MULTI-SPECIES REFORESTATION IN MATO GROSSO, BRAZIL

Document Prepared by Brcarbon and ONF Brasil

Project Title	*Multi-species Reforestation in Mato Grosso, Brazil*
Version	*V.5.1*
Report ID	*N/A*
Date of Issue	*06/09/2024*
Project ID	*665*
Monitoring Period	*26/10/2015 to 15/11/2020*
Prepared By	*BRCarbon Serviços Ambientais LTDA and ONF Brasil*
Contact	*Av. Cezira Giovanoni Moretti 655, sala 9 AgTech Garage* *Reserva Jequitibá - Piracicaba, São Paulo, +55 (19) 3424 -3583,* *contato@brcarbon.com.br, www.brcarbon.com.br*

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The "Multi-species reforestation in state of Mato Grosso, Brazil" project, aims the restoration of grasslands that were formerly deforested for the purpose of cattle grazing activities. The baseline scenario is the continuation of cattle grazing activities with the decrease of carbon stocks as it is still observed around the project area; the region is a front of agriculture going towards north to Amazonia.

Reforestation activities started in 1999, jointly with the elimination of pre-existing grazing activities. Grazing activities were not displaced and therefore did not represent a source of leakage as explained in the PD. Then, cattle grazing activities were newly developed under silvopastoral system two years after project start and are maintained until today, however, in an isolated way and following a decreasing rhythm, especially caused by the advance of regeneration.

About 50 mixed tree species are used for project activities (mainly local species, and only one introduced species) as the project was designed for the following objectives: (i) greenhouse gas removals, (ii) pedagogic activities on carbon sequestration, (iii) preservation of biodiversity, and (iv) local development.

The project scenario is in São Nicolau farm at municipality of Cotriguaçu, state of Mato Grosso and includes on the one hand, the reforestation of 1981 ha of private lands that were deforested before land purchase by ONF in 1999, and on the other hand natural forest management on 5,350 ha (not considered for issuance of carbon credits). This reforestation areas are included at Voluntary Carbon Standard and Social Carbon (VCS SC) project, with activities implemented for carbon purpose by ONF and Peugeot to replace cattle grazing activities. Therefore, degraded pastures with low carbon content were replaced by forest plantations in silvopastoral system. This system allowed the capture of greenhouse gas through photosynthesis process by trees and avoiding leakage emissions by conserving cattle in small areas.

The project also had, during the execution, a seedling production for the purpose of attending the project. The nursery where the seedling production occurs was installed inside the farm and managed by ONF Brazil and local population and has a production capacity of 20,000 seedlings per year for plantations. During the years that involve the third verification, the nursery had 80,000 seedlings production, used in farm APP's restoration.

A new stratification was carried out with four strata: assisted natural regeneration with 30.12 ha, commercial teak plantation with 147.71 ha and two classes of restoration with multiple native species (MS). The pure MS with 1567.65 and harvested MS with 235.79 ha.

In the current verification, the generation of 84,777 VCUs have been estimated. Considering the risk rating of third verification (12%), the total VCU's at third verification is 74,604 VCU's. The Non-Permanent Risk Report is available in **"Annex_15_VCS Non-Permanence Risk Report".**

Audit Type	Period	Program	VVB Name	Number of years
Validation	11/03/2011	VCS	Ernst & Young et Associés	
First Verification	01/11/1999 – 25/04/2009	VCS	Ernst & Young et Associés	10 years
Second Verification	26/04/2009 – 25/10/2015	VCS	SCS Global Services	6 years
Third Verification	26/10/2015 – 15/11/2020	VCS	Earthood ESPL	5 years
Total				21 years

1.2 Sectoral Scope and Project Type

Sectoral scope: 14. Agriculture, Forestry and Other Land Use.

Activity: Restoration of degraded land.

Scale: Project.

1.3 Project Proponent

Organization name	Office National *des Forêts* - ONF
Contact person	Benoît Fraud
Title	Director of wood commercial and services
Address	2 bis avenue du Général Leclerc - CS 30042 94704 Maisons-Alfort Cedex
Telephone	+33(0)1 40 19 79 11
Email	benoit.fraud@onf.fr

1.4 Other Entities Involved in the Project

Organization name	BRCarbon Serviços Ambientais LTDA
Role in the Project	Preparation of the third monitoring report and monitoring of the audit process.
Contact person	Diego Serrano
Title	Technical Director
Address	Av. Cezira Giovanoni Moretti 655, sala 9 AgTech Garage Reserva Jequitibá - Piracicaba, São Paulo, +55 (19) 3424 -3583, contato@brcarbon.com.br, www.brcarbon.com.br
Telephone	+55 (75) 9828 3988
Email	diretoria@brcarbon.com.br

Organization name	ONF International – ONFI
Role in the Project	Project participant: In the framework of the present project, ONF International is a project participant in charge of the implementation of the proposed project activities with ONF Brazil, and is responsible of the project design in the framework of climate change mitigation
Contact person	Pierre Emmanuel Leclercq
Title	Director
Address	Jardin Tropical 45 bis avenue de la Belle Gabrielle 94736 Nogent Cedex – France
Telephone	+33 (0) 143947219
Email	contact@onfinternational.com

Organization name	ONF Brasil, private entity – Project participant
Role in the Project	- Project participant O.N.F Brazil: O.N.F Brazil is a private subsidiary of O.N.F International, private subsidiary itself of the public entity O.N.F (see below). O.N.F Brazil is the operator of the project. Since then, O.N.F Brazil is in charge of all activities inside project area, as project operator supported by ONF

	International: forest plantations, management of natural forests, cattle grazing activities, local social program, environmental education, and local coordination of research activities. Develops monitoring actions SC.
Contact person	Estelle Dugachard
Title	CEO ONF Brazil
Address	Av. Miguel Sutil, 8000, sala 1702, Ed. Santa Rosa Tower. 78040-400 – Ribeirão da Ponte, Cuiabá. Mato Grosso – Brasil
Telephone	+55 (65) 3644 7787
Email	estelle.dugachard@onfinternational.org

Organization name	PCFPO CST (Scientific and Technical Committee)
Role in the Project	Project scientific consultative entity. In the framework of the present project, the CST is a consultative entity in charge of the scientific research program coordination and evaluation in the project.
Contact person	João Ferraz
Title	President
Address	INPA Avenida André Araújo 2936 Manaus – Brasil
Telephone	+55 (92) 3643 3377
Email	jferraz@inpa.gov.br

Organization name	PSA Peugeot Citroën
Role in the Project	Project investor
Contact person	Mr. Marc BOCQUÉ
Title	Director of Press Worldwide External Relations
Address	75, Avenue de la Grande Armée 75116 Paris, FRANCE

Telephone	+33(0)1-4066-5511
Email	marc.bocque@peugeot.fr

Brazilian entities

- The Federal University of Mato Grosso (UFMT). First partner of the project and scientific advisor of proximity, the UFMT is involved in scientific works on the project area in various activities: silviculture, forestry science, ecology of vertebrates, entomology, science of soil, etc. Until today, the project received about forty students and professors from universities in the framework of research programs.
- The UNEMAT (University of the state of Mato Grosso), often associated with the UFMT.
- The National Research Institute on Amazonia (INPA-Manaus) is a key partner of the project in forestry, silviculture, and carbon cycle with a Ph.D. program on climate and environment.
- The EMBRAPA (Brazilian Company on Research on Agriculture) for silviculture and forestry.
- The UFRRJ (Rural Federal University of Rio de Janeiro) on rural development: program of seedlings donation, socio-economic diagnostic in and around project area.
- The University of São Paulo (USP) is a more recent partner, especially through a Ph.D. work on carbon sequestration in soils, in partnership with a French research institute. The laboratory of environmental biogeochemistry of the CENA-USP (center of nuclear energy in agriculture – University of São Paulo) is also charged of the analysis of biomass samples for the carbon monitoring of forest plantations.

French entities

- The French agricultural research and international cooperation organization (CIRAD) working for the sustainable development of tropical and Mediterranean regions. CIRAD is leader of two projects which are partially implemented in the Farm: TmFO, a pan-tropical network aiming at understanding the long-term effects of logging on tropical forest ecosystems. Terramaz: an amazon wide project to tackle the persistence of deforestation and forest degradation. Terramaz is helping territories to build innovative solutions for coordination and commitments by local actors, to reconcile a sustainable agricultural transition, the conservation and restoration of forest resources and social inclusion.
- The French forestry national school (ENGREF) allows mobilizing students in forest engineering for internships of six months for the end of their studies. These internships

cover a wide range of activities: valorization of non-timber forest products, management of natural forests, geographic information system of the project, etc.

Others

- The Research and Teaching Centre on Tropical Agronomy (CATIE, Costa Rica) is another recent partner of the project. CATIE is involved in the project for silviculture and carbon sequestration activities. The adaptation of the software SILVIA for the project led to integer the project data in an international database on the growth of local tree species.
- Carbon Decisions (Costa Rica) is also a recent partner and supports the project for carbon monitoring.
- A member of the CDM AR-WG also takes part in our annual scientific committee.

1.5 Project Start Date

The reforestation project activity under the premise of atmospheric carbon removal begins on 1st November 1999. The validation and verification of the project occurred in March 2011. The first monitoring considered November 1st, 1999, to April 25th, 2009. The second monitoring period considered April 26th, 2009, to October 25th, 2015. The third monitoring report runs from October 26th, 2015, to November 15th, 2020.

1.6 Project Crediting Period

Date of crediting periods start: November 1st, 1999.

Date of crediting period end: October 31st, 2039.

Operational lifetime: 40 Years

1.7 Project Location

The project area is located at Cotriguaçu municipality, northwest of Mato Grosso state. It is 1.300 km away from Brasilia, and 675 km from Cuiaba, the capital of the state. The São Nicolau farm vertices are in the geographical coordinates: Latitude- 9°47'55" to 9°53'31" south; Longitude- 58°12'44" to 58°19'41" west. The spatial data and kml files are available in "**Annex_04_Spatial_data",** and it is also archived on project site by ONF Brazil and in France by ONF International.

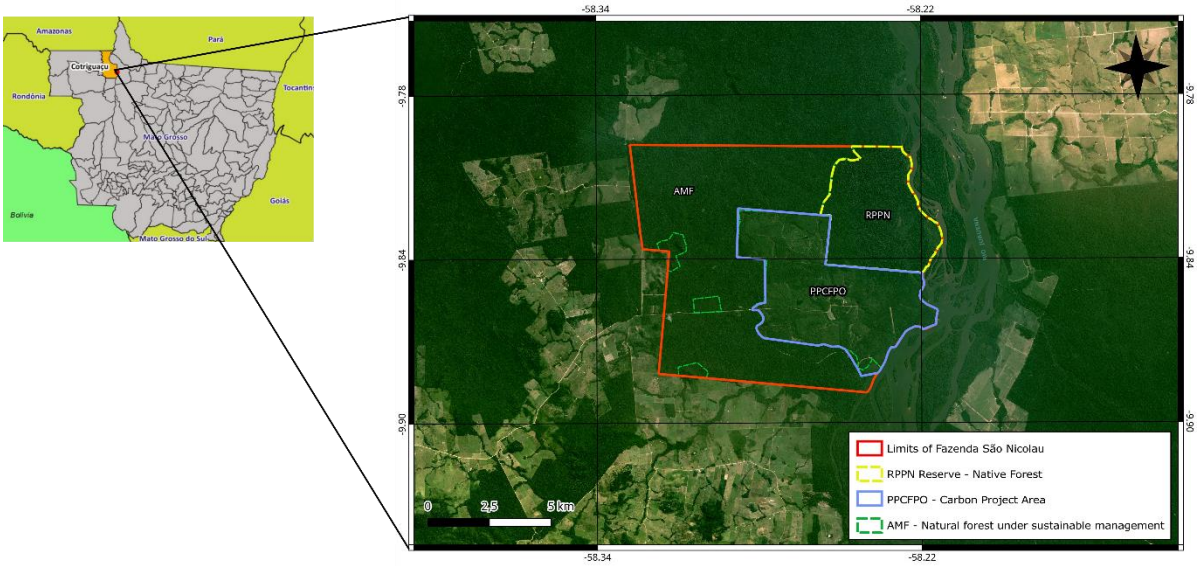


Figure 1. Geographical identification of the farm including project area and zonation of the project area.

1.8 Title and Reference of Methodology

A/R Large-scale Consolidated Methodology AR-ACM0003 / Version 02. Afforestation and reforestation of lands except wetlands.

Tools:

- CDM tool 02: Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities v 01;
- CDM tool 03: Calculation of the number of sample plots for measurements within A/R CDM project activities v2.1.0;
- CDM tool 08: Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity v4.0.0
- CDM tool 12: Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities v3.1;
- CDM tool 14: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities v4.2
- CDM tool 15: Estimation of the increase in GHG emissions attributable to displacement of pre project agricultural activities in A/R CDM project activity v2.0
- CDM tool 16: Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities v1.1.0

- CDM tool 17: Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities v1.0
- CDM tool 18: Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A/R CDM project activities v1.0.1
- CDM tool 19: Demonstration of eligibility of lands for A/R CDM project activities v2.0

1.9 Participation under other GHG Programs

Not Applicable. The project is not registered nor seeking registration in any other GHG program, rather than VCS.

1.10 Other Forms of Credit and Supply Chain (Scope 3 Emissions)

Not Applicable. The project proponent is not interested in issuing another GHG related environmental credit. To date, the project has not sought or received another form of GHG-related environmental credit. Moreover, the project activities are not impacting the emissions of goods and services in a supply chain (Scope 3 emissions) throughout the certifying period.

1.11 Sustainable Development Contributions

ONF has their strategy of sustainable development based on the 17 Sustainable Development Goals (SDGs) of the United Nations guiding the good use of natural resources. We highlight bellow some of the activities implemented during the monitoring period that resulted in SD contributions:

- The planting of seedlings for restoration: the maintenance and preservation of forests guarantees stability in the regime of rains and river floods, the biodiversity of fauna and flora, air cleanliness, and even physical barriers against pollution, flooding, and sounds. The recovery of degraded areas aims to provide the degraded environment with favorable conditions for the restructuring of life in an environment that does not have the physical, chemical and/or biological conditions to regenerate itself. This activity is in line with Goal #15 (Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss). ONF “core business” is to plant trees and restore the landscape reversing the land degradation and biodiversity loss. For more information about the restoration activities developed in the monitoring period, please refer to **"Annex_10_ONF Annual Reports”** and **“Annex_05_Timeline Action_2015_2020”.**

- Cattle Management: Rotated grazing is a management system that subdivides the pasture into paddocks and results in an improvement in the nutrition of the herd, while contributing to the renewal of the pasture, keeping the soil more conserved and productive, causing less compaction on the ground. ONF promotes territory sustainable production patterns in the farmers assisted by the organization. The main aspect of the ATER activities in ONF is to promote a transition of the agriculture model in the region adopting agroecological techniques and using less chemicals inputs in their productive areas. The activity is in line with SDG Goal #2.4, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding, and other disasters and that progressively improve land and soil quality. For more information about the ATER activities please refer to **"Annex_16_Sustainable and Education Actions".**

- PETRA's activities: the objective of the initiative is to promote sustainable development in the northwest of Mato Grosso. Small producers, public managers, students and teachers from public schools and universities, among others, benefit from the activities. Which is also in line with SDG Goals #2.4. For more information about PETRA activities please refer to "**Annex_11_PETRA Activities".** More information can be found in ONF YouTube page (https://www.youtube.com/watch?v=ilaOLdztfKU) and website (https://reflorestamentoecarbono.com.br/petra/).

- Scientific research activities: the partnerships with universities provide resolution of relevant problems and contributing for students' professional growth. These partnerships with universities take the form of internships, or the provision of an area for master's and doctoral researchers. The results are scientific publications, guides, papers, theses, and dissertations, which legitimize the importance and results of the Project and generate information on sustainable development for the public. This activity in line with Goal #13.3 through the improvement of education, awareness-raising and on climate change mitigation, adaptation, impact reduction and early warning. The partnership is evidenced in "**Annex_12_Researches_and_Agreements",** and the publications are available on ONF website (https://reflorestamentoecarbono.com.br/library/).

Regarding the contribution of the project in achieving national SDGs priorities, Brazil has created the National Commission for the Sustainable Development to adopt and implementing the 2030 Agenda (for Sustainable Development). One of the main goals is the reduction of poverty and the "Multi-Species Reforestation Project" is in line with this goal, in fact, the project was conceived from the beginning as a pilot project for the recovery of forest cover and sustainable development of surrounding communities.

Others Brazilian's strategies for sustainable development include the National Plan of Native Vegetation Recovery (PLANAVEG) and the Nationally Determined Contributions (NDCs) that provide for the restoration of at least 12 million hectares by 2030 and the goal of achieving

climate neutrality by 2060, respectively. The project contributes to achieving nationally stated sustainable development priorities.

Table 1 below, provide a quantifiable contribution of project activities to specific targets and indicators of the SDGs for the monitoring period. The official list of United Nation SDGs was consulted for the fulfillment of Table 1. All activities described in this section are evidenced in "**Annex_10_ONF Annual Reports**", "**Annex_11_PETRA Activities**", "**Annex_12_Researches_and_Agreements**", and "**Annex_16_Sustainable and Education Actions**".

Table 1. Sustainable Development Contributions.

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1	#2.4	2.4.1 Proportion of agricultural area under productive and sustainable agriculture	Implemented activities to increase	ONF promotes sustainable production patterns in the farmers assisted by the organization.	Transition of the agriculture model in the region adopting agroecological techniques and using less chemicals inputs in their productive areas.
2	#13.3	13.3.1 Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment	Implemented activities to increase	More than 10 scientific publications. The publications are available on ONF website (https://reflorestamentoecarbono.com.br/library/).	More than 20 scientific publications
3	#15.3	15.3.1 Proportion of land that is degraded over total land area	Implemented activities to decrease	In the last five years ONF has planted more than 270 thousand seedlings in the São Nicolau Farm reducing the proportion of deforested and degraded land in the landscape	Plant trees and restore the landscape reversing the land degradation and biodiversity loss. Restoration of 1981 ha of forest since the beginning of the project

2 SAFEGUARDS

2.1 No Net Harm

Since its inception, one of the main objectives of the Multi-Species Reforestation project is the social and environmental development. New activities have been developed thanks to ONF Brazil in order to better integrate local stakeholders and populations. The collection of brasil nuts by a local cooperative has been launched under a sustainable management plan registered and validated by Mato Grosso authorities. Moreover, Terramaz, a development project funded by AFD is promoting new agricultural techniques to conciliate silvopastoralism and forest protection. These very activities are designed to benefit the local populations of Cotriguaçu municipality.

ONF has a close relationship with local stakeholders, holding periodic meetings with them, always listening to possible negative impacts that might appear. Moreover, ONF have communication channels open to the public. These communication channels are accessed by ONF's technical staff and are always open for improvement suggestions, whether online or in person. To date, no incidents or complaints from stakeholder have been reported neither in person nor through the communication channels.

2.2 Local Stakeholder Consultation

ONF maintains a close relationship with local stakeholders, holding periodic meetings, always listening to possible negative impacts that may arise. In addition, ONF has communication channels open to the public. These communication channels are accessed by ONF's technical team and are always open to suggestions for improvements, whether online or face-to-face. So far, no occurrences or complaints from interested parties have been registered, either in person or through the communication channels, which can be through the ONF website, email and whatsapp.

In the project area, communication and contact with local stakeholders is quite restricted due to the lack of telecommunications infrastructure (internet, telephone, etc.) and long distances. However, ONF Brazil has exhausted all possible resources to contact local stakeholders and has successfully engaged many of them. The following table summarizes the methods used with each stakeholder, with Whatsapp and face-to-face meetings at ONF being the most effective form of contact.

Stakeholder	Communication activity	Method
Municipality	Monthly Municipal Environment Committee (CMMA) meetings	Meetings are usually pre-fixed on the last Wednesday of the month, confirmed via

		WhatsApp group
Local schools	Monthly visit + annual environmental education program	Presential meetings + annual visits at the Farm
Local smallholders and workers	Technical workshops + annual environmental education program	Presential engagement and Farm activities. Local radio announces, flyers, Facebook and website advertisements and local WhatsApp groups
Consultative Scientific Committee	Virtual trimestral meetings + trimestral scientific coordinator report + annual presential meeting + annual meeting	Email to the group with reports and doodles in order to fix calls and meeting's local, program and dates
ONF and Peugeot	Trimestral technical and financial reports + annual project meeting	Email to the focal points with reports and doodles in order to fix calls and meeting's local program and dates
SEMA (State environment secretary)	Workshops + FMMC meetings (Mato Grosso Climate Change Forum)	Emails and presential meetings
PCI (State initiative)	Workshops and meetings	Emails and WhatsApp group
PETRA Project partners and cofounders	Annual meeting	Email to the focal points with reports and doodles to fix meeting's local, program and dates
General public	Website www.reflorestamentoecarbono.com.br + Facebook "ONF Brasil"	Regular uploading of news and scientific material (articles, books, other publications) to the website + Facebook page + monthly newsletter monthly sent to mailing list. Possibility to subscribe / unsubscribe newsletter online
TERRAMAZ Project partners	Triannual meetings	WhatsApp group, website, social medias
Brazilian nuts association ACCPAJ	Annual meetings	WhatsApp group
Local PCI Compact	Monthly meetings	WhatsApp group

The opinions of the population, NGOs and local institutions are annually considered through the Scientific Advisory Committee that is held every year. Project activities are presented during this event and discussions about these activities related to project objectives take place to improve project activities and keep innovating. All the Scientific Advisory Committee's conclusions and recommendations are compiled in the Committee's annual report. The report still circulates internally, as part of internal ONF documents, but will be made available on the website for the next few years.

During the monitoring period there was no change to the risks, costs, and benefits that the project may bring to the local stakeholder, The project went as planned with no anticipated changes to stakeholders and following all relevant laws and regulations governing workers' rights. There were no changes in legislation during this framework. The stakeholders were knowledge about the verification process and the on-site visit by the VVB personally and through WhatsApp and email.

Please refer to **"Annex_18_Communication"** for evidence of ONF communication activities. The constantly presence ONF on the local communities and stakeholders are evidenced in the social medias, in the ONF Annual Reports ("**Annex_10_ONF Annual Reports"**) and also in the reports from the Environmental Education Program (PEA) and the Local Integration Program (**"Annex_16_Sustainable and Education Actions"**).

2.3 AFOLU-Specific Safeguards

No risks to local stakeholders arising from project implementation were diagnosed during the monitoring period. The project proponent is the owner of the land where the carbon project is developed, and all activities have always been implemented to mitigate risks to local stakeholders. Both planting and harvesting activities are conducted within the property boundaries and did not negatively interfere with stakeholders. It is worth emphasizing that no community resides within the project area.

The project has always brought recognition and visibility to the region in an attempt to demonstrate that it is possible to profit from tree planting, carbon trading and good agricultural practices. Nowadays, the sustainable activities carried out by ONF serve as a model for local stakeholders.

ONF has a close relationship with the local community and an active presence in the territory. The local meetings, reunions, workshops, training, and visits conducted by ONF are opportunities to identify any possible harm caused by the project. Moreover, ONF has communication channels on its website and social media so that stakeholders can be heard about any conflicts that arise between the project proponent and local interested parties.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

All the plantations were established between 1999 and 2003. At the third monitoring period the project has 1981 hectares (see section 3.2.2 with the project area update information) established, mainly with native species, only 7,5% was reforested using only one specie *Tectona grandis*. The project area is divided in 4 different strata: 1567.65 hectares of mixed plantations (native species and Teak); 235.79 hectares of mixed plantations that were harvested; 30.12 hectares of Assisted Natural Regeneration system and 147.71 hectares of monospecific plantations (*Tectona grandis*). The detailed project area information is available in the "**Annex_04_Spatial_data"**.

All activities that took place on São Nicolau farm is evidenced in the ONF Annual Reports **"Annex_10_ONF Annual Reports"**. We summarized all the activities related to the carbon project in a Timeline, available in **"Annex_05_Timeline Action_2015_2020"**. We highlight bellow some of those activities that are performed annually:

- Monitoring and maintenance of firebreaks
- Weed control (chemical and mechanical) for guaranteeing the maintenance and survival of the restored areas and combating weeds competition
- Pasture rotation
- Forest inventory conducted annually in all permanent plots
- Publication of study results in partnership with universities

ONF Brasil also conduct adjacent projects for the strengthening and conservation of the area, such as the Experimental Platform for the Management of Rural Territories in the Legal Amazon (PETRA) launched in 2012 as a partnership between ONF Brasil, ONF International and the Pantanal Research Center (CPP). The goal of the initiative is to promote sustainable development in the Northwest of Mato Grosso through social integration and sharing the results of research carried out at Fazenda São Nicolau with the local community. For more information about the PETRA results, please refer to **"Annex_11_PETRA Activities**". Another project developed by ONF Brasil in partnership with CIRAD and financed by the French Agency of Development (AFD - Agencia Francesa de Desenvolvimento) is the Terramaz Project. The main goal of the project is to support Amazon territories in implementing their policy to combat deforestation and transition to a development model that combines low-carbon economic development and ecosystem conservation. For more information about the TerrAmaz please refer to **"Annex_16_Sustainable and Education Actions".**

For the current monitoring period, different maintenance activities were carried out in all forest stands. **Table 2, 3 and 4** below present a summary of the activities carried out in each forest stand. Detailed information is provided in **"Annex_10_ONF Annual Reports ".**

Teak harvesting activities were conducted in 2019 and 2020, the stands and year that the activities were conducted are shown in Table 4. A total of 1,490.21 m^3 of teak were harvested, 599.52 in 2019 and 890.69 in 2020, corresponding to 1,438 tCO2e, which represents only 2.2% of the stratum's total carbon stock. The harvesting activities were conducted by the company Green West Madeiras do Brasil LTDA and sold to the Indian company SUDIMA. The contracts between ONF Brasil and Green West is available in **"Annex_09_Contract"**. The complete information about the logging activities is available in the 2019 and 2020 ONF annual reports **("Annex_10_ONF Annual Reports "**). It is important to emphasize that due to teak being an exotic species, harvesting activities conducted outside the Legal Reserve do not necessitate prior approval from the environmental agency. This statement is substantiated by both the Mato Grosso State Law (DECRETO Nº 1313 DE 11/03/2022) and the confirmation received via email from the municipality environmental agency (available in **"Annex_17_Tectona_grandis"**). As a result, the project's teak harvesting activities are in full compliance with the relevant legal requirements. Harvest activities will continue; however, it is important to emphasize that they will not exceed 20% of the total carbon stock in the harvested stratum.

Table 2. Forest maintenance and other activities

Stand (ID)	Maintenance activities	Stratum	Year
22a, 22b, 24a, 24b, 27, 39	Pruning	Teak	2016
11a, 11b, 22a, 30, 31, 39, 40	Weed control with Tordon Herbicide	MS	2016
All	Firebreaks maintenance	All	2016
22a, 22b, 24a, 24b, 27, 39	Pruning	Teak	2017
6, 07d, 08, 15, 16, 21, 34, 35, 40, 41	Weed control with Tordon Herbicide	MS	2017
All	Firebreaks maintenance	All	2017
22a, 22b, 24a, 24b, 27, 39	Pruning	Teak	2018
All	Firebreaks maintenance	All	2018
All	Firebreaks maintenance	All	2019
All	Firebreaks maintenance	All	2020

Table 3. Carbon forest inventory activities

Stand (ID)	Monitoring activities	Stratum	Year
All	Carbon forest inventory	All	2016
All	Carbon forest inventory	All	2017

All	Carbon forest inventory	All	2018
All	Carbon forest inventory	All	2019
All	Carbon forest inventory	All	2020

Table 4. Forest maintenance and other activities

Stand (ID)	Monitoring activities	Stratum	Year	Total volume of harvested wood (m^3)
2, 3, 49a	Logging activities	MS Harvested	2019	599.52
32, 33, 34, 17b, 18, 19, 20, 21	Logging activities	MS Harvested	2020	890.69

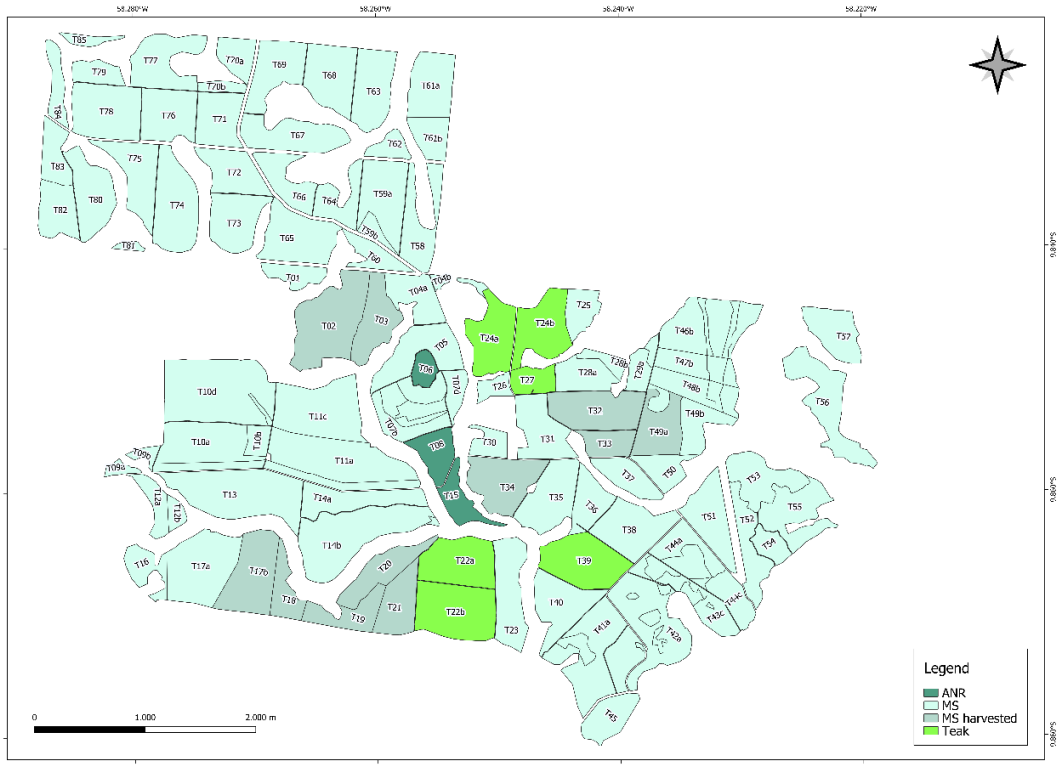


Figure 2. Project area, stands location, and its respective stratum.

According to the conditions of implementation of the proposed A/R project activities and following the methodological processes, it was demonstrated that there is not leakage, therefore its monitoring is not required during the project accreditation period. On the other hand, to guarantee the permanence of the removals, the maintenance work and the forest management

program have been followed. The species and models proposed are respected, in some mixed stands the number of species has increased, due to the natural regeneration or replacement of some species in the re-planting processes.

- **Windstorm**

In January 2018 a strong windstorm followed by rain and hail hit the farm causing small damage. The windstorm that reached the project area had low impact on carbon stocks, which can be proven by the inventory data sampled. In the 2020 forest inventory, the ONF field team recorded the trees affected by the 2018 windstorm. The team recorded the number of trees that fell, cracked, or suffered damage due to the windstorm's effects. Despite the windstorm impacting a total of 9 stands and 13 plots, the overall level of damage was remarkably low. Out of the 44,685 trees observed throughout the entire inventory, only 41 trees were found to be impacted by the windstorm. This represents a mere 0.1% of the total trees, well below the admissible materiality threshold of 5%. Consequently, these findings clearly indicate that the windstorm had a minimal impact on the tree community and, by extension, on the project's carbon stocks. The seedlings planted in the project areas are already at an advanced stage of development, which makes them more resistant to any extreme event and reduces the risk of loss of carbon content due to this fact. The complete data about the impacted trees are available in "**Annex_01_Delta_C"**,

3.2 Deviations

3.2.1 Methodology Deviations

No methodology deviation was applied during the monitoring period.

3.2.2 Project Description Deviations

There only one PD deviation in this monitoring period it can be considered as minor change and is related to the project area, in the validated PD the original project area was 1974 ha, now during this monitoring period the GIS data was updated using new remote sensing data with a higher resolution accuracy which reflected in a new project area of 1981 ha. This deviation does not impact in the methodology applicability, either in the project additionality or in the baseline scenario.

According to the VCS standard is necessary to describe and report any PD deviations applied in previous monitoring reports. So, from the last monitoring report (2019), came the following deviation.

In 2015, during the second verification, a conceptual mistake about land eligibility was detected, the project developer consulted the VCS about the following validation error: According to the Guidance for AFOLU projects 2007.1: "AFOLU projects that convert native ecosystems to generate carbon credits are not eligible under the VCS. Documented evidence shall be provided

in the VCS PD that no ARR or ALM project areas were cleared of native ecosystems within the ten years period prior to the proposed Project Start Date". In view of this we were required by the VVB to exclude those areas that were classified as forests within the ten-year period prior to the project start date. We were required to do this despite the fact the areas that were classified as forests back then were deforested by the landowner 5 years before the project start date, and there is documented evidence that there is no relationship whatsoever between the project proponent and the former owner (In fact our project is an ecosystem restoration that intends to restore a system degraded by the previous owner!). As a result, we had to excise 44% of the total area restored by the project, as it was classified as forest. However, we just realized that the Guidance for AFOLU projects 2007.1 contained additional guidance regarding the land eligibility: "…in order to be eligible for crediting under the VCS, ARR and ALM project proponents must demonstrate that the project area was not cleared of native ecosystems, such as forests, grasslands, shrublands or wetlands, to create VCUs. Such proof is not required if such clearing or conversion took place at least ten years prior to the proposed VCS project start. The burden of proof rests with the project proponent". This means that the 10-year rule is not compulsory and that it could be substituted with other proof, which we have. Therefore, the excised 44% of the area could potentially be eligible under the VCS. to which the VCS responded: "If project developer can provide evidence that the land was cleared by the previous owner of the land, and there is no relationship between them and the project, it would meet the requirements in version 2007.1 that the project was validated to, and the area can be included in the project at a future verification." This land can be included through project description deviation and requires validation by the VVB and an update to the project description (see Section 3.6.1 of the VCS Standard). The evidence provided by the project developer is the date of land purchase (1999), which is after the date of deforestation (1994). And therefore, an additional area of 884.05 ha, planted under the same proposed stand models, was added to project area for a total of 1974 hectares.

In conclusion, the project proposal validated and verified in 2011 under the VCS, was limited to 1090.16 hectares eligible, in the second monitoring period (2009-2015) it was included 884.05 ha planted under the same proposed stand models for a total of 1974 hectares.

The change in the eligible area has led to an increase in annual average anthropogenic net removals beyond the threshold of small scale (16 Mt CO2eq). Thus, under the conditions of the UNFCCC CDM for A/R projects, the project is typified as large-scale, so the project had to change the methodology applied for validation and verification, from the methodology AR-AMS0006 Version 1 (Approved simplified baseline and monitoring methodologies for small-scale silvopastoral afforestation and reforestation project activities under the clean development mechanism) to the A/R Large-scale Consolidated Methodology AR-ACM0003 (Afforestation and reforestation of lands except wetlands).

The move to the AR-ACM0003 methodology implied greater requirement in the monitoring procedures and data analysis. Likewise, the stands added in the current monitoring period have been subject to the same actions as those of the areas validated and verified in

2011, maintaining the consistency and methodological coherence as described in the PD. The conservative positions are maintained according to the methodological requirements implemented, applying the respective tools and in some cases the use of default values for the estimation under conservative assumption was considered. It is noteworthy that the new methodology allows the inclusion of two additional carbon sinks: dead wood and litter. Although no monitoring processes of these carbon pools between the years 2009 and 2015 have been developed, it could be implemented a posteriori.

Regarding Baseline and Additionality, given the change in the project scale, the baseline and additionality analysis has also changed, in the new version of the Project Document the "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities 2" was used for the entire project area (see section 2.5 of the Project Document).

3.3 Grouped Projects

Not applicable. The Multi Species Reforestation in Mato Grosso is not classified as a Grouped Project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	CF j
Data unit	t C t -1 d.m.
Description	Carbon fraction of dry matter for species of type j
Source of data	AR-AM TOOL 14
Value applied	Default value 0.47 t C t-1 d.m.
Justification of choice of data or description of measurement methods and procedures applied	Data is used for project emission calculation
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	NA

Data / Parameter	CO2e

Data unit	The factor of 3.667 (44/12) is applied to convert the tree carbon sequestered to tree CO2-e sequestered
Description	The factor of 3.667 (44/12) is applied to convert the tree carbon sequestered to tree CO2e sequestered
Source of data	IPCC (2006) default value
Value applied	3.667 (44/12)
Justification of choice of data or description of measurement methods and procedures applied	Data is used for the calculation of net GHG emission reductions or removals
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	NA

Data / Parameter	R_{TREE}
Data unit	Dimensionless
Description	Ratio of belowground biomass to aboveground biomass
Source of data	AR-AM TOOL 14
Value applied	0.25
Justification of choice of data or description of measurement methods and procedures applied	Ratio of belowground biomass to aboveground biomass (All strata)
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	NA

Data / Parameter	fMG,i
Data unit	Dimensionless
Description	Relative stock change factor for baseline management regime in stratum of the areas of land; dimensionless
Source of data	Table 6 of “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project” activities
Value applied	0.70

Justification of choice of data or description of measurement methods and procedures applied	The project meets the applicability conditions laid down in the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project"
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	NA

Data / Parameter	SOC(REF,i)
Data unit	t C ha-1
Description	Reference SOC stock corresponding to the reference condition in native lands (i.e., non- degraded, unimproved lands under native vegetation - normally forest) by climate region and soil type applicable to stratum i of the areas of land.
Source of data	Table 3 of "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project activities" and Verneyre, 2007
Value applied	Texture class: SOC_{REF} (tC/ha) Clay soil: 59.2 Clay-sandy soil: 48.6 Medium textured soil: 53.7 Sandy soil: 47.2
Justification of choice of data or description of measurement methods and procedures applied	The project meets the applicability conditions laid down in the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project"
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	NA

Data / Parameter	f LU i
Data unit	Dimensionless
Description	Relative stock change factor for baseline land-use in stratum i of the areas of land
Source of data	Table 6 of "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project activities" (default value for permanent grassland)

Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	The project meets the applicability conditions laid down in the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project" and the entire project area is permanent grassland.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	NA

Data / Parameter	F IN i
Data unit	Dimensionless
Description	Relative stock change factor for baseline input regime (e.g., crop residue returns, manure) in stratum i of the areas of land;
Source of data	Table 5 of "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project activities" (Although in baseline scenario there are not croplands, a value of 1 is assigned, assuming that residues are returned to the field.)
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	The project meets the applicability conditions laid down in the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project "
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	NA

4.2 Data and Parameters Monitored

Data / Parameter	A
Data unit	ha.
Description	Project area
Source of data	Monitoring of each strata and stand boundaries is done using a Geographical Information System (GIS)
Description of measurement methods and procedures to be applied	Field measurement: the area shall be delineated either on the ground using GPS or from georeferenced remote sensing data and staff of ONF Brazil is responsible of this activity. (See section 3.2 of the Quality Manual, ONF International 2010. Multi-Species

	Reforestation in Mato Grosso, Brazil) Annex_03: Quality Manual atualizado.pdf.
Frequency of monitoring/recording	Five years after the first verification
Value monitored	1981 hectares
Monitoring equipment	GPS and satellite images.
QA/QC procedures to be applied	Field measurement with GPS and verification with satellite images (See ONF International 2010. Multi-Species Reforestation in Mato Grosso, Brazil. Quality Manual). Annex_03: Quality Manual atualizado.pdf.
Purpose of the data	Calculation of project emissions (carbon stock in living biomass of trees under the project scenario): • Calculation of project emissions • Calculation of leakage. NA.
Calculation method	Measured
Comments	$A = \sum Ai$

Data / Parameter	Ai
Data unit	ha.
Description	Area of strata i
Source of data	Monitoring of each stratum and stand boundaries is done using a Geographical Information System (GIS).
Description of measurement methods and procedures to be applied	Field measurement: the area shall be delineated either on the ground using GPS or from georeferenced remote sensing data and staff of ONF Brazil is responsible of this activity. (See ONF International 2010. Multi Species Reforestation in Mato Grosso, Brazil. Quality Manual) Annex_03: Quality Manual atualizado.pdf.
Frequency of monitoring/recording	Five years after the first verification.
Value monitored	

Stratum	Ai (ha)
Mixed species ANR	30.12
Tectona grandis management	147.71
Mixed species	1567.65

	Mixed species management harvested	235.79
Monitoring equipment	GPS and satellite images.	
QA/QC procedures to be applied	Field measurement with GPS and verification with satellite images. (See ONF International 2010. Multi-Species Reforestation in Mato Grosso, Brazil. Quality Manual) **Annex_03: Quality Manual atualizado.pdf.**	
Purpose of the data	Calculation of project emissions (carbon stock in living biomass of trees under the project scenario). • Calculation of project emissions	
Calculation method	Measured	
Comments	NA	

Data / Parameter	Ap,i
Data unit	ha.
Description	Area of sample p in stratum i
Source of data	Field measurement
Description of measurement methods and procedures to be applied	Field measurement: the area of sample plots is guaranteed through sample plot delimitation process, in which the sample plot is located using a GPS receptor and traditional methods of map, compass and metric tape. The staff of ONF Brazil is responsible of this activity. (See ONF International 2010. Multi-Species Reforestation in Mato Grosso, Brazil. Quality Manual) **Annex_03: Quality Manual atualizado.pdf.**
Frequency of monitoring/recording	Five years after the first verification.
Value monitored	1000 m^2 for planted trees and 100 m^2 for regenerated trees
Monitoring equipment	GPS and satellite images
QA/QC procedures to be applied	Field measurement with GPS. (See VCS ARR Quality Manual) **Annex_03: Quality Manual atualizado.pdf.**
Purpose of the data	Calculation of project emissions (carbon stock in living biomass of trees under the project scenario). • Calculation of project emissions
Calculation method	Measured

Comments	Sample plots are established to monitor the growth of trees established in each stratum. See the monitoring plan for further details about form and size of the sample plots and procedures

Data / Parameter	DBH
Data unit	cm.
Description	The diameter at breast height of the tree (1.3 m)
Source of data	Field measurement
Description of measurement methods and procedures to be applied	DBH of all trees in permanent sample trees are measured with tape, this activity is made by ONF Brazil staff. Monitoring procedure is detailed in Annex_03: Protocolo de Inventário dos Plantios atualizado.pdf.
Frequency of monitoring/recording	Five years after the first verification
Value monitored	Values are provided in Annex_01_Delta_C
Monitoring equipment	Wooden stake, Vinyl tape, gage, Diametric tape
QA/QC procedures to be applied	In the “findings" worksheet, data is controlled, and doubts are forwarded between the collection and control team. See Annex_03: Quality Manual atualizado.pdf. and section 2.1.4 (Carbon Stocks inventory) of the Quality manual (ONF International 2010. Multi-Species Reforestation in Mato Grosso, Brazil. Quality Manual)
Purpose of the data	Calculation of project emissions (carbon stock in living biomass of trees under the project scenario).
Calculation method	NA
Comments	The circumference (CBH) can be measured instead of the diameter (DBH) in such case, DBH is calculated by dividing CBH by pi (3,1416) CBH or DBH is measured for all the trees inside a plot with more than 5 cm of circumference. Information needed to apply the A/R Methodological Tool, "Demonstrating appropriateness of allometric equations for estimation of aboveground biomass in A/R CDM project activities"

Data / Parameter	H
Data unit	m
Description	Total tree height.

Source of data	Field measurement
Description of measurement methods and procedures to be applied	Although height is not a parameter necessary to carbon calculations, this parameter is measured by ONF Brazil staff in the planted trees in each plot by using a clinometer.
Frequency of monitoring/recording	Five years after the first verification
Value monitored	NA
Monitoring equipment	Hypsometer, clinometer, metric tape
QA/QC procedures to be applied	Cross remeasuring to verify consistency in the values. (See Annex_03: Quality Manual atualizado.pdf.
Purpose of the data	Calculation of project emissions (carbon stock in living biomass of trees under the project scenario).
Calculation method	NA
Comments	Measured for all the trees inside a plot. Although this parameter is not used in current calculations (Allometric equation is only a function of DBH) the variable could be considered in improved allometric equations.

Data / Parameter	T
Data unit	Year
Description	Time period elapsed between two successive estimations of carbon stock in trees, shrubs, and soil.
Source of data	Verification records
Description of measurement methods and procedures to be applied	NA
Frequency of monitoring/recording	Each time a verification is conducted.
Value monitored	Years Note. Value of T does not have to be a whole number (e.g. an interval of 4 years and 5 months implies T = 4.417 yr).
Monitoring equipment	NA

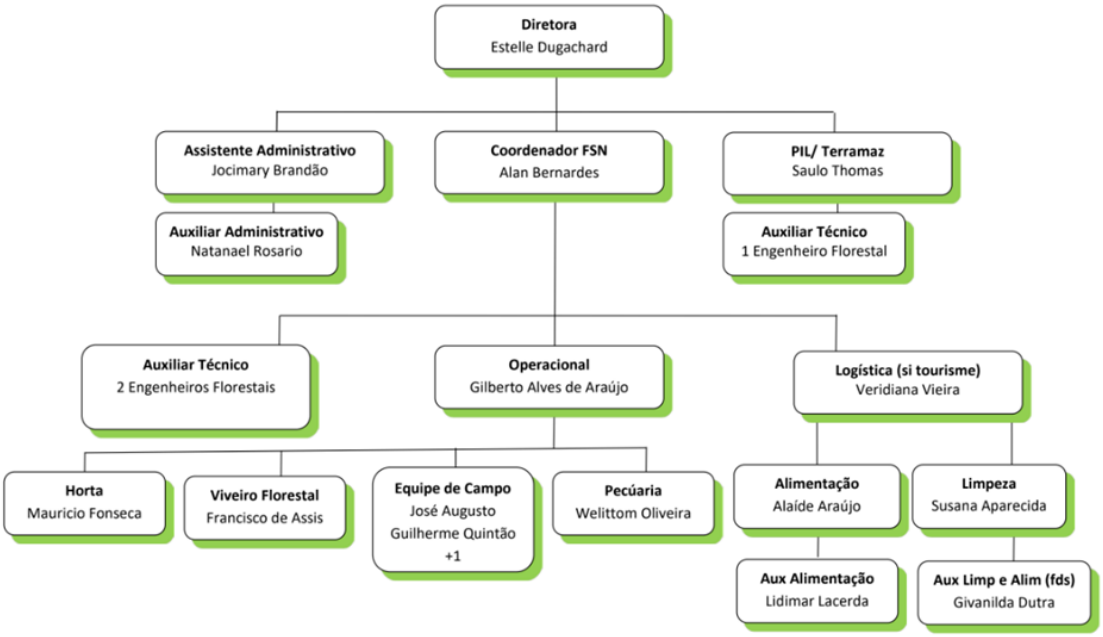
QA/QC procedures to be applied	Register the date of each measurement
Purpose of the data	Calculation of project emissions (carbon stock in living biomass of trees under the project scenario).
Calculation method	$T = t_1 - t_2$
Comments	

Data / Parameter	F (D, H)
Data unit	t d.m.
Description	Function relating measured tree dimensions (x1, x2, x3, ...) to aboveground tree biomass. Applied tool AR-AM-tool-17-v1, AR-AM-tool-18-v1.0.1. (Allometric equations).
Source of data	Secondary information or National report.
Description of measurement methods and procedures to be applied	NA
Frequency of monitoring/recording	Each time a verification is conducted.
Value monitored	$AGB = \exp\{-2.134 + 2.53 * \ln(DBH)\}$
Monitoring equipment	NA
QA/QC procedures to be applied	Applied tool AR-AM-tool-17-v1, AR-AM-tool-18-v1.0.1
Purpose of the data	Calculation of project emissions (carbon stock in living biomass of trees under the project scenario).
Calculation method	
Comments	Applied for ex-post estimation. The choice of allometric equations is done by using the following tools: 'Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities' or 'Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A/R CDM project activities' should be applied to prove the appropriateness of the equation for both ex-ante and ex-post use.

4.3 Monitoring Plan

ORGANIZATIONAL STRUCTURE

The structure of responsibilities in the monitoring process is coordinated by ONF International and monitoring activities are carried out by ONF Brazil. The organization chart is presented below:



To project monitoring and inventory, field staff is organized into teams with one person assigned as a team leader. The number of members in a team and number of teams depends on the strata, administrative unit and sample size. Team leaders are responsible for organizing the field work. The overall organization of monitoring team is the responsibility of the project coordinator. Responsibilities according to monitoring activities:

<u>Organisation for project boundaries and cartography:</u>

- The personal of ONF Brazil is responsible to obtain and supply the information to the project coordinator.
- The project coordinator must verify the information before sending it to ONF International, using formulary 1 of the Quality manual.

- The project coordinator sends to the project leader in ONF International the information for a second verification and project leader annotates in Checklist 01 the corrective actions, if applicable.
- ONF International analysis the information and updated the database and cartography.
- ONF International submits to review and approval the information to the CSC.
- If the Scientific committee approves the changes, the new database and cartography must be divulgated among all parties involved in the project.

Organisation for forest establishment and management:

- The personal of ONF Brazil is responsible to obtain and supply the information regarding to forest establishment and management to the project coordinator.
- The project coordinator must verify the information before sending it to ONF International, using Checklist 02 of the Quality Manual.
- The project coordinator sends to the project leader in ONF International the information for a second verification and project leader annotates in Checklist 02 the corrective actions, if applicable.
- ONF International analyses the information and updates the database.
- ONF International submits to review and approval the information to the Consultative Scientific Committee of the project (CSC).
- If the Scientific committee approves the changes, the new database must be divulgated among all parties involved in the project.

Organisation for inventory:

- The personal of ONF international, the project leader, is responsible to calculate and verify the sample size and supply the information to the Project coordinator in ONF Brazil.
- After each monitoring event, sampling error must be calculated by the Project leader, who takes the measures needed to guarantee a maximum error of 10%.
- Project leader must complete the checklist 03 and sent corrective actions to the project coordinator.
- ONF International is responsible for sampling planning, the project leader must give to the project coordinator in ONF Brazil, all information regarding schedules, procedures, and due dates.

- The personal of ONF Brazil, the project coordinator, is responsible for hiring and training personal and carry out the inventory.
- After each monitoring event, sampling error must be calculated by the Project leader, who takes the measures needed to guarantee a maximum error of 10% and as well determine randomly, which plots will be re-measured (10%)
- In the monitoring report 3 the processing and analysis of results were performed by BRCarbon in technical cooperation with ONF.

Organisation for data entry and storage:

- ONF Brazil is responsible for generating and collect the formularies.
- Data digitizing will be done for the project secretary in ONF Brazil, assisted by the Project coordinator. Data will be systematically checked.
- Once the data are digitized, ONF Brazil must send copy of formularies and digital file of the database.
- Project Leader in ONF International must review, verify, and validate data.

METHODS

Monitoring project boundaries

The project boundary is delineated to cover all forest stands of the project and the boundaries of the stand are demarcated using global positioning system (GPS) and verified through field surveys. Project boundaries are periodically verified, and any change is measured and recorded in the project database for submission to the DOE at the time of the next verification.

Monitoring project boundaries allows to demonstrate that the actual area reforested is consistent with the reforestation area outlined in the PD. The following activities are foreseen:

- Field surveys regarding the actual project boundary within which A/R activity has occurred, site by site;
- Measuring geographical positions (latitude and longitude of each corner polygon sites) using GPS;
- Checking whether the actual boundary is consistent with the description given in the PD;
- Input the measured geographical positions that are in conformity with the description given in the PD into the GIS system and calculate the area of each stratum and stand;

- The project boundary will be monitored periodically throughout the crediting period. If the forest area changes during the crediting period, for instance, because deforestation occurs in the project area, the specific location and area of the deforested land will be identified. Similarly, if the planting on certain lands within the project boundary fails these lands will be documented;

- Staff involved in the monitoring will be trained to identify the changes inside project boundary and to record changes in the project database for reporting of project verification.

  Shapefile of project boundaries is available in Annex_04_Spatial_data.

Monitoring of forest establishment

The monitoring of the forest establishment covers site preparation, planting, and establishment of the forest.

- The monitoring of site preparation activities covers the identification and recording of the area under site preparation. The area affected by site preparation will be measured using the GPS.

- Information on planting schedule, location, area, species planted, and spacing will be recorded in plot forms and archived in the project database.

- Survival rates of planted trees are counted at least during the three months of the planting and replanting is done to fill the gaps and the area and location of supplemental plantings undertaken to fill the gaps is recorded in the project database and identified on the strata maps. Re-planting will be conducted if the survival rate is lower than 90 percent of the final planting density expected.

Monitoring of forest management

The monitoring of forest management covers the maintenance of plantation and firebreaks, harvesting of trees and replanting or sowing actions. The detailed information about forest management activities is described in **"Annex_10_ONF Annual Reports".**

- Date, location, and type of weeding actions in plantation is recorded and archived in the project database.

- Date, location and type of maintenance actions for firebreaks is recorded and archived in the project database;

- Date, location, volume of tree harvested is recorded and archived in the project database;

- Re-planting and re-sowing actions are checked. Date, location, and type of stand are recorded and archived in the project database;
- Deviations in the forest management activities implemented in the field and the ones outlined in the PD will be monitored, and reasons for deviations will be recorded.

Monitoring of the carbon pools (forest inventory)

Stratification

In the second verification, the project was divided into three strata (Assisted Natural Regeneration (ANR), Teca plantation and Mixed Species Plantation). For the third verification, the ANR and Teak strata were kept, and the Mixed Species (MS) strata were reclassified into two different strata according to their exploitation: MS and MS harvested. Therefore, the project area is divided into four different strata:

- Exploitable Teak plantation
- Exploitable Multi Species plantation
- Non-exploitable Multi Species plantation
- Assisted Natural regeneration (ANR)

Management Plan

In general, stands with teak did not receive proper silvicultural treatments, such as regular pruning or thinning. As a result, the stands exhibit significant branching, low economic potential, uneven development, and areas of high mortality and poor growth. These factors resulted in wood quality that does not meet buyer standards, limiting harvesting to select portions of the stands. As a result, harvesting activities are focused on a small number of high-quality timber individuals with greater market value and added economic potential.

All harvesting activities are closely monitored by the ONF team, with the number, diameter, and volume of harvested timber legally recorded. The harvested volume is carefully tracked each year to ensure it does not exceed 20% of the stratum's total carbon stock. For more information about the volume of timber harvested in the present monitoring period please refer to section 3.1 and ONF Annual Reports, available at **"Annex_10_ONF Annual Reports".**

Sampling method

In accordance with the required action resulting from the last verification, the sampling plan was completed with 104 randomly drawn points in the central areas of the project. These

are added to the 415 random points already existing distributed mainly in the accessible areas. The set used for this monitoring plan therefore corresponds to a complete random sampling of 519 points covering the entire project area. See **"Annex_02_FAR"** for more details.

The figure below shows the project areas, as well as the location and strata classification of all stands, the location of all 415 permanent plots and the temporary 104 plots distributed within the project area used for carbon estimations.

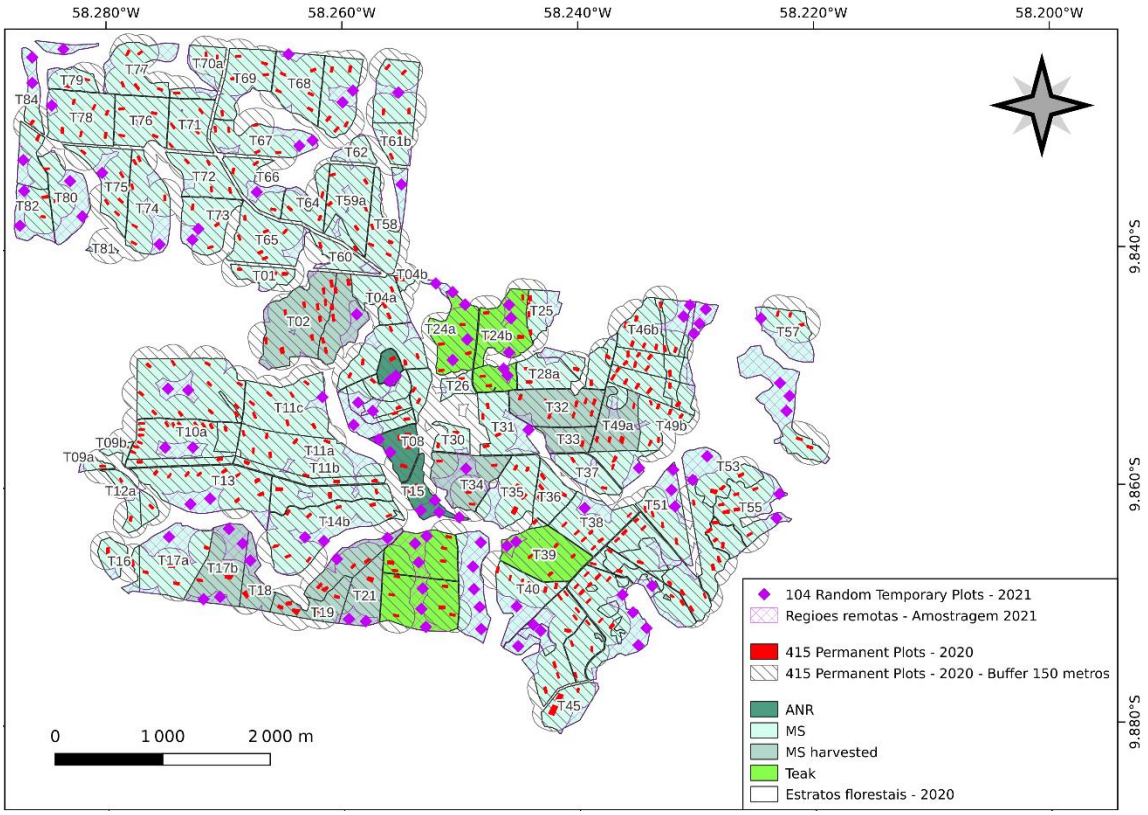


Figure 3 – Plots distribution within the project area.

Measurements and data entry

- **Tree biomass**

Permanent square 20x50m (1,000m^2) sample plots were randomly located in the plantations and regeneration areas. All data (location, stratum and coordinates) were recorded and archived with Qfield in **"Annex_04: Doc4_Tutorial Qfield.pdf."**

The growth of individual trees in sample plots is measured at each monitoring event. Non-tree vegetation such as herbaceous plants, grasses, and shrubs is not measured and accounted as per methodology applied in the framework of the VCS verification. Additionally, in subplots of

100m² established inside of 1000 m² plots, trees resulting from regeneration are measured. Diameter at breast height (DBH, 1.3 m above ground) of all the trees with DBH ≥ 4.77 within each permanent sample plot (1000 and 100 m²) is measured and registered in Qfield. Measurement procedures are detailed in "**"** ***Annex_03: Quality Manual atualizado.pdf.*** The carbon stock in above-ground biomass is estimated using the following equation. This equation is used until developing robust project specific allometric equations with at least 20 trees.

$$AGB = exp\{2.134 + 2.530 * ln(DBH)\}$$

Where:

AGB	Aboveground biomass, in kg dry matter per tree
DBH	Diameter at breast height, in cm

$$C_{AB} = AGB * CF_i$$

Where:

C_{AB}	Carbon in aboveground biomass
CF_i	Carbon fraction of dry matter for species j in tC.t d.m-1

- Below ground biomass

The carbon stock in belowground biomass is calculated using root-shoot ratio (RTREE), using the default value (0.25) of the AR-AM TOOL 14. Default value (0.47) for the carbon fraction (CFj) is used.

- Soil organic carbon

SOC is estimated with the default method, using the following equations:

$$dSOC_{t,i} = \frac{SOC_{REF,i} - (SOC_{INICIAL,i} - SOC_{LOSS,i})}{20\ years}\ for\ t_{PREP,i} < t \leq t_{PREP,i} + 20$$

Where:

$dSOC_{t,i}$	The rate of change in SOC stock in stratum i of the areas of land, in year t; t C ha-1 yr-1

$t_{PREP,i}$	The year in which first soil disturbance takes place in stratum I of the areas of land (16 for second verification period)
$SOC_{LOSS,i}$	Loss of SOC caused by soil disturbance attributable the A/R project activity, in stratum i of the area of land; t C ha-1 (Zero because not disturbance in project area)

$$SOC_{INICIAL,i} = SOC_{REF,i} * f_{LU,i} * f_{MG,i} * f_{IN,i}$$

Where:

$SOC_{INICIAL,i}$	SOC stock at the beginning of the project activity in stratum i of the areas of land; t C ha-1
$SOC_{REF,i}$	Reference SOC stock corresponding to the reference condition in native lands (i.e., non- degraded, unimproved lands under native vegetation - normally forest) by climate region and soil type applicable to stratum i of the areas of land; t C ha-1
$f_{LU,i}$	Relative stock change factor for baseline land-use in stratum i of the areas of land; dimensionless (default value for permanent grassland)
$f_{MG,i}$	Relative stock change factor for baseline management regime in stratum i of the areas of land; dimensionless (default value for severely degraded lands)
$f_{IN,i}$	Relative stock change factor for baseline input regime (e.g., crop residue returns, manure) in stratum i of the areas of land; dimensionless. a value of 1 is assigned, (default value for grassland in tropical wet with low-medium inputs.

An evaluation of soil organic carbon for the project area has been done (Verneyre, 2007). According to this work a more accurate value for the Reference SOC stock can be used. The study shows a direct correlation between SOC and soil texture. Although there is not a map of soil texture for the project area, we can estimate the proportion of area in each texture class from the sampling as follows:

Clay soil: 4 /50 plots = 8%

clay-sandy soil: 7/50 = 14%

Medium textured soil: 37/50 = 74%

Sandy soil: 2/50= 4%

According to A/R Methodological tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities, SOCREF corresponds to the reference condition in native lands. In the project area two textures classes in native forest were sampled for SOC estimations, the two others texture classes can be estimated by using the correlation between soil texture and SOC established in the same study.

Table 5. Values of SOC_{REF} and dSOC for each texture class

Texture class	SOC_{REF} (KgC/m²)	SOC_{REF} (tC/ha)	Project area (% - ha)		$SOC_{INITIAL}$ (tC/ha)	$dSOC_{t,i}$ (tC/ha/yr)
Clay soil	5.92	59.2	8	1585.5	41.44	0.8
Clay sandy soil	4.86	48.6	14	277.46	34.02	0.73
Medium textured soil	5.37	53.7	74	1466.55	37.59	0.8
Sandy soil	4.72	47.2	4	79.27	33.04	0.71
						0.79

When SOC was superior to 0.8 t C ha-1 (Clay soils, Medium textured soils), according to the tool, this value has not been accounted as more than 0.8 t ha-1 yr-1 then this value is used in ex-post estimations for clay and medium textured soils.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

In accordance with AR-TOOL14 (section 5), carbon stock in trees in the baseline can be accounted as zero if all the following conditions are met:

(a) The pre-project trees are neither harvested, nor cleared, nor removed throughout the crediting period of the project activity.

(b) The pre-project trees do not suffer mortality because of competition from trees planted in the project, or damage because of implementation of the project activity, at any time during the crediting period of the project activity.

(c) Pre-project trees are not inventoried along with project trees in monitoring carbon stocks, but their continued existence, consistent with the baseline scenario, is monitored throughout the crediting period of the project activity because they are additional compared to the baseline scenario

According to the baseline scenario described in PD, the project areas are covered by pastures and small stubble, some scattered trees, and some palms. The arboreal vegetation and the palms are not harvested in the preparation of the soils for the establishment of the trees. On the contrary, being an activity that seeks the restoration of forest cover, this helps to promote the process. The alteration on the soil is of low significance as demonstrated in PD, so that the herbaceous cover is not significantly affected. Finally, the competition of the few remaining trees in the grasslands with that of the new trees will not be given, as native species will be included in order to recreate the conditions of the natural forests of the region. In this way, the methodological conditions of AR-TOOL 14 are fulfilled.

5.2 Project Emissions

The actual net greenhouse gas removals by sinks are estimated according to section 5 of the applied methodology AR-ACM0003 Version 2. These procedures and calculations are detailed below. The detailed calculations are available in **"Annex_01_Delta_C."**

$$\Delta C_{AR-CDM,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t$$

Where:

$\Delta C_{AR-CDM,t}$	Net anthropogenic GHG removals by sinks, in year t; t CO2-e
$\Delta C_{ACTUAL,t}$	Actual net GHG removals by sinks, in year t; t CO2-e
$\Delta C_{BSL,t}$	Baseline net GHG removals by sinks, in year t; t CO2-e, equal zero, see section 5.1)
LK_t	GHG emissions due to leakage, in year t; t CO2-e, equal zero, see section 5.3)

$$\Delta C_{AR-CDM,t} = \Delta C_{ACTUAL,t}$$

Where:

$\Delta C_{AR-CDM,t}$	Net anthropogenic GHG removals by sinks, in year t; t CO2-e
$\Delta C_{ACTUAL,t}$	Actual net GHG removals by sinks, in year t; t CO2-e

As set out in section 3.2 of the VCS Standard (v4.5), ARR projects that meet or exceed the definition of harvesting activity must calculate the long-term average for each stratum, and any carbon loss due to harvesting should be quantified as part of the project emissions. According to the VCS Program Definitions (v4.4), "harvesting activity" is defined as the harvest of tree, vegetation, or other biomass, which results in a reduction by more than 20% of carbon stocks over a five-year period that starts when a reduction of carbon stocks occurs.

As detailed in section 3.1, the project harvested 14,090 m^3 of teak from the MS_harvested stratum in 2019 and 2020, corresponding to 1,438 tCO2e, which represents only 2.2% of the stratum's total carbon stock. Therefore, the long-term average does not need to be applied, and the carbon loss from this harvesting does not need to be included in the quantification of project emissions. The detailed calculations are available in "Annex_01_Delta_C". While harvesting activities will continue in the coming years, it is important to emphasize that they will remain below 20% of the total carbon stock in the harvested stratum.

As AR-ACM0003 v2.0 establishes in the section 5.5 the unique GHG emissions considerable as significant is attributable to biomass burning, due that since the use of fire is not a project activity and either didn't happen as a result of external event. All the GHG emissions within the project boundary as a result of the implementation of the A/R project activity is equal zero. So, the Net Anthropogenic GHG removals by sinks during this monitoring period (t=16 and t=22) is 84,777 tCO2e.

$$\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t}$$

Where:

$\Delta C_{ACTUAL,t}$	Actual net GHG removals by sinks, in year t; t CO2-e.
$\Delta C_{P,t}$	Change in the carbon stocks in project, occurring in the selected carbon pools, in year t; (above- and below-ground); t CO2-e.
$GHG_{E,t}$	Increase in non-CO2 GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year t, as estimated in the tool "Estimation of non-CO2

Table 6. The net GHG removals by sinks of the project

Date	Year (t)	A_i (ha)	$\Delta C_{P,t}$ (tCO2)	$GHG_{E,t}$ (tCO2/year)	$\Delta C_{ACTUAL,t}$ (tCO2/year)
November 15th, 2020	21	1,981[1]	84,777	0	84,777

$$\Delta C_{P,t} = \Delta C_{TREE_{PROJ},t} + \Delta C_{SHRUB\_PROJ,t} + \Delta C_{DW\_PROJ,t} + \Delta C_{LI\_PROJ,t} + \Delta SOC_{AL,t}$$

$$\Delta C_{P,t} = \Delta C_{TREE_{PROJ},t} + \Delta SOC_{AL,t}$$

Where:

$\Delta C_{P,t}$	Change in the carbon stocks in project, occurring in the selected carbon pools, in year t; t CO2-e
$\Delta C_{TREE_{PROJ},t}$	Change in carbon stock in tree biomass in project in year t, as estimated in the tool "Estimation of carbon stocks and changes in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO2-e
$\Delta C_{SHRUB\_PROJ,t}$	Change in carbon stock in shrub biomass in project in year t, as estimated in the tool "Estimation of carbon stocks and changes in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO2-e. This pool was conservative not considered in the carbon removals calculation, so it is equal a zero.
$\Delta C_{DW\_PROJ,t}$	Change in carbon stock in dead wood in project in year t, as estimated in the tool "Estimation of carbon stocks and changes in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO2-e. This pool was conservative not considered in the carbon removals calculation, so it´s equal a zero.
$\Delta C_{LI\_PROJ,t}$	Change in carbon stock in litter in project in year t, as estimated in the tool "Estimation of carbon stocks and changes in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO2-e. This pool was conservative not considered in the carbon removals calculation, so it´s equal a zero.

[1] See 3.2 Deviations

$\Delta SOC_{AL,t}$	Change in carbon stock in SOC in project, in year t, in areas of land meeting the applicability conditions of the tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities", as estimated in the same tool; t CO2-e

Table 7. Carbon stock changes in the project considering the selected carbon pools.

Date	Year (t)	Ai (ha)	$\Delta SOC_{,t}$ (tCO2)	$\Delta C_{TREE,t}$ (tCO2)	$\Delta C_{p,t}$ (tCO2)
November 15th, 2020	21	1,981	22,858	61,919	84,777

$$\Delta C_{TREE_{PROJ},t} = \frac{44}{12} \times CF_{TREE} \times B_{TREE}$$

$$B_{TREE} = A \times b_{TREE}$$

$$b_{TREE} = \sum_{i=1}^{M} W_i \times b_{TREE,i}$$

Where:

$\Delta C_{TREE_{PROJ},t}$	Carbon stock in trees; t CO2e.
CF_{TREE}	Carbon fraction of tree biomass; t C (t d.m.)-1.
B_{TREE}	tree biomass within the biomass estimation strata; t d.m.
A	Sum of areas of the biomass estimation strata; ha
b_{TREE}	Mean tree biomass per hectare within the biomass estimation strata; t.d.m. ha-1.
W_i	Ratio of the area of stratum i to the sum of areas of biomass estimation strata (i.e., dimensionless). $W_i = A_i/A_{W_i} = A_i/A$);
$b_{TREE,i}$	Mean tree biomass per hectare in stratum i; t d.m. ha-1.

Table 8. Mean dry biomass for each stratum in reservoir Planting.

Stratum	MS	MS harvested	ANR	Teca
Area (ha)	1,567.65	235.79	30.12	147.71
Planting bTREE,i - Mean dry biomass (t d.m./ha) BEFORE uncertainty discount	78.46	88.54	3.97	158.94
SEM expanded at 90% confidence level	6.00	11.81	6.99	22.48
Discount	0.00	0.00	0.00	0.00
Planting bTREE,i - Mean dry biomass (t d.m./ha) AFTER uncertainty discount	78.46	88.54	3.97	158.94

Table 9. Mean dry biomass for each stratum in reservoir Regeneration.

Stratum	MS	MS harvested	ANR	Teca
Area (ha)	1,567.65	235.79	30.12	147.71
Regeneration bTREE,i - Mean dry biomass (t d.m./ha) BEFORE uncertainty discount	45.28	25.96	54.26	6.72
SEM expanded at 90% confidence level	6.66	8.24	28.22	4.61
Discount	1.66	2.06	7.05	1.15
Regeneration bTREE,i - Mean dry biomass (t d.m./ha) AFTER uncertainty discount	43.62	23.89	47.20	5.57

Table 10. Mean dry biomass and total area for each stratum in reservoir Planting + Regeneration.

Stratum	MS	MS harvested	ANR	Teca

Area (ha)	1,567.65	235.79	30.12	147.71
Total (planting+regeneration) bTREE,i - Mean dry biomass (t d.m./ha)	122.08	112.43	51.17	164.51

5.3 Leakage

According to the AR-ACM0003, leakage emissions shall be estimated based in the displacement of agricultural activities due to implementation of an ARR project activity, as stated in the AR-TOOL15: "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in ARR project activity". It is estimated as the decrease in carbon stocks in the affected carbon pools of the land receiving the displaced activity, taking into consideration the following:

1. Displacement of an agricultural activity by itself does not result in leakage emission. Leakage emission occurs when the displacement leads to an increase in GHG emissions relative to the GHG emissions attributable to the activity as it exists within the project boundary, and

2. Increase in GHG emission occurring outside the project boundary attributable to the secondary effects of the ARR project activity (e.g., changes in demand, supply or price of goods) are considered insignificant for the purpose of the AR tool 15 and hence accounted as zero.

Notwithstanding, leakage emission attributable to the displacement of grazing activities under the following conditions is considered insignificant and hence accounted as zero, when:

a) Animals are displaced to existing grazing land and the total number of animals in the receiving grazing land (displaced and existing) does not exceed the carrying capacity of the grazing land.

b) Animals are displaced to existing non-grazing grassland and the total number of animals displaced does not exceed the carrying capacity of the receiving grassland.

c) Animals are displaced to cropland that has been abandoned within the last five years.

d) Animals are displaced to forested lands, and no clearance of trees, or decrease in crown cover of trees and shrubs, occurs due to the displaced animals, and

e) Animals are displaced to zero-grazing system

The potential source of leakage considered in this ARR project is related to the former cattle grazing activities and former cropping activities, as presented below:

Cattle grazing activities:

Before the farm acquisition by ONF Brazil, the previous landowner had 3,960 heads of cattle (buffalo). Without ONF Brazil, this number would have increased as the landowner had not yet reached the legal threshold of maximum area to be deforested in a private property at this time (80%). After the farm acquisition, the cattle were slaughtered by the end of their production cycle, therefore, there was no cattle displacement. Two years after the project start, a part of the former landowner's cattle (2,000 heads) remained in the farm in order to complete the production cycle. From the third year onwards, ONF Brasil leased the pasture areas between the plantations to a rural producer in the region with the aim of controlling weed competition that was costing the project a lot. The method proved to be very efficient, as in addition to not spending on labour to control the grasses, it also allowed the entry of economic resources by renting the pasture. The resources acquired by the former landowner after the sale of the São Nicolau farm and the sale of remaining cattle, the landowner purchased another farm in the State of Parana. However, this farm was already deforested and with animals on it (Locatelli, 2001). Therefore, there was no displacement of animals nor increase in GHG emissions relative to the land use changes.

Cropping activities

Besides the cattle, the São Nicolau farm also had 62 ha of coffee plantation. However, when the former landowner acquired another farm, he did not continue with the coffee plantation activities, therefore, there was no displacement of cropping activities due to the ARR project activities.

When ONF Brazil purchased the São Nicolau farm, the 62 ha of coffee plantation were abandoned, allowing natural regeneration to occur. Today, this area, located outside the project area, is dominated by secondary forest. Since there were no displacement of activities, methodological assumptions are fulfilled, and leakage emissions can be deemed as zero, dispensing the leakage monitoring.

5.4 Net GHG Emission Reductions and Removals

As shown in table below, the carbon stock changes in the baseline scenario are zero, consequently the net change in carbon stocks is equal to the GHG removals.

The non-permanence risk analysis was done following the VCS tool "AFOLU Non-Permanence Risk Tool", version 4.2 and accessed through the Verra Project Hub. Through this analysis, the minimum overall risk rating of 12% was obtained. Therefore, since the project total emissions or removals was 84,777 tCO_2e, them, 10,173.24 VCU will be deposited in the buffer

account and 74,604 VCU should be issued. The Non-Permanent Risk Report is available in **"Annex_15_VCS Non-Permanence Risk Report".**

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	VCUs eligible for issuance
Year 2015 (26/10/2015 - 31/12/2015)	*0*	*2,779.6*	*0*	*2,779.6*	*333.5*	*2,446*
Year 2016 (01/01/2016 - 31/12/2016)	*0*	*16,677.5*		*16,677.5*	*2,001.3*	*14,676*
Year 2017 (01/01/2017 - 31/12/2017)	*0*	*16,677.5*	*0*	*16,677.5*	*2,001.3*	*14,676*
Year 2018 (01/01/2018 - 31/12/2018)	*0*	*16,677.5*	*0*	*16,677.5*	*2,001.3*	*14,676*
Year 2019 (01/01/2019 - 31/12/2019)	*0*	*16,677.5*	*0*	*16,677.5*	*2,001.3*	*14,676*
Year 2020 (01/01/2020 - 15/11/2020)	*0*	*15,287.7*	*0*	*15,287.7*	*1,834.5*	*13,453*
Total	*0*	*84,777*	*0*	*84,777*	*10,173.24*	*74,604*

It is worth emphasizing that, in the second verification, the project area increased 884 ha. These new areas were planted under the same proposed stand models as the rest of the project areas. However, we could only account the CO2 removals within the monitoring period (2009-2015). Therefore, it was necessary to discount the CO2 removals before that period. A total of 97,621 tCO2e were discounted in the second verification. For that reason, the total project removals (507,249 tCO2e) are different from the total accumulated tCO2e (604,870 tCO2e) (604,870 – 97,621 = 507,249). The table below describes the total CO2 accumulated through the project and the total amount of VCUs, and buffer issued in each verification.

Total CO2 stock accumulated in first verification (t1)	*140,365*
VCU Buffer first verification (20%)	*28,073*

VCUs issued in first verification (t1)	*112,292*
Total CO2 stock accumulated in second verification (t2)	***520,093***
CO2 discount due to project area increase	*97,621*
Delta C (ΔC = t2-t1-discount)	***282,108***
Buffer second verification (10%)	*28,211*
VCUs issued in second verification (t2)	*253,897*
Total CO2 stock accumulated in third verification (t3)	***604,870***
Delta C (ΔC = t3-t2)	***84,777***
Buffer third verification (12%)	*10,173.24*
Total VCUs issued in third verification (t3)	*74,604*

As requested by the template, the table below shows comparison between the estimated ex-ante GHG emission reductions and removals presented in the Project Description and the achieved emission reductions and removals for this monitoring period. The quantities of GHG emission reductions and removals are the total quantities before any deductions for buffer credits. The comparison demonstrated that the achieved emissions reductions/removals were 50% lower than the ex-ante estimations. This variation can be attributed to various factors, primarily due to restoration being an unpredictable process influenced by factors such as seedling mortality and competition, which can impact tree growth rates. The spreadsheet containing the ex-ante emissions reductions calculations is available in **"Annex_01_Delta_C".** These calculations are based on the information provided in section 3.4 of the revised Project Description.

Ex-ante emissions reductions/removals	Achieved emissions reductions/removals	Percent difference	Justification for the difference
168,171	84,777	50%	This difference can be explained by many factors, mostly because restoration is an unpredictable process where many factors such as, seedlings mortality and

			competition can impact the tree growth rate.