



**Verified Carbon
Standard**

AFFORESTATION IN COOPERATION WITH LOCAL LANDOWNERS FOR FORESTAL SAN PEDRO S.A.

Document prepared by UNIQUE forest investment GmbH

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The VCS grouped project “Afforestation in cooperation with local landowners for Forestal San Pedro S. A.” validated in 2021 4,018.5 ha of Eucalyptus plantations in the department of San Pedro, Paraguay. Besides the management of the validated areas, the project increased its area by 306.5 ha planted in 2022, included in the document as a new management unit: FMU 10.

The current project area is 4,259.0 ha with the inclusion of a new FMU 10 planted in 2022 comprising 306.5 ha. Net loss of the already validated area (4,018.5 ha) corresponds to 66 ha: 44.5 ha due to a storm, 0.5 ha due to correction of limits through mapping and 21 ha mainly due to stagnation in the development of trees due to bad site conditions. Areas affected by the storm were included in the PDD but not verified to date, so no carbon loss took place. They were taken out of the project area, however they are still under observation and might recover through coppicing.

All silvicultural activities were implemented following the description in the PDD.

The GHG emission reduction generated from the plantations until 30-09-2022 for this monitoring period is 434,179 tCO_{2e}. The non-permanence risk rating is 15% (as determined in the AFOLU non-permanence risk report attached as a separate document). Therefore, the total number of buffer credits that need to be deposited into the AFOLU pooled buffer account is 65,127 tCO_{2e}. The number of GHG credits eligible to be issued as VCUs for the first project instances of this monitoring period is 369,052 tCO_{2e}.

Audit Type	Period	Program	WB Name	Number of years
Validation/ Verification	05-04-2015- 31-12-2020	VCS (AFOLU)	TüV Nord GmbH	5.75
Verification	01-01-2021 – 30-09-2022	VCS (AFOLU)	TüV Sud South Asia Pvt. Ltd.	1.75
Total	05-04-2015 – 30-09-2022			7.5

1.2 Sectoral Scope and Project Type

According to VCS Standard document version 4.4, the project activities fall under the eligible AFOLU project category of “Afforestation, Reforestation and Revegetation (ARR)”. The proposed project is a grouped project.

1.3 Project Proponent

Organization name	Forestal San Pedro
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1.4 Other Entities Involved in the Project

Forestal San Pedro has a service provision contract with UNIQUE for the technical management of the plantations. The operational plantation management is conducted mainly by UNIQUE’s Paraguayan subsidiary UNIQUE Wood Paraguay S.A. together with UNIQUE forest investment GmbH, with the technical assistance of UNIQUE land use GmbH.

Organization name	UNIQUE Wood Paraguay
Role in the Project	Project development and implementation
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Organization name	UNIQUE forest investment GmbH
Role in the Project	Project development support
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1.5 Project Start Date

Starting date of the ARR project activity: 05-04-2015.

1.6 Project Crediting Period

Project start date: 05-04-2015

Project end date: 04-04-2035

Total number of crediting years: 20 years, renewable

1.7 Project Location

The second instances of the grouped project are located in the same management units of the first instance, in the provinces of San Pedro and Canindeyú. Project expansion (second instance) will most likely occur within a maximum radius of 100 km from existing FMU boundaries.

This could encompass the Departments of San Pedro, Canindeyu, Caaguazú, and/or Concepción. The political limits of these 4 contiguous Departments are considered the outer project boundary (64,204 km²).

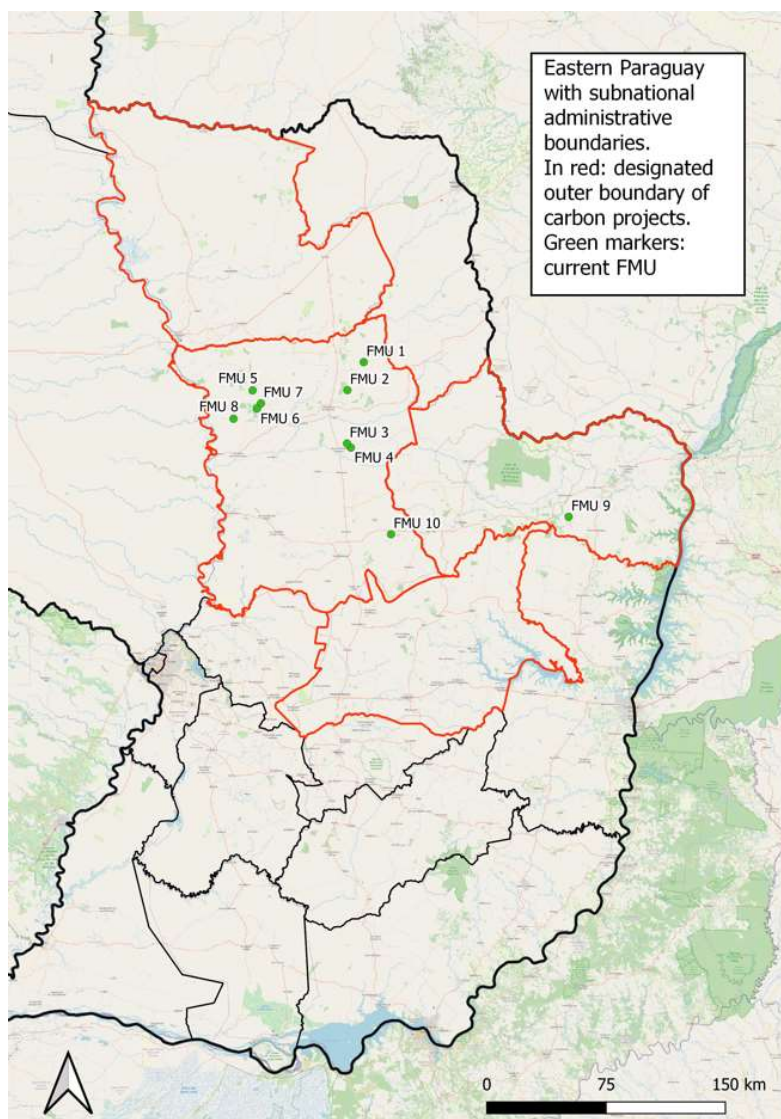


Figure 1. Project outer boundaries for future expansion and current FMUs

Project GIS maps are available as supporting documentation.

1.8 Title and Reference of Methodology

Approved CDM methodology: AR-ACM0003 “AR Large scale - Afforestation and reforestation of lands except wetlands”, version 2

These CDM methodological tools will be used in accordance with the methodology:

- “Combined tool to identify the baseline scenario and demonstrate additionality”, version 01
- “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, version 4.2

- “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities, version 3.1”
- “Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity”, version 4.0
- “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”, version 01.1.0
- Tool “Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A/R CDM project activities”, version 1.0.1

1.9 Participation under other GHG Programs

The project has not been registered or seeking registration under any other GHG program. It also has not been rejected by any other GHG program.

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

GHG removals generated by this project will not be used for compliance with binding limits to GHG emissions since such limits are not enforced in Paraguay. There are no emissions trading programs in place in the country. The grouped project is not being used to create other environmental credits.

Forestal San Pedro establishes forest plantations and sells the wood for further processing. The scope of the carbon certification only encompasses land use, meaning all emission reduction that occurs after harvesting is not captured by this certificate. In case in the future any methodology under any standard allows to account for harvested wood products affecting the value chain, the ownership and scope must be defined further downstream in the value chain.

To ensure full compliance with the standard unique has included a statement in its webpage, according to VCS Standard 4.4. section 3.23.8¹.

1.11 Sustainable Development Contributions

During the monitoring period, already established plantations were maintained – activities included ant and weed control and pruning. In addition, thinning interventions resulted in more than 100,000 m³ mainly for energy biomass, with around 20 % of quality logs sold to the plywood industry. Also, a new site was included into the scope of the project, resulting in 306.5 ha of newly established plantations. As project activities are conducted in a region with high rates of poverty (36 %), and they provide more employment than baseline land use, project activities contribute to reducing poverty by providing decent, local jobs (120 FTE in 2022, thereof 105 FTE from rural areas). In addition, the project establishes plantations in areas deforested decades ago, and promotes natural forest conservation on its production sites, contributing to

¹ <https://www.unique-forestinvestment.de/>

reforestation (SDG 15) and carbon sequestration (SDG 13). Last but not least, by producing quality timber in rotations of > 12 years, the project contributes to local industrialization and fosters manufacturing jobs (SDG 9).

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	1.1	1.1.1 Proportion of population below the international poverty line	The project provides formal jobs in the rural areas of the San Pedro Department, a region affected by high levels of poverty (36 % of its population was poor in 2020) and high levels of informality (> 70 % of employment is informal). The project pays the minimum wage and observes all benefits. Project activities provide, on average, 20-30 jobs per 1,000 ha, without considering industrialization, compared to baseline land uses of cattle (1-3 jobs per 1,000 ha) and agriculture (20-25 jobs per 1,000 ha).	The project provided on average 158 Full Time Equivalents since 2014 (23 FTE per 1,000 ha). In 2022, 105 FTE of these come from rural areas in Eastern Paraguay.	The project is expected to maintain this level of job provision. Workers engaged in project activities later in the value chain are not factored in, meaning the impact is even greater.

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
2)	15.1	15.1.1 Forest area as a proportion of total land area	The project establishes forest plantations on areas deforested decades ago and used for cattle (implanted pastures) or agriculture (mechanized soy production).	To date, FSP manages and maintains 4,259.0 ha of existing plantations under the carbon project. 306.5 ha of this area was established in 2022 in agricultural land. Please note that the total area managed and planted by the company is larger and corresponds to over 6,000 ha.	Overall, the project is expected to establish and maintain about 5,000 ha on areas deforested decades ago under the carbon project. In addition, the project requires landowners to comply with the environmental law (no deforestation) and protects remnants of natural forests (500 ha to date).
3)	9.2	9.2.1 Manufacturing value added as a proportion of GDP and per capita	Plantations are established for the production of quality timber. Large part of the timber will be processed in the country, contributing to the development of local industrialization in a country dominated by the primary sector (export of soy and beef). The forest sector has turned from net exporter to net importer in the 90s.	To date (30-09-22), the project has produced 26,976 m ³ of logs for the national plywood industry. Please note the share of quality timber will increase with plantations getting older.	The project is expected to produce around 150-200 k m ³ p.a. of quality logs starting 2025.

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
4)	9.2	9.2.2 Manufacturing employment as a proportion of total employment	Due to the relatively large scale production of quality timber, processing capacity in the country will need to be scaled up for sawn timber or plywood.	At the moment, the impact on manufacturing employment is still low, as most wood is still used for biomass production. The estimate of employment impact to date is 45 FTE.	From 2025 onwards, the project is expected to foster industrialization through the production of 150-300 k m3 of quality logs that will most likely be used for plywood or sawn timber. These sectors employ about 5 FTE per 1,000 m ³ produced.
5)	13	Tonnes of greenhouse gas emissions avoided or removed	Through tree planting, the project will conduct to net sequestration of carbon.	To date, the project has sequestered more than 650,000 t CO ₂ as evidenced through first and second verification.	The project is expected to reach at least 800,000 tCO ₂ .

2 SAFEGUARDS

2.1 No Net Harm

Project activities are FSC® certified and conducted according to best practice. Procedures are in place to ensure safeguards are implemented as exhibited in the following Tables.

Table 2: Environmental impact and mitigation measures implemented

Environmental impacts	Mitigation measures
Habitat destruction and conversion through plantations Plantations could have negative impacts on local ecosystem and biodiversity if they are established on natural ecosystems.	- Plantations are established on areas previously used for implanted pastures (beef production) or mechanized agriculture. No habitat destruction takes place, as plantations are established on heavily modified areas. Tree planting reduces erosion, contributes to an improved water household, sequesters carbon and in some cases, provides better condition for the connection of natural forests (natural corridors for biodiversity). - Under no circumstances does forest conversion take place for the establishment of plantations. A historical land use assessment is conducted before planting. - A condition for land lease is the existence of a valid environmental license by the owner. The Ministry of Environment evaluates whether deforestation has been conducted after 2004, which is the year the deforestation ban has been put in place in the region). It also evaluates whether buffer zones and other areas have been protected. - On each FMU, a baseline biodiversity study is conducted documenting the state of the site before planting to ensure no net harm on biodiversity. In addition, biodiversity monitoring is realized on High Conservation Value areas,
Impacts of eucalypts on water availability Eucalypts are characterized by high water consumption. Such behavior may cause water scarcity in dry environments.	- The project region, exhibits annual precipitation > 1,300 mm with a positive water household. Also, the region is natural forest area, highly fragmented and degraded, meaning the plantations may contribute in improving the water household (increased water retention in the soil compared to agriculture, etc.). - Eucalypts are not planted in areas important for water recharge (in lowlands subject to flooding). - Buffer zones of rivers and streams are protected.

Environmental impacts	Mitigation measures
Invasive behavior of exotic species In some areas, eucalypts have been described as having an invasive behavior. However, this has not been observed in Paraguay until now.	An invasive behavior of eucalypts has not been observed in the project to date. Following practices are applied to further diminish this risk: ▪ Exotic trees are planted only in demarcated areas. ▪ Genetic eucalypt material planted mostly encompasses clones (not seeds), with limited capacity to produce seeds and spread. ▪ Plantations are combined with grazing systems where cattle controls any unwanted regeneration.
Soil erosion Most of the FMUs are located on terrain that is either flat or shows soft declinations. Only FMU 9 has parts steeper than 15°. Due to the absence of steep terrain, the risk of erosion is low. However, forestry activities may still potentially cause erosion, during the installation and use of roads and, particularly, during harvesting.	▪ Roads are built respecting good practices to facilitate proper drainage and prevent erosion. ▪ In areas dedicated to plantations with fragile soils, contour lines, ridges or other measures are implemented to control surface runoff to counteract erosion. ▪ Thinning and harvesting are carried out in a controlled manner, with heavy machinery circulating only on the roads and tracks of the extraction of signs.
Pesticides and inputs Plantations require the application of chemical inputs, such as calk for soil acidity, fertilizer, herbicides (glyphosate) and Fipronil for ant control. Such inputs, when used without care, can affect non-target organisms and affect human health negatively.	▪ The plantations require input such as lime, fertilizer, and pesticides for ant and weed control (Glyphosate and Fipronil). These are common products in Paraguay, already used previous to the activity on these sites. The input use of the plantations is much lower when compared to agriculture, and roughly the same when compared to beef production. ▪ Inputs are quantified and applied only when needed, following specific dosage and recommendations of the producer. ▪ Pesticides and other chemical inputs are stored in deposits with impermeable floors, ventilation and fire-extinctors. ▪ The products are only received if they are in their original containers, are still valid, and accompanied by the security sheet. ▪ Packaging of potentially toxic waste is disposed according to national regulations and recycled by an accredited company. ▪ Workers are trained to apply inputs according to best practices and avoid affecting non target organisms.

Environmental impacts	Mitigation measures
Fuels and oils The machinery used in the finca requires oils and fuels. If not well maintained, these may leak into the soil or waterways.	▪ Machinery used is well maintained. ▪ Fuels and oils are organized, stored and labelled appropriately. ▪ Fuel and oil exchange are conducted on impermeable platforms.
Illegal activities Hunting, fishing and the uncontrolled extraction of timber and plants may in the finca by company workers or external people may further contribute to the degradation of ecosystems.	▪ Permanent presence of company staff in the FMU ensures the control of activities in the area. ▪ Hunting, fishing and uncontrolled logging of natural timber species is strictly forbidden. ▪ Appropriate signs are installed, and workers are continuously instructed about prohibited activities.
Forest fires Eucalyptus plantations are susceptible to fire, which can have devastating environmental consequences	▪ During the dry season, permanent vigilance is conducted. ▪ Staff are continuously trained in fire prevention and firefighting. ▪ Firebreaks are installed, the fuel on site is maintained low, particularly during the dry season. ▪ Appropriate fire prevention and firefighting tools are available at each site, as well as the protective equipment for firefighting. ▪ Cooperation with neighbors is in place in all units for vigilance and combat. Up to now in about 8 years, forest fires have affected less than 0,6 % of the total plantation area.

Table 3: Social impact and mitigation measures implemented

Risk	Affected stakeholders	Mitigation measures
Displacement/livelihoods /access to ecosystem services	Local community members	▪ The project is taking place on private properties. ▪ The legality of the titles is assessed, as well as the absence of disputes over land, including customary land. ▪ A social due diligence is carried out encompassing consultation with local communities before conducting plantations.

Risk	Affected stakeholders	Mitigation measures
		In addition, a grievance mechanism is used to rule out or act upon disputes and/or conflicts. No serious conflicts about land use or access has been raised to date. ▪ Neighboring community members do not depend on the resources on production sites, meaning plantations do not restrict local people's access or use of resources of critical importance to their livelihoods, or negatively affect ecosystem services. Mostly, community members have small plots for cultivation and animal husbandry, or work in neighboring properties. ▪ The project cooperates with neighbours. The project currently involves 23 beneficiaries participating in a long-term cooperation project to produce timber on smallholder land. More details on the project is presented below. In addition, Forestal San Pedro is assisting the indigenous community of Santa Isabel, neighbouring the new FMU 10, with yerba mate production. In summary, the project does not cause displacement, eviction, or any form of limited access to critical resources to local community members. Plantations on all sites have been established on rightfully owned private properties previously used for cattle or soy production.
Risks of accidents / Health and safety Forestry is characterized by dangerous work, particularly when harvesting. Other jobs, such as the application of pesticides and chemical products, also bear risk for human health.	Field workers	▪ Constant on-the-job trainings and trainings for specific dangerous work are implemented (e.g.: chainsaw operation). ▪ Procedures for the correct use, storage and application of pesticides and chemical products are put in place. ▪ Provision of security equipment adequate for the different types of work. ▪ Trainings in emergency preparedness, first aid and health and safety. ▪ Provision and monitoring of first aid kits.

Risk	Affected stakeholders	Mitigation measures
		- Installation of warning signs in dangerous places. - Provision of appropriate food and accommodation for workers. - Annual consultations with workers on job satisfaction. While accidents have been recorded, the rate remains low (about 3 to 4 accidents a year), and to date, none of these have resulted in severe and long-term injury or death.
Non-observation of minimum labor benefits (wage, social security, etc.). In rural Paraguay, labor is usually informal. Therefore, benefits such as social security are not observed.	Sub-contracted workers	Monitoring of minimum working standards among contractors and sub-contracted personnel. Any deviation of minimum standards is corrected. Semi-professional contractors with little experience in administration and staff management are assisted by the Company to comply with formalities, such as social security.
Dust and noise /accidents on the road Transport of wood products and inputs in and out of the FMU could increase traffic and increase dangers to the communities located on the access road. Workers circulating in motorbikes could also be at risk by increased traffic and dust.	All workers and neighboring community members	- Speeding signs are introduced along internal roads. - The use of helmets is required and monitored when using motorbikes. - Instruct drivers in safe driving, particularly on the community access road. - Grievance mechanism
Reputational risks / political risks Eucalypts have been criticized by environmental groups in Paraguay, as well as large landholdings.	The company (Forestal San Pedro)	- Engaging environmental and social actors in management decisions - Implementing best practices - Grievance mechanism - FSC certification

2.2 Local Stakeholder Consultation

In this Chapter following aspects are described:

- The procedures or methods used for engaging local stakeholders (e.g., dates of announcements or meetings, periods during which input was sought).

Please refer to sub-section A below

- The procedures or methods used for documenting the outcomes of the local stakeholder communication.

Input of stakeholders is taken into account during initial due diligence (due diligence reports and rural appraisals), through the social monitoring system (a procedure is in place) and third party-consultations. Please refer to sub-sections A and B below.

- The mechanism for on-going communication with local stakeholders.

Mainly through the social liaison officers and the grievance mechanism. However, social events and trainings are also platforms to facilitate exchange. In addition, many fieldworkers come from local communities, through whom community-Company networks are strengthened.

- How due account of all and any input received during ongoing communication has been taken. Include details on any updates to the project design or justify why updates are not appropriate.

Inputs received are documented through the social due diligence reports and the grievance mechanism. All grievances were documented and provided follow-up, as evaluated by the auditors through Company records and interviews. No high level updates or changes in the project design were conducted through these inputs during the monitoring period, however the strategy on how to engage with local stakeholders was shaped by these inputs. For instance, in 2023, a new component was introduced by which the new neighbouring community next to FMU 10 has been selected to benefit from a new social project consisting of yerba mate production. The design of this project resulted from engagement with the community.

For AFOLU projects, also demonstrate how the project has communicated the following with local stakeholders:

- The results of project implementation, including the results of monitoring.

Please refer to the public summary of the management plan (see sub-section C).

- Any changes, where relevant, to risks, costs and benefits the project may bring to local stakeholders.

The risks are analysed in the Table under Section 2.1. No additional risks have been identified, as the project expansion does not entail new operations and the expansion takes place in the same region. Through the public summary of the management plan, inception meetings and the grievance mechanism, communities are informed about possible risks and impacts.

- Any changes, where relevant, to relevant laws and regulations covering workers' right in the host country.

The local labour law is followed at all times, and service providers are monitored in this regard. No relevant changes in the labour law happened during the monitoring period.

- The process of VCS Program verification and the validation/verification body's site visit.

Audit processes are explained to local stakeholders (particularly contractors and workers).

A - Engagement with local communities and sub-contracted personnel

Plantations are established on traditional farms (private properties) that have been well established for decades (not on community land). The direct surroundings of the plantations are usually agricultural or cattle fields managed by the property owners (as plantation areas are leased and part of a larger property). The properties are surrounded by other medium and large properties dedicated to cattle and agriculture, as well as rural communities and smallholders.

Every time a new FMU is incorporated into the project, the management team identifies the communities directly neighbouring the plantation sites, and those that share the use of resources (water courses) and infrastructure (access roads), as "direct local stakeholders". In some communities, full Participatory Rural Appraisal were conducted, whereas in others, interviews and inception meetings were conducted. In addition, local contractors and workers were identified, usually from the neighbouring communities. Both local community members, as well as sub-contracted field workers, are considered the most vulnerable stakeholders, and therefore, several forms of engagement have been implemented to avoid negative impacts on them.

During the monitoring period, the new FMU 10 was included. The new production site is located next to an indigenous community called Santa Isabel.



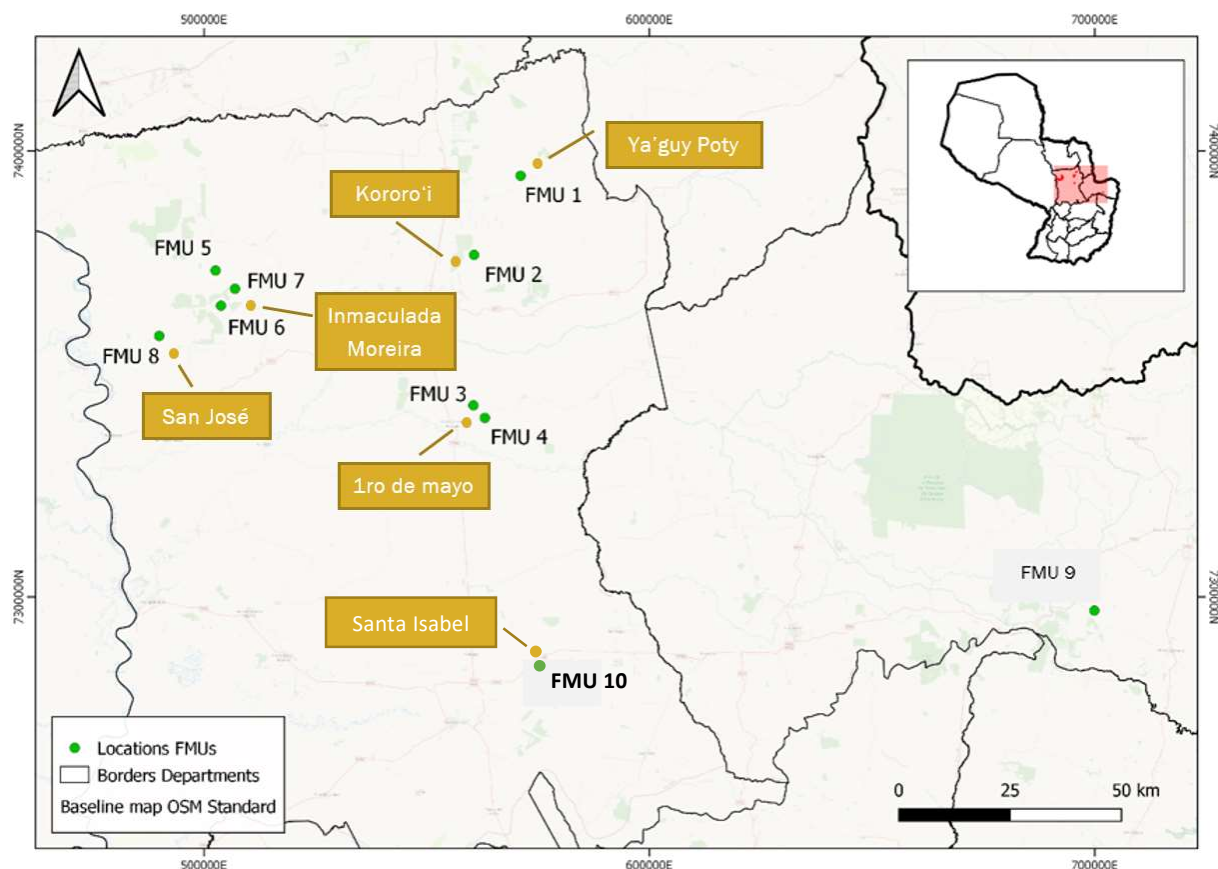


Figure 2: Map of communities surrounding the FMUs

The local stakeholder engagement strategy involves:

- Collection of basic baseline information of the community (location, number of families and main livelihood, land tenure and available infrastructure) and identification of key community representatives and local organizations.
- Collection and monitoring of all data related to sub-contracted workers (age, wage, origin). In 2022, a contractor was introduced for plantations in FMU 10.
- Inception meeting with the community to introduce the project and the team, its expected impacts, and the communication and grievance mechanism. A rapid rural appraisal was conducted in August 2022 with the indigenous Community Santa Isabel located next to FMU 10 to identify risks and impacts of project activities and rule out any land issues.
- Introduction of a Community Liaison Officer (CLO) to introduce and manage a Communication and Grievance Mechanism. The CLO acts as the main contact person between local stakeholders and project managers. In case of grievances, these are recorded and follow up is conducted for each grievance received. In 2022, 8 grievances were recorded and provided follow-up.
- Introduction of the social monitoring system, which includes the monthly assessment of labour relations, to ensure sub-contracted personnel is employed according to the conditions

of the national labour code, health and safety, and an annual or bi-annual assessment of job-satisfaction among sub-contracted personnel, fire events, grievances, accidents. Results are available in the office and a summary is annually published through the public summary of the management plan.

- Planning and implementation of social projects, support programs or punctual support to neighbouring communities depending on community needs. In 2022, 23 beneficiaries were supported with eucalypt plantations through outgrower schemes. Also, a project was initiated for yerba mate plantation with members of the Santa Isabel community. About 6,000 plants have been planted with about 30 families. In addition, the project conducted communication campaigns in schools for fire prevention, and communities were supported with road maintenance.

Table 4: Communities surrounding the FMUs, number of families, and date of the first meeting or assessment.

FMUs	Communities	Date of first meeting or assessment	No of participants in first meeting	No of families
FMU 1	Ya'guy Poty (indigenous)	July 2017	7	24
FMU 2	Kororo'i	November 2014	30	75
FMU 3	1ro de Mayo	November 2017	n.d.	96
FMU 4				
FMU 5	---			---
FMU 6	Inmaculada Moreira	November 2016	9	102
FMU 7	---			---
FMU 8	San José	November 2014	22	80
FMU 9	---			---
FMU 10	Santa Isabel	August 2022	20	200

B - Third-party stakeholder consultations

Stakeholder consultation is conducted:

- initially before planting on a new site, during social due diligence, local people and neighbours are interviewed to evaluate risks and safeguards. The social due diligence report on the community Santa Isabel located next to the new FMU 10 showed that there is no superposition or land conflict between plantation sites and local community land. In addition, a communication channel has been established between project managers and community representatives.
- every year by independent FSC auditors during annual audits. The scale and scope of these consultations varies. Usually, it includes interviews with sub-contracted workers, contractors, and community members of those FMUs audited. In 2022, the latest FSC audit, these have not resulted in critical or negative comments by project stakeholders.

- in addition, internally, the Company annually conducts job satisfaction interviews to sub-contracted field staff. Overall, job satisfaction remains high.

C - Public disclosure

A public summary of the management plan and monitoring results is disclosed for the public on an annual basis. The annual public summary for 2021-2022 can be retrieved here:

https://www.unique-wood.com/wp-content/uploads/2022/10/2021-2022-FSP_-Resumen-Plan-de-Manejo-y-Resultados-de-Monitoreo.pdf

In 2022, the results of the public summaries have been further summarized in a short video per each location and send to local stakeholders per WhatsApp.

2.3 AFOLU-Specific Safeguards

For AFOLU projects, provide details on the following:

- Activities implemented to mitigate risks to local stakeholders due to project implementation.

See Table of social risks under Section 2.1. The social monitoring system includes health and safety aspects, compliance to the labour law by service providers, grievances, accidents, meetings, trainings, and progress in the implementation of social projects.

- Any updates, where relevant, to the property and land use rights of the local stakeholders and a demonstration that the project has not negatively impacted such rights without first obtaining the free, prior and informed consent of the affected parties, and provided just and fair compensation if done so.

The due diligence conducted on the new site shows that plantations have been established on private property which is undisputed by other stakeholders. The indigenous community located next to the project area is the rightful owner of its land.

- The processes used to communicate and consult with local stakeholders during the monitoring period, including any information about any conflicts that arose between the project proponent and local stakeholders and whether any such conflicts were resolved via the established grievance redress procedure.

Notes on communication and consultation with local stakeholders

During the monitoring period, following processes for communication and consultations were conducted:

- **Communication and disclosure:** The public summary of the management plan and the summary of the monitoring results of 2021/2022 are available online [here](#) and shared with local stakeholders in a video. The video was announced and shared by the community liaison officer with community members. In addition, a

video was developed on High Conservation Values (HCV) for the communication of the HCVs in FMU 9 to local stakeholders (see the video [here](#)).

- **Benefit sharing agreement:** A benefit sharing agreement was signed with all property owners for the benefits of carbon credits.
- **Capacity building:** 12 trainings took place with workers, including own staff and staff of service providers in 2022. This encompassed the training of 96 people for a net timespan of 24 hours in fire prevention, health and safety and first aid. In addition, the Company collaborated with a consulting project and facilitated access and participation of its service providers in a training cycle on topics regarding operational planning, finances and formalization.
- **Fire prevention campaign:** Fire prevention campaigns in local schools consisted of 2 hours didactic sessions in the schools of neighboring communities. In 2022, 172 people were reached in four communities.
- **Job satisfaction:** Annually, the Company conducts work satisfaction surveys. In December 2022, the annual “Job satisfaction” interview was conducted with 58 operational staff (4 own staff of Forestal San Pedro and 54 staff working for six service providers). The job satisfaction survey includes a ranking from 1 (very low) to 5 (very high). Job satisfaction was high, with all scores recorded 4 and higher.
- **Grievance mechanism:** Throughout the year 2022, eight grievances were collected, six from operational staff regarding labor relations and work-related issues, and two related to community impacts. Of the former, three were collected during the annual job satisfaction survey. All were addressed. Regarding community impact, in Q1 there were repeated grievances by community members of San José about the state of their community road, negatively impacted by heavily loaded trucks. This must be interpreted in the context of high circulation of trucks that were paving roads in the area at the time. The impact of FSP in this context is marginal, however the Company did contribute to road repair.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project currently has 10 FMUs comprising 4,259 ha. The map below shows the location of the plantations. As presented in the map, FMU 10 is located close to the other FMUs in the Department of San Pedro, comprised within the boundary defined for the group project during validation. Baseline conditions and context are the same to the first instance.

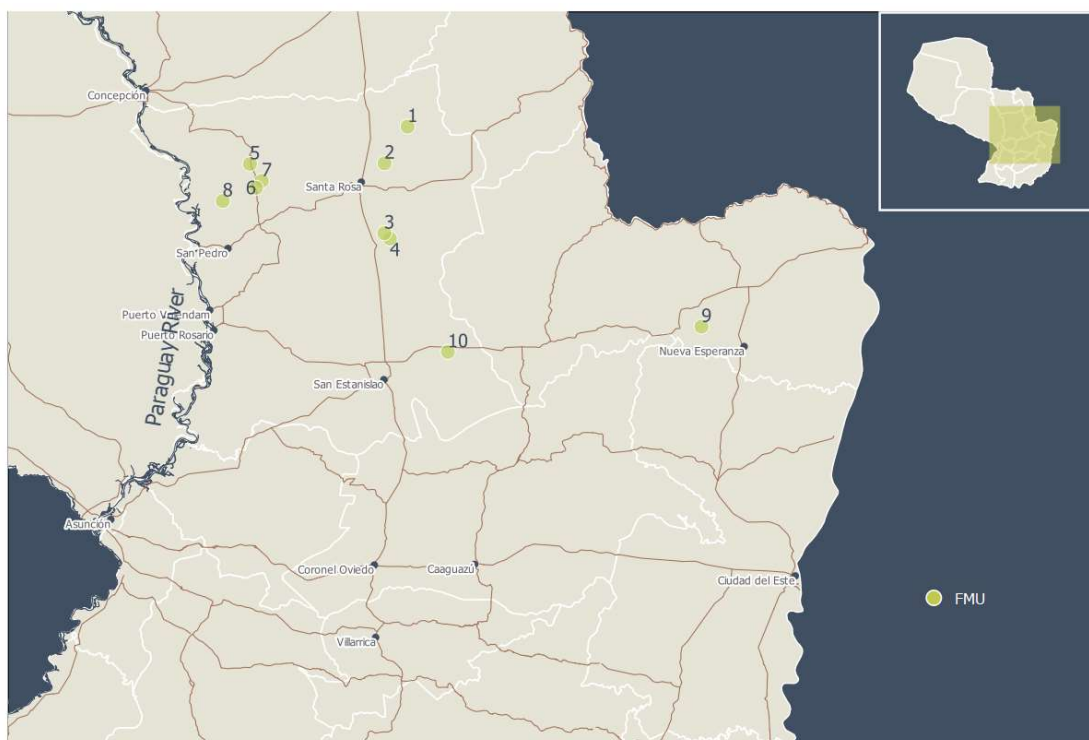


Figure 3. Location of the 10 FMUs managed by FSP

Areas

In early 2023, the GIS team re-assessed the limits of planted areas using very high-resolution imagery. The revision resulted in only a minor change of the total net production area. When compared to the initially validated area, the project area was reduced by 66 ha: thereof 44.5 ha lost due to storm, 21 ha were lost due to site condition, and 0.5 ha were discounted due to mapping adjustment. However, of the lost area, none was verified during first verification, therefore no material carbon loss took place. The table below shows the variations between the area of the different FMUs during the validation, 1st and the 2nd verification.

Table 5. Variation of areas in each FMU: M1 to M2

FMU	Area validated in PDD (ha)	Area verified in 1 st monitoring report (ha)	Area to be verified in 2 nd monitoring report (ha)	Explanation for the difference between validation and 2 nd monitoring report
FMU 1	991.5	0	947.0	-44.5 ha due to storm in August 2022
FMU 2	199.5	0	199.5	0.0
FMU 3	83.0	0	83.0	0.0
FMU 4	151.0	0	151.0	0.0
FMU 5	456.5	456.5	457.5	+1.0 ha due to remapping
FMU 6	172.5	172.5	172.0	-0.5 ha due to remapping
FMU 7	488.0	0	487.0	- 1.0 ha due to remapping
FMU 8	1017.5	888.5	1,003.5	- 14 ha due to site condition (validated area not yet verified) ²
FMU 9	459.0	0	452.0	- 7.0 ha due to sit condition
FMU 10		0	306.5	306.5 ha new establishment
Total	4018.5	1,517.5	4,259.0	240.5

Description of the area lost due to storm

In August 2022, a storm affected 44.5 ha in four different compartments in the FMU 1. The event occurred the 18th of August 2022 affecting the southwest of the FMU. Several trees were broken

² The first verification included strata planted in 2015 and 2019. In 2020, 129 ha were established and validated. 14 ha were lost due to site conditions and therefore will not be verified in this process.

and some of them were bent. The company harvested 5,100 m³ in November in the area. However, in the following months more trees have been falling, showing the fragility of the clone (G2) regarding wind. According to the last satellite imagery analysis conducted with images from June 2023, the complete area lost is 44.5 ha. This area has never been verified and therefore no loss event report is required. These areas have been now excluded from the current verification and no carbon will be claimed for them.



Figure 4. Area lost due to storm in FMU1

Silviculture

Silvicultural activities continued as planned and described in the chapter 1.11 Description of the project activity in the Joint PDD. Forestal San Pedro, acquired its FSC certification (FSC C169494) and the transfer of all plantation areas to the new owner has been completed. A new management unit, FMU 10 has been included as second instance project area, planted in 2022 and described in section 3.3.

3.2 .Deviations

3.2.1 Methodology Deviations

No deviations from the methodologies and tools used during this project were undertaken.

3.2.2 Project Description Deviations

Following deviations are currently identified:

Deviation 1

Currently, the company only measures the heights of odd-numbered trees and calculates the heights of the other trees using mathematical regressions. A regression was calculated for each FMU, and with this equation, the remaining heights are estimated for the final volume calculation. In total, of 12,471 sampled trees, the height of 6,322 was measured. When comparing measured and inferred heights, the deviation results in zero. This system has yielded results very similar to measuring all heights and greatly reduces field time during inventories, allowing for more plots to be measured, which ultimately has a positive effect on inventory accuracy. The inventory has an error of 2.24 %. Both deviations are included in section 4.3 of the Monitoring Plan.

Deviation 2

There is a second deviation in the PD regarding the inventory. Sections 5.2 and 5.3 of the PD indicate areas of 200 and 280 m² for each inventory plot, which translates into measurement of 20 originally planted trees for the plantation densities in the first instance, 714 and 1,000 trees per ha.

The permanent samples plots are established in a way to always encompass the measurement of 20 initially planted trees. If these trees are lost – through natural mortality or thinnings – this is recorded, meaning throughout the production cycle the quantity of measures of living trees in the same plot decreases due to the density reduction through thinning interventions.

For the new instances, the method for selecting the inventory plot remains the same: 5 trees in a line and 4 parallel lines are selected, marking 20 originally planted trees³. For the two new planting densities included in the second instance of 476 trees/ha established in 2019 and 417 trees/ha established in 2020, new plot sizes are established to cover the measurement of 20 trees. Establishing the 20-tree plots in these areas requires plot sizes of 420 and 480 m², respectively. Therefore, there are currently 4 plot sizes: 200, 280, 420, and 480 m².

In all of them, 20 originally planted trees are recorded, but not necessarily 20 trees are measured, as some may have died or been thinned. In this way, we account for survival, which allows us to estimate the current density. Diameters and heights are also measured, and with these three data points, volumes are estimated.

³ The way this is written in the PD may suggest that 20 standing trees are always measured. The correct explanation is that each plot includes 20 originally planted trees, regardless of their survival. A plot may have only 6 or 8 trees and still be a valid plot.

3.3 Grouped Projects

The proposed project activity supports the scope of the VCS program by initiating project activities that sequester carbon through afforestation of former agricultural and implanted pasture land through forest plantations (first project instance comprised 4,018.5 ha, updated to 3,952.5ha in the second monitoring period).

In 2022 the project was expanded by 306.5 ha in a new management unit, which comprises the second instance. With this new addition, project instances of the San Pedro Carbon Project are distributed as follows:

Table 6. Planted area vs certifiable area in the project instances

Year	Carbon certifiable area in PDD	Carbon certifiable area in 2 nd monitoring (ha)	Status
2015 - 2020	4,018.5	3,952.5	First project instance
2021 - 2022	-	306.5	Second project instance
Total	4,018.5	4,259.0	

Inclusion of New Project Activity Instances

According to VCS Standard v.4.4, grouped projects provide for the inclusion of new project activity instances subsequent to the initial validation of the project. New project activity instances shall comply with a set of eligibility criteria that ensure that the new project activity instances meet the applicability conditions set out in the methodology applied to the project. According to VCS Standard 4.4 Section 3.6.17, new project activity instances shall:

- 1) *Occur within one of the designated geographic areas specified in the project description.*

The map below shows the project boundaries, the location of the current FMUs and how the new FMU 10 is located within the project boundaries.

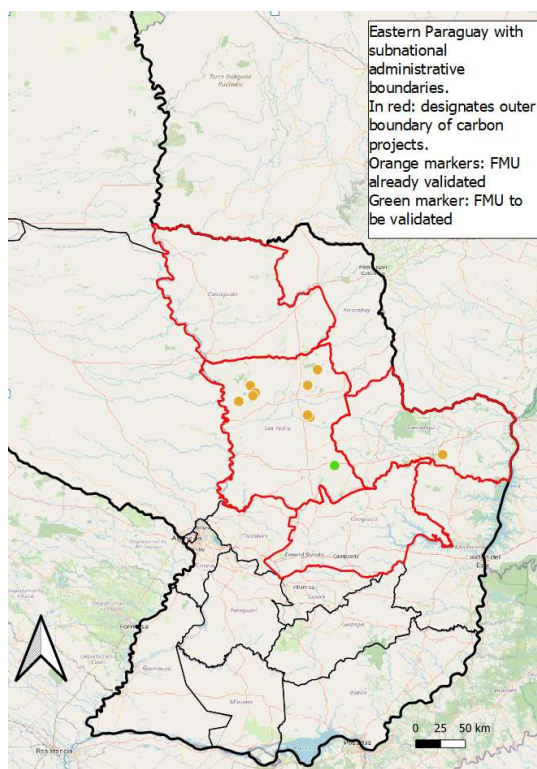


Figure 5. Project boundaries and location of FMU 10

2) *Conform with at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial conformance with multiple sets of eligibility criteria is insufficient.*

According to the PDD (as per VCS Standard 4.4 , any new instance will meet the following criteria:

The second instance project activity supports the scope of the VCS program by sequestering carbon through afforestation of former agricultural and implanted pasture land. The following eligibility criteria are met, and therefore, the project instance may be accounted as AFOLU, AFF project under the VCS:

10 years no deforestation of native ecosystems:

According to the VCS Standard (V4) Appendix 1.1., eligible AR areas must have been cleared of native ecosystems at least 10 years prior project establishment. Furthermore, according to chapter 3.2.4 activities that convert native ecosystems to generate GHG credits are not eligible under the VCS Program.

The project area consisted of agricultural fields, namely mechanized soy, before tree planting took place. The project instance has been introduced into the scope of the FSC certification in 2022 (FSC®- C169494) and follows FSC Principles and Criteria that establish a non-deforestation cut-off date of 1994.

For the carbon project, all plantation sites were assessed to ensure compliance with the VCS standard. The historical land use assessment is available as part of supporting documentation of the audit. No deforestation took place in the 10 years prior to plantation establishment.

No Drainage

The VCS Standard Art 3.2.5 states: “Activities that drain native ecosystems or degrade hydrological functions to generate GHG credits are not eligible under the VCS Program.”

Forestal San Pedro does not target areas that need drainage for planting. No draining has taken place for planting.

Besides the main requirements, the evaluation of the different methodologies used showed other applicability conditions as follows:

3) Be included in the monitoring report with sufficient technical, financial, geographic, and other relevant information to demonstrate conformance with the applicable set of eligibility criteria and enable evidence gathering by the validation/verification body.

As part of the supporting documentation, soil studies, social due diligence, biodiversity baseline and historical land use assessments have been provided to show that all assessments took place to ensure compliance with grouped projects requirements and additionality.

The A/R Large-scale Consolidated Methodology used for the calculations was: AR-ACM0003 Afforestation and Reforestation of lands except wetlands v. 2.0. According to the methodology, the plantations have to comply with the following applicability conditions:

The land subject to the project activity does not fall in wetland category;

San Pedro plantations are established on former agricultural and pasture lands. Wetlands, degraded forests and other sites are not eligible for planting as they are not suited for quality timber production.

According to internal SOP's, plantations are not established on wetlands. Soil analysis of the plantations, which were conducted by independent consultants, confirm this procedure. The most representative soil types on the FMU 10 are Cambic Arenosols, associated with Calcaric cambisols, and Plinthic Acrisols. The data of a Cambic Arenosol are shown in Table 7. These soil types belong to the IPCC class of “Sandy Soils”, with over 70% sand and less than 8% clay.

Table 7. Sample data of a Cambic Arenosol soil type, data HWSD ⁴

⁴ <https://iiasa.ac.at/models-tools-data/hwsd>

Parameter	Value
Dominant soil group	Cambic Arenosol
Topsoil texture	loamy sand
Drainage class	Somewhat excessive
Topsoil sand fraction (%)	83
Topsoil silt fraction (%)	10
Topsoil clay fraction (%)	7
USDA Texture classification	sandy loam
Reference Bulk density (kg/dm ³)	1.56
Topsoil gravel content (%)	0
Topsoil organic carbon (% weight)	0.47
Topsoil pH	7.9
Topsoil CEC (cmol/kg)	11

Besides the general study of the HWSD, FSP conducted a soil analysis before planting, available as supporting documentation. The results show a participation of 10-11% of clay and a sandy loam texture. All area was agricultural land before establishment of the plantation, so no deforestation or removal of biomass was required.

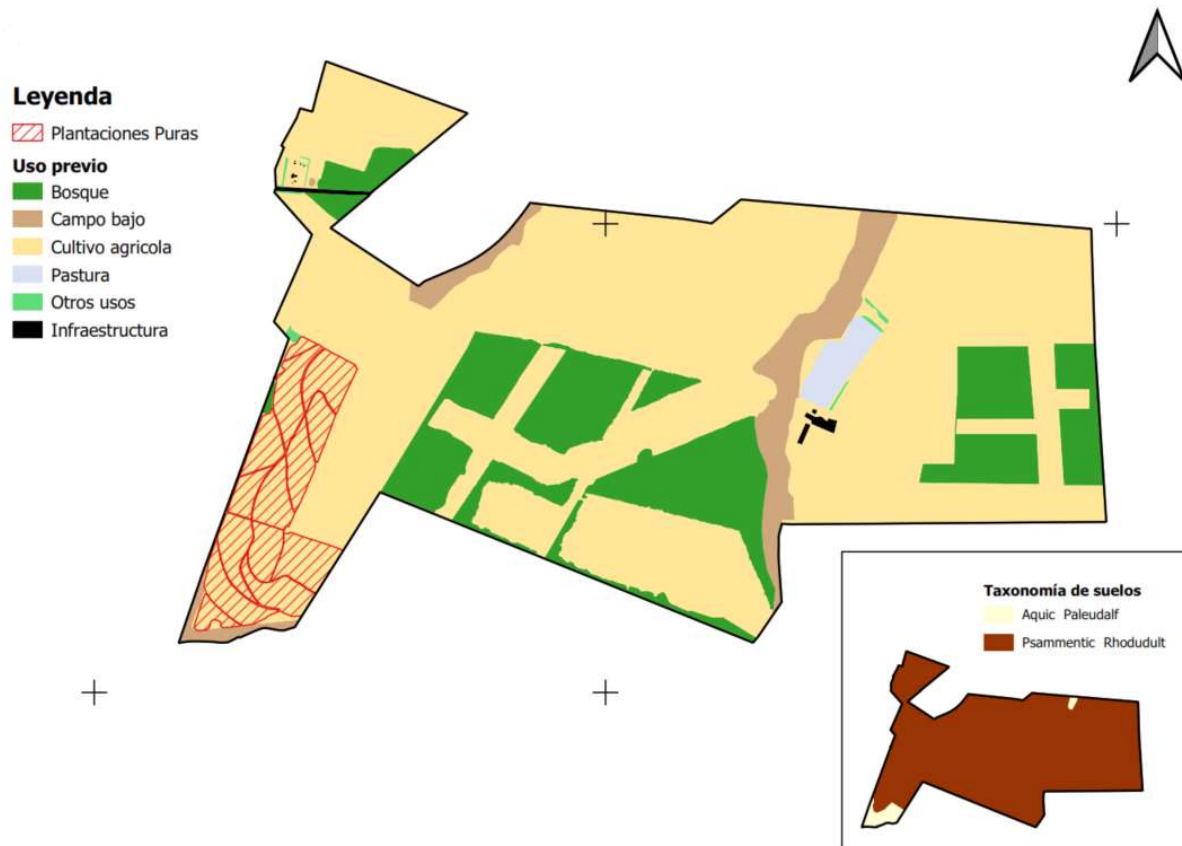


Figure 6. Previous land use of FMU 10, soil taxonomy and area planted (in red)

Soil disturbance attributable to the project activity does not cover more than 10 per cent of area in each of the following types of land, when these lands are included within the project boundary:

Land containing organic soils;

Land which, in the baseline, is subjected to land-use and management practices and receives inputs listed in appendices 1 and 2 to this methodology.

Soil disturbance in the project only happens during soil preparation before plantation. This activity is conducted only in the lines where trees will be planted, with a width of maximum 50 cm and up to 50 cm depth. The maximum density of plantations comprises a spacing of 5 x 2 m, with a separation of 5 meters between lines and 2 m between trees for pure plantations. In the case of silvopastoral systems, trees are established in double rows of 5 x 2 m like pure plantations, and then separated by a wider alleyway in between of 9 m. In the worst-case scenario using the spacing of 5 x 2 m, soil disturbance affects 10 % of the area considering:

- A line of trees every 5 m results in 20 lines/ha
- $20 \text{ lines} \times 0,5 \text{ m of width} \times 100 \text{ m of length/ha} = 1,000 \text{ m}^2 \text{ of soil disturbance/ha}$

The new instance FMUs has a spacing of 6 x 2 and therefore the soil disturbance is lower than the described above.

A biodiversity baseline as well as a social due diligence was conducted (available as supporting documentation) to ensure the compliance of all social and environmental requirements of FSC. The FMU 10 is since 2022 already certified as part of the FSP project.

The new management unit (FMU 10) complies with the same technical and silvicultural management as the rest of the project. Technologies and measures are applied in the same manner as specified in the project description.

Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.

The project is located within the boundaries of the project. Previous to the establishment of the forest plantation, the complete area was used for mechanized agriculture as part of the rest of the project. Agriculture, together with cattle ranching, are the scenarios considered in the common practice analysis conducted for the additionality assessment.

The same activities and technical measures are implemented in the FMU 10 and therefore the additionality analysis conducted in the Project Description is still valid.

4) Be included in an updated project description, with updated project location information (as set out in Section 3.11), which shall be validated at the time of verification against the applicable set of eligibility criteria.

The description is presented in this monitoring report and supporting documentation has been provided to the auditors during verification to evaluate the applicability of the additionality argument. Also, all technological and financial barriers that support the additionality argument are still sustained in the project region. Forestry is still an emerging land use system in the region, therefore the project proponents still face the same difficulties. Below the barrier analysis is presented.

5) Have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions).

FSP has the forestry surface rights of the plantation through a leasing contract available as part of the supporting documentation.

6) Have a start date that is the same as or later than the grouped project start date.

The project start date is 05-04-2015 and the FMU 10 was established in August 2022.

7) Be eligible for crediting from the start date of the project activity instance through to the end of the project crediting period (only).

FMU 10 was established between August and September 2022. Start date of the FMU 10: 01-08-2022.

8) Only eligible for crediting from the start of the verification period in which they were added to the grouped project.

The start of the verification period is 05-04-2015 and therefore it is in compliance with this criteria. In addition, FMU 10 is only included for validation at this stage, as trees planted were still too young for first inventory measurements during this verification. Therefore crediting will only occur during the next verification.

9) Not be or have been enrolled in another VCS project.

The FMU 10 is not part of any other VCS project.

10) Adhere to the clustering and capacity limit requirements for multiple project activity instances set out in 3.6.8 - 3.6.9.

The methodology used for this project is: A/R Large-scale Consolidated Methodology used for the calculations was: AR-ACM0003 Afforestation and Reforestation of lands except wetlands v. 2.0. The capacity limit requirements of the current methodology are in compliance with the inclusion of the second instance of this project.

Then, applicability conditions for leakage were checked according to AR Tool 15:

This tool is not applicable if the displacement of agricultural activities is expected to cause, directly or indirectly, any drainage of wetlands or peat lands.

Furthermore, according to Paragraph 9, Note 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.*

After careful evaluation leakage is shown to be zero, as the property owner has not expanded agricultural activities after reforestation on FMU 10. This is shown through satellite imagery of the property. Also, the property owner has a valid environmental licence, which proves adherence

to the environmental law, according to which deforestation is banned in the region since December 2004.

Additionality and barrier analysis

In addition, the new instances face the same barriers as the ones described in the PDD at the time of project initiation. The applicability of the barriers to the new instances is described below.

Barriers preventing the proposed land use according to the PDD	Applicability to the second instance
Investment barriers - Financial risk related to long term uncertainties in a context with a lack of similar experience - High hurdles to invest in forestry due to high initial investment and long payback period compared to common land uses, mainly grain and beef production.	Lack of appropriate funding vehicles for long-term investments has been an important hurdle in Paraguay as described in the PDD. While forestry is slowly becoming more accepted, and some credit lines are emerging for forestry, the high upfront investment and long payback period is considered risky, particularly in an emerging market like Paraguay, where wood and timber markets are not mature. In fact, the expansion onto the new instances could be conducted through finances secured through a combination of equity, loans and carbon credit income, but project expansion is much below the initial plan, due to lower project performance as expected. This is why carbon finance is particularly important for building the forest resource in the initial years, to kickstart the diversification in land use, carbon sequestration and allow for funding in associated higher impact models with high environmental and social impact.
Barriers related to the timber and wood market Non-leveled playing field due to the competition with the highly informal woodfuel market (low prices for woodfuel), and under-developed market for quality timber. Possibilities of price risks due to the fluctuations in the prices	The biomass market (wood used for energy purposes) is still highly informal in Paraguay. Despite governmental efforts to formalize the biomass value chain through Decree 4,056/2015, most of the energy matrix is still covered with wood from informal sources. Paraguay has the highest

Barriers preventing the proposed land use according to the PDD	Applicability to the second instance
of products over the project period in the absence of efficient markets and insurance mechanisms.	hydroelectric energy production per capita in the world, and much of this is exported. However in 2020, 36% of the domestic energy demand is still covered by biomass (IDB, 2022), most of this from informal/non sustainable sources (IDB ⁵ , 2022). Sales of biomass are particularly important during the first thinnings of the project, where harvested wood is of low quality and can only be sold for energy purposes. The competition in the informal market continued. Prices for biomass have not increased in the last few years. In addition, the quality timber market continues to be underdeveloped. The situation has not changed with respect to what has been described in the PDD. How this has affected the Project is presented to the reviewers in separate documentation.
Barriers due to local ecological conditions, inter alia: ○ Changing climatic patterns and increase of extreme weather events ○ Incidence of pests and diseases	As described in the PDD, there are risks associated to long term crops in a place without long term track record. In Forestal San Pedro, the sandy soils make the area particularly vulnerable to drought, as the soil retains low humidity. While growth is largely positive, due to the dry spell in the last years, it is not reaching initial expectation.
Technological barriers ○ Lack of capacity to predict systems productivity (e.g. lack of long-term forestry experience, first ground proof of growth models)	The lack of long-term research leads to lack of knowledge regarding site-species matching, growth and yield, and the timber quality of different species. This increases the risk for quality timber investment and is a hurdle that can only be addressed through long term observations and increased experience.
Barriers related to local tradition, inter alia:	Forestal San Pedro is the first and oldest Company producing quality timber production

⁵ <https://publications.iadb.org/publications/spanish/document/Breve-resena-del-sector-de-energia-en-Paraguay.pdf>

Barriers preventing the proposed land use according to the PDD	Applicability to the second instance
○ Traditional equipment and technology of the forest industry, based on natural forest species that were depleted ○ Local culture still opts for the most traditional/common land uses ○ Absence of professional service providers ○ The land use scenario is the “first of its kind”: No activity of this type is currently operational in the host country or region	in the region, and therefore this is still an alternative business in the region. Currently, Forestal San Pedro is one of three Companies in the region in this sector, and none of these Companies has completed one rotation. All risks associated to an emerging market in this sense are still applicable to the new instances as described in the PDD.

In summary, the project is eligible under the VCS requirements.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	MAI
Data unit	m ³ /ha/yr
Description	Mean Annual Increment
Source of data	Estimated growth tables
Value applied	35
Justification of choice of data or description of measurement methods and procedures applied	The value applied is a conservative average of all plantations. Growth estimations are based on inventory data, locally available information on growth performance and the eucalyptus growth simulator of EMBRAPA.
Purpose of Data	Determination of Ex-Ante volume growth of the plantations
Comments	-

Data / Parameter	Conversion factor from C to CO ₂
Data unit	tCO ₂ /tC
Description	Carbon coefficient times the fraction oxidized times the ratio of the molecular weight of carbon dioxide to carbon
Source of data	Default as per IPCC
Value applied	44/12
Justification of choice of data or description of measurement methods and procedures applied	44/12 is the molecular weight ratio to convert tonnes of carbon to tonnes of CO ₂ as used per IPCC default value
Purpose of Data	Conversion factor from C to CO ₂
Comments	Conversion factor from C to CO ₂

Data / Parameter	CF _{TREE}
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Data unit	t C(t.d.m.) ⁻¹
Description	Carbon fraction of tree biomass
Source of data	Default value
Value applied	0.47
Justification of choice of data or description of measurement methods and procedures applied	According to the applied tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" IPCC default value of 0.47 is used
Purpose of Data	Determination of baseline emissions/removals and project emission/ removals
Comments	-

Data / Parameter	R _{TREE_BSL}
Data unit	dimensionless
Description	Root : Shoot ratio of trees
Source of data	Default value
Value applied	0.25
Justification of choice of data or description of measurement methods and procedures applied	According to the applied tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" IPCC default value of 0.25 is used
Purpose of Data	Determination of baseline emission/removals
Comments	-

Data / Parameter	b _{Forest}
Data unit	t d.m. ha ⁻¹
Description	Total Aboveground biomass of trees in the country, where the AR CDM project activity is located
Source of data	Value for tropical moist deciduous forest in Paraguay, de Sy et al. (2015)
Value applied	80
Justification of choice of data or description of measurement methods and procedures applied	Scientific study
Purpose of Data	Calculation of baseline emission removals

Comments	-
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Data / Parameter	ΔC_{DW_BSL}
Data unit	percent
Description	Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass
Source of data	Default factor
Value applied	1%
Justification of choice of data or description of measurement methods and procedures applied	According to the applied tool " Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities ", the project mean annual precipitation is 1300 mm/yr.
Purpose of Data	Calculation of baseline emission removals
Comments	-

Data / Parameter	ΔC_{LI_BSL}
Data unit	percent
Description	Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass
Source of data	Default factor
Value applied	1%
Justification of choice of data or description of measurement methods and procedures applied	According to the applied tool " Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities ", the project mean annual precipitation is 1,300 mm/yr.
Purpose of Data	Calculation of baseline emission removals
Comments	-

Data / Parameter	BEF
Data unit	dimensionless
Description	Biomass expansion factor, expressing the additional biomass of a tree when only stem volume is known.
Source of data	Default factor
Value applied	1.15

Justification of choice of data or description of measurement methods and procedures applied	According to IPCC Good Practice Guidance for LULUCF – Table 3A.1.10, Broadleaf Temperate forest since no sub-tropical values are available, lower confidence interval
Purpose of Data	Calculation of project emission removals
Comments	-

Data / Parameter	$R_{TREE, project}$
Data unit	dimensionless
Description	Mean of Root : Shoot ratios published for Eucalyptus globulus, E. camaldulensis and E. urograndis
Source of data	Inventory
Value applied	formula: $e^{(-1,085+0,9256*\ln(abg))/abg}$. In average 0.25.
Justification of choice of data or description of measurement methods and procedures applied	Recommended formula to estimate the R_j by the tool AR-tool 14 v 4.2.
Purpose of Data	Calculation of ex-ante and ex-post project emission removals
Comments	-

Data / Parameter	Wood density
Data unit	t/m ³
Description	Weight to volume relation of Eucalyptus grandis and E. urophylla
Source of data	Zanne et al. (2009)
Value applied	0,54
Justification of choice of data or description of measurement methods and procedures applied	According to Zanne et al. (2009) a mean of all available wood densities of E. grandis and E. urophylla was calculated.
Purpose of Data	Calculation of project emission removals
Comments	-

Data / Parameter	$SOC_{REF,i}$
Data unit	t C ha ⁻¹

Description	Reference SOC stock corresponding to the reference condition in native lands
Source of data	IPCC Default value, See CDM Tool 'tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities'
Value applied	47
Justification of choice of data or description of measurement methods and procedures applied	According to the applied tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" a default value of 47 for tropical moist climate regions and soils with low activity clay (LAC).
Purpose of Data	Calculation of project emission removals
Comments	-

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	IPCC Default value, See CDM Tool 'tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities'
Value applied	Agriculture: 0.48
Justification of choice of data or description of measurement methods and procedures applied	Pasture/Grassland: 1.0
Purpose of Data	Table 4 of the applied tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" gives 0.48 as a relative stock change factor for long term cultivation in a tropical moist region and 1.0 for grasslands.
Comments	Calculation of project emission removals

Data / Parameter	$f_{MG,i}$
Data unit	dimensionless

Description	Relative stock change factor for baseline management regime in stratum I of the areas of land
Source of data	IPCC Default value, See CDM Tool 'tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities'
Value applied	Full tillage/Agriculture: 1
Justification of choice of data or description of measurement methods and procedures applied	Moderately degraded/Pasture: 0.97
Purpose of Data	Table 4 of the applied tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" gives a default value of 1 for full tillage in agriculture and Table 6 0.97 for tropical moderately degraded grasslands
Comments	Calculation of project emission removals

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	IPCC Default value, See CDM Tool 'tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities'
Value applied	Medium/cropland: 1
Justification of choice of data or description of measurement methods and procedures applied	Medium/grasslands: 1
Purpose of Data	According the Table 5 of the applied tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" an input factor of 1 is used when medium manure input is applied, while table 6 shows an input factor of 1 for medium manure inputs in grasslands.
Comments	Calculation of project emission removals

4.2 Data and Parameters Monitored

Data / Parameter	FF
Data unit	-
Description	Form Factor for volume
Source of data	Empiric measurement
Description of measurement methods and procedures to be applied	Diameter and height were measured in 2024 in 35 trees in different stem lengths to determine the tree volume according to the methodology AR Tool 18. All strata were included and the p value was lower than 0.2 as per requirement of the tool.
Frequency of monitoring/recording	In 2024, 35 trees were measured and statistically analyzed to ensure the requirements of the AR tool 18.
Value monitored	0.4
Monitoring equipment	Diameter tape
QA/QC procedures to be applied	The team was trained for the activity and the results were proofed by the technical expert.
Purpose of the data	Calculation of volume
Calculation method	Excel
Comments	Excel "Form Factor Calculation" available as supporting documentation.

Data / Parameter	A _i												
Data unit	Ha												
Description	Area of tree biomass stratum i												
Source of data	GIS or/and GPS												
Description of measurement methods and procedures to be applied	Areas in project area will be tracked in the field using the GPS. Each plot which will be subject to planting is tracked - a standard procedure of the baseline and monitoring inventory												
Frequency of monitoring/recording	Before the start of the project (planting) and adjusted thereafter every y since yearly with satellite imagery												
Value monitored	<table border="1"> <thead> <tr> <th>Stratum (Year_tree density)</th><th>Area (ha)</th></tr> </thead> <tbody> <tr> <td>2015_714</td><td>866.5</td></tr> <tr> <td>2015_1000</td><td>439.5</td></tr> <tr> <td>2016_714</td><td>199.5</td></tr> <tr> <td>2016_1000</td><td>185.5</td></tr> <tr> <td>2017_714</td><td>1,747.5</td></tr> </tbody> </table>	Stratum (Year_tree density)	Area (ha)	2015_714	866.5	2015_1000	439.5	2016_714	199.5	2016_1000	185.5	2017_714	1,747.5
Stratum (Year_tree density)	Area (ha)												
2015_714	866.5												
2015_1000	439.5												
2016_714	199.5												
2016_1000	185.5												
2017_714	1,747.5												

	2018_714	377.0
	2019_476	22.0
	2020_416	115.0
Monitoring equipment	GPS (Garmin), GPS Smartphones, QGIS software	
QA/QC procedures to be applied	Field-team members are fully aware of all procedures and the importance of collecting data as accurately as possible; all field team members are trained in GPS/GIS application	
Purpose of the data	Calculation of project emissions	
Calculation method	GIS tool	
Comments	-	

Data / Parameter	w _i																			
Data unit	Dimensionless																			
Description	Relative weight of the area of stratum I, the area of the stratum i divided by the project area.																			
Source of data	Calculated																			
Description of measurement methods and procedures to be applied	N/A																			
Frequency of monitoring/recording	Calculated for each monitoring event, at least every five years																			
Value monitored	For ex ante situation the following values are estimated from the first project instance: <table><tr><th>Stratum (Year_tree density)</th><th>W_i</th></tr><tr><td>2015_714</td><td>0.22</td></tr><tr><td>2015_1000</td><td>0.11</td></tr><tr><td>2016_714</td><td>0.05</td></tr><tr><td>2016_1000</td><td>0.05</td></tr><tr><td>2017_714</td><td>0.44</td></tr><tr><td>2018_714</td><td>0.10</td></tr><tr><td>2019_476</td><td>0.01</td></tr><tr><td>2020_416</td><td>0.03</td></tr></table>		Stratum (Year_tree density)	W _i	2015_714	0.22	2015_1000	0.11	2016_714	0.05	2016_1000	0.05	2017_714	0.44	2018_714	0.10	2019_476	0.01	2020_416	0.03
Stratum (Year_tree density)	W _i																			
2015_714	0.22																			
2015_1000	0.11																			
2016_714	0.05																			
2016_1000	0.05																			
2017_714	0.44																			
2018_714	0.10																			
2019_476	0.01																			
2020_416	0.03																			
Monitoring equipment	N/A																			
QA/QC procedures to be applied	N/A																			
Purpose of the data	Calculation of project emissions/removals																			

Calculation method	Area of the stratum i divided by the project area
Comments	-

Data / Parameter	S_i																		
Data unit	t d.m. (or t d.m. ha ⁻¹)																		
Description	Estimated standard deviation of biomass stock in stratum i																		
Source of data	Project based monitoring system																		
Description of measurement methods and procedures to be applied	N/A																		
Frequency of monitoring/recording	s_i is calculated for each monitoring event, at least every five years																		
Value monitored	For ex ante situation the following values are estimated from the first project instance: <table border="1"> <thead> <tr> <th>Stratum (Year_tree density)</th><th>S_i</th></tr> </thead> <tbody> <tr> <td>2015_714</td><td>24.61</td></tr> <tr> <td>2015_1000</td><td>39.66</td></tr> <tr> <td>2016_714</td><td>16.33</td></tr> <tr> <td>2016_1000</td><td>46.11</td></tr> <tr> <td>2017_714</td><td>22.81</td></tr> <tr> <td>2018_714</td><td>12.87</td></tr> <tr> <td>2019_476</td><td>9.89</td></tr> <tr> <td>2020_416</td><td>7.67</td></tr> </tbody> </table>	Stratum (Year_tree density)	S_i	2015_714	24.61	2015_1000	39.66	2016_714	16.33	2016_1000	46.11	2017_714	22.81	2018_714	12.87	2019_476	9.89	2020_416	7.67
Stratum (Year_tree density)	S_i																		
2015_714	24.61																		
2015_1000	39.66																		
2016_714	16.33																		
2016_1000	46.11																		
2017_714	22.81																		
2018_714	12.87																		
2019_476	9.89																		
2020_416	7.67																		
Monitoring equipment	N/A																		
QA/QC procedures to be applied	N/A																		
Purpose of the data	Calculation of uncertainty of project emissions/removals																		
Calculation method	Excel or tool available to calculate standard deviation																		
Comments	-																		

Data / Parameter	n_i
Data unit	Dimensionless
Description	Number of sample plots in stratum i
Source of data	Calculated
Description of measurement methods	N/A

and procedures to be applied																			
Frequency of monitoring/recording	n_i is calculated for each monitoring event, at least every five years																		
Value monitored	For ex ante situation the following values are estimated from the first project instance: <table border="1"> <thead> <tr> <th>Stratum (Year_tree density)</th><th>n_i</th></tr> </thead> <tbody> <tr> <td>2015_714</td><td>229</td></tr> <tr> <td>2015_1000</td><td>104</td></tr> <tr> <td>2016_714</td><td>26</td></tr> <tr> <td>2016_1000</td><td>50</td></tr> <tr> <td>2017_714</td><td>357</td></tr> <tr> <td>2018_714</td><td>48</td></tr> <tr> <td>2019_476</td><td>6</td></tr> <tr> <td>2020_416</td><td>20</td></tr> </tbody> </table>	Stratum (Year_tree density)	n_i	2015_714	229	2015_1000	104	2016_714	26	2016_1000	50	2017_714	357	2018_714	48	2019_476	6	2020_416	20
Stratum (Year_tree density)	n_i																		
2015_714	229																		
2015_1000	104																		
2016_714	26																		
2016_1000	50																		
2017_714	357																		
2018_714	48																		
2019_476	6																		
2020_416	20																		
Monitoring equipment	N/A																		
QA/QC procedures to be applied	N/A																		
Purpose of the data	Calculation of project emissions/removals																		
Calculation method	The calculation method is described in the Chapter 4.3																		
Comments	-																		

Data / Parameter	$A_{p,i}$										
Data unit	Ha										
Description	Size of a sample plot in stratum i										
Source of data	Field measurement										
Description of measurement methods and procedures to be applied	After calculating the No of sample plots required to achieve the desired precision level (90/10) a stratified random selection is carried out.										
Frequency of monitoring/recording	Yearly										
Value monitored	<table border="1"> <thead> <tr> <th>Spacing</th><th>Plot size (m2) – 20 trees</th></tr> </thead> <tbody> <tr> <td>9 x 5 x 2</td><td>280</td></tr> <tr> <td>5 X 2</td><td>200</td></tr> <tr> <td>5 x 9 x 3</td><td>420</td></tr> <tr> <td>8 x 3</td><td>480</td></tr> </tbody> </table>	Spacing	Plot size (m2) – 20 trees	9 x 5 x 2	280	5 X 2	200	5 x 9 x 3	420	8 x 3	480
Spacing	Plot size (m2) – 20 trees										
9 x 5 x 2	280										
5 X 2	200										
5 x 9 x 3	420										
8 x 3	480										

Monitoring equipment	N/A
QA/QC procedures to be applied	Field-team members are fully aware of all procedures and the importance of collecting data as accurately as possible; all field team members are trained in GPS/GIS application
Purpose of the data	Calculation of project emission removals
Calculation method	It is calculated based on the area needed to include 20 trees in the Permanent Sample Plot, varying strictly by tree planting density.
Comments	-

Data / Parameter	DBH
Data unit	cm
Description	The diameter at breast height (1.3 m from the ground)
Source of data	Field measurements in sample plots.
Description of measurement methods and procedures to be applied	The circumference or DBH of the tree at 1.3 m will be measured in the field for each tree presented in the Permanent Sample Plot.
Frequency of monitoring/recording	Every year after the first year of plantation
Value monitored	n.a. (see Excel base carbon accounting sheet)
Monitoring equipment	Diameter tapes
QA/QC procedures to be applied	Training of inventory team is fundamental to ensure the quality of the data. Analysis to avoid typos or mistakes comparing with past years are conducted after the measurements and re-measurements might be required.
Purpose of the data	Estimation of ex-post project emissions/removals
Calculation method	N/A
Comments	-

Data / Parameter	H
Data unit	m
Description	Height of tree planted
Source of data	Field measurements in sample plots. For ex ante estimations, H values are derived from growth tables used in the project

Description of measurement methods and procedures to be applied	Height of the tree is measured using a vertex IV
Frequency of monitoring/recording	Every year after the first year of plantation
Value monitored	N/A (see Excel base carbon accounting sheet)
Monitoring equipment	Vertex IV
QA/QC procedures to be applied	To ensure that measurements have been taken correctly, it is important to calibrate the Vertex IV at least once every day, even twice when the temperatures are very high.
Purpose of the data	Estimation of ex-post project emissions/removals
Calculation method	-
Comments	Calculation of project emission removals

Data / Parameter	T
Data unit	Year
Description	Time period elapsed between two successive estimations of carbon stock in a carbon pool
Source of data	Recorded time
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	N/A
Value monitored	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of the data	Calculation of project emission removals
Calculation method	N/A
Comments	If the two successive estimations of carbon stock in a carbon pool are carried out at different points of time in year t2 and t1, (e.g. in the month of April in year t1 and in the month of

December in year t2), then a fractional value will be assigned to T

4.3 Monitoring Plan

Monitoring system structure

Forestal San Pedro has a technical team that manages and monitors the plantations. The monitoring system uses standard procedures in order to obtain verifiable and reliable information on the growth of the plantations, thus allowing the accounting of the sequestered carbon.

The complete monitoring system of the project includes different aspects. On the one hand, a monitoring system is used to record operations, inputs used and associated costs, using Excel tools for different analyses. In addition, yearly inventories are conducted to assess the development of the plantations. A GIS project is also continuously updated with reliable information of location, project boundaries, plots, infrastructures, etc.

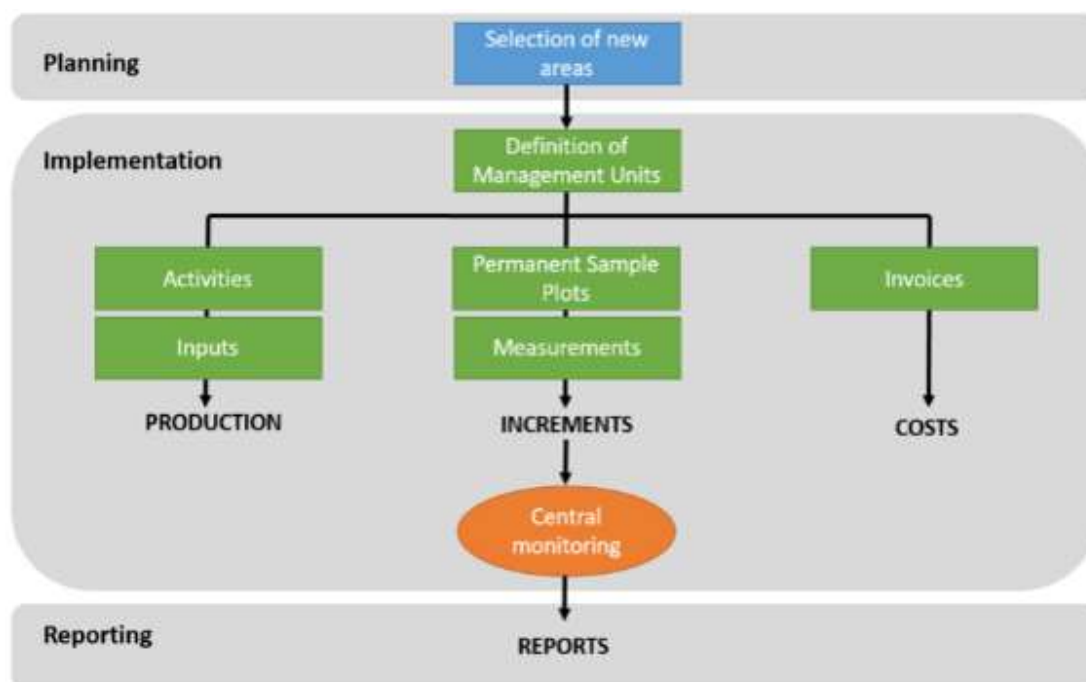


Figure 7. Overview of the production monitoring system of the project

Forest growth monitoring is based on field measurements once a year, starting after plantations turn 1-year of age. During inventories, the development of planted trees is evaluated, including aspects such as forest health and the quality of pruning. The objective of the measurements is to be able to monitor the growth of the trees and the progression of the value of the assets.

Inventories were conducted during the last few months of each year. In 2022, the period of data collection was earlier than usual, July until October, instead of November until December as in previous years. The analysis of the inventory data feeds into the decision-making for the upcoming year. This allows to report reliably to investors and to plan silvicultural interventions, leading to adaptive management. The data is used to choose the genetic material to be planted in new sites according to their behaviour and adjust the schedules of pruning and harvesting.

Geographical delimitation of project boundaries

The area of the project has been delimited using satellite imagery. The plantations are divided into compartments, the smallest monitoring unit with an average surface of around 30-40 ha. Each compartment is tracked and recorded as polygon and sent to the GIS department. The GPS track in the first approach, and later, the overall plantation boundaries, are continuously re-assessed and updated with GIS and satellite imagery.

Stratification and update of effective areas

Stratification was primarily conducted based solely on soil analysis conducted before planting. The classification refers to differences expected in the Mean Annual Increment (MAI) and is therefore a sensitive step for overall growth calculation. However, soil analysis does not always cover all the eventualities in the terrain (eg. Depth). This first classification is re-evaluated on a yearly basis based on the growth differences of the same species. When significant differences are identified, the classification might be readapted.

Each compartment shares a common stratum (same age, species and ideally soil quality and growth). This is the smallest unit used for all silvicultural measures.

Sampling design, plot selection and location

For the monitoring of plantation growth and the estimation of future yields, annual forest inventories are conducted in Permanent Sample Plots (PSPs) installed randomly in all production sites. The data obtained is fundamental to assess survival rates, forest health, to calibrate growth and yield tables, and finally, to predict the mean annual increment (MAI) and the sequestered carbon of the plantations.

As a general rule, the PSPs consist of 20 planted trees (regardless of whether they survived or not) and are established randomly.



Table 8. PSP size depending on planting density

Spacing	Plot size (m2) – 20 trees
9 x 5 x 2	280
5 X 2	200
5 x 9 x 3	420
8 x 3	480

Trees in PSPs are numbered as shown in Figure 25 and their coordinates are recorded. Measurements are performed every year. The first measurement takes place at least one year after planting.

Data Collection

Following data is measured: Vitality of the tree, tree height (every uneven tree, the rest is adjusted with a regression formula), diameter at breast height (DBH), manifestation of diseases or damages, quality of silvicultural treatments applied, and additional observations if any. Data collection is conducted using an application developed by UNIQUE.

For measuring heights, a regression is calculated for each FMU. and with this equation, the remaining heights are estimated for the final volume calculation. Then, measured and inferred heights are compared. When the average deviation is less than 1 meter (the error assumed by the Vertex), inferred heights are considered valid.

The company has SOPs for the measurement of PSPs and data collection, the document is available as complementary documentation.

Data analysis

The analysis of the inventory data is done with the simple average of the trees in the plot and interpolation to area occupied by the trees measured. These values are then averaged at the compartment level. To calculate the total volume per compartment and property, values are multiplied by the reported area of the compartment. In this way, following parameters are calculated at compartment level:

- Minimum, average and maximum DAP
- Minimum, average and maximum height
- Density of living trees *
- Active stand density *
- Basal area *
- Volume *
- Average affection by pests (wasp, fungus) and cattle damage

*These values are calculated per hectare and require the area of the plot for interpolation. The area of the plot depends on the planting density.

Calibration of growth and yield tables

Production tables used to estimate growth and yield are based on inventory data, locally available information on growth performance and the eucalyptus growth simulator of EMBRAPA (Brazilian

Agricultural Research Corporation; Empresa Brasileira de Pesquisa Agropecuária). Tables used are separated by silvicultural system and the expected MAI. In Paraguay, there are no production tables available based on long standing scientific research, and therefore, tables may be subject to variations while they are calibrated. A MAI variation of 5-10 % from one year to the other is considered acceptable and within the normal ranges of biological production. Within time, the reliability of these production tables is expected to increase.

Currently, for the quality timber production there are 4 basic growth tables to reflect the differences in silvicultural regime, and to separate standard quality sites from marginal sites. The growth tables for standard quality sites foresee thinnings at the age of 2, 6 and 9, and the final cut in year 12 for both silvicultural regimes. In some cases when planting density is lower than 500, rotation applied is only 10 years and only 1 thinning in age 5 is planned. Whenever the site conditions are below standard and the plantations are underperforming, growth tables for marginal sites were applied, where the final cut is estimated at year 15. According to the measured plantation development, standard quality and marginal sites are subdivided into site classes (MAI classes) in function of the development of tree height over plantation age.

Procedures for internal auditing and QA/QC

Monitoring requires provisions for quality assurance (QA) and quality control (QC) to be implemented via a QA/QC plan. The main parts of this QA/QC are:

- Collecting reliable field measurements
- Verifying methods used to collect field data
- Procedures to ensure reliable field measurements
- Data maintenance and archiving

Collecting reliable field measurement data

Collecting reliable field measurement data is an important step in the quality assurance plan. Those responsible for the measurement work are properly trained in all aspects of the field data collection as well as the different instruments to use during the activity. The local forest manager responsible is well trained to use the instruments and conduct the inventories. The FMU manager conducts yearly on-the-job trainings with the workers supporting the activity, ensuring new workers are properly trained.

Verifying methods used to collect field data

The data collection app is calibrated annually and verified by the monitoring responsible. Also, its correct use is described by the SOPs, and updated whenever necessary by the monitoring responsible.

Verifying data entry and analysis techniques

Analysis is conducted by the forest manager of the FMU, results are discussed and corrected, if needed, with input from the local forest managers, and then verified by and discussed with an experienced supervisor. Final data is also underlying the analysis of the Biological Asset Value, which is under great scrutiny by investors. Annually, growth and monitoring results are reported on specifically.

Procedures to ensure reliable field measurements

Before conducting the analysis of the data, quality control of the obtained data is conducted by the monitoring responsible. Unexpected results or high deviations between trees in the PSPs are evaluated, and PSPs are re-measured when necessary. Also, a comparison with previous years is conducted to ensure consistency of the data throughout the project lifetime.

To ensure correct and reliable data regarding carbon sequestration, every verification year a re-measurement of 5% of all plots is conducted 1 to 4 months after the first measurement has been completed.

Data maintenance and archiving

Because of the relatively long-term nature of project activities, data archiving (maintenance and storage) are an important component of the work. All data are automatically updated in a cloud facilitated by the project manager (UNIQUE), to which the technical staff of the project and monitoring team has access too. Occasionally, access is given to third-parties, such as auditors.

Copies of all raw data, reports of analysis and supporting spreadsheets will be stored in a dedicated long-term electronic archive for at least 2 years following the end of the last crediting period.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

The monitoring period of the second verification is: 01-01-2021 until 30-09-2022.

Calculations in the following chapters explain the calculation of the carbon stock and its variation for all management units validated in the PDD.

5.1 Baseline Emissions

Baseline emissions for this monitoring period (m²) was calculated based in the methodology AR-ACM0003. "Afforestation and reforestation of lands except wetlands" (Version 02.0) baseline net GHG removals by sinks are calculated using Equation 1 of the methodology. It is expected that soil carbon stocks will not show a permanent net increase:

$$\Delta C_{BSL,t} = \Delta C_{TREE_BSL,t} + \Delta C_{SHRUB_BSL,t} + \Delta C_{DW_BSL,t} + \Delta C_{LI_BSL,t}$$

Where:

$\Delta C_{BSL,t}$ = Baseline net GHG removals by sink in year t; t CO₂-e

$\Delta C_{TREE_BSL,t}$ = Change in carbon stock in baseline tree biomass within the project boundary in year t

$\Delta C_{SHRUB_BSL,t}$ = Change in carbon stock in baseline shrub biomass within the project boundary, in year t

$\Delta C_{DW_BSL,t}$ = Change in carbon stock in baseline dead wood biomass within the project boundary, in year t

$\Delta C_{LI_BSL,t}$ = Change in carbon stock in baseline litter biomass within the project boundary, in year t

The baseline for the areas part of this monitoring report was already calculated as part of the Project description in 2020. In the PDD is described the method use for the assessment. In order to calculate correctly the LTA in the ex-post calculations of the current monitoring report, all calculations were done based on the stratification of year and plantation density. FMU 5,6 and 8 were already part of the first verification and therefore excluded from the baseline analysis of this second verification.

The table below shows the distribution of the areas to be part of the verification distributed between the verification.

Table 9. Distribution of areas in the project (1st verification and 2nd verification)

Stratum (Year_Density)	Total project area (ha)	Areas part of 1 st verification	New areas of 2 nd verification
2015_714	866.5	866.5	0
2015_1000	438.5		438.5
2016_714	199.5		199.5
2016_1000	185.5	172.5	13.5 ⁶
2017_714	1,747.5	456.5	1,290.5
2018_714	378.0		378.0
2019_476/417	22.0	22.0	-
2020_476/417	115.0		115.0
Total	3,952.5	1,517.5	2,435.5

The table below displays the baseline carbon stocks for the pre-existing trees for the planting years 2015-2020 which are subject to this monitoring period.

Table 10. Baseline biomass for this monitoring period

Stratum (Year_Density)	Project year	Annual planted area (ha)	$C_{TREE_{BSL}}$ and $C_{SHRUB_{BSL}}$ and (t CO ₂ e)	$C_{DW,i,t}$ and $C_{LI,i,t}$ trees (t CO ₂ e)	Total Baseline emission (t CO ₂ e)
2015_714	1	866.5	0	0	0
2015_1000	1	438.5	227.0	3.0	230.0
2016_714	2	199.5	-	0	0
2016_1000	2	185.5	5.9	0	5.9
2017_714	3	1,747.5	378.6	4.7	383.3
2018_714	4	378.0	148.5	1.9	150.5
2019_476/417	5	22.0	-	0	0
2020_476/417	6	115.0	54.2	0.8	55.0
Total	-	3,952.5	814.1	10.5	824.6

The values of baseline will be included in the year 2021 for this monitoring period.

⁶ Please note that there is 0.5 ha lost from first verification (the verified area now would be 172.0 ha, which with the addition of 13.5 ha results in the total project area for the strata 2016_1000 of 185.5 ha).

5.2 Project Emissions

The actual net GHG removals by sinks have been calculated using equation 2 of the methodology (AR-ACM0003: Afforestation and reforestation of lands except wetlands. Version 02.0) as described below.

$$\Delta\text{CACTUAL}_{t} = \Delta\text{CP}_{t} - \text{GHGE}_{t}$$

Where:

$\Delta\text{CACTUAL}_{t}$ = Annual actual net greenhouse gas removals by sinks at time t; t CO₂-e yr⁻¹

ΔCP_{t} = Change in carbon stocks in project, occurring in the selected carbon pools, at time t; t CO₂-e yr⁻¹

GHGE_{t} = Increase of non-CO₂ GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year t, t CO₂-e

Change in the carbon stocks in project have been calculated using equation 3 of the methodology, however shrub biomass is not considered in this project:

$$\Delta\text{CP}_{t} = \Delta\text{CTREE_PROJ}_{t} + \Delta\text{CSOC_PROJ}_{t}$$

Where:

ΔCP_{t} = Change in carbon stocks in project, occurring in the selected carbon pools, at time t; t CO₂-e yr⁻¹

$\Delta\text{CTREE_PROJ}_{t}$ = Change in carbon stock in tree biomass in project in year t, as estimated in AR-TOOL14; t CO₂-e yr⁻¹

$\Delta\text{CSOC_PROJ}_{t}$ = Change in carbon stock in the soil organic carbon (SOC) pool within the project boundary, as estimated in AR-AM0014, in year t; t CO₂-e yr⁻¹

Update of LTA

The project developed an LTA calculation for the Ex-Ante estimation. The LTA was calculated for each density, based on the theoretical growth of three different growth tables. The obtained value is presented in the table below:

Table 11. Ex-Ante LTA for all strata

Tree Density	Ex-Ante LTA (tCO ₂ e/ha)
714	190.2
1,000	213.0
417/476	191.4

The ex-post LTA was calculated to update the theoretical value. The company has inventory values for each strata for almost every year since plantation. Based on the established baseline and the monitored growth, the company established new LTA values. All values up to 2022 were updated with actual emission reduction measured, whereas future estimations remain as planned initially. The table below shows the new values per strata, compared with the Ex-Ante LTA.

Table 12. Ex post and ex ante LTA per strata

Stratum (Year_Density)	Area planted (ha)	Ex-Ante LTA (tCO ₂ e/ha)	Ex-Post LTA (tCO ₂ e/ha)
2015_714	866.5	190.2	150.4
2015_1000	438.5	213.0	180.0
2016_714	199.5	190.2	171.8
2016_1000	185.5	213.0	194.6
2017_714	1,747.5	190.2	172.1
2018_714	378.0	190.2	171.2
2019_476/417	22.0	191.4	172.2
2020_476/417	115.0	191.4	173.5
	3,952.5	193.8	169.2

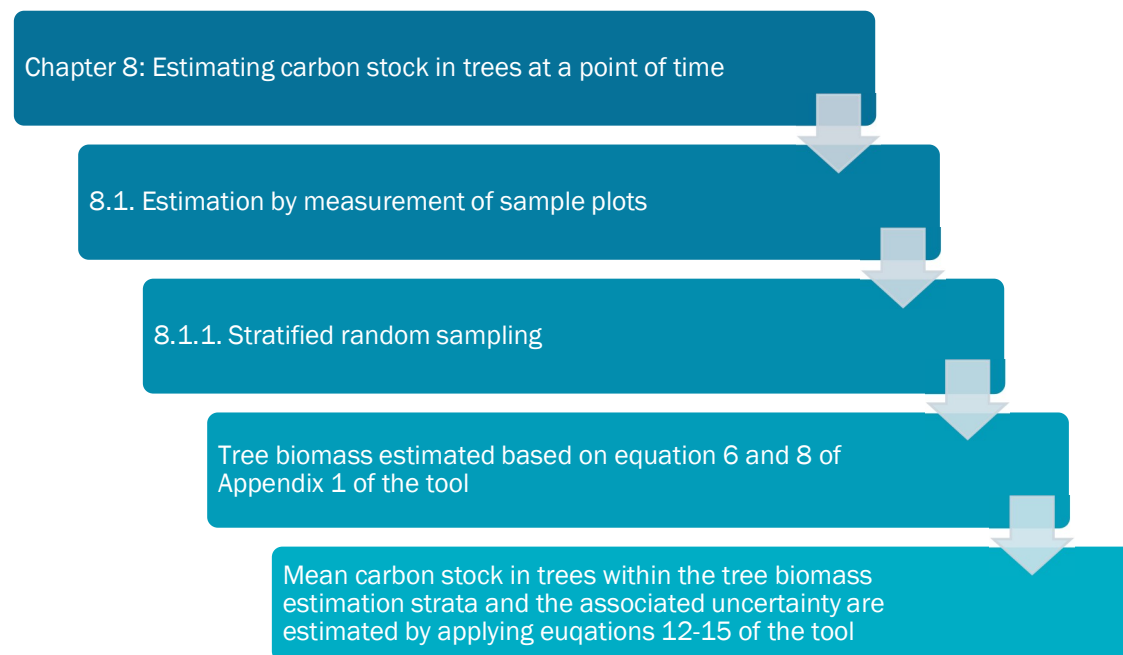
The main change in the LTA from the Ex-ante to the Ex-post is the change in the Root-shoot, before estimated in 0.37. Lower performance in some of the strata, especially the plantation established in 2015 with 714 trees/ha had also a strong impact. The excel "Ex-Post LTA calculation" is available as supporting documentation and will be reevaluated in following verifications.

Estimation of carbon stock changes in trees and shrubs

Carbon stock changes of trees and shrubs are estimated applying the AR-Tool 'A/R Methodological tool: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities' (Version 04.1).

Estimation of carbon stock change in trees

The following sections and equations of the tool are applied:



The following equations of the methodology have been applied:

$$C_{TREE,t} = \frac{44}{12} * CF_{TREE} * B_{TREE,t}$$

$$B_{TREE,t} = b_{TREE,t} * A$$

$$b_{TREE,t} = \sum_{i=1}^M w_i * b_{TREE,t,i}$$

Where:

CTREE, t	= Carbon stock in tree biomass within the project boundary at a point in time in year t; t CO ₂ -e.
CFTREE	= Carbon fraction of tree biomass; t C (t d.m.) ⁻¹ .
BTREE, t	= Total tree biomass within the project boundary at a given point in time in year t; t d.m.
bTREE, t	= Mean tree biomass per hectare within the project boundary at a given point in time in year t; t d.m. ha ⁻¹
A	= Project area; ha
w _i	= Ratio of the area of stratum i to the sum of areas of tree biomass estimation strata (A _i /A), dimensionless
bTREE ,t,i	= Mean tree biomass per hectare in stratum i at a given point in time in year t; t d.m. ha ⁻¹

Determination of tree biomass $b_{TREE, t, j}$

Tree biomass estimation follows the guidance for measurement of variable plots given in Appendix 1 of the Tool, equations 6 and 8.

The following table summarizes the values applied for equation 8 (of Appendix 1 of the Tool):

Table 13. Values applied to calculate tree biomass

Equation value	Description	Value applied	Source
$v_{TREE, j}$ (BA _{p, i})	$v_{TREE} = DBH * height * form$ factor Stem volume per hectare of trees of species j in sample plot p of stratum i estimated by using the basal area of the plot as entry data into a volume table or volume equation; m ³ ha ⁻¹ . The form factor applied is 0.4.	See Excel inventory data 2022	Published and project volume tables.
D _j	Density (over-bark) of tree species j; t d.m. m ⁻³	0.54	Zanne et al (2009) ⁷

⁷ <https://datadryad.org/stash/dataset/doi:10.5061/dryad.234>

BEF _{2,j}	Biomass expansion factor for conversion of tree stem biomass to above-ground tree biomass, for tree species j; dimensionless	1.15	IPCC value, Table 3A.1.10, Broadleaf Temp
R _j	Root-shoot ratio for tree species j; dimensionless	$e^{(-1.085+0.9256 \times \ln b)/b}$	Formula available in AR-Tool 14 v.4.2 – appendix 1

The ex post LTA was compared against the values obtained from the inventory, meaning against sequestration actually measured in 2022, showing that 3 strata reached their LTA during this verification period:

Table 14. Comparison between actual carbon sequestration and LTA per strata

Stratum (Year_Density)	Area planted (ha)	Average CTREE, i t CO ₂ e	LTA Ex-Post, tCO ₂ e	Δ LTA, t CO ₂ e to reach LTA
2015_714	866.5	145.2	150.4	5.2
2015_1000	438.5	244.5	180.0	-64.5
2016_714	199.5	173.1	171.8	-1.3
2016_1000	185.5	207.1	194.6	-12.5
2017_714	1,747.5	149.1	172.1	23.0
2018_714	378.0	92.6	171.2	78.6
2019_476/417	22.0	55.0	172.2	117.3
2020_476/417	115.0	21.3	173.5	152.2

In these three cases, the b_{tree} used was the one derived from the LTA value of the correspondent strata to avoid claiming more carbon than the established by the LTA. The calculation of the tree biomass was done in Excel. The file ‘2022 San Pedro Carbon Inventory M2’ is available as supporting documentation.

Table 15. Summary calculation BTREE and CTREE

Stratum	Area (ha)	w _i	b _{TREE} , t t d.m. ha ⁻¹	B _{TREE} , t t d.m.	C _{TREE} , t t CO ₂ -e
2015_714	866.5	0,22	84.2	72,996	125,796
2015_1000	438.5	0,11	104.4	45,796	78,921
2016_714	199.5	0,05	99.7	19,884	34,266

2016_1000	185.5	0,05	112.9	20,952	36,107
2017_714	1,747.5	0,44	86.5	151,164	260,505
2018_714	378.0	0,10	53.8	20,320	35,018
2019_476/417	22.0	0,01	31.9	702	1,210
2020_476/417	115.0	0,03	12.4	1,422	2,450
TOTAL	3,952.5	1,00	84.3	333,234	574,273

¹ Please note that the bTREE total (84.3 t d.m. ha-1) is a weighted average as required by the methodology.

Calculation of uncertainty following the guidance of Appendix 2 of the A/R Methodological Tool

Table 16. Calculation of uncertainty

Stratum	S_i t.d.m. ha ⁻¹	n_i	U_c %	U_c mean (t CO ₂ -e)	U_c Discount (t CO ₂ -e)
2015_714	24.6	229	1.6%	9,185.0	0
2015_1000	39.7	104			
2016_714	16.3	26			
2016_1000	46.1	50			
2017_714	22.8	357			
2018_714	12.9	48			
2019_476/417	9.9	6			
2020_476/417	7.7	20			
Total	40.0	840			

The uncertainty calculated is 1.6 %. Based on the Tool no discount of C_{TREE} is necessary as $U_c < 10\%$

Estimation of changes in soil organic carbon stocks

For ex-post estimation of the SOC changes under the project scenario for this monitoring period, the default method of the A/R Methodological tool 'Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities' (Version 01.1.0) is applied. The application and justification of the tool is outlined in section 4.2.

The rate of change in SOC stock in the project scenario until the steady state in SOC content is reached (assumed in 20 years from the time of the initial site preparation) is calculated as 0.61 tC/ ha/ yr which represents the weighted average value over all baseline strata.

For this monitoring period, for each new planting area included in a certain year, only nine months are assumed for that planting year with the dSOC value.

Table 17. Calculation of SOC change for the project since beginning up to September 2022

Year	SOC area (ha)	Cumulative SOC area (ha)	Total ΔSOC strata 1-4 (t CO ₂ -e)
2015	1,305.0	1,305.0	2,233.0
2016	385.0	1,690.0	4,008.3
2017	1,747.5	3,437.5	7,327.8
2018	378.0	3,815.5	9,469.7
2019	22.0	3,837.5	9,830.8
2020	115.0	3,952.5	10,046.4
2021	-	3,952.5	10,144.8
2022	-	3,952.5	7,608.6
Total	3,952.5	3,952.5	60,669.3

According to the first monitoring period, the claiming of soil organic carbon was 18,735 tCO₂-e. After discounting the carbon claimed in M1 of this project, the calculation of the current SOC change for the monitoring period M2 is presented in the table below.

Table 18. Calculation of SOC change for the monitoring period M2.

Year	SOC area (ha)	Cumulative SOC area (ha)	Total ΔSOC strata 1-4 (t CO ₂ -e)
2015	1,305.0	1,305.0	935.7
2016	385.0	1,690.0	1,526.0
2017	1,747.5	3,437.5	3,977.6
2018	378.0	3,815.5	5,631.3
2019	22.0	3,837.5	5,959.4
2020	115.0	3,952.5	6,151.4
2021	-	3,952.5	10,144.8
2022	-	3,952.5	7,608.6
Total	3,952.5	3,952.5	41,934.6

The SOC of years 2015 to 2020 will be added to the vintages in 2021.

Change in carbon stocks of trees

According to the tool AR-TOOL14 A/R Methodological tool 'Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities' (Version 04.1) at the first verification CTREE, t₂ is set equal to the carbon stock in the first verification. Based on this, the following table shows the change in carbon stock during the period between two points of time t₁ (pre-existing baseline tree biomass for 6 FMUs and end of 2020 for the already monitored FMU 5, 6 and 8) and t₂. The Excel sheet '2022 San Pedro Carbon Inventory M2' details the full calculation of emission reductions for this monitoring period and is available upon request. The following table show the change in carbon stocks of trees separated by the point of time t₁. Column Ctree (M1 31-12-2020) shows the calculations for FMU 5,6, and 8, and t₁ is therefore 31-12-2020, and the rest of the FMUs are agrupated in Cree (plantation date).

Table 19. Change in carbon stocks during the period between two points of time t1 (pre-existing tree and shrub biomass) and t2.

Stratum (year_den sity)	Area strata included in year t (ha)	$C_{TREE,t1} =$ $C_{TREE_BSL,t1}$ (M1 31-12-2020)	$C_{TREE,t1} =$ $C_{TREE_BSL,t1}$ (plantation date)	$C_{TREE_PROJ_DI}$ SCOUNT; t2	$C_{DW_}$ PROJ; t2	$\Delta C_{TREE+DW}$ _PROJ; (t2-t1)
2015_714	866,5	102,956	0	125.897	-	22.941
2015_1000	438,5	0	230	63.711	-	63.481
2016_714	199,5	0	0	28.986	-	28.986
2016_1000	185,5	20,568	6	26.952	-	6.379
2017_714	1,747,5	54,242	383	253.901	-	199.276
2018_714	378,0	0	150	54.921	-	54.771
2019_476/ 417	22,0	2,614	0	3.196	-	582
2020_476/ 417	115,0	0	55	16.709	-	16.654
TOTAL	3,952,5	180,379	825	574.273	-	393.069

Actual net greenhouse gas removals by sinks

The table below shows the distribution of the carbon based on the monitoring period (01-01-2021 to 30-09-2022).

Table 20. Actual net greenhouse gas removals by sinks for the different years of the monitoring period

Year	Project implementation (cum. months)	Cumulative tree net GHG removals by sinks, in year t; (t CO ₂ -e)	Actual tree net GHG removals by sinks, in year t; (t CO ₂ -e)	Actual SOC net GHG removals by sinks, in year t; (t CO ₂ -e)*	Actual total net GHG removals by sinks, in year t; (t CO ₂ -e)
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01-01-2021 31-12-2021	12	224,611	224,611	34,326	258,937
01-01-2022 30-09-2022	21	393,069	168,458	7,609	176,067
Total	21	393,069	393,069	41,935	435,004

*SOC as shown in table 15 are accounted to the start of the current verification period.

5.3 Leakage

Leakage is in compliance with Section 6 of the A/R Tool as no displacement of cattle or agriculture took place for planting. The leakage assessment for the new project instance can be found in Section 3.3.

Table 21. GHG emissions due to leakage, in year t

Year	Leakage (t CO ₂ -e)
2021	0
2022	0
Total	0

5.4 Net GHG Emission Reductions and Removals

Table 22. Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)	Buffer pool allocation	VCUs eligible for issuance
01-January - 2021 ⁸ to 31-	825	258,937	-	258,112	38,717	219,396

⁸ Baseline emissions for 2021 are cumulative of baseline emissions for previous vintage from 05-April-2015 to 31-December-2020 for FMU 1, 2, 3, 4, 7 and 9 and current monitoring period from 01-January-2021 to 30-September-2022 for FMU 1 to 9.

December-2021*						
01-January-2022 to 30-September-2022	0	176,067	-	176,067	26,410	149,657
Total	825	435,004	-	434,179	65,127	369,052

*Baseline emissions as shown in table 10 are accounted for at the start of the current verification period.

The total GHG emission reductions for the 2nd monitoring period 01-01-2021 to 30-09-2022 are 434,179 tCO₂e. The non-permanence risk rating is 15% (as determined in the AFOLU non-permanence risk report attached as a separate document). Therefore the total number of buffer credits that need to be deposited into the AFOLU pooled buffer account is 65,127 tCO₂e. The number of GHG credits eligible to be issued as VCU for the first project instances of this monitoring period is 369,052 tCO₂e.

Cumulative emission reductions claimed during first verification and to be claimed in this second verification are compared to ex-ante estimations in the Table below:

Table 23. Comparison of cumulative ex-ante vs achieved emission removals

<u>Ex-ante emissions reductions/removals</u>	<u>Achieved emissions reductions/removals</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
785,839	632,699	20%	Reduction of Root-shoot value, tree growth slower than estimated in some areas and areas lost as reported in table 5 reducing the expected area.