha)		Merchantable (trees) (t/ha)	Palms (aboveground) (t/ha)	Aboveground (total) (t/ha)	Belowground (t/ha)	Total aboveground per stratum (t)	Total belowground per stratum (t)
Aluvial	11,145.45	19.2%	132.4	4.9	224.7	83.1	2,504,040.0	926,494.8
Encosta	8,074.82	13.9%	158.0	6.0	268.3	99.3	2,166,273.2	801,521.1
FOB Densa Submontana	453.49	0.8%	133.4	2.4	223.9	82.8	101,518.0	37,561.7
FOB Submontana Cipós e Palmeiras	38,362.55	66.1%	140.0	6.3	238.7	88.3	9,157,545.7	3,388,291.9
Total	**58,036.31**	**100.0%**					**13,929,377.0**	**5,153,869.5**

Under Deforestation Risk Analysis	**49,528.21**
	CF
	0.47

	Carbon Pools	
Stratum	**Aboveground, per stratum (tCO_2)**	**Belowground, per stratum (tCO_2)**
Aluvial	4,315,295.6	1,596,659.4
Encosta	3,733,210.9	1,381,288.0
FOB Densa Submontana	174,949.3	64,731.2
FOB Submontana Cipós e Palmeiras	15,781,503.8	5,839,156.4
Total	24,004,959.6	8,881,835.1
	C_{AB_tree}	C_{BB_tree}

Figure 5. Characterization of above and belowground carbon stocks in Project Area (FSM estate), for different vegetation strata

Baseline emissions from unplanned deforestation

For estimating emissions from unplanned deforestation that would occur in Project Area in the absence of project (i.e. in the baseline case), the annual estimated area to be deforested (see "Estimation of annual areas of unplanned deforestation"; Table 5) was multiplied by the sum of aboveground and belowground carbon stocks in forest for each biomass stratum (see "Characterization of biomass in Project Area"; Figure 5). The result of this procedure is shown in Table 7.

The areas exploited inside the FSM farm from 13rd April 2009 to 31st December 2011, and from 1st April 2017 to 12th April 2019, were excluded from the calculation of VCU benefits. This is due to the fact that these areas were not certified by the FSC (Forest Stewardship Council) at the moment of timber harvest and, consequently, were not eligible to the Project, according to M-MON v2.1. The documents showing the areas exploited within this time period are available for consultation by auditors and will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

Table 7. Summary of gross baseline emissions from unplanned deforestation that would occur within the Project Area in the baseline case

Gross baseline emissions from deforestation in FSM			Stratum FOB Densa Submontana	
Year	ha/year	ha (accumulative)	tCO_2/year	tCO_2
2012	0.00	0.00	0.00	0.00
2013	0.00	0.00	0.00	0.00
2014	0.00	0.00	0.00	0.00
2015	0.00	0.00	0.00	0.00
2016	0.00	0.00	0.00	0.00
2017	0.00	0.00	0.00	0.00
2018	0.00	0.00	0.00	0.00
2019	0.00	0.00	0.00	0.00

Gross baseline emissions from deforestation in FSM			Stratum Encosta	
Year	ha/year	ha (accumulative)	tCO_2/year	tCO_2
2012	6.07	6.07	3,842.76	3,842.76
2013	9.18	15.24	5,811.78	9,654.55
2014	9.18	24.42	5,811.78	15,466.33
2015	9.18	33.59	5,811.78	21,278.12
2016	9.18	42.77	5,811.78	27,089.90
2017	9.18	51.95	5,811.78	32,901.69
2018	9.18	61.12	5,811.78	38,713.47
2019	2.56	63.69	1,624.12	40,337.59

Gross baseline emissions from deforestation in FSM			Stratum Aluvial	
Year	ha/year	ha (accumulative)	tCO_2/year	tCO_2
2012	367.69	367.69	195,037.74	195,037.74
2013	556.10	923.79	294,974.44	490,012.18
2014	556.10	1,479.89	294,974.44	784,986.63
2015	556.10	2,035.98	294,974.44	1,079,961.07
2016	556.10	2,592.08	294,974.44	1,374,935.51
2017	556.10	3,148.18	294,974.44	1,669,909.95
2018	556.10	3,704.28	294,974.44	1,964,884.39
2019	155.40	3,859.68	82,431.21	2,047,315.60

Gross baseline emissions from deforestation in FSM			Stratum FOB Submontana Cipós e	
Year	ha/year	ha (accumulative)	tCO_2/year	tCO_2
2012	849.56	849.56	478,802.95	478,802.95
2013	1,284.88	2,134.44	724,140.00	1,202,942.95
2014	1,284.88	3,419.31	724,140.00	1,927,082.95
2015	1,284.88	4,704.19	724,140.00	2,651,222.95
2016	1,284.88	5,989.06	724,140.00	3,375,362.95
2017	1,284.88	7,273.94	724,140.00	4,099,502.95
2018	1,284.88	8,558.82	724,140.00	4,823,642.95
2019	359.06	8,917.88	202,362.41	5,026,005.36

Gross baseline emissions from deforestation in FSM			Sum of Strata	
Year	ha/year	ha (accumulative)	tCO_2/year	tCO_2
2012	1,223.32	1,223.32	677,683.46	677,683.46
2013	1,850.15	3,073.47	1,024,926.22	1,702,609.69
2014	1,850.15	4,923.62	1,024,926.22	2,727,535.91
2015	1,850.15	6,773.77	1,024,926.22	3,752,462.13
2016	1,850.15	8,623.92	1,024,926.22	4,777,388.36
2017	1,850.15	10,474.06	1,024,926.22	5,802,314.58
2018	1,850.15	12,324.21	1,024,926.22	6,827,240.81
2019	517.03	12,841.24	286,417.74	7,113,658.55

Emissions from biomass burning in the baseline

Based on the IPCC 2006 Inventory Guidelines, estimating greenhouse gas emissions from biomass burning was determined as:

$$E_{BiomassBurn,i,t} = \sum_{g=1}^{G} \left(\left(\left(A_{burn,i,t} * B_{i,t} * COMF_i * G_{g,i} \right) * 10^{-3} \right) * GWP_g \right)$$

Where:

$E_{BiomassBurn,i,t}$ Greenhouse emissions due to biomass burning as part of deforestation activities in stratum *i* in year *t*; tCO_2-e of each GHG (CO_2, CH_4, N_2O)

$A_{Burn,i,t}$ Area burnt for stratum *i* at time *t*; ha

$B_{i,t}$ Average aboveground biomass stock before burning stratum *i*, time *t*; tonnes d.m. ha^{-1}

$COMF_i$ Combustion factor for stratum *i*; dimensionless (default value derived from Table 2.6 of IPCC, 2006) [20]

$G_{g,i}$ Emission factor for stratum *i* for gas *g*; kg t^{-1} dry matter burnt (default values derived from Table 2.5 of IPCC, 2006) [21]

GWP_g Global warming potential for gas *g*; t CO_2/t gas *g* (default values from IPCC SAR: CO_2 = 1; CH_4 = 21; N_2O = 310)

[20] E-BB; ANNEX 1; Table 2.6; page 6 "All tertiary tropical forest": 0.59

[21] E-BB; Table 2.5; page 8 "Tropical forest": For CH_4: 6.8 - 2 = 4.8 g kg^{-1} dry matter burnt (conservative); For N_2O: 0.20 g kg^{-1} dry matter burnt (unique value proposed).

g	1, 2, 3 ... *G* greenhouse gases
i	1, 2, 3 … *M* strata
t	1, 2, 3 … *t* years elapsed since the start of the REDD project activity

Table 8 shows the parameters used in calculation of biomass burning for the baseline scenario, as well as results accounted for CH_4 and N_2O emissions generated as a consequence of incomplete biomass burning of non-commercial wood after logging.

Table 8. Summary of parameters used in calculation and results for biomass burning emissions in the baseline scenario (CH_4 and N_2O)

COMF	0.59	adimensional		
G $_{CH4}$	4.8	g/kg of dry matter burnt	***GWP*** $_{CH4}$	25
G $_{N2O}$	0.2	g/kg of dry matter burnt	***GWP*** $_{N2O}$	298

Biomass Burning Emissions			**CH₄** Sum of Strata		**N₂O** Sum of Strata	
Year	**ha/year**	**ha (accumulative)**	**tCO_2/year**	**tCO_2**	**tCO_2/year**	**tCO_2**
2012	1,223.32	1,223.32	19,241.77	19,241.77	9,556.75	9,556.75
2013	1,850.15	3,073.47	29,101.19	48,342.96	14,453.59	24,010.34
2014	1,850.15	4,923.62	29,101.19	77,444.15	14,453.59	38,463.93
2015	1,850.15	6,773.77	29,101.19	106,545.34	14,453.59	52,917.52
2016	1,850.15	8,623.92	29,101.19	135,646.53	14,453.59	67,371.11
2017	1,850.15	10,474.06	29,101.19	164,747.72	14,453.59	81,824.70
2018	1,850.15	12,324.21	29,101.19	193,848.90	14,453.59	96,278.29
2019	517.03	12,841.24	8,132.39	201,981.29	4,039.09	100,317.37

The areas exploited inside the FSM farm from 13rd April 2009 to 31st December 2011, and from 1st April 2017 to 12th April 2019, were excluded from the calculation of VCU benefits. This is due to the fact that these areas were not certified by the FSC (Forest Stewardship Council) at the moment of timber harvest and, consequently, were not eligible to the Project, according to M-MON v2.1. The documents showing the areas exploited within this time period are available for consultation by auditors and will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

Wood products carbon pool in the baseline

For estimating the biomass carbon of the commercial volume extracted in the process of deforestation, the following equation was applied, according to "Option 2: Commercial inventory estimation", as recommended in CP-W:

$$C_{XB,i} = C_{AB\_tree,i} * \frac{1}{BCEF} * Pcom_i$$

Where:

$C_{XB,i}$ Mean stock of extracted biomass carbon from stratum *i*; t CO_2-e ha^{-1}

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

BCEF BCEF for conversion of merchantable volume to total aboveground tree biomass; dimensionless

P_{comi} Commercial volume as a percent of total aboveground volume in stratum i; dimensionless (calculated as the ratio between the volume of merchantable wood in exploitation, 35.08 m^3/ha, and the total volume of aboveground biomass per stratum)

i 1, 2, 3 … *M* strata

In order to calculate the proportion of biomass carbon extracted that remains sequestered in long-term wood products after 100 years, it was simply and conservatively assumed that all extracted biomass not retained in long-term wood products after 100 years is emitted in the year harvested, instead of tracking annual emissions through retirement, burning and decomposition. All factors are derived from Winjum et al. 1998 [22].

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

Where:

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

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

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

WW_{ty} Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product *ty*; dimensionless (0.24 for developing countries; Winjum et al. 1998 cited by CP-W)

SLF_{ty} Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product *ty*; dimensionless (0.20 for sawnwood; Winjum et al. 1998 cited by CP-W)

OFty Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product *ty*; dimensionless (0.80 for sawnwood in tropical forests; Winjum et al. 1998 cited by CP-W)

ty Wood product class – defined here as sawnwood (s)

i 1, 2, 3 … *M* strata

The parameters used in calculation of wood products carbon pool in the baseline, as well as the results of estimates (sum of strata), are demonstrated in Table 9.

Table 9. Summary of calculations of wood products carbon pool in the baseline scenario

Merchantable wood in exploitation (m^3/ha)	35.08
Wood average density (t/m^3)	0.59
Forest management cycle (years)	1
WW_{ty}	0.24
SLF_{ty}	0.20
OF_{ty}	0.80

Stratum	C_{AB_tree} (t_{CO2e}/ha)	BCEF	Pcom	C_{XB} (t_{CO2e}/ha)	C_{WP} (t_{CO2e}/ha)
Aluvial	387.18	1.66	0.09217	21.50	2.61
Encosta	462.33	1.66	0.07719	21.50	2.61
FOB Densa Submontana	385.78	1.66	0.09250	21.50	2.61
FOB Submontana Cipós e Palmeiras	411.38	1.66	0.08675	21.50	2.61
				86.0	**10.46**

Wood average density (0.59 t/m3): Source: Brown, S., A. J. R. Gillespie, and A. E. Lugo, 1989. Biomass estimation methods for tropical forests with applications to forest inventory data. Forest Science, 35:881-902. (see pg. 890, Table 4, Moist)

Wood products carbon pool in baseline			Sum of Strata	
Year	ha/year	ha (accumulative)	tCO_2/year	tCO_2
2012	1,223.32	1,223.32	3,197.85	3,197.85
2013	1,850.15	3,073.47	4,836.42	8,034.27
2014	1,850.15	4,923.62	4,836.42	12,870.69
2015	1,850.15	6,773.77	4,836.42	17,707.11
2016	1,850.15	8,623.92	4,836.42	22,543.53
2017	1,850.15	10,474.06	4,836.42	27,379.94
2018	1,850.15	12,324.21	4,836.42	32,216.36
2019	517.03	12,841.24	1,351.55	33,567.91

Pasture carbon pools in the baseline

For calculation of the carbon pool remaining on pasture after deforestation, a conservative value of 15.0 tCO_2/ha was applied (2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 4, Chapter 6: Grassland, pg. 6.27, Table 6.4). The proportion of baseline deforestation converted to pasture was considered as 90%. Table 10 summarizes the results obtained for pasture carbon pools in the baseline scenario.

Table 10. Results obtained for calculations of pasture carbon pools in baseline scenario

Baseline Pasture Carbon Pool			Sum of Strata	
Year	ha/year	ha (accumulative)	tCO_2/year	tCO_2
2012	1,223.32	1,223.32	16,507.14	16,507.14
2013	1,850.15	3,073.47	24,965.35	41,472.49
2014	1,850.15	4,923.62	24,965.35	66,437.84
2015	1,850.15	6,773.77	24,965.35	91,403.19
2016	1,850.15	8,623.92	24,965.35	116,368.54
2017	1,850.15	10,474.06	24,965.35	141,333.89
2018	1,850.15	12,324.21	24,965.35	166,299.24
2019	517.03	12,841.24	6,976.62	173,275.86

Coffee carbon pools in the baseline

For calculation of the carbon pool remaining on coffee crops after deforestation, a conservative value of 84.0 tCO_2/ha was applied [23]. The proportion of baseline deforestation converted to coffee cultivation was conservatively considered as 10%. The results obtained for coffee cultivation carbon pools in the baseline scenario are presented in Table 11.

[23] DOSSA et. al. Above- and belowground biomass, nutrient and carbon stocks contrasting an open-grown and a shaded coffee plantation. Agroforest Syst (2008) 72:103–115. DOI 10.1007/s10457-007-9075-4.

Table 11. Results obtained for calculations of coffee cultivation carbon pool in baseline scenario

Baseline Cofee Carbon Pool			Sum of Strata	
Year	ha/year	ha (accumulative)	tCO_2/year	tCO_2
2012	1,223.32	1,223.32	10,271.83	10,271.83
2013	1,850.15	3,073.47	15,535.08	25,806.91
2014	1,850.15	4,923.62	15,535.08	41,341.99
2015	1,850.15	6,773.77	15,535.08	56,877.07
2016	1,850.15	8,623.92	15,535.08	72,412.15
2017	1,850.15	10,474.06	15,535.08	87,947.23
2018	1,850.15	12,324.21	15,535.08	103,482.31
2019	517.03	12,841.24	4,341.31	107,823.62

5.2 Project Emissions

The project emissions are related to forest management activities carried out inside the Project Area. The net emissions in the project case are estimated by combining:

- Emissions arising from logging gap: encompass emissions from felling timber tree and emissions from incidental damage caused by falling timber trees,
- Emissions from infrastructure: from constructing logging infrastructure for removal of timber, such as haul roads, skid trails and logging decks;
- Wood products carbon pool from timber harvested in the Project Area.

Emissions from logging in the Project Case

The areas exploited inside the FSM farm from 1st April 2017 to 12th April 2019, were excluded from the calculation of VCU benefits. This is due to the fact that these areas were not previously certified by the FSC (Forest Stewardship Council) and, consequently, were not eligible to the Project, according to M-MON v2.1. Thus, the emissions occurring inside these areas were not quantified for the present verification period.

Thus, the project emissions were calculated only for areas harvested within 4th May 2012 and 31st March 2017. In the project case, emissions occur as a direct result of the death of the timber tree and due to the death of trees killed when the timber tree is felled. To estimate the damage of felling timber trees, a LDF (Logging Damage Factor) of 0.67 tC/m^3 was applied. This is the default conservative value, according to M-MON v2.1, Annex 1, page 51. Considering the maximum volume of timber permitted to be harvest per unit of area (30 m^3/ha, according to the Brazilian Law) and the volumes of harvested timber registered in official logging reports (see $V_{ex,i}$ in “4.2 Data and Parameters Monitored” of this Monitoring Report), the estimates of emissions from logging inside the FSM farm are presented in Table 12.

Table 12. Project emissions from logging inside the PA (Logging gap)

Year	Total area exploited per year (ha/year)	Extracted wood (m^3/ha)	Total extracted wood (t/year)	Damage (tCO_2/year)	Gross emission (tCO_2/year)
2012	0.0	30.0	0.0	0.0	0.0
2013	48.8	30.0	863.9	3,595.4	5,084.2
2014	0.0	30.0	0.0	0.0	0.0
2015	1,263.1	30.0	22,367.9	93,091.2	131,638.6
2016	873.7	30.0	15,471.7	64,390.4	91,053.2
2017	0.0	30.0	0.0	0.0	0.0
2018	0.0	30.0	0.0	0.0	0.0
2019	0.0	30.0	0.0	0.0	0.0

The estimate of project emissions attributed to management roads and decks was performed based on the Annual Operational Plans of the Sustainable Management Plan, which are the documents containing all information regarding the infrastructure needed for timber harvesting. The values used in this calculation are presented in “4.2 Data and Parameters Monitored” of this Monitoring Report (see $A_{DECKS,i,t}$ and $A_{ROAD,i,t}$) and results are compiled in Table 13.

Table 13. Project emissions from roads and decks inside the PA (Logging infra)

Year	A_{ROAD} (ha)	A_{DECKS} (ha)	ΔC_{ROADS} + ΔC_{DECKS} (tCO_2e)
2012	0.00	0.00	0.00
2013	0.00	0.00	0.00
2014	24.50	6.00	19,318.35
2015	0.00	0.00	0.00
2016	21.22	9.05	19,175.02
2017	0.00	0.00	0.00
2018	0.00	0.00	0.00
2019	0.00	0.00	0.00

The estimate of project emission also considered the vegetation loss caused by the trails produced by skidders. For ex-post calculations of emissions arising from creation of skid trails, roads, and logging decks, it was conservatively assumed the emission equivalent to the stratum with the highest biomass (i.e. “Encosta” stratum). It is assumed that the machinery used to create the skid trail kills all aboveground and belowground tree biomass located within the path of the skid trail. This biomass becomes deadwood and is assumed to be immediately emitted. The results of project emissions attributed to skid trails are presented in Table 14.

Table 14. Project emissions from skidder trails inside the PA (Logging infra)

Year	L_{SKID} (m)	ΔC_{SKID} (tCO_2e)
2012	0	0.00
2013	0	0.00
2014	105,694	24,368.12
2015	0	0.00
2016	166,729	38,440.00
2017	0	0.00
2018	0	0.00
2019	0	0.00

Wood products carbon pool in the Project Case

Part of the carbon stock composing the wood harvested from the Project Area is considered to be fixed in long-term wood products. The calculation of this carbon pool is described in section "Wood products carbon pool in the baseline" of this Monitoring Report (CP-W), and the results are summarized in Table 15.

Table 15. Carbon stock in wood products in the project case

Year	Total area exploited per year (ha/year)	Extracted wood (m^3/ha)	C_{AB_tree} (t_{CO2e}/ha)	BCEF	Pcom	C_{XB} (t_{CO2e}/ha)	C_{WP} (t_{CO2e}/ha)	C_{WP} (t_{CO2e}/year)
2012	0.0	30.0	413.62	1.66	0.07378	18.38	2.24	0.00
2013	48.8	30.0	413.62	1.66	0.07378	18.38	2.24	109.06
2014	0.0	30.0	413.62	1.66	0.07378	18.38	2.24	0.00
2015	1,263.1	30.0	413.62	1.66	0.07378	18.38	2.24	2,823.71
2016	873.7	30.0	413.62	1.66	0.07378	18.38	2.24	1,953.14
2017	0.0	30.0	413.62	1.66	0.07378	18.38	2.24	0.00
2018	0.0	30.0	413.62	1.66	0.07378	18.38	2.24	0.00
2019	0.0	30.0	413.62	1.66	0.07378	18.38	2.24	0.00

5.3 Leakage

Market Leakage - LK-ME

As explained in previous topics, the process of deforestation in the baseline scenario involves timber harvesting for commercial markets, prior to implementation of pasture or coffee crops. As described in item "*1.10 Conditions Prior to Project Initiation*" of the VCS-PD, coffee crops represent about 10% of land use in BAU, while pasture accounts for virtually all the remaining land occupation. The implementation of these BAU activities is usually financed by means of initial capital obtained in wood logging. Similarly to the Reference Area and Project Area, the Leakage Belt is also subject to serious risks of land-grabbing promoted by illegal organizations (i.e. family-scale land-grabber associations, land-property documentation forgers), mostly supported by unscrupulous sawmills and political interests. As seen in "*STEP 2. Investment analysis to determine that the proposed project activity is not the most economically or financially attractive of the identified land use scenarios*" of the VCS-PD, the maintenance of native forest is far of being the most attractive economic scenario, giving the opportunity for land use shifting from native forest to pasture and coffee crops. In this context, the local communities have a widespread culture of deforestation, mainly led by economic factors. Thus, market leakage estimate is mandatory for this project. Leakage due to market effects is equal to the baseline emissions from logging multiplied by a leakage factor:

$$LK_{MarketEffects,timber} = \sum_{i=1}^{M} \left(LF_{ME} * AL_{T,i} \right)$$

Where:

$LK_{MarketEffects,timber}$ Total GHG emissions due to market- effects leakage through decreased timber harvest; t CO_2-e

LF_{ME} Leakage factor for market-effects calculations; dimensionless

$AL_{T,i}$ Summed emissions from timber harvest in stratum *i* in the baseline case potentially displaced through implementation of carbon project; t CO_2-e

i 1,2,3…*M* strata

The deduction factor (LF_{ME}) was adopted as 0.2, based on the fact that the forest biomass is considered to be less in Project Area than in the average of Amazon Biome. It is important to consider that the Market Leakage is not calculated only for the Reference Area, but for all Amazon Biome. The scientific literature demonstrates that the forest occurring inside the FSM region has less biomass than that observed in the average of Amazon Biome. Thus, it is expected that the areas to be deforested in the Amazon Biome in the project case, as a result of project leakage, are less than those that would be observed in the project region.

The total volume that would have been logged in the baseline in the project area, across strata and time periods, is estimated as follows:

$$AL_{T,i} = \sum_{t=1}^{t} \left(C_{BSL,XBT,i,t} \right)$$

Where:

$AL_{T,i}$ Summed emissions from timber harvest in stratum *i* in the baseline case potentially displaced through implementation of carbon project; t CO_2-e

$C_{BSL,XBT,i,t}$ Carbon emission due to displaced timber harvests in the baseline scenario in stratum *i* in time t; t CO_2-e

i 1, 2, 3 …M strata

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

The carbon emission due to the displaced logging has two components: the biomass carbon of the extracted timber and the biomass carbon in the forest damaged in the process of timber extraction:

$$C_{BSL,XBT,i,t} = \left(\left[V_{BSL,XE,i,t} * D_{mn} * CF \right] + \left[V_{BSL,XE,i,t} * LDF \right] + \left[V_{BSL,XE,i,t} * LIF \right] \right) * \frac{44}{12}$$

Where:

$C_{BSL,XBT,i,t}$ Carbon emission due to timber harvests in the baseline scenario in stratum *i* at time *t*; t CO_2-e

$V_{BSL,EX,i,t}$ Volume of timber projected to be extracted from within the project boundary during the baseline in stratum *i* at time *t*; m^3

D_{mn} Mean wood density of commercially harvested species; t d.m.m^{-3}

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

LDF Logging damage factor; t C m^{-3} (default 0.67 t C m^{-3} for broadleaf and mixed forests)

LIF Logging infrastructure factor; t C m^{-3} (default 0.29 t C m^{-3})

i 1, 2, 3 … *M* strata

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

Table 16 summarizes the calculation steps and results of market leakage estimates for the FSM-REDD Project.

Table 16. Market Leakage: calculation steps and annual estimates

D_{mn}	0.59	t/m^3
CF	0.47	
LDF	0.67	tC/m^3
LIF	0.29	tC/m^3

Year												$C_{BSL,XBT,i,t}$
2012	(	1	+	3.4036	+	1.4732	)	*	3.666667	=		**23.0 tCO_2/ha**
2013	(	1	+	3.4036	+	1.4732	)	*	3.666667	=		**23.0 tCO_2/ha**
2014	(	1	+	3.4036	+	1.4732	)	*	3.666667	=		**23.0 tCO_2/ha**
2015	(	1	+	3.4036	+	1.4732	)	*	3.666667	=		**23.0 tCO_2/ha**
2016	(	1	+	3.4036	+	1.4732	)	*	3.666667	=		**23.0 tCO_2/ha**
2017	(	1	+	3.4036	+	1.4732	)	*	3.666667	=		**23.0 tCO_2/ha**
2018	(	1	+	3.4036	+	1.4732	)	*	3.666667	=		**23.0 tCO_2/ha**
2019	(	1	+	3.4036	+	1.4732	)	*	3.666667	=		**23.0 tCO_2/ha**

Year	V_{BSL}	
2012	5.1	m^3/ha
2013	5.1	m^3/ha
2014	5.1	m^3/ha
2015	5.1	m^3/ha
2016	5.1	m^3/ha
2017	5.1	m^3/ha
2018	5.1	m^3/ha
2019	5.1	m^3/ha

Market Leakage			Sum of Strata	
			$C_{BSL,XBT}$	AL_T*LF_{ME}
Year	**ha/year**	**ha (accumulative)**	**tCO_2/year**	**tCO_2/year**
2012	1,223.32	1,223.32	28,196.70	5,639.3
2013	1,850.15	3,073.47	42,644.60	8,528.9
2014	1,850.15	4,923.62	42,644.60	8,528.9
2015	1,850.15	6,773.77	42,644.60	8,528.9
2016	1,850.15	8,623.92	42,644.60	8,528.9
2017	1,850.15	10,474.06	42,644.60	8,528.9
2018	1,850.15	12,324.21	42,644.60	8,528.9
2019	517.03	12,841.24	11,917.12	2,383.4

Leakage outside the Leakage Belt (Step 4 - LK-ASU)

Immigrants prevented from migrating into and deforesting the project area are conservatively assumed to migrate to an alternative forest area and to cause deforestation in the alternative area. The alternative forest area could be within the Leakage Belt or it could be elsewhere in the country. The proportion migrating to the Leakage Belt is calculated as the area of the Leakage Belt as a proportion of the total available forest area nationally (AVFOR). AVFOR was estimated as follows:

$$AVFOR = TOTFOR - PROTFOR - MANFOR$$

Where:

AVFOR	Total available national forest area for unplanned deforestation; ha
TOTFOR	Total available national forest area; ha
PROTFOR	Total area of fully protected forests nationally; ha
MANFOR	Total area of forests under active management nationally; ha

As the country has a great variety of forest biomes in all its extension, TOTFOR considered only the Amazon Rainforest biome. This is a conservative approach. Thus, as a representation of the total area of Amazon Rainforest in Brazilian Territory, TOTFOR consisted of the total Amazon forest area (5.015.067,749 km²) multiplied by the net preserved forest (97%). As a result, TOTFOR represents 486,461,572 ha.

As TOTFOR is considered only for the Amazon biome, PROTFOR and MANFOR were evaluated solely for Brazilian Northern and Centre-West macro-regions. According to the ISA (2020)[24], PROTFOR is estimated as 128,868,351 ha. MANFOR, in turn, is estimated as 1,400,000 ha[25].

According to the SNUC (National System of Conservation Units) (regulated by Federal Decree No. 4340, August 22, 2002), there are two groups of Conservation Units, instituted by Federal Law No.9985/2000: 1) Integral Protection Units and 2) Sustainable Use Units (SEMA, 2011 [26]). The value of PROTFOR already comprises both types of Conservation

[24] https://uc.socioambiental.org/pt-br/paineldedados

[25] https://www.gov.br/ibama/pt-br/assuntos/noticias/2020/manejo-sustentavel-autorizado-pelo-ibama-em-2019-totalizou-39-mil-hectares

[26] http://www.sema.rs.gov.br/

Units. Thus, PROTFOR (above) already includes data on Forest Management Lands (UCs) (MANFOR).

In this context, AVFOR is estimated as 356,193,221 ha.

The proportion of Leakage Belt area related to the total available national forest area (PROPLB) is calculated by dividing Leakage Belt area (LBFOR; 64,460 ha) by AVFOR. This procedure results in PROPLB equal to $1.8097.10^{-4}$ (dimensionless).

The average carbon stock across the Leakage Belt (C_{LB}; 413.6 tCO_2/ha; based on similarity analysis, data from the Project Area was applied to Leakage Belt area) and the average carbon stock for all available forest area outside the Leakage Belt (C_{OLB}; 578.1 tCO_2/ha [27]) were taken for calculation of the proportional difference in carbon stocks between areas of forest available for unplanned deforestation both inside and outside the Leakage Belt ($PROP_{CS}$). $PROP_{CS}$ is calculated by dividing the stock outside the Leakage Belt (C_{OLB}) by the stock inside the Leakage Belt (C_{LB}), which results in a value of 1.3976.

The proportion of baseline deforestation caused by immigrating population ($PROP_{IMM}$) was estimated for a period from 2012 to 2019. For calculating $PROP_{IMM}$, the participatory rural appraisal (PRA) approach was replaced by local data available from IBGE and DataSus. This practice is justified by the fact that these sources have a precise approach for accounting population locally, which allows calculating the number of immigrants for a given period of time in the municipality of Colniza. The number of immigrants can be estimated by subtracting the number of annual births from the total annual population growth in the municipality of Colniza. It is then assumed that the total annual population growth in a given municipality is attributed to: i) births and ii) immigration. Thus, by subtracting the number of annual births from the total annual population growth, it is possible to infer the number of immigrants. This technique also assumes that the IBGE assessment is applicable to estimate population movements in both urban and rural zones (i.e. it is assumed that the residential proportion of immigrants in the urban zone was estimated with accuracy similar to that observed in the rural zone estimates). According to the number of immigrants, we have inferred the proportion of deforestation attributed to immigrant agents ($PROP_{IMM}$) as 3.11%.

The proportional leakage for areas with immigrating populations (LK_{PROP}) was then equal to the immigrating proportion multiplied by the proportion of available national forest area outside the Leakage Belt multiplied by the proportional difference in stocks between forests inside and outside the Leakage Belt.

$$LK_{PROP} = PROP_{IMM} * \left(1 - PROP_{LB}\right) * PROP_{CS}$$

[27] S.S. Saatchi, R.A. Houghton, R.C. dos Santos Alvalá, J.V. Soares, and Yifan Yu. Distribution of Aboveground Live Biomass in the Amazon Basin. 2007. (157.66.tC/ha).

Where:

LK_{PROP} Proportional leakage for areas with immigrating populations; proportion

$PROP_{IMM}$ Estimated proportion of baseline deforestation caused by immigrating population; proportion

$PROP_{LB}$ Area of forest available for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion

$PROP_{CS}$ Proportional difference in stocks between areas of forest available for unplanned deforestation both inside and outside the Leakage Belt; proportion

LK_{PROP} was estimated in 0.0435.

Table 17 summarizes the results obtained for ex post calculation of Leakage outside the Leakage Belt.

Table 17. Estimation results for ex post leakage outside the Leakage Belt

Leakage Outside	Sum of Strata $\Delta C_{LK-ASU,OLB}$
Year	**tCO_2/year**
2012	1,172.15
2013	1,767.91
2014	1,767.91
2015	1,767.91
2016	1,772.75
2017	1,767.91
2018	1,767.91
2019	494.05

Finally, the leakage emissions due to activity shifting in the Leakage Belt area are presented in Table 18.

Table 18. Estimation of ex post emissions from activity shifting inside the Leakage Belt

TOTAL LEAKAGE			Sum of Strata	
			Total Leakage	Shifting Leakage
Year	**ha/year**	**ha (accumulative)**	**tCO_2/year**	**tCO_2/year**
2012	0.00	0.00	0.00	0.0
2013	0.00	0.00	0.00	0.0
2014	0.00	0.00	0.00	0.0
2015	0.00	0.00	0.00	0.0
2016	0.00	0.00	0.00	0.0
2017	0.00	0.00	0.00	0.0
2018	984.00	984.00	557,592.40	557,592.4
2019	126.00	1,110.00	71,399.03	71,399.0

5.4 Net GHG Emission Reductions and Removals

Net GHG Emission Reductions and Removals can be summarized as the "**Estimated baseline emissions**" minus the "**Estimated project emissions**" minus the "**Estimated leakage emissions**", whose components are presented below.

Estimated baseline emissions:

Baseline emissions from unplanned deforestation

(+)

Emissions from biomass burning in the baseline

(-)

Sum of Wood Products, Pasture, and Coffee Carbon Pools in the baseline case

Estimated project emissions:

Emissions arising from logging gap in Project Area

(+)

Emissions from constructing logging infrastructure for removal of timber in Project Area

(-)

Wood Products Carbon Pool in Project Area

Estimated leakage emissions

(Sum of Market Leakage, Leakage outside the Leakage Belt and Leakage emissions due to activity shifting)

The areas exploited inside the FSM farm from 13rd April 2009 to 31st December 2011, and from 1st April 2017 to 12th April 2019, were excluded from the calculation of VCU benefits. This is due to the fact that these areas were not previously certified by the FSC (Forest Stewardship Council) and, consequently, were not eligible to the Project, according to M-MON v2.1. The documents showing the areas exploited within this time period are available for consultation by auditors and will be kept in a secure retrievable manner for at least two years after the end of the project crediting period.

The Buffer pool allocation was estimated using the most recent version of the VCS-approved AFOLU Non-Permanence Risk Tool and the resulting value for the current monitoring period was 10%.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation (tCO_2e)	VCUs eligible for issuance (tCO_2e)
2012	676,505	0	6,811	669,694	64,771	604,923
2013	1,023,144	4,975	10,297	1,007,872	97,461	910,410
2014	1,023,144	43,686	10,297	969,161	93,590	875,570
2015	1,023,144	128,815	10,297	884,032	85,077	798,955
2016	1,023,144	146,715	10,302	866,127	83,287	782,839
2017	1,023,144	0	10,297	1,012,847	97,959	914,888
2018	1,023,144	0	567,889	455,255	97,959	357,295
2019	285,920	0	74,276	211,643	27,375	184,268
Total	**7,101,290**	**324,192**	**700,466**	**6,076,632**	**647,480**	**5,429,148**