FAZENDA BOA VISTA AFFORESTATION PROJECT

Document Prepared by Carbon Credits Consulting Brazil

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Project Title	*Fazenda Boa Vista Afforestation Project*
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Prepared By	*Carbon Credits Consulting Brazil* *Technical team*
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CONTENTS

1. PROJECT DETAILS

1.1. Summary Description of the Project

The Fazenda Boa Vista Afforestation Project (FBV Project) aims to establish *Eucalyptus* plantations in the Municipality of Ponto dos Volantes in the north-eastern part of Minas Gerais state (Brazil). The Project is located in a transition zone of Atlantic Rainforest and Cerrado Biome.

The FBV Project is developed in a private property, the Fazenda ("Farm") Boa Vista II that correspond to the Project Zone. At the Starting Date (**23-01-2020**) the farm was composed by areas of degraded pasture because of the extensive and traditional cattle breeding and remnants of natural forest. In this farm (and commonly in all other farms of the region) such pastures have been historically subject to burns that took place with the objective to reduce tree covers, expand pastures, and stimulate the regrowth of tender and nutritious sprouts during the dry season when pasture becomes fibrous in order to develop extensive cattle ranching activities.

The property also conserves forests remnants and natural areas but these latter were severely damaged due to the fire practice and the animals grazing that historically occurred in the region. Irrational and "extractive" cattle farming, which had been practiced for decades before the Project start, led to a progressive soil impoverishment and to extensive erosion formation, which, together with significant environmental damage, gradually and inexorably compromised even productivity rates and economic returns deriving from livestock farming activities.

The FBV Project is a typical Afforestation Project and aimed to plant **293.12** ha of degraded pastures with the hybrid *Eucalyptus "urocam"* (*E. urophylla* x *E. camaldulensis*) and *Eucalyptus "tricross"* (*E. camaldulensis* x *E. grandis* and *E. urophylla*). These two hybrids, derived from species originating from Australia, have adapted very well to the soil and climate typical of Minas Gerais, mainly due to the abundant rainfall and the high photoperiod, which ensure a high yield of this timber species. The Project also aims to recover the remnant natural savanna restoration of the Project Zone. The set of areas planted with *Eucalyptus* hybrids and the areas of regenerated savannah are a typical mosaic-shaped landscape that guarantees the protection of the soil and the recovery of biodiversity typical of the Project Zone.

The Crediting Period lasts 20 years and it runs from **January 23, 2020** to **January 22, 2040**.

The Project is expected to capture 428,486 tCO_2e in 20 years, with an average annual GHG removal of 21,424 tCO_2e.

Figure 1. One of the planted parcels of the Project (2022).

1.2. Sectoral Scope and Project Type

The FBV Project is a VCS AFOLU (Agriculture, Forestry and Other Land Use) project, Scope 14, and, specifically, it falls under the ARR (Afforestation, Reforestation and Revegetation) category.

1.3. Project Eligibility

The FBV Project is eligible under the scope of the VCS Program because of his characteristics listed below:

- The FBV Project is an Afforestation Project, so it falls into the ARR Category.
- The Project Area was not cleared of native ecosystems within the 10-year period prior to the project star date.

  See technical Report of Analysis and Diagnosis of Vegetation Through Remote Sensing (Document 05), where is evident that already in 2008 the land of the Project Area was characterized by degraded pasture, and before the starting date the activity practiced still was cattle breeding.

  Under the terms of the New Forest Code (Law No. 12,651/12) the Consolidated Area is defined as the area of rural property with anthropic occupation (resulting from human action) pre-existing

on July 22, 2008, with buildings, improvements, or agronomic activities. As shown in the Map of Consolidated Areas (Appendix 02), the planting area (Project Area) is entirely within Consolidated Areas.

- The Project is not developed inside a REDD+ program zone (Brazil does not have REDD+ programs in Minas Gerais). REDD+ program zones in Brazil are usually located in Amazon region.
- The activities foreseen by the Project did not convert native ecosystems because the plantations were made on old and degraded pasture areas as shown in Report of Analysis and Diagnosis of Vegetation Through Remote Sensing (Document 05), where it was concluded that the Project Area corresponding to degraded pasture.
- The activities carried out during the Project did not lead to any type of hydrogeological degradation. None of the planted plots has been drained (there are no wet land areas in the Project Zone, Report of Analysis and Diagnosis of Vegetation Through Remote Sensing (Document 05).

1.4. Project Design

The **FBV Project** includes a single installation of an activity. This activity includes the plantation of 293.12 ha with two Eucalyptus hybrid varieties and was developed in a private property, the Fazenda Boa Vista.

1.5. Project Proponent

Organization name	Carbon Credits Consulting SRL
Role in the project	Project Proponent
Contact person	Davide Rossi
Title	Founder & Head of Carbon Projects
Address	Palazzo Boncompagni – Via Del Monte 10, 40126, Bologna - Italy
Telephone	+55 67 99254-3491
Email	dr@carboncreditsconsulting.com

1.6. Other Entities Involved in the Project

Organization name	Carbon Credits Consulting Brazil

Role in the project	Project Developer
Contact person	Cristiano de Souza Alves
Title	Geographer – Office's Administrator
Address	Edifício Fórum Business Center, Av. André Araújo, 97, Adrianópolis, 69057-025 Manaus – Amazonas - Brasil
Telephone	+55 92 98254-6091
Email	ca@carboncreditsconsulting.com

Organization name	Brazilian Forestry Empreendimentos Florestais LTDA
Role in the project	Land and Forest Owner
Contact person	Dilma Barbosa do Amaral
Title	Partner and Manager
Address	Faz. Boa Vista II - S/N - Direção A São Pedro - Zona Rural, 39615-000 Ponto dos Volantes – Minas Gerais - Brasil
Telephone	+55 21 98157-4752
Email	dilmabruna@hotmail.com

1.7. Ownership

The Fazenda Boa Vista II, that constitutes the Project Zone, has an extension of 664.65 ha, of which 293.12 ha designated to produce carbon credits (Project Area).

The Landowner is Brazilian Forestry Empreendimentos Florestais Ltda., and the ownership of the land is demonstrated in the Title Deed ("Certidão de Propriedade") issued by the Cartório Registro de Imóveis (CRI) of Jequitinhonha, Minas Gerais, available for consultations (Document 02).

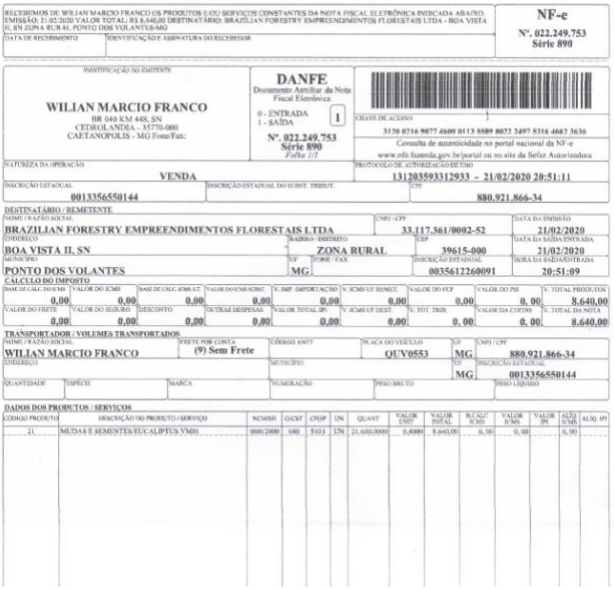
The carbon rights are defined by the Collaboration and Partnership Agreement ("Contratto di Collaborazione e Partnership per L'ottenimento di VCUs") verified and sealed by the notary office Foro di Milano (Italy), available for consultations (Document 03).

Figure 2. Entrance of the planting areas (2022).

1.8. Project Start Date

The Project Start Date is defined on **23-01-2020**; on this date also started the Crediting Period. This date is justified by the Planting Reports (Document 04) and corresponds to the beginning of the plantation activities in block 71 (first block planted).

In the figures 3 to 5 are displayed the seedling purchase invoices (Document 06).



RECEBEMOS DE WILIAN MARCIO FRANCO OS PRODUTOS E/OU SERVIÇOS CONSTANTES DA NOTA FISCAL ELETRÔNICA INDICADA ABAIXO. EMISSÃO: 21/02/2020 VALOR TOTAL: R$ 8.640,00 DESTINATÁRIO: BRAZILIAN FORESTRY EMPREENDIMENTOS FLORESTAIS LTDA - BOA VISTA II, SN ZONA RURAL PONTO DOS VOLANTES-MG

DATA DE RECEBIMENTO | IDENTIFICAÇÃO E ASSINATURA DO RECEBEDOR

NF-e
Nº. 022.249.753
Série 890

IDENTIFICAÇÃO DO EMITENTE

WILIAN MARCIO FRANCO
BR 040 KM 448, SN
CEDROLANDIA - 35770-000
CAETANOPOLIS - MG Fone/Fax:

DANFE
Documento Auxiliar da Nota Fiscal Eletrônica
0 - ENTRADA
1 - SAÍDA
1
Nº. 022.249.753
Série 890
Folha 1/1

CHAVE DE ACESSO
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Consulta de autenticidade no portal nacional da NF-e www.nfe.fazenda.gov.br/portal ou no site da Sefaz Autorizadora

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CÁLCULO DO IMPOSTO

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VALOR DO FRETE	**VALOR DO SEGURO**	**DESCONTO**	**OUTRAS DESPESAS**	**VALOR TOTAL IPI**	**V. ICMS UF DEST.**	**V. TOT. TRIB**	**VALOR DA COFINS**	**V. TOTAL DA NOTA**
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TRANSPORTADOR / VOLUMES TRANSPORTADOS

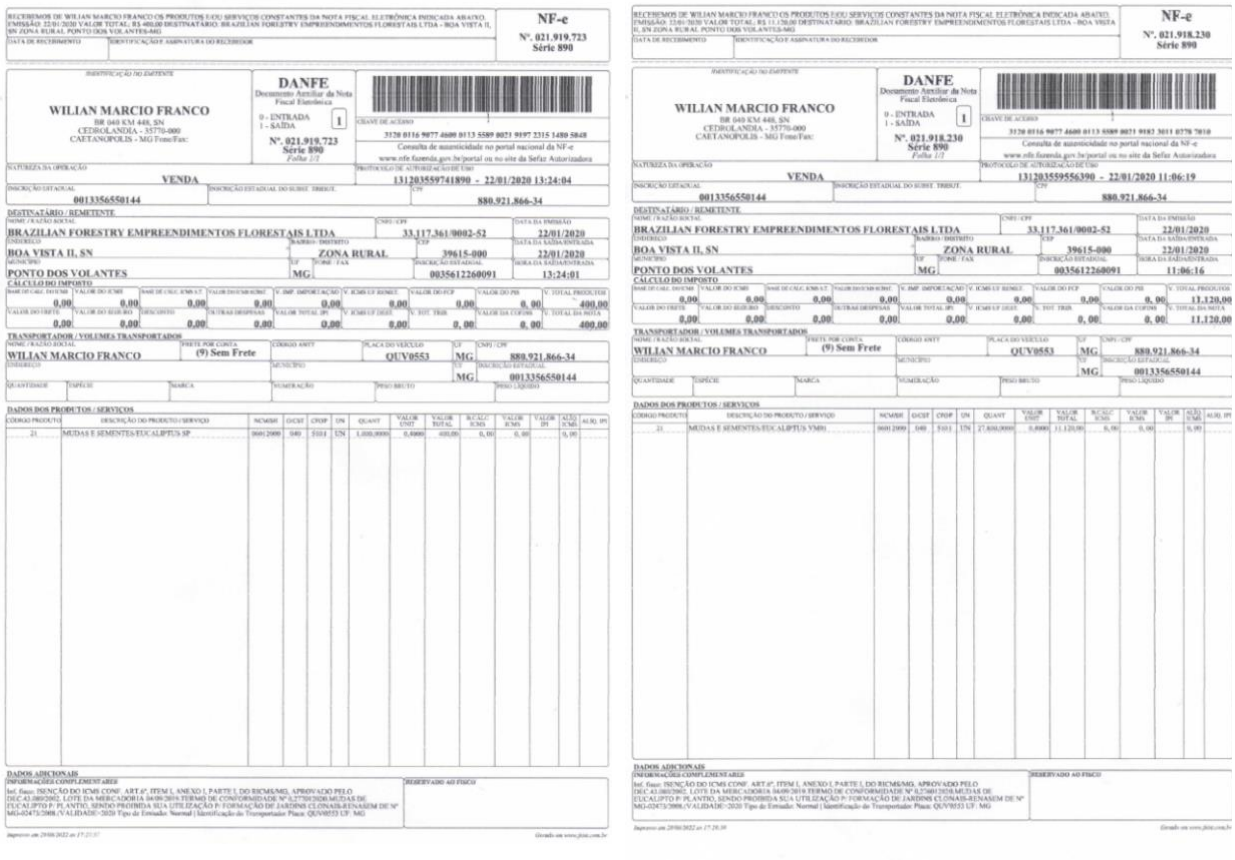
NOME / RAZÃO SOCIAL	FRETE POR CONTA	CÓDIGO ANTT	PLACA DO VEÍCULO	UF	CNPJ / CPF
WILIAN MARCIO FRANCO	(9) Sem Frete		QUV0553	MG	880.921.866-34
ENDEREÇO		MUNICÍPIO	UF	INSCRIÇÃO ESTADUAL
			MG	0013356550144

QUANTIDADE	ESPÉCIE	MARCA	NUMERAÇÃO	PESO BRUTO	PESO LÍQUIDO

DADOS DOS PRODUTOS / SERVIÇOS

CÓDIGO PRODUTO	DESCRIÇÃO DO PRODUTO / SERVIÇO	NCM/SH	O/CST	CFOP	UN	QUANT	VALOR UNIT	VALOR TOTAL	B.CÁLC ICMS	VALOR ICMS	VALOR IPI	ALÍQ ICMS	ALÍQ. IPI
21	MUDAS E SEMENTES-EUCALIPTUS VM01	0601 2099	040	5101	UN	21.600,0000	0,4000	8.640,00	0, 00	0, 00		0, 00	

Figure 3. Invoice of seedlings.



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DATA DE RECEBIMENTO | IDENTIFICAÇÃO E ASSINATURA DO RECEBEDOR

NF-e
Nº. 021.919.723
Série 890

IDENTIFICAÇÃO DO EMITENTE

WILIAN MARCIO FRANCO
BR 040 KM 448, SN
CEDROLANDIA - 35770-000
CAETANOPOLIS - MG Fone/Fax:

DANFE
Documento Auxiliar da Nota Fiscal Eletrônica
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1 - SAÍDA
1
Nº. 021.919.723
Série 890
Folha 1/1

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DESTINATÁRIO / REMETENTE

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CÁLCULO DO IMPOSTO

BASE DE CÁLC. DO ICMS	VALOR DO ICMS	BASE DE CÁLC. ICMS S.T.	VALOR DO ICMS SUBST.	V. IMP. IMPORTAÇÃO	V. ICMS UF REMET.	VALOR DO FCP	VALOR DO PIS	V. TOTAL PRODUTOS
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VALOR DO FRETE	**VALOR DO SEGURO**	**DESCONTO**	**OUTRAS DESPESAS**	**VALOR TOTAL IPI**	**V. ICMS UF DEST.**	**V. TOT. TRIB**	**VALOR DA COFINS**	**V. TOTAL DA NOTA**
0,00	0,00	0,00	0,00	0,00	0,00	0, 00	0, 00	400,00

TRANSPORTADOR / VOLUMES TRANSPORTADOS

NOME / RAZÃO SOCIAL	FRETE POR CONTA	CÓDIGO ANTT	PLACA DO VEÍCULO	UF	CNPJ / CPF
WILIAN MARCIO FRANCO	(9) Sem Frete		QUV0553	MG	880.921.866-34
ENDEREÇO		MUNICÍPIO	UF	INSCRIÇÃO ESTADUAL
			MG	0013356550144

QUANTIDADE	ESPÉCIE	MARCA	NUMERAÇÃO	PESO BRUTO	PESO LÍQUIDO

DADOS DOS PRODUTOS / SERVIÇOS

CÓDIGO PRODUTO	DESCRIÇÃO DO PRODUTO / SERVIÇO	NCM/SH	O/CST	CFOP	UN	QUANT	VALOR UNIT	VALOR TOTAL	B.CÁLC ICMS	VALOR ICMS	VALOR IPI	ALÍQ ICMS	ALÍQ. IPI
21	MUDAS E SEMENTES-EUCALIPTUS SP	0601 2099	040	5101	UN	1.000,0000	0,4000	400,00	0, 00	0, 00		0, 00	

DADOS ADICIONAIS

INFORMAÇÕES COMPLEMENTARES	RESERVADO AO FISCO
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Figure 4. Invoice of seedlings.

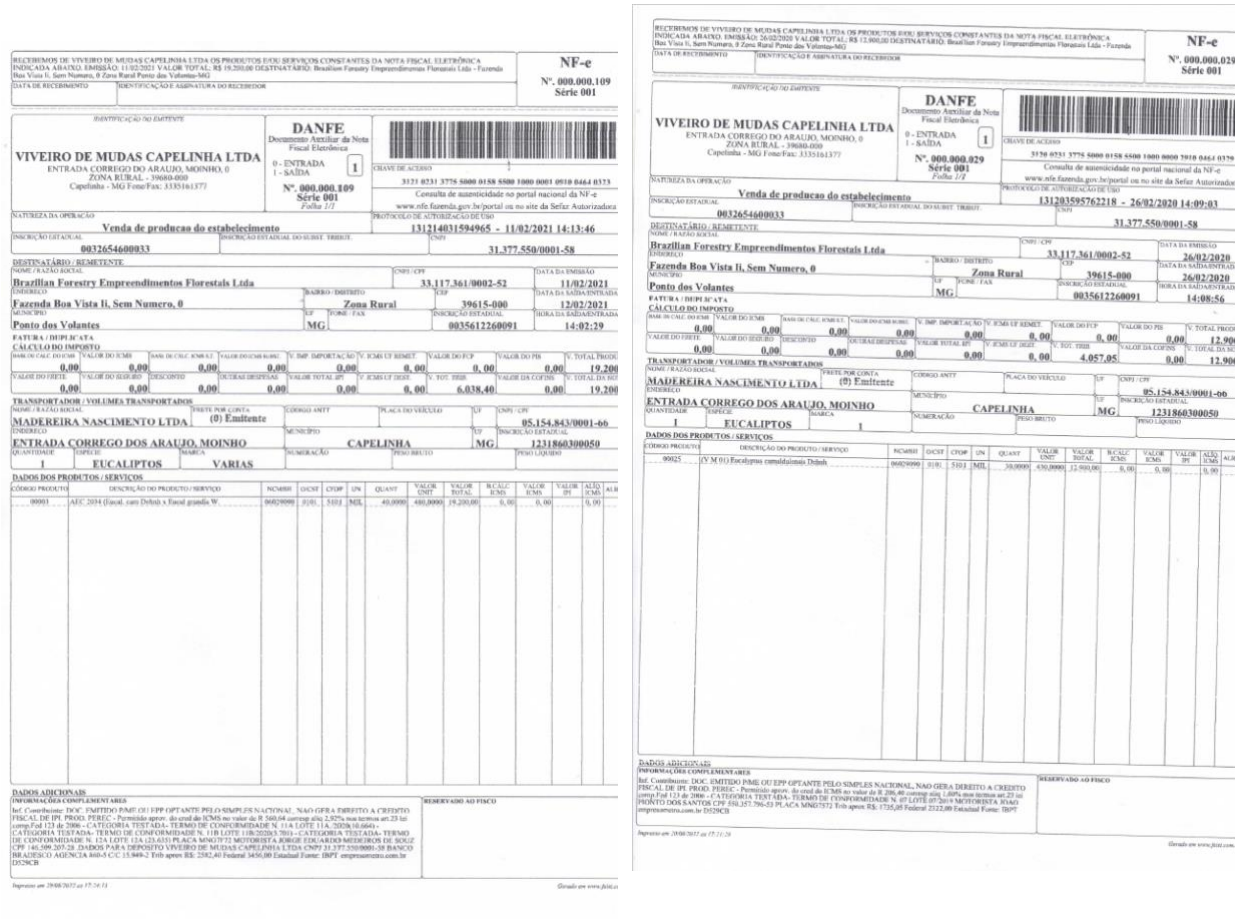


Figure 5. Invoice of seedlings.

1.9. Project Crediting Period

The Crediting Period will be of **20 years and 0 months**. This period starts on ***23*-01-2020** and ends on **22-01-2040**. The beginning of the Crediting Period coincides with the Project Start Date.

1.10. Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Table 1. Yearly estimated GHG removals.

Year	Estimated GHG emission reductions or removals (tCO_2e)
2020	21,424.32
2021	21,424.32
2022	21,424.32
2023	21,424.32
2024	21,424.32
2025	21,424.32
2026	21,424.32
2027	21,424.32
2028	21,424.32
2029	21,424.32
2030	21,424.32
2031	21,424.32
2032	21,424.32
2033	21,424.32
2034	21,424.32
2035	21,424.32
2036	21,424.32
2037	21,424.32
2038	21,424.32
2039	21,424.32
Total estimated ER's	428,486.45
Total number of crediting years	20
Average annual ERs	21,424.32

1.11. Description of the Project Activity

The Project was planned with the aim of recovering degraded soil of the farm through the planting of *Eucalyptus* trees characterized by rapid growth and high CO_2 absorption potential. Therefore, the Project's primary purpose is the highest CO_2 absorption during its lifetime. To achieve this goal, during the 30 years of the Project, no cutting of the plants will be carried out.

As already mentioned in item 1.3, the Project is not developed inside a REDD+ program zone (Brazil does not have REDD+ programs in Minas Gerais state).

Figure 6. Eucalyptus "tricross" plantation in Fazenda Boa Vista II (2022).

1.11.1. Planted Areas

The FBV Afforestation Project relates to a total area of 293.12 ha. This area corresponds to the Project Area and is divided in **10 planted blocks** of different extensions. All the planted blocks are listed in the Table 03 below. In this table are present information about each block.

Table 2. Planted blocks area and time of implantation.

Block number	Area (ha)	Cultivar	Number of trees/ha	Planting Month
66	13.49	VM01	1,050	Feb/20
67	6.85	VM01	1,050	Apr/20
68	15.51	VM01	1,050	Apr/20
69	10.81	VM01	1,050	Apr/20
70	28.01	AEC 2034	1,050	Mar/20
71	25.72	AEC 2034	1,050	Jan/20
72	48.1	AEC 2034	1,050	Jan/20
73	47.59	AEC 2034	1,050	Mar/20
74	37.55	AEC 2034	1,050	Feb/20
75	59.49	AEC 2034	1,050	Apr/20
Total	293.12			

All the blocks were planted in 2020, from January to April. Before the beginning of the plantation all these blocks were characterized by soil degradation with moderated erosions due to the extensive cattle breading.

Figure 7. Areas with degraded pasture before the planting (2019).

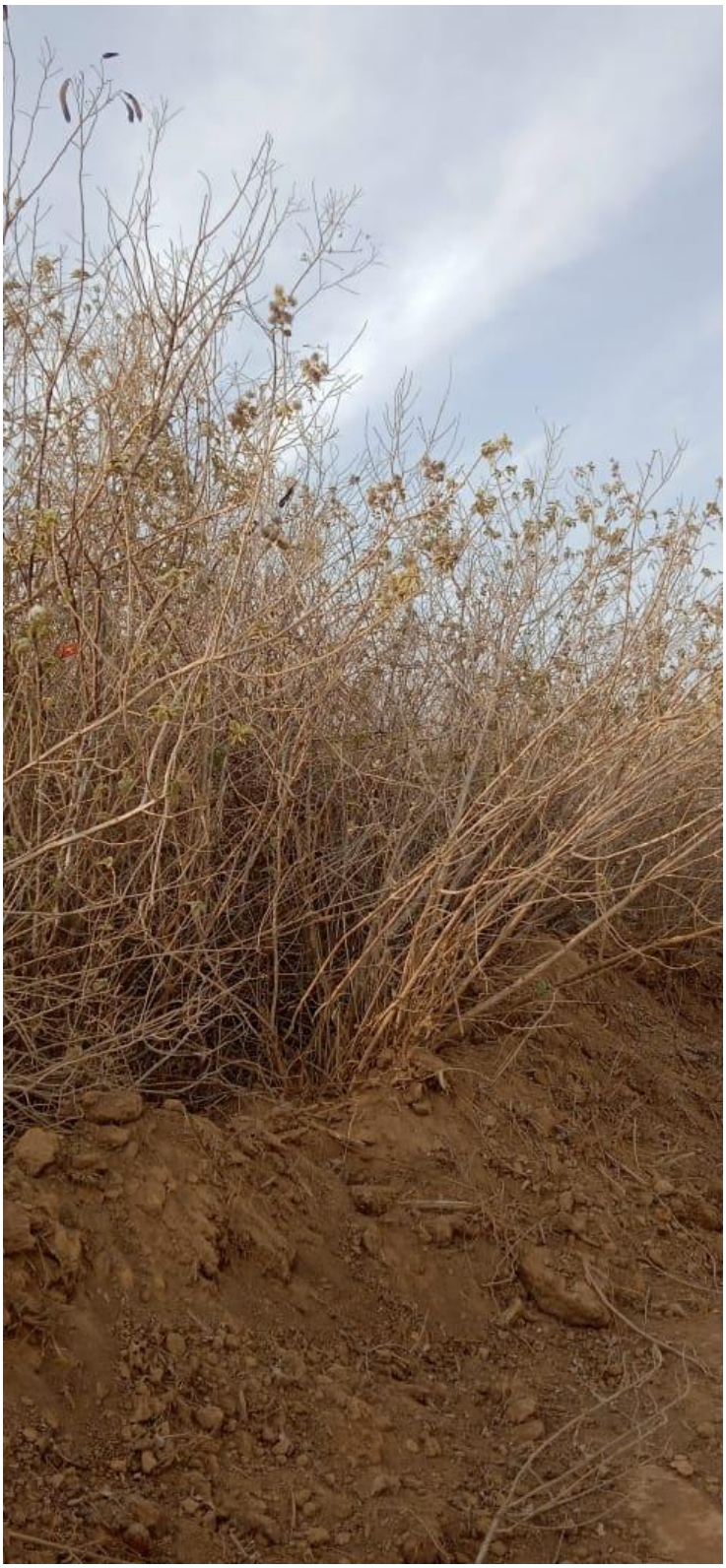


Figure 8. Areas with degraded pasture before the planting (2019).

All the area was planted with Eucalyptus cultivar VM01 (E. “urocam”) and AEC 2034 (E. “tricross”) with and 4.00 x 2.40 m spacing (1,050 plants/ha). The plantlets have been bought by a Brazilian company specialized on produce monoclonal plantlets of Eucalyptus spp. The plantlets have been stored in the Fazenda (Plant nursery) and irrigated before the planting.

Figure 9. Plant nursery before the planting (2020).

Prior to planting, it conducted and soil preparation, in February, with the following steps:

- ant combat;
- correction of soil acidity;
- subsoiling (opening the planting line);
- fertilization in the planting line, with fertilizer NPK 09-39-09 + Micros, 140 kg/ha;
- opening of the plant furrows;
- application of forest termite killer in the total area.

A manual planter was used. During planting, the first irrigation was also carried out. One week after planting, starter fertilization was carried out, directly in the plant furrow, using 100kg/ha of NPK 09-39-09 + Micros fertilizer.

Figure 10. Manual planting operations (2020).

After the planting operations a field checking was carried out to find and replace dead seedlings. The replantation involved less than 5% of the plantlets. Then the following activities were carried out in each block:

- irrigation with an interval of four days, during the first month after planting;
- light harrowing between the planting lines;
- hand weeding;
- mechanized mowing;
- 12-month fertilization 150 Kg/ha potassium chloride fertilizer.

All these activities are described also in the following item 1.11.3 - Silvicultural activities.

1.11.2. Planted Species

It has been used two hybrids of genus Eucalyptus, because of the high adaptability to the soil and climate condition that characterized the region of the Project and because of its very rapid growth and big potential as carbon capture and sequestration.

- VM01 – E. "urocam" – (*E. urophylla* x *E. camaldulensis*)

The use of techniques such as hybridization and cloning of eucalyptus in Brazil aims to improve productivity, reduce production costs, and enhance growth and consequently carbon sequestration. The

hybrid VM01 has high density, tolerates very well regions with water deficit and soils with low clay content (MIGUEL, 2009)[1].

- AEC 2034 – E. "tricross" – ((*E. camaldulensis* x *E. grandis*) x *E. urophylla*)

The main feature of this clone is the production of high-density wood. The Clone AEC 2034 is a good productivity specimen, generating good volume of biomass per ton, with a basic density of 580 kg m^3 (CARNEIRO, 2016)[2].

Figure 11. Seedlings in their plastic tubes (2020).

[1] MIGUEL, E. P. Avaliação biométrica e prognose da produção de Eucalyptus urophylla (S.T. Blake) na região norte do estado de Goiás. 2009. 165 f. Dissertação (Mestrado em Engenharia Florestal) - Universidade Federal do Paraná. Curitiba – PR.

[2] CARNEIRO, J. P. Adequação da adubação fosfatada em mudas de eucalipto ectomicorrizadas. 2016. [51] p. Dissertação (Mestrado em Produção Vegetal) – Programa de Pós-Graduação em Produção Vegetal, Universidade Federal dos Vales do Jequitinhonha e Mucuri, Diamantina, 2016.

1.11.3. Silvicultural activities

In the table below follows the description of the silvicultural activities implemented in the Project Area. For all these activities was used local labor coming from in the nearby of the Fazenda Boa Vista II.

Table 3. Project area silvicultural activities.

Activity	Description
Land preparation	Delineation of the area, map production. Identification of the protection areas, such as areas with primary forest, forest relicts, biological corridors and water bodies. Analysis of soil samples for accurate fertilization. Ploughing and levelling of eroded areas. Ploughing of areas with greatly compressed soil. Division in to 10 blocks, separated by corridors of between 10 to 20 m. Control the colonies of ants in the total area and surroundings. Mechanized cleaning performed to eliminate weeds and grass cover of some areas. Soil acidity correction with dolomitic limestone application in the total area. Ploughing for incorporation of limestone in the soil. Subsoiling with fertilization in the planting line - 140kg/ha fertilizer NPK 09-39-09 + Micro-minerals. Opening of the plant furrows, measuring 0.40cm x 0.40cm x 0.20cm. Application of forest termite killer in the total area.
Planting	Planting the seedlings with a spacing of 4.00m x 2.40m, in the previously subsoiled and fertilized planting line. Irrigation of the seedlings with water tank, directly in the hole. The hole is covered, and the soil is pushed down to secure the fixing of the seedling. Checking was carried out to find and replace dead seedlings. The replantation involved less than 5% of the plantlets.
Fertilization	Starter fertilization: one week after planting, starter fertilization was carried out, directly in the plant furrow, using 100kg/ha of NPK 09-39-09 + Micros fertilizer. 2ª fertilization: after 12-month, fertilization 150 Kg/ha potassium chloride fertilizer.

	Fertilization should be executed during the wet season to allow the fertilizer to penetrate the soil and reach the roots. A forestry engineer will decide when to stop with the fertilizations according to the soil and foliar analysis results and also depending on the age of the plant and dry matter production.
Weed control	A cleaning is performed which hand weeding and mechanized mowing.
Maintenance	Irrigation with an interval of four days, during the first month after planting; Ant control, witch patrols. Fire prevention, especially in dry season. There are no more activities other than those listed, for all the duration of the Project.

Figure 12. Post planting irrigation (2020).

Figure 13. Manual weed control cutting (2020).

Figure 14. Plantlets with 2 months of age (2020).

Figure 15. Plants with 6 months (2020).

Figure 16. Mechanized weed control cutting (2021).

1.11.4. Stratification of the Project Area

The species implanted in the Project Area are different. For this reason, the project area was divided into two strata. The features that define the strata are:

- same pedological and environmental characteristics.
- same species, hybrid or cultivar.

- same number of trees per ha (the same spacing of 4.00 m x 2.40 m was performed (1,050 plants/ha).
- same soil management and the same subsequent operations.
- planted in different months, but close together, not causing great differentiation.

Thus, the stratification for the ex-ante estimation is proposed according to the species difference. This division is described in the table below.

Table 4. Planted blocks stratification.

Stratum	Block Code	Extension (ha)	Planting Month	Nº of trees/ha	Cultivar
1	66	13.49	feb/20	1,050	VM01
	67	6.85	apr/20	1,050	VM01
	68	15.51	apr/20	1,050	VM01
	69	10.81	apr/20	1,050	VM01
	Total stratum	46.66			
2	70	28.01	mar/20	1,050	AEC 2034
	71	25.72	jan/20	1,050	AEC 2034
	72	48.10	jan/20	1,050	AEC 2034
	73	47.59	mar/20	1,050	AEC 2034
	74	37.55	feb/20	1,050	AEC 2034
	75	59.49	abr/20	1,050	AEC 2034
	Total stratum	246.46			
	TOTAL	293.12			

If, during the ex-post estimate, any further heterogeneous biomass distribution is encountered within one of the two strata already defined, it will be opportune to divide the inhomogeneous stratum in question into further strata, in order to achieve homogeneity.

1.12. Project Location

1.12.1. Geographic boundaries

The **FBV Project** was developed in a private farm called Fazenda Boa Vista II. The farm is located in Ponto dos Volantes Municipality, in a region known as Jequitinhonha Valley, in the State of Minas Gerais – MG, part of Southeastern Brazil's macro-region[3].

The Ponto dos Volantes Municipality has an extension of 1,212 km² and is in the northeastern part of Minas Gerais (extension: 586,528 km²), occupying 0.21% of State's total area. It is located approximately 100 km before the border with the state of Bahia. Its geographical coordinates are: 16°45'39" south

[3] IBGE - Instituto Brasileiro de Geografia e Estatística. Cidades. Ponto dos Volantes. 2017.

latitude and 41°29'36" west longitude. Distances: 584 km from the state capital (Belo Horizonte) and 1,005 km from the country capital (Brasília)[4].

The Jequitinhonha Valley region is called that because the Jequitinhonha River crosses its entire length. It is an area widely known due to its low social indicators. On the other hand, it has exuberant natural beauty and enormous cultural wealth[5].

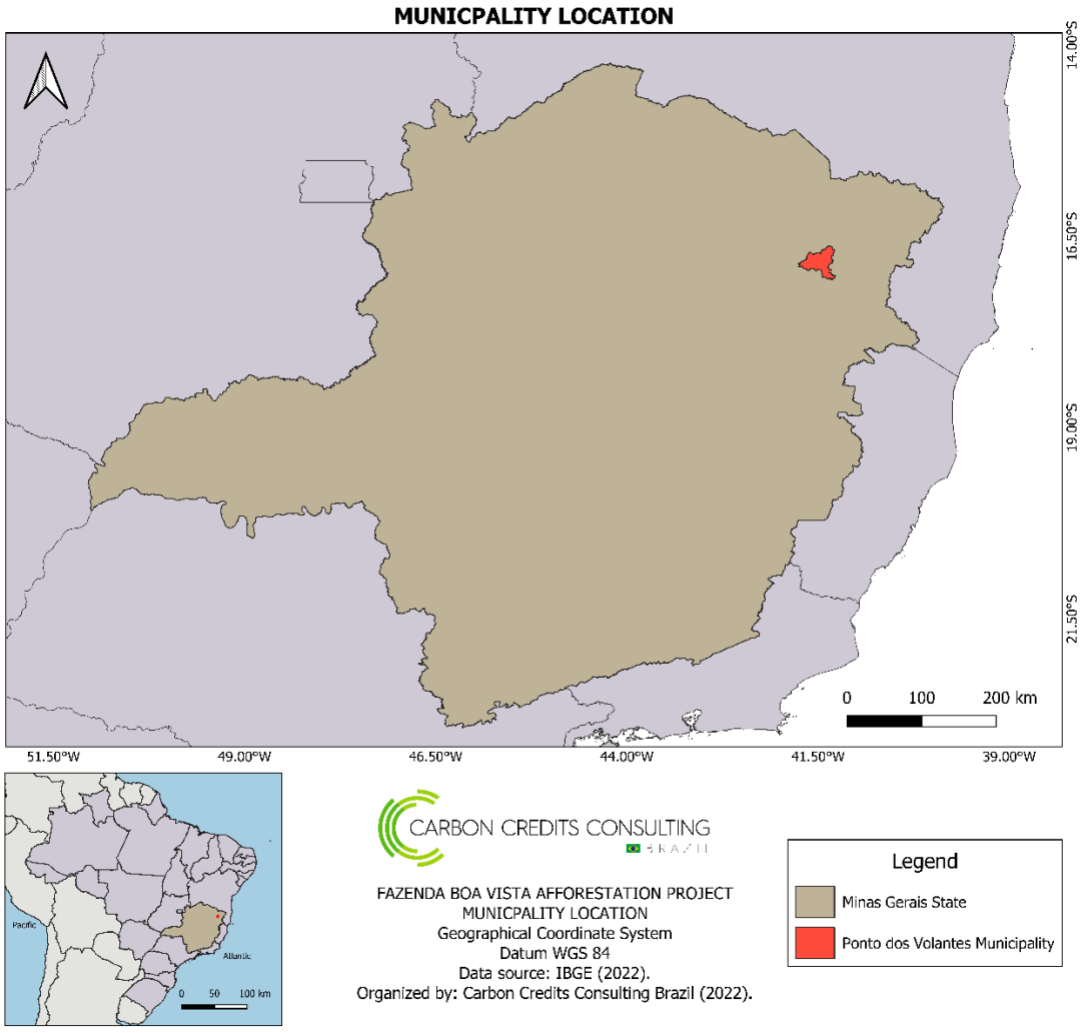


Figure 17. Municipality Location in Minas Gerais State (Source: own elaboration, 2022. Data: IBGE, 2022).

[4] IBGE - Instituto Brasileiro de Geografia e Estatística. Cidades. Ponto dos Volantes. 2017.

[5] UFMG – Universidade Federal de Minas Gerais - Sobre o Vale do Jequitinhonha - https://www.ufmg.br/polojequitinhonha/o-vale/sobre-o-vale-do-jequitinhonha/

1.12.2. Project Zone

The Project Zone corresponds to the total area of the property Fazenda Boa Vista II, located in the municipality of Ponto dos Volantes.

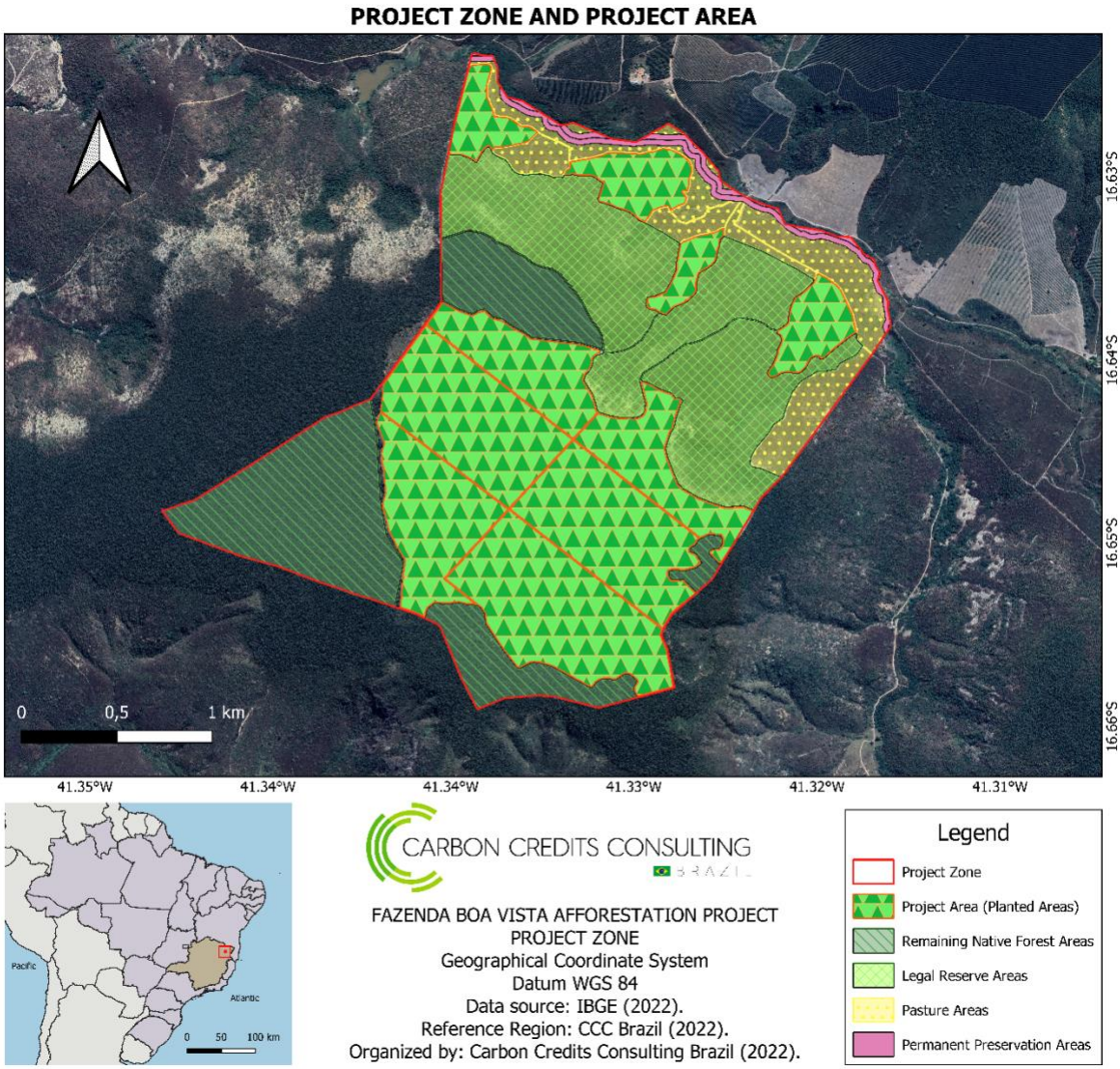


Figure 18. Location of the Project Zone (red line) (Source: own elaboration, 2022. Data: IBGE, 2022).

Fazenda Boa Vista covers a total area of 664.65 ha and as of today (2022) and about 2 and half years after the starting of the Project, is divided into:

Planted Areas: 293.12 ha (44.10%)

This area is composed by the planted areas within the Project (Project Area) and is divided into 10 planted blocks of different extensions.

Legal Reserve Areas: 155.39 ha (23.38%)

According to Law 12,651/2012, every rural property must maintain an area with native vegetation cover, as a Legal Reserve. It is an area located within a rural property or possession, with the function of ensuring the sustainable economic use of the rural property's natural resources, assisting the conservation and rehabilitation of ecological processes, and promoting the conservation of biodiversity, as well as the shelter and protection of wildlife and native flora. Its minimum size in percentage terms depends on area where the property is located. For example, in Minas Gerais the Legal Reserve correspond to the 20% of the rural property. Legal Reserve Areas of the farm are higher than 20%.

Permanent Preservation Areas: 12.79 ha (1.92%)

As defined by Law no. 12,651/2012, Permanent Preservation Area is a protected area, whether covered by native vegetation or not, with the environmental function of preserving water resources, the landscape, geological stability, and biodiversity, facilitating the gene flow of fauna and flora, protecting soil and ensure the well-being of human populations.

Pasture Areas: 56.27 ha (8.47%)

In this area dairy cattle breeding is practiced for the landowners' own consumption and for the farm workers' consumption.

Roads + Corridors: 17.84 ha (2.68%)

This area corresponds to roads that give access to every part of the Fazenda; the corridors that permit the access to the planted blocks and to the remaining pastures; the headquarter area, where are located the workers houses, the sheds, and the farm offices.

Remaining Native Forest Areas: 129.22 ha (19.44%)

One of the major concerns of forestry projects is the conservation of biodiversity in its natural environment, to maintain viable populations over time.

In this sense, Fazenda Boa Vista was concerned with delimiting areas for the purpose of regenerating native vegetation, composing forest mosaics (figure below) together with the planting areas, forming ecological corridors that benefit the local fauna. The property already has a legally sufficient area for the protection of native vegetation (Legal Reserve); however, the owners were concerned about reserving additional areas for the purpose of regeneration and preservation of native vegetation. These mosaics can contribute to the maintenance of natural processes that guarantee ecological sustainability to wild fauna species, forming ecological corridors, contributing to the ecosystem biological integrity.

Figure 19. Areas of regeneration of native vegetation, composing forest mosaics next to the planting areas (2022).

1.12.3 Project Area

The Project Area corresponds to **10 blocks** of the Fazenda that was planted between **January 2020** and **April 2020** and has an extension of 293.12 ha. The information necessary to identify the Project location description are presented below:

▪ Project Zone name: **Fazenda Boa Vista II**.

▪ Datum: WGS 84**; MC -39°; FUSO 24.**

▪ Geodetic coordinates: below is the list of geodetic coordinates of the central point of the blocks that compose the Project Area:

Table 5. Planted blocks area and location.

Stratum	Block Code	Extension (ha)	Coordinate (X)	Coordinate (Y)
1	66	13.49	252722.26	8159017.98
1	67	6.85	252058.52	8159313.48
1	68	15.51	251796.54	8159806.55
1	69	10.81	250972.13	8160121.12
2	70	28.01	251211.47	8158791.80

2	71	25.72	251917.23	8158244.60
2	72	48.1	250925.40	8158497.41
2	73	47.59	251673.12	8157894.49
2	74	37.55	250722.68	8157961.85
2	75	59.49	251402.13	8157460.63

The Project Zone Map is provided as a PDF file in the Document 02 - Project Area Map and represented in the Figure 18.

The KML file of the Project Zone and Project Area that helps to delineate the area using geodetic polygons is provided in the Document 01 – KML Map.

1.13. Conditions Prior to Project Initiation

According to the analyses and diagnosis of vegetation through remote sensing, between the period of the first half of 2008 and the last half of 2018, it was found that the Boa Vista property had about 46% of consolidated area (pasture: 29% and poorly covered soil: 17%) and 54% of vegetated area (see Appendix 1 – Project Zone Map).

The land within the Project Area prior to the start of the Project was degraded pasture occupied by extensive livestock. This terrain was characterized by erosion spots and reduced soil fertility (decrease in organic matter, decrease in macro and micro trace elements).

The factors that led to this gradual depletion of pasture and soil were cattle grazing, cattle trampling and lack of fertilization and rational pasture care. Such pastures have historically been subject to fire activities that occurred with the aim of reducing tree cover and expanding fields to develop extensive livestock activities.

These conditions existing before the start of the project correspond perfectly to the Baseline Scenario (see item 3.4 – Baseline Scenario).

Below is a brief description of the environmental conditions of the region where the Project Area is located, with adequate information on climate, hydrology, topography, soils, vegetation, and ecosystems.

- **Altitude:** the average altitude of Ponto dos Volantes is 675 meters above the sea level[6].
- **Topography:** The municipal relief has flat (5%), undulating (45%) and mountainous (50%) topography[7].

[6] IBGE Cidades - https://www.ibge.gov.br.

- **Soil:** The latosol prevails in the farm area. They are mineral, homogeneous soils. They are normally deep and well drained, making them suitable for forest plantations and perennial crops. In the region there is also the presence of red argisoils[7].

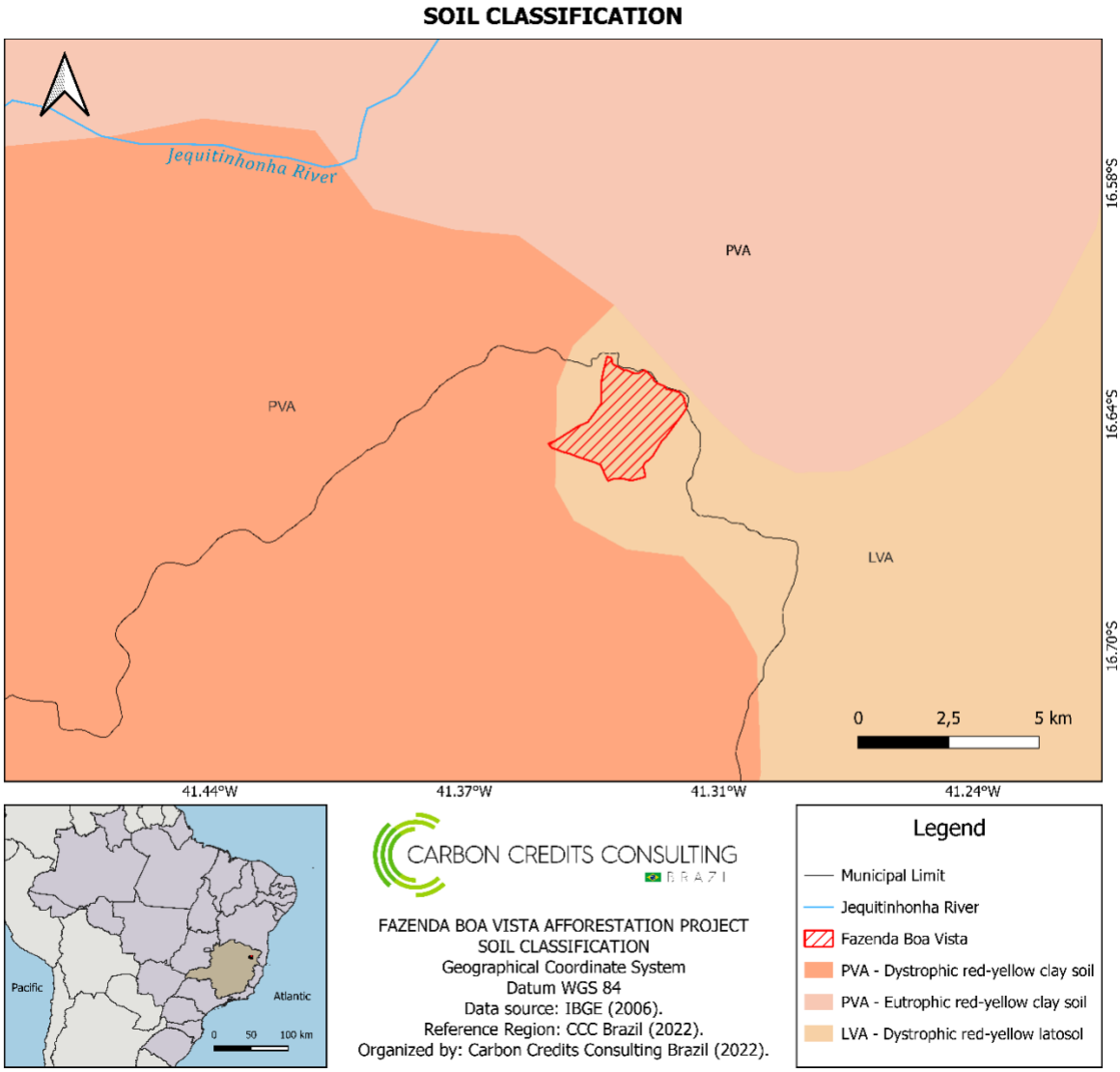


Figure 20. Soil classification map (Source: own elaboration, 2022. Data: IBGE, 2006).

- **Climate:** The state of Minas Gerais, located in the Southeast macro-region of Brazil, is characterized by a tropical climate. The climate of the Ponto dos Volantes region is considered Tropical Hot Central Brazil, with average temperatures above 18°C in all months, ranging from semi-humid to semi-arid, with four to six dry months[8].

[7] IBGE Solos - https://geoftp.ibge.gov.br.

[8] IBGE – Climatologia - https://www.ibge.gov.br.

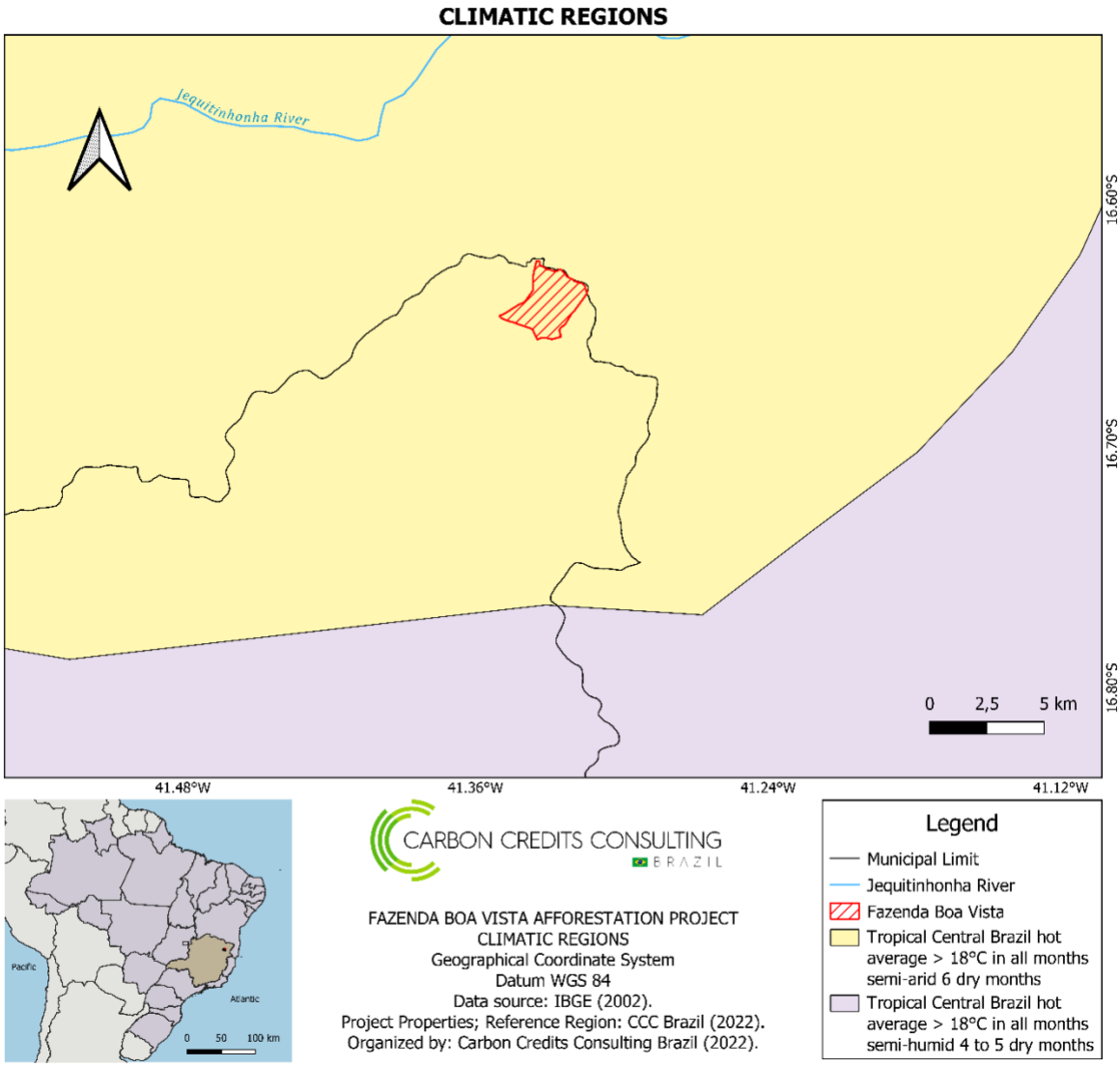


Figure 21. Climatic regions map (Source: own elaboration, 2022. Data: IBGE, 2002).

- **Temperature:** The graphic below shows the average maximum and minimum temperatures recorded throughout the year in Ponto dos Volantes. The highest average temperatures are recorded in the months of January (34.6°C), while the lowest temperatures are recorded in July (15.7°C)[9].

[9] Agritempo – Embrapa: Dados Meteorológicos – http://www.agritempo.gov.br/agritempo

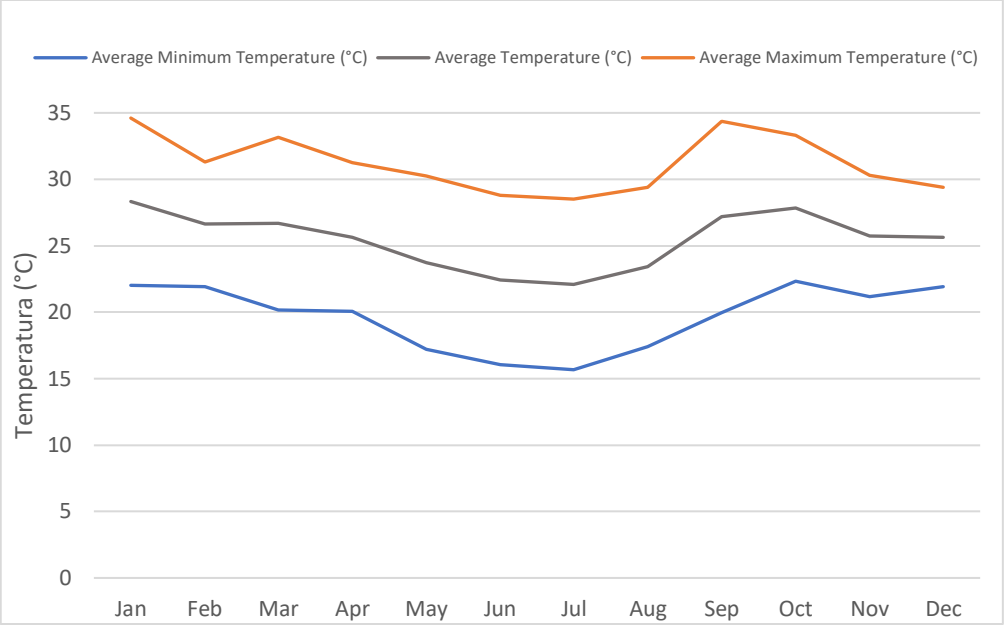


Figure 22. Graphic of average maximum and minimum temperatures recorded throughout the year in Ponto dos Volantes (Source: own elaboration, 2022. Data: Agritempo – Embrapa, 2022 [10]).

- **Rainfall:** In Ponto dos Valentes July is the driest month with 8.7 mm. The month of greatest rainfall is December, with an average of 160.7 mm[10].

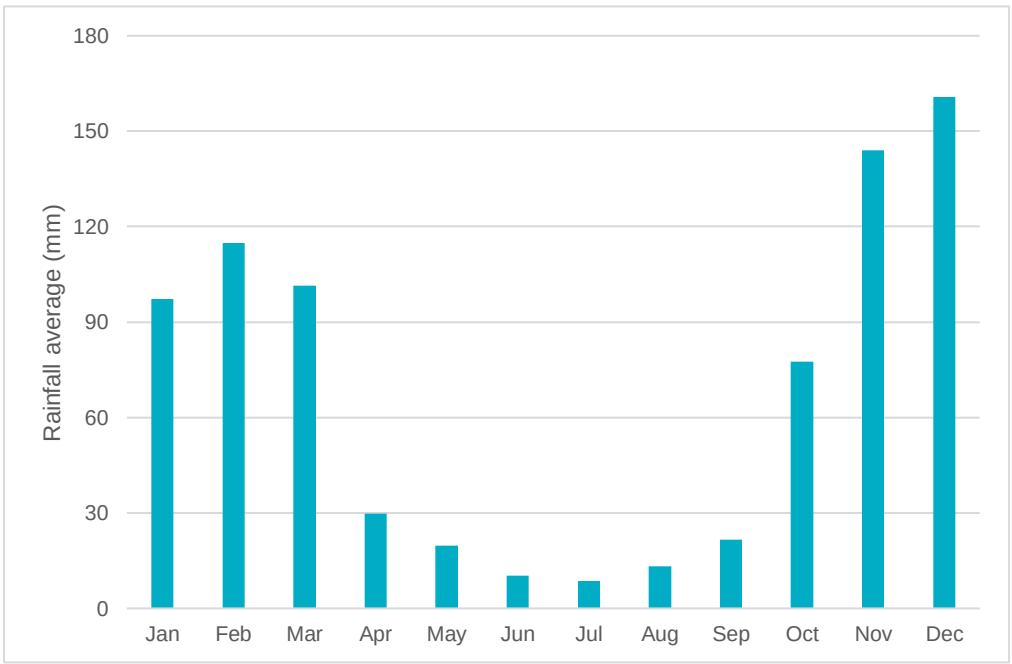


Figure 23. Graphic of average rainfall throughout the year in Ponto dos Volantes (Source: own elaboration, 2022. Data: Agritempo – Embrapa, 2022) [10].

[10] Agritempo – Embrapa: Dados Meteorológicos – http://www.agritempo.gov.br/agritempo

- **Vegetation:** The municipality of Ponto dos Volantes is located in the Atlantic Forest biome, but this is a transition area, where the Cerrado Biome is influenced. Fazenda Boa Vista II is located exactly in a transition region of Savanna and Seasonal Forest vegetation[11].

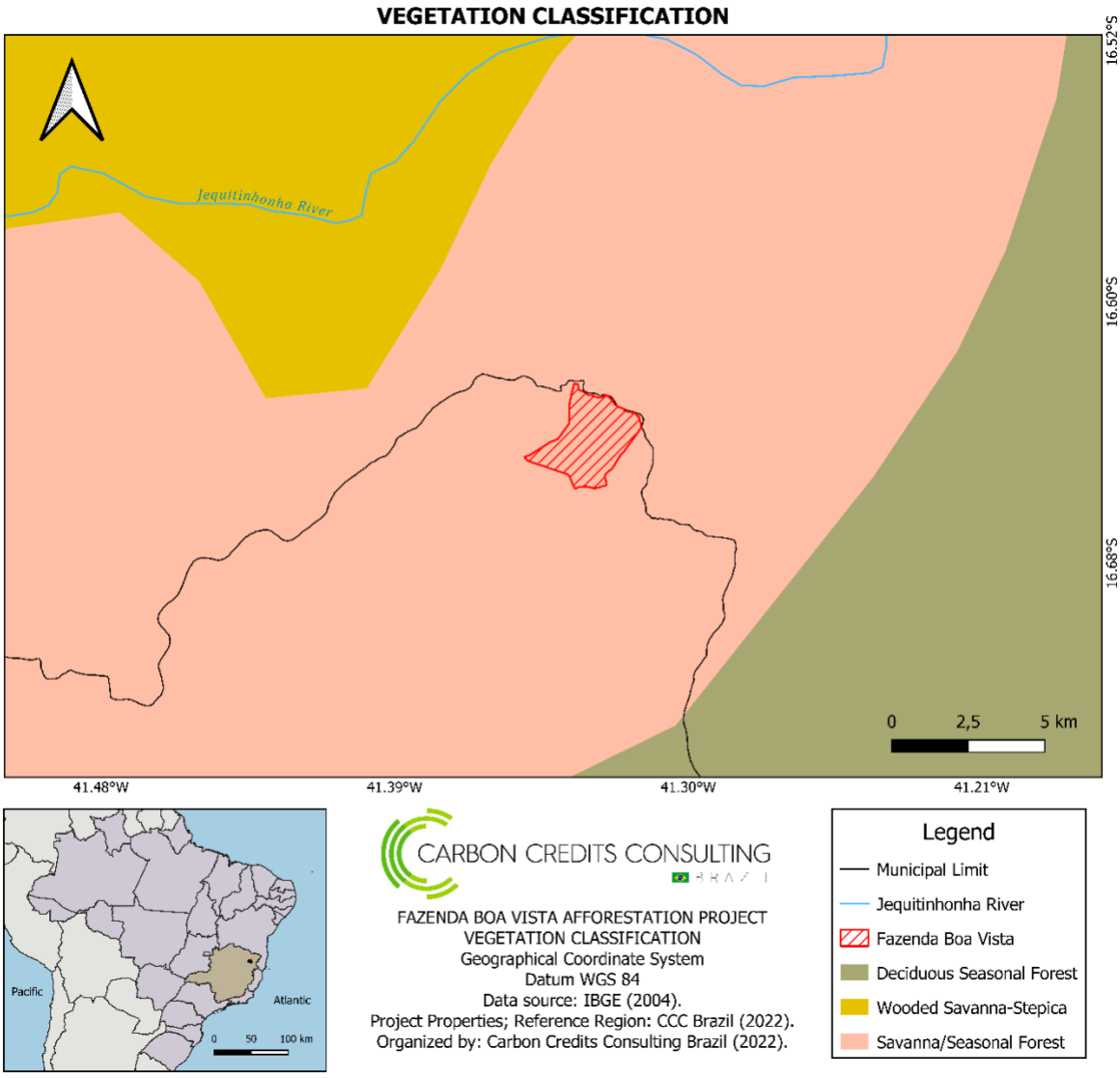


Figure 24. Vegetation classification map (Source: own elaboration, 2022. Data: IBGE, 2004).

- **Demography and Land Use:** according to IBGE 2021[12], the State of Minas Gerais has a total extension of 586,513.983 km² (58.65 million hectares) and the resident population amounts to 19,597,330 inhabitants with a population density of 33.41 inhabitants/km². The State is divided into 853 Municipalities, including Ponto dos Volantes, home to the Project. Minas Gerais has very

[11] IBGE– Instituto Brasileiro de Geografia e Estatística: Vegetação - https://www.ibge.gov.br

[12] IBGE – Instituto Brasileiro de Geografia e Estatística: Cidades e Estados – https://www.ibge.gov.br/cidades-e-estados/mg.

diversified economic activities: agriculture, livestock, industry, services, power generation and mining. In Ponto dos Volantes, agriculture and livestock predominate.

The State ranks[13] fourth in Brazil by number of cattle (22.1 million heads - 10.2% of all cattle in Brazil). Forests cover 33.5% of the total area of Minas Gerais, also including planted forests. Land Use is summarized in box below.

Class	Area (million ha)
Agricultural	34.5
Forest	19.7
Non-Forestry Natural Formation	3.3
Water	0.6
Non-Vegetative Area	0.6

Source: IBGE, 2021 [13].

1.14. Compliance with Laws, Statutes and Other Regulatory Frameworks

- **Regulatory framework**

Brazil is a member of the UNFCCC (United Nations Framework Convention on Climate Change) and an active member of the ITTO (International Tropical Timber Organization). The country has ratified the UNFCCC (1995), the Kyoto Protocol (2005), and has established a Designated National Authority under the CDM (currently the country has more than one registered CDM Afforestation/Reforestation project). Brazil also has recently signed the Paris Agreement (Paris 2015, COP21). The Project complies with this regulatory framework, because in the AFOLU scope, Afforestation/Reforestation is one of several mechanisms by which GHG emissions are expected to be reduced.

- **National and Local Legislation**

A brief overview of the main national laws regulating the forest sector is provided here in the Table 6 below. FAO also makes a compilation of all forest-related laws[14]. These laws regulate the use and protection of native natural forests and the management and exploitation of commercial forests derived from reforestation projects.

Table 6. Project legislation overview.

Law	Object	Compliance
Law n° 12,727 of 17/10/2012	Establishes general norms on the protection of the vegetation, areas of Permanent Preservation and the areas of Legal Reserve; Logging, supply of forest raw materials, control of the origin of forest	Fazenda Boa Vista Afforestation Project is in compliance with this law because: -The Legal Reserve area within the Project borders is larger than the 20% as required

[13] IBGE – Instituto Brasileiro de Geografia e Estatística: PPM - Pesquisa da Pecuária Municipal – https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/9107-producao-da-pecuaria-municipal.html?=&t=resultados.

[14] FAOLEX Database Brasil Forestry – https://www.fao.org/faolex/country-profiles.

15	products and control and prevention of forest fires and provides economic and financial instruments to achieve its objectives. In Minas Gerais, to get a permission to plant commercial forests in rural areas, it is necessary a Legal Reserve equal or more than 20% of the land and regulate all potential APP – Áreas de Preservação Permanente (Permanent Preservation Areas - PPA). According to this Law all rural property must maintain an area with native vegetation coverage, as a Legal Reserve. This is an area located inside a rural property, with the function of ensuring the sustainable use of the natural resources of the rural property, assisting the conservation and rehabilitation of ecological processes and promoting the conservation of biodiversity, as well as the shelter and protection of wildlife and native flora. Its minimum size in percentage of to the rural area is dependent on its location (article 12): 80% in rural properties located in Rain Forest areas in the Legal Amazon; 35% in properties located in *Cerrado* areas in the Legal Amazon; 20% in properties located in other forest and fields areas in any region of the country (as in the Project). In these areas it's permitted the collection of non-timber forest products, such as fruits, flowers, vines, leaves, root, and seeds, which do not endanger the survival of individuals and of the species collected, is allowed (Article 21). Sustainable forestry is forbidden for commercial purposes, but it's allowed for use in the property, with a maximum limit of 20 cubic meters / year (Article 23). It is not allowed cattle farming or any other agricultural activity. According to the Law, APP - Permanent Preservation Area is a protected area, covered or not by native vegetation, with the environmental function of preserving water resources, landscape, geological stability, and biodiversity, facilitating the flow of flora and fauna, protect the soil and ensure the well-being of human populations.	by the legislation (it is **155.39** ha and represents **23.38%** of the farm). - The areas of Legal Reserve are all geo-referenced and fenced, - Inside the areas of the Legal Reserve there are no cars, people, breeding and agriculture are not practiced. - APPs are established for: hills with slopes greater than 45 ° and areas adjacent to rivers and wetlands. - The Permanent Preservation Area (PPA) have been fenced and geo-referenced and these are composed by areas with more than 45% of slope, together with the vegetation areas that preserve the rivers, springs and lakes that are present in the property. These PPA has an extension of **12.79 ha** and represents **1.92%** of the farm). - All measures are taken to prevent and control fires.

[15] Planalto – LEI Nº 12.727 – http://www.planalto.gov.br/ccivil_03/_Ato2011-2014/2012/Lei/L12727.htm.

	Within the APP, the only allowed activities are research and eco-tourism. By law, all territories with more than 45° slopes must be included in the APP. Also, all the rivers, springs and lakes must be included in the APP, which must have vegetation belts with radius that depends on the width of the river or lake.	
Law n° 12,651 of 25/10/2012 [16]	Establishes the New Brazilian Forest Code.	This law formalizes the previous requirements in a more complete and solid law.
Law n° 20,922 of 16/10/2013 – SIAM[17]	Provides for forestry and biodiversity protection policies in the State of Minas Gerais.	In article 69 of this law, it is defined that the planting and reforestation with native or exotic forest species do not depend on prior authorization, provided that the limitations and conditions provided for in the current legislation are observed, and must be informed to the competent environmental agency, within a period of up to one year for source control purposes. It is also established that the extraction of firewood and other products from forests planted in areas not considered APPs and Legal Reserves is free.
Portaria IEF Nº 28, of 13/02/2020 [18]	Implemented the forest plantation register provided for in Law No. 20,922 of 2013 and regulated by Decree No. 47,749 of 2019.	Establishes guidelines for registering the planting and harvesting of forests planted with native and exotic species in the State of Minas Gerais. Defines that planting and reforestation with native or exotic forest species does not require prior authorization.
Law nº 21,972 of 21/01/2016 – SEMAD[19]	Provides for the State System of Environment and Water Resources - (SISEMA)	This law defines the State Environment and Water Resources System - Sisema - as a set of bodies and entities responsible for environmental and water resources policies, with the purpose of conserving, preserving and recovering environmental resources and promoting sustainable

[16] Planalto – LEI Nº 12.651 – http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm.

[17] LEI Nº 20.922 – SIAM - Sistema Integrado de Informação Ambiental de Minas Gerais - http://www.siam.mg.gov.br/sla.

[18] PORTARIA IEF Nº 28 – SIAM - Sistema Integrado de Informação Ambiental de Minas Gerais - http://www.siam.mg.gov.br/sla/download.pdf?idNorma=51046.

[19] Lei Nº 21972 DE 21/01/2016 – SISEMA – https://www.legisweb.com.br/legislacao/?id=126274.

		development. And the improvement of the environmental quality of the State of Minas Gerais. The Boa Vista II farm has a certificate that grants the property a Simplified Environmental License, LAS/Cadastro modality, in compliance with current environmental standards and imposed constraints.
Decree nº 47,787, of 13/12/2019 [20]	Provides for the organization of the Secretary of State for the Environment and Sustainable Development – SEMAD.	Semad operates within the State as a sectional body of the National System for the Environment – Sisnama, is part of the National System for the Management of Water Resources, and is responsible for coordinating the State System for the Environment and Water Resources – Sisema. The Boa Vista II farm has a certificate that grants the property a Simplified Environmental License, LAS/Cadastro modality, in compliance with current environmental standards and imposed constraints.

1.15. Participation under Other GHG Programs

1.15.1. Projects Registered (or seeking registration) under Other GHG Program(s)

The Project is not registered under any other GHG Programs.

1.15.2. Projects Rejected by Other GHG Programs

The Project has not been rejected by any other GHG programs.

1.16. Other Forms of Credit

1.16.1. Emissions Trading Programs and Other Binding Limits

The Project does not reduce GHG emissions from activities included in an emissions trading program or any other mechanism, therefore, reductions and removals generated by this Project will not be used for compliance under any other program or mechanism.

1.16.2. Other Forms of Environmental Credit

[20] DECRETO Nº 47.787 – http://www.siam.mg.gov.br/sla/download.pdf?idNorma=50263.

The Project has no intention to generate any other form of credits related to reductions or removals under the VCS program.

1.17. Sustainable Development Contributions

The Project is responsible for more than just carbon fixation through reforestation. The project is also in line with the SDGs (Sustainable Development Goals), on the United Nations Sustainable Development Summit.

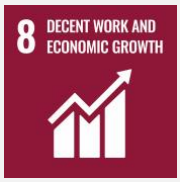
The project activity promotes reforestation in areas suitable for this purpose and proper handling of the land, contributes to the mitigation of climate change by removing GHG from the atmosphere, generates sustainable development through their activities and generate social, climatic, and environmental co-benefits.

The implementation of project activities will be managed through the Social and Environmental Management Plan. This plan is under development and should be based on the SDG indicators framework.

The Fazenda Boa Vista Afforestation Project contributes to achieve the following sustainable development priorities:

Table 7. UN Sustainable Development Goals applicable to the Project.

Related SDG	Description
	These socio-economic benefits are in line with the project's goals; that seeks to prioritizing the acquisition of local resources and labor; stimulating the establishment of new enterprises and jobs to guarantee the benefits to the communities targeted by the project. Prior to the project, community workers were working with livestock, where the wages are among the lowest. Thanks to the Fazenda Boa Vista Afforestation Project, it will be possible to increase the salary level to allow workers also an economic gratification, with consequent benefits to their families.
	To develop the Fazenda Boa Vista Afforestation Project, it will be necessary for all those involved to be technically prepared and well oriented. For this, it will be invested in training and instructions to guarantee a quality performance. The training of farm's employees on forest fires will contribute to the implementation of forest fire risk mitigation activities. Access to training will also improve the participant's skills and will qualify them to access better-paid jobs and professional or technical opportunities. Access to training and workshops will also facilitate networking which can result in further access to formal and informal education.

	The project will promote and encourage access to inclusive, equitable and quality education through training focused on the environmental and socioeconomic areas, focusing especially on activities, good practices and innovation in agriculture; importance of forest recovery and conservation of standing forest; and entrepreneurship.
	Project activities implementation are already significantly changing the quality of the work environment, as it has changed the type of work done by the farm's workers and their living quarters, will be providing more financial stability year-round and training. Income increase over time for project workers is expected to occur as workers get qualified and project income increases due to the revenues from the sale of carbon credits.
	Planted forests play a fundamental role in mitigating climate change, especially by removing CO_2 from the atmosphere and storing carbon in forests and in the products derived from them, in addition to avoiding emissions by providing products and services of renewable origin, replacing those of fossil or non-renewable origin. In addition to contributing to the reduction of soil erosion and increased water infiltration, cycling of nutrients from deeper layers of the soil, air quality improvement, thermal comfort, water sources flow improvement, recovery of degraded areas, reduction of pressure on native forests, increased biodiversity, among others. In general, all activities provided for by the project seek to encourage initiatives to mitigate climate change and its impacts and, consequently, reduce environmental degradation in the Project Area.
	The Project had a positive impact on the farm's soil; Before the start of the Project, the land was characterized by degraded pastures with erosion. After planting, the soil improved its macro and micromineral characteristics, in addition to showing an improvement in the levels of organic matter, due to the formation of decomposing biomass above the ground, from residues of branches and leaves. This biomass, when deposited under the soil, can return its nutrients to the ecosystem, helping to maintain soil moisture, ensuring the cycling of various nutrients of extreme importance for the survival of the species that live there. Eucalyptus also produces a lower susceptibility of the soil to erosion. The ground cover improves water infiltration, minimizing the impact of rain on the ground and reducing the flow rate of water during rains. Deep roots contribute to soil stability. As for biodiversity in the specific case of Fazenda Boa Vista Afforestation Project different bird species (including hawks, woodpeckers, snake-hunting birds, and various species of passerines) mammals (including anteaters, tapirs, deer, foxes, wild boar, and numerous rodent species), reptiles and amphibians can often be found in the Project Zone. This is mainly because the planted forest areas are interspersed with Legal Reserve areas (which must represent at least 20% of the Farm's land according to Brazilian legislation) that normally shelter an extremely varied fauna. This type of mosaic cultivation and environmental diversification fully respect and can even

	enhance the region's biodiversity, despite the presence of a monoculture such as eucalyptus plantations.

1.18. Additional Information Relevant to the Project

1.18.1. Leakage Management

The Project activity did not expect any displacement of agricultural activities present in the Project Area before the start of the Project. On the Project Start Date (**23–01–2020**) there were no cattle in the Project Area. Beef cattle had been commercialized years before the current owner acquired the land. At this time, the pastures were already degraded with a low level of profitability for cattle raising activities.

1.18.2. Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

1.18.3. Further Information

There is no other relevant information about the Project.

2. SAFEGUARDS

2.1. No Net Harm

Starting from a completely degraded land and carrying out the rigorous work done by the Landowner (already extensively explained in this PD) on the land, enriched by planting a new forest, is rather difficult to highlight the potential negative environment and socio-economic impact. An operation of this type can issue environmental, social and the biodiversity benefits.

How the Fazenda Boa Vista Afforestation Project contributes to achieve the sustainable development goals is described in 1.17.

The adverse effect refers to lower biodiversity, in comparison to a forest restoration system with native species, as the project uses exotic species planted in a monoculture system. To mitigate this impact, it was delimited areas for the purpose of regenerating native vegetation, composing forest mosaics along with the planted areas.

These mosaics can contribute to the maintenance of natural processes that guarantee ecological sustainability to wild fauna species, forming ecological corridors, contributing to the ecosystem biological integrity. The previous land use, which was degraded pasture, would never allow this maintenance of biodiversity, or any other of the benefits already proven with the project implementation.

The Project created better living and working conditions for Fazenda Boa Vista workers, resulting in fair wages, improved well-being for workers and their families, and greater access to health and social security services.

The implementation of project activities such as planting, weed control, chemical and harvesting management, can generate incidents and accidents to workers. To prevent and mitigate them, the Project will train its professionals in work safety issues to reduce the potential for accidents.

Residents will benefit from the transfer of technology and training that, among others, refer to reforestation initiatives. Within the Project Zone, some ecotourism activities may be carried out in the future, due to wildlife abundance. And also, employment generation derived from the activities of establishment and maintenance of agroforestry activities.

The Project will increase the interest of additional investors seeking to implement productive agroforestry projects in the region.

At the beginning of Fazenda Boa Vista's forestry business, the only income was represented by the sale of wood from the Remaining Native Forest Areas. Today, VCU sales can become a significant income diversification. In addition, ecotourism activities developed in the coming years may represent greater income diversification.

2.2. Local Stakeholder Consultation

The identification of the stakeholders was carried out with the help of the Landowner and Forest Manager, Mrs. Dilma Barbosa Do Amaral. The following stakeholders have been identified and were divided into institutional and community stakeholders.

a) Institutional Stakeholders:

- IEF – Instituto Estadual de Florestas – Teófilo Otoni Municipality.
- Secretary of Public Services and Environment – Ponto dos Volantes Municipality.

b) Community Stakeholders:

- Internal farm workers (employees).
- Neighboring farmers.

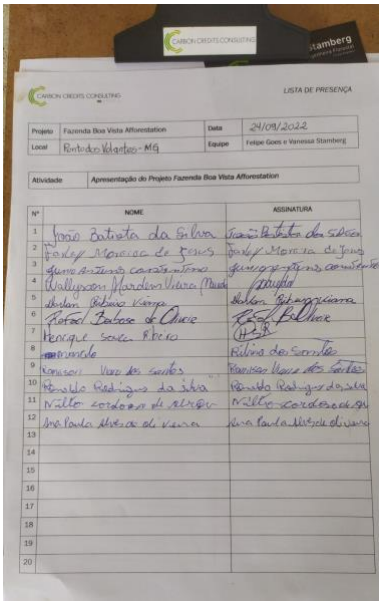
In relation to the Community Stakeholders, they were informed about the progress and details of the Project in a meeting and in-person fraternization that took place on 24-09--2022.

The meeting took place at the headquarters of Fazenda Boa Vista II (figure below). Rural workers were notified of the meeting verbally, and outside guests were notified by phone.

Figure 25. Meeting with rural workers, family members and external guests (2022).

During this meeting, the purpose, activities, and benefits of the Project were explained. Twelve in-house workers from the farm and about thirty guests participated in the meeting, including relatives of workers, neighbors, and friends from the farms.

This meeting produced a participation sheet signed by Fazenda Boa Vista's contract employees (figure below).



LISTA DE PRESENÇA

Projeto	Fazenda Boa Vista Afforestation	Data	24/09/2022
Local	Rintodo Velantes - MG	Equipe	Felipe Goes e Vanessa Stamberg

Atividade	Apresentação do Projeto Fazenda Boa Vista Afforestation

Nº	NOME	ASSINATURA
1	João Batista da Silva	João Batista da Silva
2	Jorge Moreira de Jesus	Jorge Moreira de Jesus
3		
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Figure 26. Participation sheet signed by Fazenda Boa Vista's contract employees (2022).

To facilitate the understanding of the unknown and complex issues, a digital material was presented with slides in a simplified language.

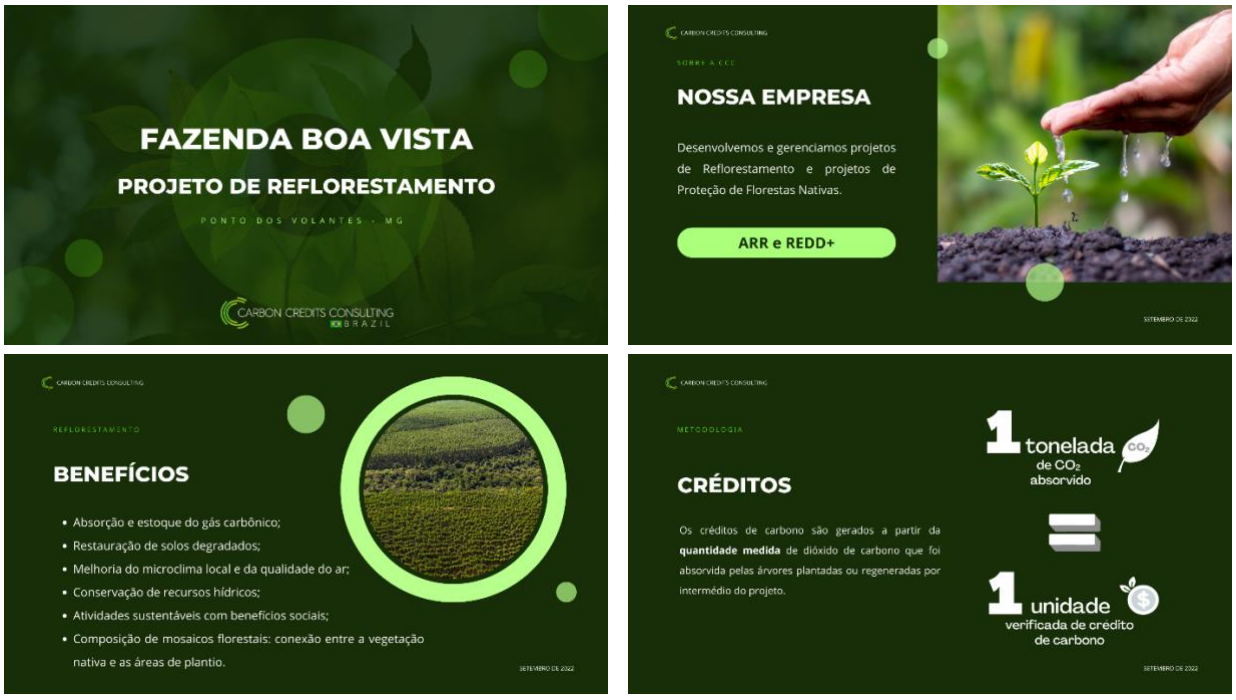


Figure 27. Part of the digital material presented with slides in simplified language (2022).

In addition, each participant has been able to express his point of view on the Project. None of the participants demonstrated negative opinions on the Project, indeed they understood the importance of the Project and expressed their desire for the Project to obtain certification. Future meetings are planned for the post-meeting period to update them on the progress of the Project.

As for neighbouring farmers and external guests, they were very curious about the economic viability of a carbon afforestation project. If the Fazenda Boa Vista Afforestation Project is successful, these farmers may be interested in developing similar projects on their properties.

In relation to institutional audiences, initially the contact took place via email and telephone with the Secretary of Public Services and Environment of the Municipality of Ponto dos Volantes and with the State Forestry Institute (IEF).

Subsequently, presential meetings took place. With the Municipality of Ponto dos Volantes, the meeting took place on 22-09-2022, in the morning (figure below).

Figure 28. Presential meeting with institutional stakeholder of Municipality of Ponto dos Volantes (2022).

With the State Forestry Institute, the meeting took place on 23-09-2022 in the afternoon (figure below) in the municipality of Teófilo Otoni - MG.

Figure 29. Presential meeting with institutional stakeholder IEF – Instituto Estadual de Florestas (2022).

Project progress will be communicated to all community stakeholders through specific and periodic meetings.

While we choose the form of official communication via e-mail to Institutional stakeholders. This will be done for the entire validation phase and for all verification and monitoring phases.

To all the stakeholders will also be communicate the risks, costs, and benefits of the project, as will the project be developed in compliance with all relevant laws and regulations covering workers' rights in the host country.

2.3. Environmental Impact

In the state of Minas Gerais, an environmental impact assessment is not required to plant eucalyptus species. Eucalyptus plantations are considered like any other crop, such as soy, corn, sugar cane.

In Minas Gerais, to plant native or exotic tree species, it is only necessary to register the planting area with the State Forestry Institute (IEF).

Based on art. 4, item V of Law No. 21,972[21], of January 21, 2016, in accordance with art. 51, its §1, item I, of Decree No. 47,787[22], of December 13, 2019, and art. 8, item III and its §4, item I, of Normative Deliberation COPAM No. 217, of December 6, 2017, Fazenda Boa Vista was granted the Environmental License for Annual, Semi-Perennial and Perennial Crops and Forestry.

The Certificate No. 928 Simplified Environmental Licensing was issued on 03-12-2020 and is available for queries in Document 07.

There is a specific and complete work on commercial eucalyptus plantations called "Environmental Impact of Eucalyptus Forests (VITAL, 2007)[23], which brings together all the articles and works to update the impact of eucalyptus on soil, climate and biodiversity. This job demonstrates how the rational management of this type of forest can have a beneficial effect on the environment in general. With regard to biodiversity, it is reported that a forest of Eucalyptus will never have the benefits of a native forest, but compared to other crops such as corn, soybeans, sugar cane, cotton and coffee Eucalyptus produces more abundantly and differentiated biodiversity.

According to Vital (2007)[24] the impact of eucalyptus plantations on water, soil and Biodiversity depends on the conditions prior to planting the forest: if planted in degraded areas or in areas previously used for pastures and other crops, the increase in flora and faunal biodiversity can be recorded.

A monoculture can never offer the same diversity of the original products and benefits of native forests. In fact, the replacement of the original vegetation cover composed of different plant species with a single monoculture, be it native or exotic, is primarily harmful to biodiversity. Also, in the case of eucalyptus plantations, due to the characteristics of the forest, there is a greater variety of flora and fauna than in other forms of monoculture (DAVIDSON, 1985)[25].

Reforestation with monoculture plantations can serve as a shelter for a diverse fauna, as long as rational techniques are implemented, for example, maintaining belts of native vegetation (biological corridors) or by planting fruit trees, shrubs and grasses, they can meet the food needs of wildlife throughout the year

[21] LEI Nº 21.972, DE 21 DE JANEIRO DE 2016 – Sistema Estadual de Meio Ambiente e Recursos Hídricos – Sisema – http://www.siam.mg.gov.br/sla/download.pdf?idNorma=40095

[22] DECRETO Nº 47.787, DE 13 DE DEZEMBRO DE 2019 – Secretaria de Estado de Meio Ambiente e Desenvolvimento Sustentável – http://www.siam.mg.gov.br/sla/download.pdf?idNorma=50263.

[23] VITAL, Marcos Henrique Figueiredo. Impacto ambiental de florestas de eucalipto. Revista do BNDES, Rio de Janeiro, v. 14, n. 28 , p. [235]-275, dez. 2007.

[24] VITAL, M. H. F. Impacto ambiental de florestas de eucalipto. Revista do BNDES, Rio de Janeiro, v. 14, n. 28 , p. [235]-275, dez. 2007.

[25] DAVIDSON, J. Setting aside the idea that eucalyptus are always bad. UNDP/FAO Project Bangladesh BGD/79/017, 1985.

(ALMEIDA, 1979)[26]. Vital (2007) stated that, despite more reduced variety of species observed in eucalyptus forests compared to native forests.

A great variety of mammals, birds and insects can be observed in planted forests. Silveira (2005)[27] stated that, despite the fauna biodiversity in planted forests being lower than observed in native forests, the undergrowth present in these homogeneous forests can provide food, shelter, and an environment conducive to animal growth.

The Project Area is fully fenced and has information boards with warnings for the prohibition of illegal activities (figure below), ensuring environmental protection for the area.

Figure 30. Information boards with warnings for the prohibition of illegal activities (2022).

In compliance with the environmental preservation will implement activities to prevent wildfires. There are many preventive activities such as: a) training and firefighting courses for farm employees; b) establishment of a network of firebreaks surrounding forests blocks; c) permanent surveillance of the project area, particularly at times of medium to high risk of fire; d) transit of non-authorized hunters, hikers or campers is forbidden.

A first stage of the training course for forest firefighting brigades has already been implemented, on July 30, 2021, with the participation of 7 employees. Participation certificates can be consulted in Document 08.

[26] ALMEIDA, A. F. Influência do tipo de vegetação nas populações de aves em uma floresta implantada de *Pinus spp*, na região de Agudos-SP. Ipef, n. 18, jun. 1979.

[27] SILVEIRA, P. B. Mamíferos de médio e grande porte em florestas de *Eucalyptus spp* com diferentes densidades de sub-bosque no município de Itatinga, SP. 2005.

ASSUNTOS MINISTRADOS

Portaria nº 51/2020 CBMMG
Portaria nº 54/2020 CBMMG
CBMMG IT 12 – Brigada de Incêndio (3ª Ed. 28 dez 2020)
NÍVEL BÁSICO COM CONTEÚDO COMPLEMENTAR DE COMBATE A INCÊNDIO FLORESTAL (24 horas)

Disciplina de Combate a Incêndio	Disciplina de Primeiros Socorros	Disciplina de Combate a Incêndio Florestal
Carga Horária 4h (Teoria e Prática)	Carga Horária 4h (Teoria e Prática)	Carga Horária 16h (Teoria e Prática)
Introdução	Avaliação inicial: Avaliação do cenário, mecanismo de lesão e número de vítimas	Aspectos gerais dos incêndios florestais
Responsabilidade do brigadista	Vias aéreas: Causas de obstrução e liberação	Aspectos operacionais do combate ao incêndio florestal
Teoria do Fogo: Combustão, seus elementos e a reação em cadeia	RCP (reanimação cardiopulmonar): Ventilação artificial e compressão cardíaca externa	Equipamentos e ferramentas específicos para incêndios florestais
Propagação do fogo: Condução, convecção e irradiação	AED/DEA: Desfibrilação semiautomática externa	Organização de pessoal
Classes de incêndio: Classificação e características	Estado de choque: Classificação prevenção e tratamento	
Prevenção de incêndio: Técnicas de prevenção	Hemorragias: Classificação e tratamento	
Métodos de extinção: Isolamento, abafamento, resfriamento e extinção química	Movimentação, remoção e transporte de vítimas: Avaliação e técnicas	
Agentes extintores: Água, Pós, CO_2, espumas e outros		
EPI (equipamentos de proteção individual)		
Equipamentos de combate a incêndio: Extintores e acessórios		
Equipamentos de combate a incêndio: Hidrantes, mangueiras e acessórios		
Equipamentos de detecção, alarme, luz de emergência e comunicações: Tipos e funcionamento		
Abandono de área		
Pessoas com mobilidade reduzida		
Riscos específicos da planta: Conhecimento		

João Carlos Cordeiro Santos, Sd BM nº 164.613-2 INSTRUTOR
Elizio Souza Almeida, Cb BM nº 136.117-9 INSTRUTOR
João C. Ornelas Oliveira Jr, Cb BM nº 154.974-0 INSTRUTOR
Laércio Rodrigues Leite, 2º Ten BM nº 132.240-3 INSTRUTOR

REGISTRO: 337 LIVRO: 01
FOLHA: 18 DATA: 11/05/21
CONFERIDO:

Figure 31. Forest firefighting course - subjects (2021).

All these research lead to the conclusion that eucalyptus has greater benefits for soil, biodiversity and climate than any other tree or herb monoculture.

2.4. Public Comments

The public comments will be included on their receipt during the public comment period.

2.5. AFOLU-Specific Safeguards

It was discovered during the local stakeholder meeting that there is no risk to the farmers who are participating in the project region. Section 2.2 details stakeholder meetings (Local Stakeholder Consultation section).

In sections 2.1 and 2.3, hazards associated with project implementation are the main topic. No risk was reported overall. There are no risks associated with the local population. The impacts on populations are mainly positive.

This project will increase the income of farmers through the generation of formal employment, which is very scarce in the region.

The project's negative impacts on local populations are negligible. The complaints redress procedure will be established as set out in the VCS rules and requirements v4.3 default:

1) The project proponent should try to amicably resolve all grievances and provide a respond to grievances in a way that is culturally appropriate.

2) Any complaints that are not resolved by amicable negotiations will be referred to mediation by a neutral third party.

3) Any claims that are not resolved through mediation will be referred to a) arbitration, to the extent permitted by the laws of the relevant jurisdiction or b) competent courts in the jurisdiction, without prejudice to a party's ability to bring the claim to a supranational court, if any.

The project strictly follows all labor and property laws and regulations, operates only with community consent and relevant governmental approval, and maintains an open grievance channel to enhance communication and foster stakeholder trust.

3. APPLICATION OF METHODOLOGY

3.1. Title and Reference of Methodology

The proposed project is an ARR project that aims to reforest degraded lands, which are expected to remain degraded or to continue degrading in the absence of the Project. This project encompasses ARR activities that increase carbon sequestration by establishing, increasing, and restoring forest vegetative through the planting of woody vegetation.

The project area shall not be cleared of native ecosystems within the 10-year period prior to the project start date, as set out in the VCS Program document VCS Standard.

Title of the methodology: AR-ACM0003 – A/R Large-scale Consolidated Methodology. Afforestation and Reforestation of Lands Except Wetlands. Version 02.0 of 04-10-2013.

The following documents are indispensable for application of this methodology:

(a) Clean Development Mechanism project standard.

(b) A/R methodological tools:

The tools and modules to be applied are:

- AR-TOOL02: “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities” – Version 01

- AR–TOOL14: "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in AR CDM project activities" – Version 04.1.
- AR–TOLL12: "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in AR CDM project activities" – Version 03.1.
- AR–TOOL16: "Tool for estimation of change in soil organic carbon stocks due to the implementation of AR CDM project activities" – Version 01.1.0.
- AR-TOOL08: "Estimation of non-CO_2 greenhouse gas (GHG) emissions resulting from burning of biomass attributable to an A/R CDM project activity" – Version 04.0.0.
- AR-TOOL15: "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity" – Version 02.0

3.2. Applicability of Methodology

The AR-ACM0003 Methodology is applicable under the following conditions:

Table 8. Methodology criteria met by the project.

Applicability Criteria	Description of how the project meets these criteria
The land subject to the project activity does not fall in wetland category.	Despite containing Permanent Preservation Areas (APP), the project does not fit into the concept of wetlands. Within the project boundaries there are no lakes, mangroves, swamps, or any areas that are permanently flooded and that could fall into the category of wetlands. In addition, Figure 03 shows that the project area is not located in wetlands.
Soil disturbance attributable to the project activity does not cover more than 10% of area in each of the following types of land, when these lands are included within the project boundary: (a) Land containing organic soils. (b) 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.	The soil at Fazenda Boa Vista is not classified as an organic soil. This is confirmed by the Soil Analysis presented in Document 09, carried out in May 2022. According to the results, the organic matter contained in the soil is 3.64 ± 0.18 dag/Kg. The land within the Project Area prior to the start of the Project was degraded pasture occupied by extensive livestock, and without receiving inputs such as listed in appendices 1 and 2 to the methodology AR-ACM003. Such grasslands under tropical conditions have less carbon compared to plantations and forest cover. Therefore, it is expected for soil organic carbon to increase more in the presence of the Project activity relative to the previous land use. Soil disturbance attributable to the Project activity does not cover more than 10%. Furthermore, the baseline of the project is defined as extensive livestock, as per the Additionality analysis and Conditions Prior to Project Initiation (see section 1.13).

The Project applies this methodology and complies with the applicability conditions of the following methodological tools:

Table 9. Methodological tools applied by the project.

Methodological tool	Applicability conditions	Project compliance
Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities.	(a) This tool is applicable for forestation of the land within the proposed project boundary performed with or without being registered as the A/R CDM project activity shall not lead to violation of any applicable law even if the law is not enforced. (b) This tool is not applicable to small-scale - scale afforestation and reforestation project activities.	(a) Forestation of the land will not lead to violation of any applicable law (see section 1.14. Compliance with Laws, Statutes and Other Regulatory Frameworks). (b) The proposed Project is not a small-scale afforestation and reforestation project as per the definitions of the CDM. Are considered small-scale projects: 1) those that are expected to result in net anthropogenic greenhouse gas removals by sinks of less than 8 kilotons of CO_2 per year; and 2) are developed or implemented by low-income communities and individuals as determined by the host Party".
Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities.	This tool has no internal applicability conditions.	The estimation of change in carbon stocks of trees and shrubs is described and accounted in the section 4.4 – Net GHG Emission Reductions and Removals.
Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities.	This tool has no internal applicability conditions. This tool makes the following assumptions: (a) Linearity of change of biomass in dead wood and litter over a period of time: Change of biomass in dead wood and litter may be assumed to proceed, on average, at an approximately constant rate between two points of time at which the biomass is estimated. (b) Appropriateness of root-shoot ratios: Root-shoot ratios appropriate for estimation of below-ground biomass from above-ground biomass of living trees are also appropriate for dead trees.	The estimation of change in dead wood and litter is accounted in the section 4.4 – Net GHG Emission Reductions and Removals.
Tool for estimation of change in soil organic carbon stocks due to the	This tool is applicable when the areas of land, the baseline scenario, and the project activity meet the following conditions:	(a) The Project areas of land do not fall into wetland category, do not contain organic soils and are not subject to any of the land management practices and application of inputs as listed in the Tables 1 and 2 of the

Methodological tool	Applicability conditions	Project compliance
implementation of A/R CDM project activities	(a) The areas of land to which this tool is applied: (i) Do not fall into wetland category. (ii) Do not contain organic soils as defined in Annex A: Glossary of the IPCC GPG LULUCF 2003. (iii) Are not subject to any of the land management practices and application of inputs as listed in the Tables 1 and 2. (b) The A/R CDM project activity meets the following conditions: (i) Litter remains on site and is not removed in the A/R CDM project activity. (ii) Soil disturbance attributable to the A/R CDM project activity, if any, is: • In accordance with appropriate soil conservation practices, e.g. follows the land contours. • Limited to soil disturbance for site preparation before planting and such disturbance is not repeated in less than twenty years.	AR-TOLL-16 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)". (b) The litter remain on site and will not be removed in any site. Besides the soil disturbance is done by following appropriate soil conservation practices and it is only for site preparation before planting. The estimation of change in SOC is accounted in the section 4.4 – Net GHG Emission Reductions and Removals.
Estimation of non-CO_2 greenhouse gas (GHG) emissions resulting from burning of biomass attributable to an A/R CDM project activity	The tool is applicable to all occurrence of fire within the project boundary. Non-CO_2 GHG emissions resulting from any occurrence of fire within the project boundary shall be accounted for each incidence of fire which affects an area greater than the minimum threshold area reported by the host Party for the purpose of defining forest, provided that the accumulated area affected by such fires in a given year is ≥5% of the project area.	No burning of biomass is attributable to the Project activity, thus Project emissions are accounted as zero (see section 4.2 – Project Emissions).
Estimation of the increase in GHG emissions attributable to	This tool is not applicable if the displacement of agricultural activities is expected to cause,	The Project activity does not cause, directly or indirectly, any drainage of wetlands or peat lands and does not expect any

Methodological tool	Applicability conditions	Project compliance
displacement of pre-project agricultural activities in A/R CDM project activity.	directly or indirectly, any drainage of wetlands or peat lands.	displacement of agricultural activities present in the Project Area before the beginning of the Project. Leakage emissions are considered insignificant and hence accounted as zero (see section 4.3 – Leakage).

3.3. Project Boundary

Table 10. Project GHG removals sources.

Source		Gas	Included?	Justification/Explanation
Baseline	Above and below ground biomass	CO_2	Yes	Above and below ground carbon stock in the baseline is presented in the isolated trees and grasses. The trees present in the Project Area before the Project was neither harvested, nor cleared, nor removed. Remaining trees didn't suffer mortality because of competition from trees planted in the project, or damage because of implementation of the Project activity and they are not inventoried along with the Project trees in monitoring of carbon stocks throughout the crediting period of the project activity. Therefore, carbon stock in the baseline can be accounted as zero.
		CH_4	No	This is not a requirement of the methodology.
		N_2O	No	This is not a requirement of the methodology.
	Dead wood, litter	CO_2	Yes	It is expected that carbon stock in these pools will not decrease due to the implementation of the Project activity.
		CH_4	No	This is not a requirement of the methodology.
		N_2O	No	This is not a requirement of the methodology.
	Soil Organic Carbon	CO_2	Yes	It is expected that carbon stock in these pools will not decrease due to the implementation of the Project activity.
		CH_4	No	This is not a requirement of the methodology.
		N_2O	No	This is not a requirement of the methodology.
	Burning of woody biomass	CO_2	No	The project proponents will not burn biomass for site preparation or forest management.
		CH_4	No	The project proponents will not burn biomass for site preparation or forest management.
		N_2O	No	The project proponents will not burn biomass for site preparation or forest management.
Project		CO_2	Yes	Carbon stock in above ground biomass is the major carbon pool subjected to Project activity and it is expected to

Source		Gas	Included?	Justification/Explanation
	Above and below ground biomass			increase due to the implementation of the Project activity. Besides, carbon stock in below ground biomass is expected to increase due to the implementation of the Project activity.
		CH_4	No	This is not a requirement of the methodology.
		N_2O	No	This is not a requirement of the methodology.
	Dead wood, litter	CO_2	Yes	Carbon stock in these pools may increase due to implementation of the Project activity.
		CH_4	No	This is not a requirement of the methodology.
		N_2O	No	This is not a requirement of the methodology.
	Soil Organic Carbon	CO_2	Yes	Carbon stock in these pools may increase due to implementation of the Project activity.
		CH_4	No	This is not a requirement of the methodology.
		N_2O	No	This is not a requirement of the methodology.
	Burning of woody biomass	CO_2	No	The project proponents will not burn biomass for site preparation or forest management.
		CH_4	No	The project proponents will not burn biomass for site preparation or forest management.
		N_2O	No	The project proponents will not burn biomass for site preparation or forest management.

The figure below shows the project boundaries and their physical locations, as well as the forest inventory plots, planting areas and the respective cultivated species (*E. urocam and E. tricross*). These are the areas considered for project activity.

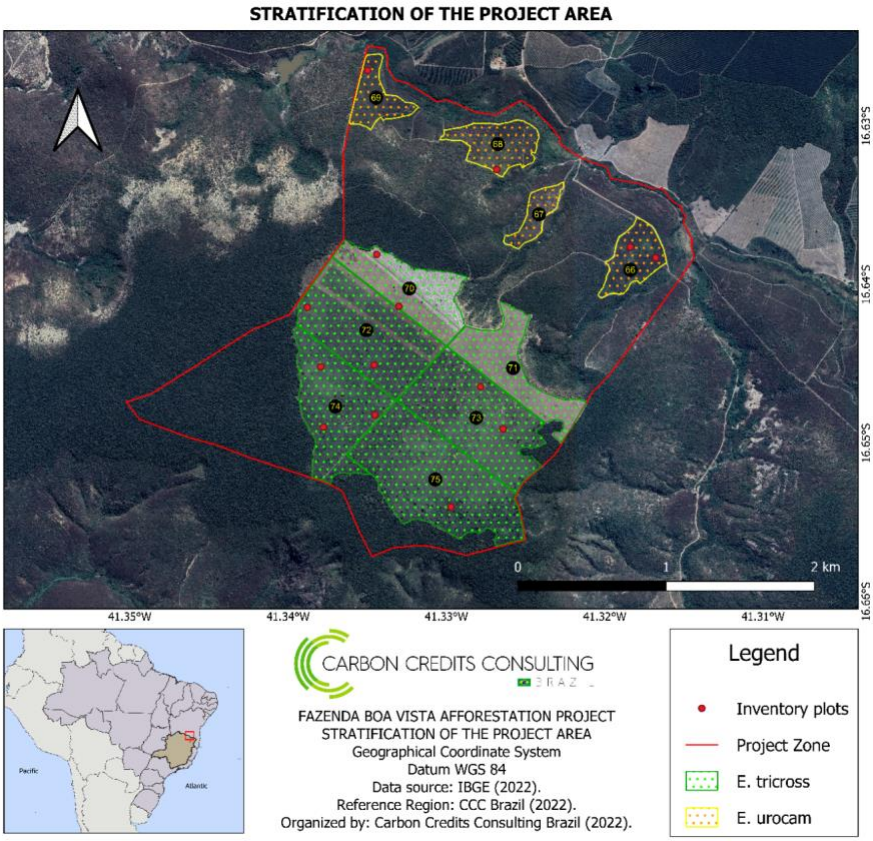


Figure 32. Stratification map of the Project Area and location of the inventory plots (Source: own elaboration, 2022. Data: IBGE, 2022).

3.4. Baseline Scenario

The baseline scenario will be justified in the next section 3.5 - Additionality, applying the A/R CDM Methodological tool AR-TOOL02 - "*Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities*" (Version 01).

The baseline scenario of the Project Area corresponds to cattle ranching in degraded pasturelands, caused by years of extensive cattle farming practiced by the previous landowners of the farm.

Before the start of the project, the land within the Project Area boundary was characterized by degraded pasture with sparse trees in landscape, as occurs in the same region and municipality.

Such pastures have historically been subject to burning activities that took place with the objective to reduce tree covers and expand pastures in order to develop extensive cattle ranching activities, according to described in section 1.13. In the Fazenda Boa Vista II, over the years, this irrational cattle ranching practice had caused a serious degradation pasture process. The most obvious signs of this process were land erosion patches and reduction in soil fertility (decreased organic matter, decreased macro and micro trace elements).

3.5. Additionality

The assessment and demonstration of additionality and the identification and justification of the baseline scenario are described using the "Combined tool to identify baseline scenario and demonstrate additionality in A/R CDM project activities (Version 02)", issued by the CDM executive board at the United Nations, which shall be hereinafter referred to as "additionality tool". The additionality tool is applicable according to the conditions presented in section 3.2.

According to the additionality tool the following steps have been applied:

STEP 0. Preliminary screening based on the starting date of the A/R project activity

STEP 1. Identification of alternative scenarios

STEP 2. Barrier analysis

STEP 3. Investment analysis (if needed)

STEP 4. Common practice analysis

3.5.1. STEP 0. Preliminary screening based on the starting date of the A/R project activity

The starting date of the Project Fazenda Boa Vista is **10-01-2020**, thus after 31-12-1999.

Table 11. Starting date evidence and justifications.

Procedure	Justification
Provide evidence that the starting date of the A/R CDM project activity was after 31 December 1999.	A Collaboration and Partnership Agreement was signed on July 10, 2019, between Brazilian Forestry Empreendimentos Florestais Ltda, and Carbon Credits Consulting S.R.L. for the elaboration of projects with the objective of producing annual VCU's. However, the project start date is considered from the planting of the seedlings, that is, **January 23, 2020**. Anyway, after December 31, 1999, as required by AR-TOOL02. The duration of the contract will be 20 years.
Provide evidence that the incentive from the planned sale of CERs was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available to third parties at, or prior to, the start of the project activity	Evidence that the incentive of the planned sale of CERs was seriously considered in the decision to proceed with the project activity is evidenced in the Collaboration and Partnership Agreement between the parties involved. The contract provides that during the period of 20 years there will be no cutting of the forest in the project area.

3.5.2. STEP 1. Identification of alternative land use scenarios to the proposed A/R CDM project activity

Sub-step 1a. Identify credible alternatives land use scenarios to the proposed project activity

In the specific area where the Project will focus, the alternative land uses in absence of the VCS forestry proposal are cattle ranching activities and the forestry activities without the VCS component. These two agricultural activities are not attractive for the Landowners.

Table 12. Alternative land use scenarios.

Scenario	Alternative Land Use Scenarios
Scenario 01: Continuation of Extensive Cattle Ranching.	The first alternative Scenario is the permanence and continuation of the extensive cattle ranching in degraded pasture lands. According to data from the Monitoring of Land Cover and Use, from the Brazilian Institute of Geography and Statistics (IBGE, 2018), for the state of Minas Gerais, the biggest changes that occurred in the period 2000 - 2018 were the reduction of grassland vegetation and the increase of agricultural areas, forestry, pasture with management and meadow mosaics and expansion of agriculture in areas occupied by pasture with management. According to IBGE (2017)[28], the state of Minas Gerais has a total of 22.1 million of bovines that represents 10.2% of the total bovine herd of Brazil. For cattle breeding is used natural grasslands and lands originally occupied by the *Cerrado*, that had suffered a process of deforestation and were transformed into pasture. This deforestation process still exists throughout Brazil. Agriculture has not been practiced in the Project Area and in the Project Zone (entire farm) in the past ten years, mainly due to the characteristics of the terrain (steep slopes). Although in Minas Gerais almost 59%[29] of the land use class is agricultural, most of this territory is covered by pasture, precisely because of terrain relief limitations. According to Mongabay (2018)[30] the annual rate of deforestation in the Brazil has continued to increase from 2001 to recent years (2018) because of several factors. The removal of *Cerrado*, to make way for cattle ranching, was the leading cause of deforestation and land degradation in this region of Minas Gerais. Cattle ranching has resulted in massive deforestation, and it is regarded as one of the main causes of fragmentation and land degradation, affecting the supply of ecosystem services and biodiversity conservation. Under the Deforestation Monitoring Program of the Brazilian Biomes of the Ministry of Environment[31], the current situation of deforestation in the *Cerrado* has been mapped (2012), based on the comparison of satellite images. According to this mapping, between 2002 and 2010, the *Cerrado* or Savannah

[28] https://biblioteca.ibge.gov.br/visualizacao/periodicos/84/ppm_2017_v45_br_informativo.pdf.

[29] IBGE – Instituto Brasileiro de Geografia e Estatística: PPM - Pesquisa da Pecuária Municipal – https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/9107-producao-da-pecuaria-municipal.html?=&t=resultados

30 https://rainforests.mongabay.com/deforestation/archive/Brazil.htm

31 CENTRO DE GESTÃO E ESTUDOS ESTRATÉGICOS - CGEE. Desertificação, degradação da terra e secas no Brazil. Brasília: Centro de Gestão e Estudos Estratégicos, 2016. 252 p. ISBN(9788555691126). http://flegt.info/en/featured/Brazil-2/

	had its cover removed by 92,710 km², which is approximately 11,588 km² deforested annually during this period. The percentage of deforested areas in 2002 was 55.7% and in 2010, rose to 60.2%. Currently, in some regions of Brazil, deforestation and irrational extensive cattle ranching are causing serious desertification phenomena. The recent research work "*Desertificação, degradação da terra e secas no Brazil*[32]", conducted by CGEE (2016) states that "the climate is not responsible for the extreme soil impoverishment", which already characterizes many regions of Brazil. It also points out that "while drought is a climatic phenomenon, desertification is a human phenomenon". The same document has also highlighted that "the deforestation of primary forests for the use of timber and the subsequent allocation of pastures for livestock rearing, associated with the lack of measures to curb soil erosion, inexorably lead to the soil impoverishment down to its ultimate "collapse". In conclusion cattle ranching is very widespread in Minas Gerais (and in Brazil as well), it is clearly established in the local economic culture but if managed in an irrational manner may cause serious repercussions on environment, land and climate.
Scenario 02: afforestation of the land within the Project boundary performed without being registered as the A/R VCS project activity.	The Scenario 02 is represented by **afforestation of the land** within the Project boundary performed without being registered as the A/R VCS project activity. Brazil has millions of hectares of planted with reforestation species as *Eucalyptus*, Pine and other species like Acacia (*Acacia mearnsii*), Seringueira (*Hevea spp.*), Teca (*Tectona grandis*), Paricá (*Schizolobium parahyba*), Araucária (*Araucaria angustifólia*) and Álamo (*Populus spp.*), used in the production of pulp, paper, architecture, furniture, energy and biomass. In addition, planted trees play an important role preventing deforestation of native forests, protecting biodiversity, and preserving the soil and springs. They recover degraded areas, and contribute to reducing GHG emissions, as they are natural carbon inventories [33]. Today these planted forests occur mostly in monoculture systems and rarely associated in two or more species. In recent years, major progress has been made by research on these agroforestry systems and it has shown many favorable results in all respects, from an economic, environmental, and social point of view. Some important functions of planted forests are: ▪ Decreased pressure on native forests; ▪ Restoration of degraded lands due to agriculture and livestock breeding; ▪ Carbon sequestration; ▪ Soil and water protection;

32 https://www.cgee.org.br/documents/10195/734063/DesertificacaoWeb.pdf

33 http://www.florestal.gov.br/snif/recursos-florestais/as-florestas-plantadas

	▪ Shorter production cycles than in temperate climate countries (because of the rapid growth of the plants due to the longer photoperiod and to the abundance of the rain water typical of the humid tropical zones); ▪ Improved product consistency, facilitating all mining and industrial processes. Planting activity is managed in accordance with sustainable forestry management principles, aiming to reduce environmental impacts and pursuing the goal to promote economic and social development of the communities surrounding the plantations. In general, these lands are initially degraded, but they suit the needs of the plantations. The plantations also allow preserving extensive areas of natural resources in places named in Brazil as Permanent Preservation Areas (APP) and Legal Reserves (RL). In Minas Gerais are reforestation areas with commercial species and according to SFB (*Serviço Florestal Brasileiro*, 2020) the total area occupied by these forest plantations is approximately 2,300,000 ha[34]. All the commercial plantations in Minas Gerais are regulated by national and regional laws and decrees presented in the item 1.14.

Outcome of Sub-step 1a:

▪ Cattle ranching.

▪ Forest plantations (without being registered as a carbon project).

Sub-step 1b. Consistency of credible alternative land use scenarios with enforced mandatory applicable laws and regulations.

According to the information in sub-step 1a all of these alternative land use scenarios are legal and enforced by mandatory applicable laws and regulations taking into account the enforcement in Brazil and Minas Gerais region region.

In summary the alternative land uses scenarios in the Project Area that are in compliance with all mandatory applicable legal and regulatory requirements are:

▪ Cattle farming: this activity is regulated by the following main laws: Law n° 11,443 - 05-01-2007[35], Law n° 12,727 - 17-10- 2012[36], Law n° 12,805, 29-04-2013[37].

▪ Forest plantations (without being registered as a carbon project): all the laws that regulate the forest plantations in Mato Grosso do Sul are presented in the § 1.14.

[34] https://blogs.canalrural.com.br/florestasa/2020/03/02/area-plantada-mg-23-milhoes-de-hectares/

[35] http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2007/Lei/L11443.htm

[36] http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12727.htm

[37] http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2013/lei/l12805.htm

Outcome of Sub-step 1b:
▪ Cattle ranching (continuation of baseline scenario).
▪ Forest plantations (without being registered as a carbon project).

3.5.3 STEP 2. Barrier analysis

Sub-step 2a. Identification of barriers that would prevent the implementation of at least one alternative land use scenarios.

Investment barrier

Forest plantations (without being registered as a carbon project) have some remarkable financial barriers which are:
▪ High concentration of costs in the first years of production.
▪ Long production cycle (minimum 7-10 years).
▪ Long wait for economic returns.
▪ Market uncertainty (in recent years the selling price of wood, coal and in Brazil has undergone strong fluctuations).
All this leads to the need to have capital to cover the initial investment of planting and fertilizing the forest and the cash flow necessary to maintain it until harvesting time (or until the prices of forest products are reasonable).

Because of these barriers who decides to invest in this specific sector usually are the big enterprises that belong to the wood supplying chain and that have significant financial availability. These big entities also had and still have greater access to credit lines and incentives at the expense of small and medium-sized rural enterprises.

Nowadays the small-medium forestry entrepreneurs are disadvantaged in working in this kind of context and in a market become an oligopoly.

The Forest Owner of the Fazenda Boa Vista Afforestation Project is a small and independent forest enterprise that has experienced these barriers, in contrast to the big companies that control the market. Thanks to VCS mechanism that could provides VERs at every verification each 2 years, he will quickly recover the invested capital for plantation, and he will have revenues to cover the maintenance costs. Obtaining VERs, the Forest Owner can overcome these barriers in a terms of revenue stream that guarantee an adequate return on investment. Also, the Project Proponent is remunerated by the Forest Owner using these carbon credits.

Outcome of Sub-step 2a:
List of barriers that may prevent one or more land use scenarios identified in the Step 1b:
▪ Investment barrier

Sub-step 2b. Elimination of land use scenarios that are prevented by the identified barriers
Reforestation without carbon revenues faces the identified barrier. Extensive cattle farming is the only land use alternative that does not face the identified barrier. Table 14 shows the list of land use scenarios and the list of the faced barrier.

Table 14: Summary of barriers faced for alternative use scenarios.

Project alternative	Barrier Faced
Cattle Farming	No barrier faced
Forest plantations (without being registered as a carbon project).	▪ Investment barrier

Forest plantations without carbon revenues face the identified investment barrier. Degraded pasture by extensive livestock is the land use alternative does not face the identified barrier. Forest plantation with carbon revenues will alleviate the identified barrier.

Outcome of Sub-step 2b:
List of land use scenarios that are not prevented by any barrier:
▪ Cattle farming

Sub-step 2c. Determination of baseline scenario (if allowed by the barrier analysis)
Apply the following decision tree to the outcome of sub-step 2b:
Is forestation without being registered as an A/R VCS project activity included in the list of land use scenarios that are not prevented by any barrier? → NO.
If NO then: Does the list contain only one land use scenario? → YES.
If YES, then the remaining land use is the baseline scenario. Continue with Step 4: Common practice test.

Applying the decision tree presented in the "*Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project* (Version 01)" is concluded that:
▪ Reforestation without being registered as an A/R VCS Project activity is included in the list of land use scenarios that are prevented by the barriers listed.
▪ Cattle farming is the baseline scenario.

3.5.4 STEP 4. Common practice analysis

A survey carried out by the Indústria Brasileira de Árvores (IBÁ – Relatorio 2019[38]), together with state associations of forest-based companies, pointed out that Minas Gerais is the state with the largest area of planted forests in Brazil. In total there are 2.3 million hectares, which represents 24% of the entire forest base in the country.

In Minas Gerais, about 96% of cultivated forests are of the eucalyptus genus, which gives rise to essential products: from charcoal to pulp and paper, panels, sheets, laminated flooring, and wood for various purposes.

These big plantations mostly belong to large industrial groups and have great advantages: lower costs due to economies of scale, greater contractual power and easy access to credit. The tactic of those forest owners (multinational company) is part of a strategic industrial plan which is called vertical integration of the supply chain (upstream integration in this specific case). The client of the forest and the forest owner itself (in most of the cases) is the same entity. These big plantations have industrial purposes (charcoal, pulp, paper) and have cutting cycles of 7-10-15 years.

The differences between these large-size forests and the Eucalyptus plantation of the Fazenda Boa Vista Afforestation Project are remarkable:

1. the Fazenda Boa Vista Forest Owner is a small entrepreneur and planted a small Eucalyptus plantation (293,61 ha).
2. He didn't had access to credit like the big companies. He had to personally finance the planting of the forest and faced investment barriers already widely described in the Sub-step 2a.
3. He doesn't have enough resources for all forest maintenance tasks for 7-10-15 years.
4. He will not cut the forest to produce timber, pulp nor charcoal, he will produce VERs.
5. The emission and the consequent sale of the VERs every 2 years will permit the maintaining of the forest throughout the Project Period.

In Mina Gerais there are no other projects of this kind registered or under development in the Verra Registry.

For all these reasons it can therefore be stated that the proposed A/R VCS project activity is not the common practice in Minas Gerais and, hence, it is additional.

3.6. Methodology Deviations

No methodology deviations are reported.

[38] https://iba.org/datafiles/publicacoes/relatorios/iba-relatorioanual2019.pdf

4. QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1. Baseline Emissions

According to the A/R Large-scale Consolidated Methodology, Afforestation and Reforestation of lands except wetlands (Version 2.0), the baseline estimation is given as follows (equation 1 of the AR-ACM0003 methodology):

$$\Delta C_{BSL,t} = \Delta C_{TREE\_BSL,t} + \Delta C_{SHRUB\_BSL,t} + \Delta C_{DW\_BSL,t} + \Delta C_{LI\_BSL,t}$$

Where:

$\Delta C_{BSL,t}$	=	Baseline net GHG removals by sinks in year *t*; t CO_2-e
$\Delta C_{TREE\_BSL,t}$	=	Change in carbon stock in baseline tree biomass within the project boundary in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO_2-e
$\Delta C_{SHRUB\_BSL,t}$	=	Change in carbon stock in baseline shrub biomass within the project boundary, in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO_2-e
$\Delta C_{DW\_BSL,t}$	=	Change in carbon stock in baseline dead wood biomass within the project boundary, in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO_2-e
$\Delta C_{LI\_BSL,t}$	=	Change in carbon stock in baseline litter biomass within the project boundary, in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO_2-e

- $\Delta C_{BSL,t} = 0$

Section 3.4 above determines the baseline scenario – or the most likely scenario in the absence of the project activity – as the continuation of the pre-project land use (unused, unforested land). This section describes of the conditions prior to the Project that fulfill the criteria presented in the A/R Methodological tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project

activities" (Version 4.1) to consider the carbon stock in trees and shrubs in the baseline as zero (Section 5.11 and 5.12 of this tool).

- $\Delta C_{TREE\_BSL,t}$=0

The change in carbon stock in baseline tree biomass within the project boundary in year t ($\Delta C_{TREE\_BSL,t}$) can be accounted as zero due to all of the following conditions:

a. The Baseline trees are neither harvested, nor cleared, nor removed throughout the crediting period of the Project activity.

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

c. The Baseline trees are not inventoried along with the project trees in monitoring of carbon stocks but their continued existence, consistent with the baseline scenario, is monitored throughout the crediting period of the Project activity.

The Baseline trees represent a very limited number, and this is explained by the fact that, as mentioned in the PD, in the Project Zone was used the fire to regenerate the pasture after the dry season. The use of fire allowed the survival of very few trees per hectare, and in particular only large trees, precisely thanks to the fact that fire was unable to reach their crowns. Being therefore tall and mature these trees have never suffered from the competition of eucalyptus plants. Even during the on-site visit, the small presence of these trees was noted. For this reason, their counting is not necessary since they have no influence on the carbon stock.

- $\Delta C_{SHRUB\_BSL,t} = 0$

Is assumed to be zero in the baseline scenario, due to the fact that changes in carbon stock of above and below ground biomass of non-tree vegetation of the degraded land in baseline scenario is not possible.

- Also $\Delta C_{DW\_BSL,t} = 0$ and $\Delta C_{LI\_BSL,t}$=0

Are assumed to be zero due to the fact that the baseline scenario was degraded pasture, where fire was often used, which did not allow accumulation of dead wood and litter.

That is why the estimated baseline emissions or removals are considered insignificant and hence accounted as zero.

4.2. Project Emissions

Whereas in the baseline scenario burning practice was widely used to burn vegetable litter, to deforest, to stimulate the regrowth of the pasture when become hard and fibrous, since January 2020 no Project activity included use of fire.

Increase in non-CO_2 GHG emissions within the Project boundary as a result of the implementation of the A/R VCS project activity, in year t. is estimated in the AR-Tool "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity" Version 4.0.0".

Considering equation 1 of this tool.

$$GHG_{E,t} = GHG_{SPF,t} + GHG_{FMF,t} + GHG_{FF,t}$$

$GHG_{E,t}$	=	Emission of non-CO_2 GHGs resulting from burning of biomass and forest fires within the project boundary in year t; t CO_2-e
$GHG_{SPF,t}$	=	Emission of non-CO_2 GHGs resulting from use of fire in site preparation in year t; t CO_2-e
$GHG_{FMF,t}$	=	Emission of non-CO_2 GHGs resulting from use of fire to clear the land of harvest residue prior to replanting of the land or other forest management. in year t; t CO_2-e
$GHG_{FF,t}$	=	Emission of non-CO_2 GHGs resulting from fire, in year t; t CO_2-e.
t	=	1.2.3. … years counted from the start of the project activity

It can be stated that:

- Fire has not been used for the preparation of the Project area and has been used in the area at least once during the period of ten years preceding the start of the A/R VCS Project activity. Thus $GHG_{SPF,t}$=0.
- Project lifetime considers activities of harvesting but does not consider the use of fire to clear the land of harvest residue or for other forest management. Thus $GHG_{FMF,t}$=0.
- Emission of non-CO_2 GHGs resulting from fire are insignificant. Thus $GHG_{FF,t}$=0.

Thus, Project Emissions ($GHG_{E,t}$) are accounted as zero.

4.3. Leakage

The Project activity did not expect any displacement of agricultural activities present in the Project Area before the beginning of the Project. At the Project Start Date (**23-01-2020**) in the Project Area there had been no cattle. The breeding of beef cattle had been sold years earlier, even when the property belonged to another owner, due to degraded pastures that no longer allowed this activity to be profitable. The last animals were sold in 2015 by the previous owner of the land. Thus, leakage emissions are considered insignificant and hence accounted as zero.

Whereas in the baseline scenario burning practice was widely used to burn vegetable litter, to deforest and to stimulate the regrowth of the pasture when become hard and fibrous, since April 2015 no Project activity included use of fire.

Increase in non-CO_2 GHG emissions within the Project boundary as a result of the implementation of the A/R VCS project activity, in year t. is estimated in the AR-Tool "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity" Version 04.0.0".

Considering equation 1 of this tool:

$$GHG_{E,t} = GHG_{SPF,t} + GHG_{FMF,t} + GHG_{FF,t}$$

$GHG_{E,t}$	=	Emission of non-CO_2 GHGs resulting from burning of biomass and forest fires within the project boundary in year t; t CO_2-e
$GHG_{SPF,t}$	=	Emission of non-CO_2 GHGs resulting from use of fire in site preparation in year t; t CO_2-e
$GHG_{FMF,t}$	=	Emission of non-CO_2 GHGs resulting from use of fire to clear the land of harvest residue prior to replanting of the land or other forest management. in year t; t CO_2-e
$GHG_{FF,t}$	=	Emission of non-CO_2 GHGs resulting from fire, in year t; t CO_2-e.
t	=	1.2.3. … years counted from the start of the project activity

It can be stated that:

- Fire has not been used for the preparation of the Project area and has been used in the area at least once during the period of ten years preceding the start of the A/R VCS Project activity. Thus $GHG_{SPF,t}$=0.
- Project lifetime considers activities of harvesting but does not consider the use of fire to clear the land of harvest residue or for other forest management. Thus $GHG_{FMF,t}$=0.
- Emission of non-CO GHGs resulting from fire are insignificant. Thus $GHG_{FF,t}$=0.

Thus, Project Emissions ($GHG_{E,t}$) are accounted as zero.

Since the acquisition of the farm, in the year 2019, until today there are no cattle on the farm. The previous owner of the property raised cattle until 2015, after which the grazing area was abandoned. Therefore, no leak management zones have been identified. Also, market leakage and activity-shifting leakage is negligible.

4.4. Net GHG Emission Reductions and Removals

4.4.1. Stratification

The stratification was defined according to the A/R Large-scale Consolidated Methodology: "Afforestation and reforestation of lands except wetlands", Version 02.0, Section 5.3.12.b: "For actual net GHG removals by sinks the stratification for ex ante estimations is based on the project planting/management plan. If natural or anthropogenic impacts (e.g. local fires) or other factors (e.g. soil type) significantly alter

the pattern of biomass distribution in the project area, then the ex post stratification is revised accordingly.".

Table 15. Project strata areas.

Stratum	Area (ha)	Starting Credit Year
Stratum A	46.66	2020
Stratum B	246.46	2020
Total Area	**293.12**	

4.4.2. Estimating carbon stock in trees at a point of time

To estimate the carbon stock in tree biomass at a point of time, the following tool was used: "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in AR-TOOL14 - AR Methodological tool Estimation of carbon stocks and change in carbon stocks of trees and shrubs in AR CDM project activities Version 4.1. According to Section 8.2 of this tool, this method is used for ex-ante estimation (projection) of carbon stock in tree biomass.

- Step 1: Tree biomass estimation

Specific equations for the cultivars of VM01 and AEC 2034 derived from age has not been found. The equations available for this species depend on allometric parameters and there is not an available database with allometric parameters that allow us to adjust a time equation to estimate the ex-ante carbon stocks.

Considering this, the annual increment in volume of wood suitable for industrial processing value (I_V) of 31.25 $m^3\ ha^{-1}\ year^{-1}$ (trunk biomass volume) for *E. urocam* (VM01) and 33.75 $m^3\ ha^{-1}\ year^{-1}$ for *E. tricross* (AEC 2034), was used in combination with other parameters derived from ANNEX 3A.1 "Biomass Default Tables for Section 3.2 Forest Land" of IPCC Good Practice Guidance for LULUCF[39], to find the total biomass per hectare.

Table 16. Average reference values for increment in volume.

AVERAGE ANNUAL ABOVE GROUND NET INCREMENT IN VOLUME IN PLANTATIONS BY SPECIES (m^3/ha/yr)		
Species	$I_V\ m^3\ ha^{-1}\ year^{-1}$	
	Range	Mean
E. grandis	15-50	32.5
E. camaldulensis	15-30	22.5

[39] IPCC Good Practice Guidance for LULUCF - Biomass Default Tables - https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Anx_3A_1_Data_Tables.pdf

E. urophylla	20-60	40

The 31.25 m^3 ha^{-1} $year^{-1}$ I_V value applied is the average between *E. urophyla* and *E. camaldulensis* indices; and 33.75 m^3 ha^{-1} $year^{-1}$ is the average I_V value between *E. camaldulensis* and *E. grandis*, and then this mean's average with *E. urophilla* I_V value.

Table 17. Calculated increment in volume for VM01.

E. urocam (VM01)	
Species	**I_V m^3 ha^{-1} $year^{-1}$**
E. urophylla	40
E. camaldulensis	22.5
Total	**31.25**

Table 18. Calculated increment in volume for AEC 2034.

E. tricross (AEC 2034)	
Species	**I_V m^3 ha^{-1} $year^{-1}$**
E. grandis	32.5
E. camaldulensis	22.5
Mean	31.25
E. urophylla	40
Total	**33.75**

To calculate the above and below-ground biomass we used the equation 3.2.5 of the IPCC "Good Practice Guidance for Land Use, Land-Use Change and Forestry" where G_{TOTAL} is the expansion of annual increment rate of above-ground biomass (G_W) to include its below ground part, involving multiplication by the ratio of below-ground biomass to above-ground biomass (often called the root-to-shoot ratio (R)) that applies to increments. This may be achieved directly where G_W data are available as in the case of naturally regenerated forests or broad categories of plantation. In case G_W data are not available, the increment in volume can be used with biomass expansion factor for conversion of annual net increment to aboveground biomass increment. Equation 3.2.5 shows the relationship:

EQUATION 3.2.5
AVERAGE ANNUAL INCREMENT IN BIOMASS

$$G_{total} = G_w \times (1 + R) \quad \text{(A)}$$

In case aboveground biomass increment (dry matter) data are used directly. Otherwise G_W is estimated using equation B or its equivalent

$$G_W = I_V \times D \times BEF_1 \quad \text{(B)}$$

In case net volume increment data are used to estimate G_W.

Where:

G_{TOTAL} = average annual biomass increment above and below-ground, tons d.m. ha^{-1} yr^{-1}

G_W = average annual aboveground biomass increment, ton^{-1} ha^{-1} yr^{-1}

R = root-to-shoot ratio appropriate to increments, dimensionless

I_V = average annual net increment in volume suitable for industrial processing, m^3 ha^{-1} yr^{-1}

D = basic wood density, tons d.m. m^{-3}

BEF_1 = biomass expansion factor for conversion of annual net increment (including bark) to aboveground tree biomass increment, dimensionless

The other parameters used in the calculation are described in the table below:

Table 19. Parameters and values used to calculate.

Cultivar	Parameter	Value	Source
VM01 – *E. urocam* (*E. urophylla* x *E. camaldulensis*)	Annual increment in volume of wood, IV (m^3/ha/year)	31.25	Source: IPCC – TABLE 3A.1.7 of ANNEX 3A.1 "Biomass Default Tables for Section 3.2 Forest Land" of IPCC Good Practice Guidance for LULUCF. Mean value between IV values of *E. urophylla* and *E. camaldulensis*.
	Wood density, D	0.60	Source: Zanne, Amy E. et al. Towards a worldwide wood economics spectrum. 2009 IPCC – Data: Global Wood Density Database. Mean value between density values of *E. urophylla* and *E. camaldulensis*.
	Biomass Expansion Factor, BEF1	1.50	Source: IPCC – TABLE 3A.1.10 of ANNEX 3A.1 "Biomass Default Tables for Section 3.2 Forest Land" of IPCC Good
	Root-shoot-ratio, R	0.45	Source: IPCC – TABLE 3A.1.8 of ANNEX 3A.1 "Biomass Default Tables for Section 3.2 Forest Land" of IPCC Good Practice Guidance for LULUCF. This is the mean value for Eucalyptus plantations when above-ground biomass is in a range of 50 to 150 t/ha.
AEC 2034 – *E. tricross* ((*E. camaldulensis* x *E. grandis*) x *E. urophylla*)	Annual increment in volume of wood, IV (m^3/ha/year)	33.75	Source: IPCC – TABLE 3A.1.7 of ANNEX 3A.1 "Biomass Default Tables for Section 3.2 Forest Land" of IPCC Good Practice Guidance for LULUCF. Mean value between IV values of *E. camaldulensis* and *E. grandis* and *E. urophylla*.
	Wood density, D	0.59	Source: Zanne, Amy E. et al. Towards a worldwide wood economics spectrum. 2009 IPCC – Data: Global Wood Density Database. Mean value between density values of (*E. camaldulensis* x *E. grandis*) x *E. urophylla*.
	Biomass Expansion Factor, BEF1	1.50	Source: IPCC – TABLE 3A.1.10 of ANNEX 3A.1 "Biomass Default Tables for Section 3.2 Forest Land" of IPCC Good
	Root-shoot-ratio, R	0.35	Source: IPCC – TABLE 3A.1.8 of ANNEX 3A.1 "Biomass Default Tables for Section 3.2 Forest Land" of IPCC Good Practice Guidance for LULUCF. This is the mean value for Eucalyptus

			plantations when above-ground biomass is in a range of 50 to 150 t/ha.

In the table below follows the calculation of the average annual increments of above and below ground biomass of the two cultivars planted. These values were used to calculate the Project's carbon stock.

Table 13. Values used in carbon stock calculations.

Cultivar	Increment wood vol (m^3/ha/year) I_V	Wood density D	Biomass Exp Fact BEF_1	Increment biomass ABOVE ton/ha/year $G_W=I_V \times D \times BEF_1$	Root - shoot ratio R	Increment biomass ABOVE+BELOW ton/ha/year $G_{TOTAL}=G_W x(1+R)$
VM01 *E. urocam* (*E. urophylla* x *E. camaldulensis*)	31.25	0.60	1.5	28.15	0.35	38.00
AEC 2034 *E. tricross* ((E.camaldulensis x *E. grandis*) x *E. urophylla*)	33.75	0.59	1.5	29.65	0.35	40.03

- Step 2: Mean tree biomass estimation

The estimation of the mean tree biomass per hectare in the tree biomass estimation strata was calculated according to the equation 13 of the AR-TOOL14:

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

Where:

B_{TREE}	=	Tree biomass in the tree biomass estimation strata; t d.m.
A	=	Sum of areas of the tree biomass estimation strata; ha
b_{TREE}	=	Mean tree biomass per hectare in the tree biomass estimation strata; t d.m. ha^{-1}

- Step 3: Mean tree carbon stock in terms of CO_2e

The estimation of the mean carbon stock in trees within the tree biomass estimation strata was calculated according to the equation 12 of the AR-TOOL14:

$$C_{TREE} = \frac{44}{12} \times CF_{TREE} \times B_{TREE}$$

Where:

C_{TREE}	=	Carbon stock in trees in the tree biomass estimation strata; t CO_2e
CF_{TREE}	=	Carbon fraction of tree biomass; t C (t d.m.)$^{-1}$
B_{TREE}	=	Tree biomass in the tree biomass estimation strata; t d.m.

- Step 4: SOC - Soil Organic Carbon

Estimations of soil organic carbon (SOC) stocks were done in accordance with the "Tool for the estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activity", Version 1.1.0". As suggested by the tool, it is assumed that the implementation of the Project activity increases the SOC content of the lands from the pre-project level to the level that is equal to the steady-state SOC content under native vegetation. The increase in SOC content in the Project scenario takes place at a constant rate over a period of 20 years from the year of planting.

The Project meets the applicability conditions of this tool in the area managed with Eucalyptus: the areas of land to which the tool is applied do not fall into wetland category, do not contain organic soils and are not subject to any of the land management practices and application of inputs listed in Tables 1 and 2 of the tool.

The initial SOC stock at the start of the Project is estimated as follows (equation 1 of the tool):

$$SOC_{INITIAL,i} = SOC_{REF,i} \times f_{LU,i} \times f_{MG,i} \times f_{IN,i}$$

Where:

$SOC_{INITIAL,i}$	=	SOC stock at the beginning of the A/R CDM project activity in stratum i of the areas of land; t C ha^{-1};
$SOC_{REF,i}$	=	Reference SOC stock corresponding to the reference condition in native lands (i.e. non-degraded, unimproved lands under native vegetation – normally forest) by climate region and soil type applicable to stratum i of the areas of land; t C ha^{-1};
$f_{LU,i}$	=	Relative stock change factor for baseline land-use in stratum i of the areas of land; dimensionless;
$f_{MG,i}$	=	Relative stock change factor for baseline management regime in stratum i of the areas of land; dimensionless;
$f_{IN,i}$	=	Relative stock change factor for baseline input regime (e.g. crop residue returns, manure) in stratum i of the areas of land; dimensionless;
i	=	1, 2, 3, … strata of areas of land; dimensionless.

The values of $SOC_{REF,i}$, $f_{LU,i}$, $f_{MG,i}$, $f_{IN,i}$, are presented in the below table.

Table 14. Parameters and factors for SOC estimation.

Parameter	Symbol	Value	Source: SOC estimation tool
Reference SOC (tC/ha)	$SOC_{REF,i}$	35	Table 3 of the tool; LAC Soils, Tropical dry.
Land use factor	$f_{LU,i}$	1	Table 6 of the tool; All permanent grassland.
Management factor	$f_{MG,i}$	0.7	Table 6 of the tool; Lands are identified as severely degraded lands.
Input factor	$f_{IN,i}$	1	Table 6 of the tool; Pasture without input of fertilizers.
SOC at the beginning of the Project activity	$SOC_{INITIAL,i}$	24.5	Calculated, with Eq. Above described

Then, the rate of change in SOC stock in Project scenario until the steady-state is reached is estimated as follows (equation 6 of the tool):

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

Where:

$dSOC_{t,i}$	=	The rate of change in SOC stock in stratum *i* of the areas of land, in year *t*; *t* C ha^{-1} yr^{-1};
$SOC_{REF,i}$	=	Reference SOC stock corresponding to the reference condition in native lands (i.e. non-degraded, unimproved lands under native vegetation – normally forest) by climate region and soil type applicable to stratum *i* of the areas of land; *t* C ha-1;
$SOC_{INITIAL,i}$	=	SOC stock at the beginning of the A/R CDM project activity in stratum *i* of the areas of land; *t* C ha^{-1};
$SOC_{LOSS,i}$	=	Loss of SOC caused by soil disturbance attributable the A/R CDM project activity, in stratum *i* of the areas of land; *t* C ha^{-1};
$t_{PREP,i}$	=	The year in which first soil disturbance takes place in stratum *i* of the areas of land;
i	=	1, 2, 3, … strata of areas of land; dimensionless.
t	=	1, 2, 3, … years elapsed since the start of the A/R CDM project activity.

In the case of the soil disturbance attributable to Project activity and for which the total area disturbed, over and above the area is less than 10% of the area of the stratum. Then the carbon loss is assumed as zero. The application of these equations results in an estimated rate of 0.53 t C ha yr-1 in soil organic carbon.

$$dSOC_{t,i} = 0.53 \quad tC/ha/year$$

The change in SOC stock for all the strata of the areas of land, in year t. is calculated as indicated in equation 8 of the tool.

$$\Delta SOC_{AL,t} = \frac{44}{12} \times \sum A_i \times dSOC_{t,i} \times 1 \text{ year}$$

Where:

$\Delta SOC_{AL,t}$	=	Change in SOC stock in areas of land meeting the applicability conditions of this tool. in year t; t CO_2-e;
A_i	=	The area of stratum i of the areas of land; ha;
$dSOC_{t,i}$	=	SOC stock at the beginning of the A/R CDM project activity in stratum *i* of the areas of land; *t* C ha^{-1};
i	=	1, 2, 3, … strata of areas of land; dimensionless.

$\Delta SOC_{AL,t} = 564{,}26$	*tCO_2e/year*

- Step 5: Dead Wood

Estimations were done in accordance with the AR-TOOL12 "*Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*", Version 03.0". Values of the conservative default-factors expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass was selected according to the guidance provided in the methodological tool.

Project Proponent won't make sampling-based measurements for estimation of C stock in dead wood for all strata to which this default method is applied, the carbon stock in dead wood was estimated as is indicated in equation 9 of the tool, using the default values presented in:

$$C_{DW,i,t} = C_{TREE,i,t} \times DF_{DW}$$

Where:

$C_{DW,i,t}$	=	Carbon stock in dead wood in stratum i at a given point of time in year t; t CO_2e
$C_{TREE,i,t}$	=	Carbon stock in trees biomass in stratum i at a point of time in year t. as calculated in the tool "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*"; t CO_2e
DF_{DW}	=	Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass; per cent

i = 1. 2. 3. … biomass estimation strata within the Project boundary

t = 1. 2. 3. … years elapsed since the start of the A/R Project activity

Parameter	Description	Value	Comments
DF_{DW}	Conservative default factor expressing carbon stock in **dead wood** as a DW percentage of carbon stock in tree biomass.	**2%**	Biome: tropical Elevation: <2,000 m Precipitation: <1,000 mm·yr^{-1}

$$C_{DW,i,t} = 401.16 \quad tCO_2e/year$$

- Step 6: Litter

Estimations were done in accordance with the *tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"* (Version 3.0). Values of the conservative default-factors expressing carbon stock in litter as a percentage of carbon stock in tree biomass was selected according to the guidance provided in the methodological tool.

If the Project proponent will not make sampling based measurements for estimation of C stock, they will use the default method described in tool.

For all strata to which this default method is applied, the carbon stock in litter will be estimated as is indicated in equation 15 of the tool, using the default values presented in:

$$C_{LI,i,t} = C_{TREE,i,t} \times DF_{LI}$$

$C_{LI,i,t}$ = Carbon stock in litter in stratum i at a given point of time in year t; t CO_2e.

$C_{TREE,i,t}$ = Carbon stock in trees biomass in stratum i at a point of time in year t. as calculated in tool "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*"; t CO_2e.

DF_{LI} = Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass; percent.

i = 1. 2. 3. … biomass estimation strata within the Project boundary.

t = 1. 2. 3. … years elapsed since the start of the A/R Project activity.

Parameter	Description	Value	Comments
DF_{LI}	Default factor for the relationship between carbon stock in **litter** and carbon stock in living trees.	**2%**	Biome: tropical Elevation: <2,000 m Precipitation: <1,000 mm yr^{-1}

$C_{LI,i,t} = 401.16$ *tCO2e/year*

- Step 7: Change in the carbon stocks in Project

Change in the carbon stocks in Project $\Delta C_{P,t}$, occurring in the selected carbon pools in year t were calculated according to the equation 3 of AR-ACM0003 methodology:

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

Where:

$\Delta C_{P,t}$ = Change in the carbon stocks in project, occurring in the selected carbon pools, in year *t*; t CO_2-e

$\Delta C_{TREE\_PROJ,t}$ = Change in carbon stock in tree biomass in project in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO_2-e

$\Delta C_{SHRUB\_PROJ,t}$ = Change in carbon stock in shrub biomass in project in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO_2-e

$\Delta C_{DW\_PROJ,t}$ = Change in carbon stock in dead wood in project in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO_2-e

$\Delta C_{LI\_PROJ,t}$ = Change in carbon stock in litter in project in year *t*, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO_2-e

$\Delta SOC_{AL,t}$ = Change in carbon stock in SOC in project, in year *t*, in areas of land meeting the applicability conditions of the tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities", as estimated in the same tool; t CO_2-e

- Step 8: Actual net GHG removals by sinks

The actual net GHG removals by sinks are calculated using equation 2 of the AR-ACM0003 methodology as follows:

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

Where:

$\Delta C_{ACTUAL,t}$ = Actual net GHG removals by sinks, in year *t*; t CO_2-e

$\Delta C_{P,t}$ = Change in the carbon stocks in project, occurring in the selected carbon pools, in year *t*; t CO_2-e

$GHG_{E,t}$ = Increase in non-CO_2 GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year *t*, as estimated in the tool "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity"; t CO_2-e

Since the Project Emissions are accounted to zero (see item 3.3), $\Delta C_{ACTUAL,t} = \Delta C_{P,t}$.

- Step 9: Net Anthropogenic GHG removals by sinks

According to the equation 5 of the AR-ACM0003 methodology, the net anthropogenic GHG removals by sinks shall be calculated as follows:

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

Where:

$\Delta C_{AR-CDM,t}$ = Net anthropogenic GHG removals by sinks, in year *t*; t CO_2-e

$\Delta C_{ACTUAL,t}$ = Actual net GHG removals by sinks, in year *t*; t CO_2-e

$\Delta C_{BSL,t}$ = Baseline net GHG removals by sinks, in year *t*; t CO_2-e

LK_t = GHG emissions due to leakage, in year *t*; t CO_2-e

Given that $\Delta C_{BSL,t}$ can be considered as zero according to item 3.2 and LK_t can be considered as zero according to item 3.4, then $\Delta C_{AR-CDM,t} = \Delta C_{ACTUAL,t}$.

The period over which the long-term average GHG benefit is calculated is 30 years. The total GHG benefit, calculated as the sum of stock changes along the 30-year period, is **637,087 tCO_2e**, with an average annual GHG emission of **21,236 tCO_2e**.

Table 15. Estimated GHG removals for the project lifetime.

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
	$\Delta C_{BSL,t}$	$\Delta C_{ACTUAL,t}$	LK_t	$\Delta C_{AR-CDM,t}$
1	0,00	21.424,32	0,00	21.424,32
2	0,00	21.424,32	0,00	21.424,32
3	0,00	21.424,32	0,00	21.424,32
4	0,00	21.424,32	0,00	21.424,32
5	0,00	21.424,32	0,00	21.424,32
6	0,00	21.424,32	0,00	21.424,32
7	0,00	21.424,32	0,00	21.424,32
8	0,00	21.424,32	0,00	21.424,32
9	0,00	21.424,32	0,00	21.424,32
10	0,00	21.424,32	0,00	21.424,32
11	0,00	21.424,32	0,00	21.424,32
12	0,00	21.424,32	0,00	21.424,32
13	0,00	21.424,32	0,00	21.424,32
14	0,00	21.424,32	0,00	21.424,32
15	0,00	21.424,32	0,00	21.424,32
16	0,00	21.424,32	0,00	21.424,32
17	0,00	21.424,32	0,00	21.424,32
18	0,00	21.424,32	0,00	21.424,32
19	0,00	21.424,32	0,00	21.424,32
20	0,00	21.424,32	0,00	21.424,32
21	0,00	20.860,07	0,00	20.860,07

22	0,00	20.860,07	0,00	20.860,07
23	0,00	20.860,07	0,00	20.860,07
24	0,00	20.860,07	0,00	20.860,07
25	0,00	20.860,07	0,00	20.860,07
26	0,00	20.860,07	0,00	20.860,07
27	0,00	20.860,07	0,00	20.860,07
28	0,00	20.860,07	0,00	20.860,07
29	0,00	20.860,07	0,00	20.860,07
30	0,00	20.860,07	0,00	20.860,07

5. MONITORING

5.1. Data and Parameters Available at Validation

Data / Parameter	Mean annual Increment in Volume (I_V)
Data unit	$m^3\ ha^{-1}\ yr^{-1}$
Description	It is the average annual net increment in volume suitable for industrial processing and it's used to calculate the average annual above-ground biomass increment (Gw) with the Equation 3.2.5 of IPCC "*Good Practice Guidance for LULUCF*".
Source of data	Table 3A.1.7 of ANNEX 3A.1 of IPCC "*Good Practice Guidance for LULUCF*".
Values applied	**31.25** This is the mean value between I_V values of *E. urophylla* and *E. camaldulensis*. **33.75** This is the mean value between I_V value of *E. urophylla* and the mean I_V value between *E. camaldulensis*. and *E. grandis*.
Justification of choice of data or description of measurement methods and procedures applied	As the forest plantation has not been measured yet, data reported in the literature was used for estimation of GHG removals. Once the monitoring is developed this value will be replaced for the actual growth of the forest.

Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	**Wood density (D)**
Data unit	t/m^3
Description	Wood density is used to convert the commercial tree volume into tree biomass.
Source of data	Table 3A.1.9-2 of ANNEX 3A.1 of IPCC "*Good Practice Guidance for LULUCF*".
Values applied	**0.60** This is the mean value between wood density values of *E. urophylla* and *E. camaldulensis*. **0.59** This is the mean value between wood density value of *E. urophylla* and the mean wood density value between *E. camaldulensis* and *E. grandis*.
Justification of choice of data or description of measurement methods and procedures applied	As used to determine mean annual increment in volume, average wood density of each single species was calculated to estimate the clones wood density value.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	**Biomass Expansion Factor (BEF_1)**
Data unit	Dimentionless
Description	Ratio of aboveground oven-dry biomass to oven-dry biomass of the steam.
Source of data	Table 3A.1.10 of ANNEX 3A.1 of IPCC "*Good Practice Guidance for LULUCF*".
Values applied	**1.50**
Justification of choice of data or description of	The above-ground tree biomass is calculated using the BEF_1 in connection to Increment in Volume data using Equation 3.2.5 of

measurement methods and procedures applied	the IPCC "Good Practice Guidance for LULUCF". The BEF_1 value for Tropical Climatic Zone and Broadleaf Forest Type was used.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	**Root-to-shoot Ratio (R)**
Data unit	Dimentionless
Description	Ratio of the weight of the roots to the weight of the top of the tree. Used for below-ground tree biomass estimation.
Source of data	Table 3A.1.8 of ANNEX 3A.1 of IPCC "*Good Practice Guidance for LULUCF*".
Values applied	**0.35 (stratum 2)** and **0.45 (stratum 1)**
Justification of choice of data or description of measurement methods and procedures applied	Below-ground biomass is usually estimated with this factor as below-ground sampling is destructive and expensive. This is the mean value for Eucalyptus plantations when above-ground biomass is in a range of 50 to 150 t/ha.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	**Carbon Fraction (CF)**
Data unit	tC/d.m.
Description	Biomass proportion corresponding to carbon. CF is used to convert biomass to carbon.
Source of data	AR-TOOL 14 "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*", Version 04.2.
Values applied	**0.47**
Justification of choice of data or description of measurement methods and procedures applied	The default value from the AR-TOOL 14 was used.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.

Comments	

Data / Parameter	CO_2e
Data unit	tCO_2/tC
Description	Factor applied to convert the tree carbon sequestered to tree CO_2e sequestered.
Source of data	IPCC default value.
Values applied	44/12
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	Reference SOC ($SOC_{REF,i}$)
Data unit	$tC\ ha^{-1}$
Description	Reference Soil Organic Carbon stock corresponding to the reference condition in native lands (i.e. non-degraded, unimproved lands under native vegetation, normally forest) by climate region and soil type applicable to stratum i of the areas of land.
Source of data	Table 3 of "*Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*", Version 01.1.0.
Values applied	35
Justification of choice of data or description of measurement methods and procedures applied	Default reference of $SOC_{REF,\ i}$ for Tropical Dry Climate Region and Low Activity Clay Soils.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	Land Use Factor ($f_{LU,i}$)
Data unit	Dimentionless
Description	Relative stock change factor for baseline land use in stratum i of the areas of land.
Source of data	Table 6 of "*Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*", Version 01.1.0.
Values applied	1
Justification of choice of data or description of measurement methods and procedures applied	Default reference of $f_{LU,i}$ assigned to all permanent grassland.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	Management Factor ($f_{MG,i}$)
Data unit	Dimentionless
Description	Relative stock change factor for baseline management in stratum i of the areas of land.
Source of data	Table 6 of "*Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*", Version 01.1.0.
Values applied	0.70
Justification of choice of data or description of measurement methods and procedures applied	Default reference of $f_{MG,i}$ assigned to lands severely degraded.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	Input Factor ($f_{IN,i}$)
Data unit	Dimentionless

Description	Relative stock change factor for baseline input regime (e.g. crop residue returns, manure) in stratum i.
Source of data	Table 6 of "*Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*", Version 01.1.0.
Values applied	1
Justification of choice of data or description of measurement methods and procedures applied	Default reference of $f_{IN,i}$ assigned to all grassland without input of fertilizers.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	DF_{DW}
Data unit	%
Description	Conservative default factor expressing carbon stock in dead wood as a DW percentage of carbon stock in tree biomass.
Source of data	AR-TOOL12 "*Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*", Version 03.0, Section 8.
Values applied	2
Justification of choice of data or description of measurement methods and procedures applied	Default value for Tropical Biome, Elevation < 2000 m, Precipitation < 1000 mm yr^{-1}.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	DF_{LI}
Data unit	%
Description	Default factor for the relationship between carbon stock in litter and carbon stock in living trees.

Source of data	AR-TOOL12 "*Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*", Version 03.0, Section 8.
Values applied	2
Justification of choice of data or description of measurement methods and procedures applied	Default value for Tropical Biome, Elevation < 2000 m, Precipitation < 1000 mm yr^{-1}.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	**A**
Data unit	ha
Description	Project area
Source of data	Monitoring of strata and stand boundaries, using Geographical Information Systems (GIS).
Values applied	**293.12**
Justification of choice of data or description of measurement methods and procedures applied	
Purpose of Data	Definition of Project spatial boundaries, estimation of GHG Emission Reductions and Removals.
Comments	

Data / Parameter	A_i
Data unit	Ha
Description	Area of stratum i
Source of data	Projected planting areas by stratum and specie (see Table 05)
Values applied	See Table 05

Justification of choice of data or description of measurement methods and procedures applied	The stratification for *ex post* estimations is based on the actual implementation of the project planting/management plan. It may even be necessary to evaluate the possibility of re-stratifying the project boundary, according to the development of the stand models. It would enable the merging of several strata in order to optimize the costs and improving the outcomes in forest inventories. New strata could be defined too.
Purpose of Data	Estimation of GHG Emission Reductions and Removals.
Comments	

5.2. Data and Parameters Monitored

Data / Parameter	A
Data unit	ha
Description	Project area (planted area)
Source of data	Survey databases of each polygon that is part of the Project and is under the control of the Project participants.
Description of measurement methods and procedures to be applied	Field measurement: the area shall be delineated either on the ground, using GPS or from geo-referenced remote sensing data.
Frequency of monitoring/recording	At the beginning of site preparation, in final establishment of the Project and each time a verification is conducted.
Value applied	293.12
Monitoring equipment	GPS equipment (precision 1- 5 m) and Remote Sensing data.
QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.
Purpose of data	Calculation of Project Removals.
Calculation method	Measurement

Comments	

Data / Parameter	A_i
Data unit	ha
Description	Area of stratum i
Source of data	Monitoring of strata and stand boundaries is done employing Geographical Information Systems (GIS) allowing the integration of data from different sources (including GPS coordinates and Remote Sensing data).
Description of measurement methods and procedures to be applied	Field measurement: the area shall be delineated either on the ground, using GPS or from geo-referenced remote sensing data.
Frequency of monitoring/recording	Each time a verification is conducted.
Value applied	See Table 05
Monitoring equipment	GPS equipment (precision 1- 5 m) and Remote Sensing data.
QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.
Purpose of data	Calculation of Project Removals.
Calculation method	Measurement
Comments	The stratification for *ex post* estimations is based on the actual implementation of the project planting plan. It may even be necessary to evaluate the possibility of re-stratification of the project boundary, according to the development of the stand models, as it would enable the merging of several strata in order to optimize the costs and improving the outcomes in forest inventories.

Data / Parameter	$A_{p,i}$
Data unit	m^2
Description	Area of sample plot in stratum i

Source of data	Field measurement.
Description of measurement methods and procedures to be applied	Standard Operating Procedures (SOPs) prescribed under the national forest inventory are applied. In the absence of these, SOPs from published handbooks or from the IPCC GPG LULUCF 2003 are applied.
Frequency of monitoring/recording	Each time a verification is conducted.
Value applied	Ex-post
Monitoring equipment	Measuring tape and GPS.
QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.
Purpose of data	Calculation of Project Removals.
Calculation method	
Comments	Sample plot location is registered with a GPS and marked on the Project map.

Data / Parameter	n
Data unit	Dimentionless
Description	Number of plots to be established in the Project Area.
Source of data	Estimation
Description of measurement methods and procedures to be applied	This value will be estimated based on a pre-sampling developed in the project area before monitoring.
Frequency of monitoring/recording	Each time a verification is conducted.
Value applied	Ex-post
Monitoring equipment	
QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied.

Purpose of data	Estimate the number of plots needed for complying with a sampling error less than 15%.
Calculation method	5.3.2 – Methods for measuring (number of sample plots)
Comments	

Data / Parameter	n_b
Data unit	Dimentionless
Description	Number of plots to be established in each stratum.
Source of data	Estimation
Description of measurement methods and procedures to be applied	This value will be estimated using the total number of plots and the area of each stratum.
Frequency of monitoring/recording	Each time a verification is conducted.
Value applied	Ex-post
Monitoring equipment	
QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied.
Purpose of data	Estimate the number of plots needed for complying with a sampling error less than 15%.
Calculation method	5.3.2 – Methods for measuring (number of sample plots)
Comments	

Data / Parameter	Plot Location
Data unit	Lat/Long
Description	Localization of each sampling plots
Source of data	Data field sampling plots
Description of measurement methods	Measured with GPS.

and procedures to be applied	
Frequency of monitoring/recording	Each time a verification is conducted.
Value applied	
Monitoring equipment	GPS
QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks or from the IPCC GPG LULUCF 2003 are applied.
Purpose of data	Calculation of Project Removals.
Calculation method	
Comments	Sample plot is registered with GPS and marked in the Project map.

Data / Parameter	DBH
Data unit	cm
Description	Trees diameter at breast height
Source of data	Field measurements in sampling plots
Description of measurement methods and procedures to be applied	Typically measured 1.3 m above-ground. Measure all the trees above some minimum DBH in the permanent sample plots that result from the Project activity.
Frequency of monitoring/recording	Each time a verification is conducted.
Value applied	Ex-post
Monitoring equipment	Measuring tape
QA/QC procedures to be applied	Personnel involved in the field measurement work should be fully trained in field data collection. Field measurements shall be checked by a qualified person to correct any errors in techniques.
Purpose of data	Calculation of Project Removals.
Calculation method	
Comments	5.3.2 – Methods for measuring (Tree (DBH) measurement) provides the detailed procedures to be applied.

Data / Parameter	H
Data unit	m
Description	Trees total height
Source of data	Field measurements in sampling plots
Description of measurement methods and procedures to be applied	Measure the height of 40% of the trees in the permanent sample plots that result in the Project activity.
Frequency of monitoring/recording	Each time a verification is conducted.
Value applied	Ex-post
Monitoring equipment	Clinometer, measuring tape
QA/QC procedures to be applied	Personnel involved in the field measurement work should be fully trained in field data collection. Field measurements shall be checked by a qualified person to correct any errors in techniques.
Purpose of data	Calculation of Project Removals.
Calculation method	See monitoring plan
Comments	5.3.2 – Methods for measuring (Tree height measurement) provides the detailed procedures to be applied.

Data / Parameter	T
Data unit	Year
Description	Period elapsed between two successive estimations of carbon stock in trees and shrubs.
Source of data	Verification records.
Description of measurement methods and procedures to be applied	See the monitoring plan
Frequency of monitoring/recording	Each time a verification is conducted.

Value applied	Ex-post
Monitoring equipment	N.A.
QA/QC procedures to be applied	N.A.
Purpose of data	Calculation of Project Removals.
Calculation method	T = t2 - t1
Comments	If the two successive estimations of carbon stock in trees 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 September in year t2), then a fractional value is assigned to T.

5.3. Monitoring Plan

The aim of the Monitoring Plan is to record and monitor several different parameters in order to ensure that the project followed the methodology in the validated and registered PD and that the inputs to the carbon calculations are both accurate and up to date.

Monitoring stage comprised gathering information, performing calculations, and making estimations of GHG removals. In this monitoring event, it is ensured that commonly established principles of forest inventory and management were put into practice. All data gathered as part of the monitoring plan was archived electronically and in hard copies and will be kept at least for two years after the end of the crediting period.

The following organizational and operational structure is responsible for the project's monitoring forest inventories and are divided into three basic departments: General management, Technical management, and Operators.

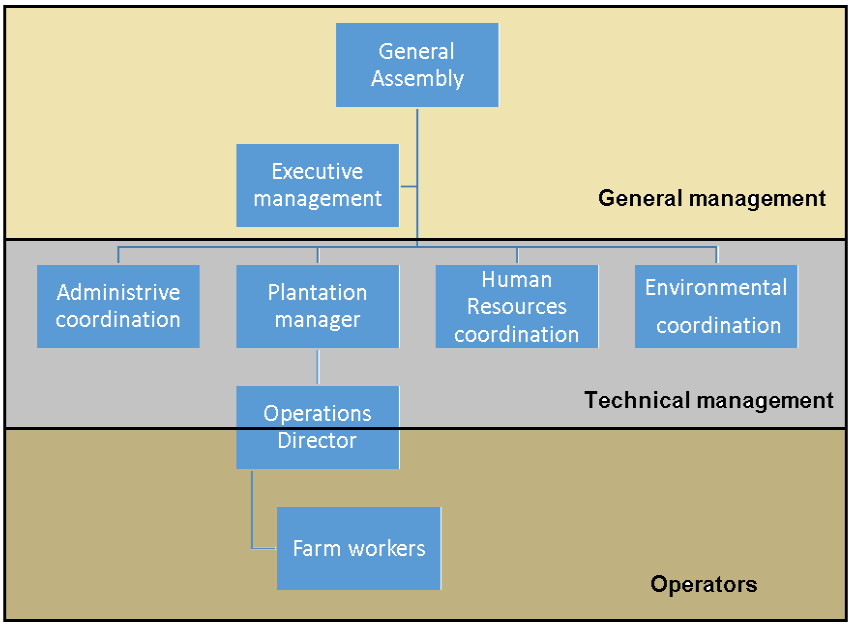


Figure 33. Operational and Management Structure.

Field crew will be composed of CCC Brazil technical team and unskilled farm workers. The crew that will carry out the data collecting for all the parameters mentioned in item 5.2 - Data and Parameters Monitored will follow a standard operational procedure that addresses the assessment of the timber growing stock (volumes) on forest plantations. CCC Brazil has already this SOP, which will be applied by its monitoring team.

5.3.1. Forest Inventory Standard Operational Procedure

According to the methodology applied, monitoring covers carbon stock changes for aboveground biomass. Belowground biomass will be estimated indirectly based on aboveground biomass measurements and litter and dead wood will be estimated as a percentage of carbon stock in tree biomass.

Project boundaries are defined at the beginning of project activity and the same geographic boundary will be maintained, according to VCS AFOLU requirements. However, the project area will be permanently monitored along the crediting period, since new strata may be created due to after potential disturbances effects (pests, droughts, fire). Geographic coordinates are established recorded and archived. A Geographic Information System was implemented for the validation and verification.

The purpose of this SOP is to set guidelines for field measurements in forest inventory conducted with the aim of measuring aboveground biomass, developed for projects in homogeneous forest stands (forest plantations).

The data collection phase is of great importance to generate good results, regardless of the type of scientific research. For this, it is important to list beforehand the equipment needed for field data

collection. It is also necessary to verify equipment and/or material use condition and, if possible, calibrate it, thus avoiding non-sampling errors. Below is the list of equipment needed for the forest inventory.

Field Equipment

Table 16. Equipment to be used by field data collection team.

Material/Equipment	Quantity	Utility
Diametric or measure tape	2	Measure trees diameter (if a DBH tape is used). If a tape measure is used, note that this measurement is the CBH (circumference at breast height - 1.30m from the ground)
30 meters measuring tape	1	Delimitation of plot size
Marking or signaling tape	Various	Delimitation of plots' center
Clipboard	2	Assistance in recording information
Field Forms	Various	Notes on the inventoried individual's information
Pens and markers	Various	Registration of field information
Backpacks	2	Transport of small materials and field forms
GPS device	1	Collection of plot coordinates or relevant points of interest
Clinometer	1	Measurement of tree heights
PPE	Various	Safety (helmet, boots, leg brace etc.)
First Aid kit	Various	Provision of first aid in case of minor accidents

Sampling

To calculate the number of samples, first the need of stratification will be evaluated considering the area characteristics. This evaluation will be done visually inspecting the forest, using images (from drones,

satellites, and others). Then a pilot inventory will be carried out in a number of samples determined based on field experience and regional characteristics.

With the data from the pilot inventory the sampling error (Equation 1) will be calculated based on the standard error. The expected error should be lower than 15%, therefore if this value is higher, more samples will be collected. Equation 2 will be used to determine the exact number of samples.

$$E(\%) = \frac{t * S_{\bar{y}}}{\bar{X}} * 100 \qquad \text{Equation 1}$$

where:

E (%) = sampling error.

t = the sample statistic from the t-distribution for the 95% confidence level. t is usually set at 2 as sample size is unknown at this stage.

Sy = standard error.

X = mean of carbon values calculated for the plots.

$$n = \frac{(\sum_{h=1}^{3} N_h * s_h)^2}{\frac{N^2 * E^2}{t^2} + (\sum_{h=1}^{3} N_h * s_h^2)} \qquad \text{Equation 2}$$

where:

E = allowable error or the desired half-width of the confidence interval.

t = the sample statistic from the t-distribution for the 95% confidence level.

Nh = number of sampling units for stratum h.

n = number of sampling units in the population (n = ∑ Nh).

sh = standard deviation of stratum h.

Plot Allocation

The plots will be systematically located with a random start in each stratum to avoid subjective choice of plot locations. Geographical Information Systems (GIS) tools will be used to generate random points withing the project area layer. The number of points will be determined for each project, therefore is variable.

Each point will be given a number and will be identified by stand (or parcel) to facilitate the location in the field. For each plot the geographic position (GPS coordinate), administrative location and stratum code will be recorded and archived.

From those random points the coordinates X and Y will be generated and used to locate the points in the field with the help of a GPS device, where the central points of each plot will be registered as waypoints. A local member of the field crew will help to access the plots easily. When arriving to the plot central point, a permanent marker (a wooden stake marked on the bottom with red paint) will be placed exactly on the central point of the plot. In cases where obstacles obstructed such exact location (due to tree, rock, river, etc.) the permanent marker was placed as close as possible to the central point of the plot. Marker location data will be collected in a form or as a waypoint using the GPS.

This procedure needs to be executed in the first monitoring year, while in the subsequent years the plots will already been stablished, therefore its only necessary to locate them in the field using a GPS looking for the marker.

Tree Measuring Procedures

To determine the aboveground biomass stock there will be used allometric equations using DBH and H as independent variables. Therefore, the measurement of those two variables will be done based in the following.

To start the measurements, the rolling measuring tape will be stretched from the central marker, and the most east tree line need to be identified and the trees in that line measured, starting with the most north tree (tree number 1). After all the trees in the first line being measured, the measurement will begin in the next line using an opposite direction, therefore making a zigzag pattern. A tree will only be considered inside the plot if at least half of the steam is inside the circular plot. Details can be observed in figure below.

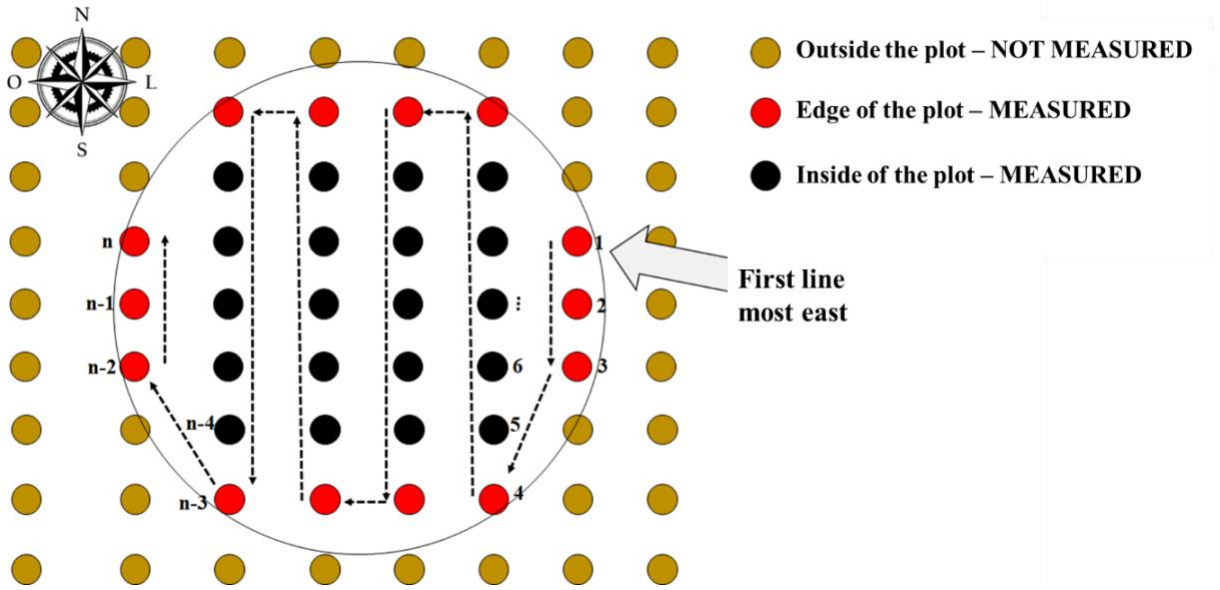


Figure 34. Plot measurement scheme (Source: own elaboration, 2021).

Diameter at breast height - DBH

All trees inside the plot with over 2.5 cm of DBH will have their CBH (Circumference at Breast Height – 1.3m) measured and recorded in a field form. The CBH will be later used to calculate the DBH (DBH = CBH/π). Trees will be marked with red paint at breast height (1.30 m above ground) in order to identify the measuring point for further measurements.

Tree CBH will be measured over bark at breast height, 1.3 m above the ground, as shown below figure, except for cases mentioned in the following. Measurement will be carried out with the help of a measuring tape (tape which diameter unit is in centimeters).

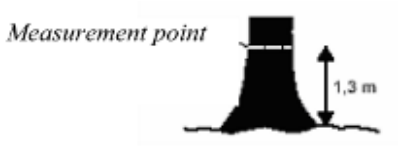


Figure 35. Position for diameter measurement at breast height in flat terrain.

Some preventive measures need to be considered:

- Measuring tape will be kept in a position that perpendicularly cut the tree axis at 1.3 m.
- The person measuring will make sure that the tape is not twisted, and it is well stretched around the tree in a perpendicular position to the stem. Nothing should prevent a direct contact between the tape and the bark of the tree to be measured.
- On inclined terrain, CBH measurement at 1.3 m will be taken from an uphill position.

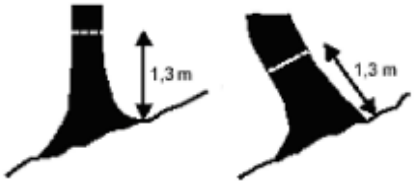


Figure 36. DBH measurement position for a tree on steep terrain.

- For forked trees, according to the point where the fork divides the stem, the following methodology will be applied. If the fork begins (the point where the core is divided) below 1.3 m height, each stem having the diameter required (≥10 cm) will be considered as a single tree stem and measured. Diameter measurement of each stem will be taken at 1.3 m height. If the fork began at 1.3 m or a little higher, the tree will be counted as one single tree. The diameter measurement in the later case will be carried below the fork intersection point, just below the bugle that could influence the DBH.

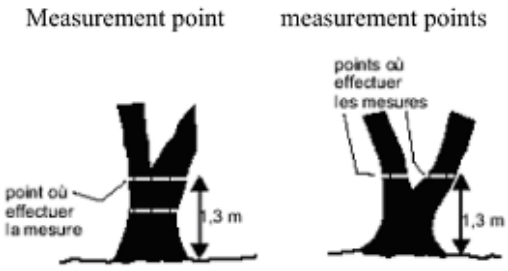


Figure 37. Measurement points at fork trees.

• Trees with irregular stem at 1.3 m, like trees with bulges, wound, hollows and branches, etc. at breast height, will be measured just above the irregular point, where the irregular shape does not affect the stem.

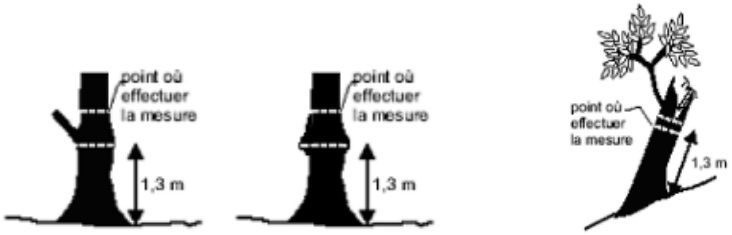


Figure 38: DBH measurement position for a tree with branch enlargement at 1.3 m and for other trees.

Height - H

In each forest inventory approximately 40% of the trees will have their heights measured and recorded. Height measurements will be taken with a clinometer. With the data collected a hypsometric model will be constructed for the area. This model will be used for estimating the tree height of the remaining trees.

The process for measuring three heights will be the following:

• Choice of a point away from the tree where the person in charge of the measurement can clearly observe the crown of the tree.

• Measure of the horizontal distance (D) from the point chosen, to the base of the tree. Slope corrections must be applied when needed. The distance value will be added in the clinometer.

• Observation of the height: the operator must observe the base and the top of the tree (figure below), the digital clinometer will automatically calculate the height to be recorded in the field form.

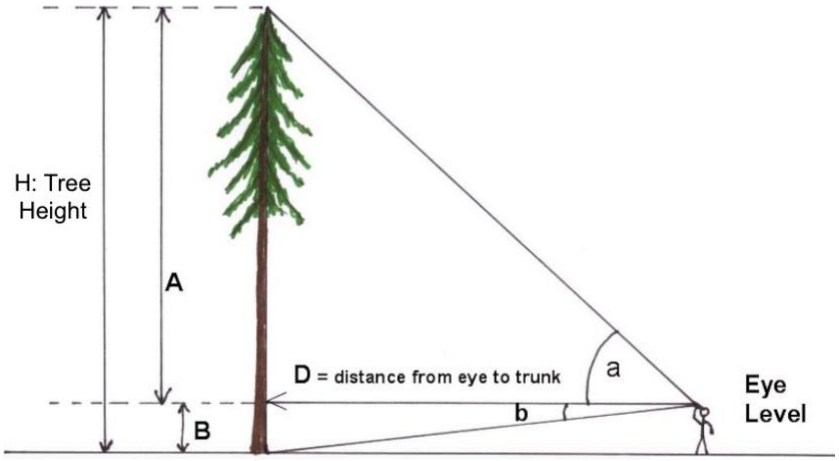


Figure 39: Measuring method for tree height.

The selected trees for height measurement should represent the diameter distribution of the forest, but the selection can be done visually. Biforked trees and trees with some kind, some distortion, or with abnormal CBH (either very small or large) should not be measured for height.

Data Record

The field data will be recorded using specifically designed forms and reported on paper and digital format. Figure shows the field form that should be used for collecting the data in each plot (a) and one example of form used in past (b). The collected data, the calculations and the related outputs will be stored with dedicated backup in multiple copies.

a)

Project		**Date**	
Location		**Pearson 1**	
Stratum		**Pearson 2**	
Plot/Parcel		**GPS (lat/long)**	

Measurements

Tree	Line	CBH (cm)	H (m)	OBS

b)

Projeto:
Parcela: 12
GPS:

	Árvore	DAP	Altura total
1F	1	54	
	2	13	9,3
	3	40	
	4	18	12,1
	5	52	
2F	6	41	
	7	52	
	8	48	
	9	61	
	10	65	
	11	48	
	12	64	
3F	13	55	

Figure 40. Example of field form. a) new form, b) old model.

Due to the long length of the project and the speed at which technology changes, data archiving will be an essential component. Data will be archived in several forms and copies of all data will be provided to each project participant. Original copies of the field measurement (data sheets and electronic files) will be stored in a secure location. Copies will be stored in a dedicated and safe place (preferably offsite) of all data analysis and models, the final estimate of the amount of carbon sequestered, any GIS products, and the measuring and monitoring reports.

Electronic copies of all data and reports will be updated periodically and converted to any new format required by future software or hardware. A Project participant involved in the field measurements will be assigned to implement this updating. The data collected shall be archived for a period of at least two years after the end of the last crediting period of the Project activity.

5.3.2. Quality Assurance and Quality Control (QA/QC)

The personnel involved in the measurement of carbon pools will be fully trained in field data collection and analysis. SOPs were developed for each step of the field measurements and followed so that measurements are comparable over time. If different interpretations of the SOPs exist among the field team, they will be jointly revised to ensure clearer guidance. This procedure will be repeated during the field data collection.

The proper entry of data into the data analyses spreadsheets is required to produce reliable carbon estimates. All data sheets will include a "Team members" field. Communication between all personnel involved in measuring and analyzing data will be used to resolve any apparent anomalies before final analysis of the monitoring data can be completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot will not be used in the analysis. Expert judgment and comparison with independent data will be used to ensure data results are in line with expectations.

Table 17. QA/QC activities and procedures.

QC activity	Procedures
Check that assumptions and criteria for the selection of emission factors and other estimation parameters are documented.	1 Cross-check descriptions of project activity, emission factors and other estimation parameters with information on source and sink categories and ensure that these are properly recorded and archived.
Check for transcription errors in data input and reference.	2 Confirm that bibliographical data references are properly cited in the internal documentation. 3 Cross-check a sample of input data (either measurements or parameters used in calculations) for transcription errors.
Check that removals are calculated correctly.	4 Reproduce a representative sample of removal calculations. 5 Selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy.

Check that parameter and units are correctly recorded and that appropriate conversion factors are used.	6	Check that units are properly labeled in calculation sheets.
	7	Check that units are correctly carried through from beginning to end of calculations.
	8	Check that conversion factors are correct.
	9	Check that temporal and spatial adjustment factors are used correctly.
Check the integrity of database files.	10	Confirm that the appropriate data processing steps are correctly represented in the database.
	11	Confirm that data relationships are correctly represented in the database.
	12	Ensure that data fields are properly labeled and have the correct design specifications.
	13	Ensure that adequate documentation of database and model structure and operation are archived.
Check that the movement of inventory data among processing steps is correct	14	Check that removal data are correctly reported when preparing summaries.
	15	Check that removal data are correctly transcribed between different intermediate products.
Check that uncertainties in removals are estimated or calculated correctly.	16	Check that qualifications, assumptions and expert judgments are recorded.
	17	Check that calculated uncertainties are complete and calculated correctly, following the methodology requirements.
Undertake review of internal documentation	18	Check that there is detailed internal documentation to support the estimates and to enable reproduction of the emission, removal estimates.
	19	Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review.
	20	Check integrity of any data archiving arrangements of outside organizations involved in inventory preparation.
Check time series consistency.	21	Check for temporal consistency in time series input data for biomass estimation.
	22	Check for consistency in the algorithm/method used for calculations throughout the time series.
Undertake completeness checks	23	Confirm that estimates are reported for all years.
	24	Check that known data gaps that may result in incomplete emissions estimates are documented and treated in a conservative way.

Compare estimates to previous estimates.	25	Current inventory estimates should be compared to previous estimates, if available. If there are significant changes or departures from expected trends, re-check estimates and explain the difference.

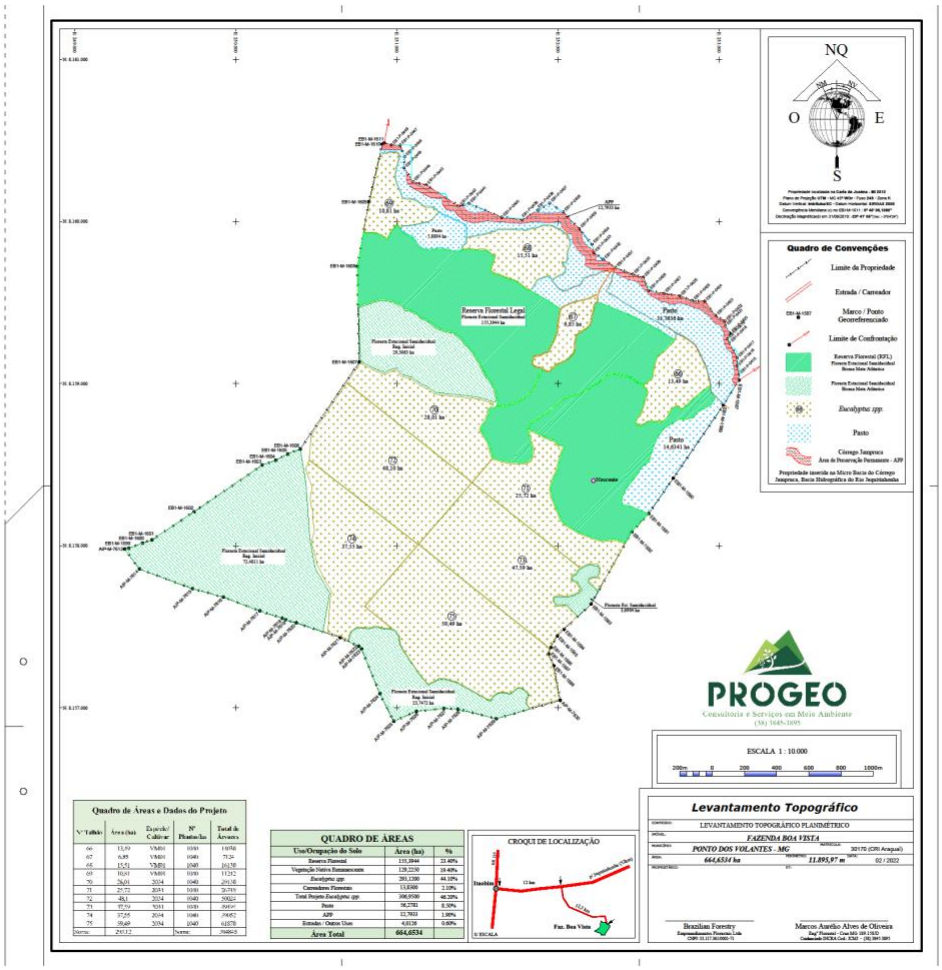
Non-conformances

Any non-conformances associated with documentation and reporting are dealt with by CCC Brazil technical team, while non-conformances in the field are dealt with by monitoring field data collection team.

CCC Brazil technical team provide advises to monitoring team to make sure the monitoring activities are in line with relevant requirement, and review the monitoring results before each verification, in case any non-conformances founded, technical team will ask the monitoring team to take necessary compensation measures (redo some of the monitoring activities or calculation) until all the non-conformances been corrected.

6. APPENDIX

Appendix 1: Project Zone Map



Appendix 2: Map of Consolidated Area Under the terms of the New Forest Code (Law No. 12,651/12)