SYMBIOSIS CONTINUOUS COVER FOREST PROJECT

Document Prepared by Symbiosis Investimentos e Participações S.A.

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The **Symbiosis Continuous Cover Forest Project** is a reforestation project, proposed by Symbiosis Investimentos e Participações S.A., a company focused on the restoration of degraded land through the sustainable commercial reforestation of the Atlantic Rainforest native species.

The Atlantic Forest Biome (Mata Atlântica) is the most degraded in Brazil, with less than 12.4% left of its original area and very fragmented. The degradation started in the 16th century in the State of Bahia. Today, the same pattern of destruction is seen in the Amazon Biome, which started in the 70's after the Atlantic Rainforest resources were depleted. In addition, plant breeding with the Atlantic Forest native species has not been implemented before.

The project is designed as a grouped project, with an initial instance at "Fazenda Novo Horizonte", in Trancoso District of Porto Seguro municipality, Bahia State. It is situated in close proximity to Symbiosis headquarters, where seedlings are produced and where research and development activities take place. Novo Horizonte has a total area of 669.28 ha, from which 236.50 consist of the initial project area. Symbiosis expansion plans for the grouped project are focused on the South of Bahia, with projected 50,000 hectares of mixed species reforestation, in addition to 15,000 hectares of ecological restoration and 5,000 hectares of agroforestry with cocoa (also a relevant product of the region).

The land use in the region is predominantly focused on pasture, which is also the prior condition of all of the regions where the grouped project is intended to occur.

The project is designed for a 30-year crediting period, in which 24,311,876 tCO_2e will be reduced/removed.

Audit Type	Period	Program	VVB Name	Number of years
Validation/ Verification	Validation only.	VCS	Earthood	-
Total	-	-	-	-

1.2 Sectoral Scope and Project Type

The project falls under Sectoral Scope 14 – Agriculture, Forestry and Other Land Use" (AFOLU), specifically at the project category "Afforestation, Reforestation and Revegetation" (ARR). It refers to a grouped project, starting with one initial instance.

1.3 Project Eligibility

According to the VCS Standard, v4.4, the scope of the VCS Program includes "Project activities supported by a methodology approved under an approved GHG program, unless explicitly excluded". The proposed Project was developed under the CDM approved methodology AR-ACM0003: "Afforestation and reforestation of lands except wetlands", v.2.0.[1], which use is currently authorized by VCS.

Regarding specific AFOLU requirements, the Project is classified as "ARR", an eligible category under the VCS Program (see the VCS Standard, v.4.4. Appendix 1 – "Eligible AFOLU Project Categories").

Table 1 sets out more specific AFOLU eligibility criteria and how they were met for the Project case.

Table 1 – Demonstration of Project Eligibility.

Eligibility Requirement	Explanation for the Project Case
Activities that convert native ecosystems to generate GHG credits are not eligible under the VCS Program. Evidence shall be provided in the project description that no ARR project areas were cleared of native ecosystems to create GHG credits (e.g., evidence indicating that clearing occurred due to natural disasters such as hurricanes or floods). Such proof is not required where such clearing or conversion took place at least 10 years prior to the proposed project start date.	No conversion of native ecosystem has happened over the last 10 years. Land use comparison maps between 2010-2020 is presented in Section 1.13.
Activities that drain native ecosystems or degrade hydrological functions to generate GHG credits are not eligible under the VCS Program. Evidence shall be provided in the project description that	No activities that drain native ecosystems or degrade hydrological functions were carried out. The project location does not include any type of wetland, as per land use demonstration and soil classification presented in Section 1.13.

[1] AR-ACM0003, v.2.0, available at: https://cdm.unfccc.int/filestorage/T/H/N/THNRJC15IW4K89UBE6DFZYX23OVP0Q/EB75_repan30_AR-ACM0003_ver02.0.pdf?t=dWN8cnN3czQ4fDC_yHZibzEDgG_J16ZHcV

Eligibility Requirement	Explanation for the Project Case
any AFOLU project area was not drained or converted to create GHG credits. Such proof is not required where such draining or conversion took place prior to 1 January 2008.	
Eligible ARR activities are those that increase carbon sequestration and/or reduce GHG emissions by establishing, increasing, or restoring vegetative cover (forest or non-forest) through the planting, sowing, or human-assisted natural regeneration of woody vegetation.	The proposed activities increase carbon sequestration through the restoration of degraded land by sustainable reforestation practices, using mostly native species, combined with accessory species (details in Section 1.11).
Eligible ARR projects may include timber harvesting in their management plan. The project area shall not be cleared of native ecosystems within the 10-year period prior to the project start date.	The proposed activities including timber harvesting through a management plan, for commercial purposes.

1.4 Project Design

This is a grouped Project, starting with one Project Activity Instance (PAI-01) – Fazenda Novo Horizonte. Different PAIs will be included in the Project during its crediting period.

Eligibility Criteria

Every PAI included at the Grouped Project must meet the following eligibility criteria:

1) Be located within the Project Zone, which is specified in Section 1.12 (Atlantic Rainforest biome, Bahia State, within specific delimitation).
2) Have a start date that is the same as or later than the grouped project start date (September 9th, 2020).
3) The duration of the crediting period for each PAI may start and finish within the Grouped Project crediting period (Section 1.9).
4) Provide evidence of project ownership, aligned with the documents provided by PAI-01.
5) Meet all VCS and specific methodology requirements, as set in Section 1.3 and Section 3.1.
6) Have consistent baselines (degraded land) and additionality criteria adopted for the Grouped Project (as per Section 3.5).
7) Follow the same management models and technologies defined for the initial instance and projected for the following instances.

1.5 Project Proponent

Organization name	Symbiosis Investimentos e Participações S.A.
Contact person	Bruno Mariani
Title	Director
Address	Parque Coqueiro Alto, 2900/2950 – Trancoso – Porto Seguro – BA – Brazil
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1.6 Other Entities Involved in the Project

Organization name	BMO Radicle - Brazil
Role in the project	Project Developer
Contact person	Roberto Strumpf Susian Martins Elisa Guida Lucas Aidar
Title	Brazil Office Director Technical Team
Address	Rua Cônego Eugênio Leite, 933 – Cj. 131 – Pinheiros – São Paulo – Brazil – CEP: 05414-010
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1.7 Ownership

The Project ownership is demonstrated as per the VCS Standard v4.4 requirements:

> "Project ownership arising by virtue of a statutory, property or contractual right in the land, vegetation or conservational or management process that generates GHG emission reductions and/or removals (where the project proponent has not been divested of such project ownership)."

For the first PAI – “Fazenda Novo Horizonte” – two land titles proof ownership of Symbiosis over the total area:

- Land Title number 41,986/2017, which states that Symbiosis is the rightful owner of an approximately 502 hectares parcel of “Novo Horizonte I”.
- Land Title number 41,987/2017, which states that Symbiosis is the rightful owner of an approximately 166 hectares parcel of “Novo Horizonte I”.

These two documents collectively cover the entire area of Fazenda Novo Horizonte.

To include other PAIs in the Grouped Project, ownership must be demonstrated according to the following conditions:

- New areas owned by Symbiosis, with clear supporting documentation.
- New areas owned by other participants of the Grouped Project, but with contractual rights established with Symbiosis.

The Land Titles are available for consultation at **Appendix 1.**

1.8 Project Start Date

According to the VCS Standard, v4.4, the project start date of an AFOLU project is: “the date on which activities that led to the generation of GHG emission reductions or removals are implemented”.

The Project start date is September 09, 2020, when planting first commenced on the plots included in the Project Area at Fazenda Novo Horizonte. This information can be found in the operational records maintained by Symbiosis.[2]

1.9 Project Crediting Period

The Project Crediting Period is 30 years, starting on September 9, 2020 until September 8, 2050.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Considering the possibility of the grouped project, the project scale aims at large project.

Project Scale	
Project	
Large project	x

[2] File: Implantação NH 2020.xlsx

Year	Estimated GHG emission reductions or removals (tCO_2e)
01 (Sep 09, 2020 – Sep 08, 2021)	741
02 (Sep 09, 2021 – Sep 08, 2022)	1,023
03 (Sep 09, 2022 – Sep 08, 2023)	2,313
04 (Sep 09, 2023 – Sep 08, 2024)	4,670
05 (Sep 09, 2024 – Sep 08, 2025)	23,789
06 (Sep 09, 2025 – Sep 08, 2026)	55,155
07 (Sep 09, 2026 – Sep 08, 2027)	108,122
08 (Sep 09, 2027 – Sep 08, 2028)	195,834
09 (Sep 09, 2028 – Sep 08, 2029)	414,770
10 (Sep 09, 2029 – Sep 08, 2030)	627,814
11 (Sep 09, 2030 – Sep 08, 2031)	937,933
12 (Sep 09, 2031 – Sep 08, 2032)	1,323,943
13 (Sep 09, 2032 – Sep 08, 2033)	1,603,047
14 (Sep 09, 2033 – Sep 08, 2034)	1,993,630
15 (Sep 09, 2034 – Sep 08, 2035)	2,291,145
16 (Sep 09, 2035 – Sep 08, 2036)	2,422,426
17 (Sep 09, 2036 – Sep 08, 2037)	2,436,596
18 (Sep 09, 2037 – Sep 08, 2038)	2,368,963
19 (Sep 09, 2038 – Sep 08, 2039)	2,260,874
20 (Sep 09, 2039 – Sep 08, 2040)	1,679,095
21 (Sep 09, 2040 – Sep 08, 2041)	1,324,602
22 (Sep 09, 2041 – Sep 08, 2042)	1,024,255
23 (Sep 09, 2042 – Sep 08, 2043)	630,340
24 (Sep 09, 2043 – Sep 08, 2044)	1,098,101
25 (Sep 09, 2044 – Sep 08, 2045)	1,128,384
26 (Sep 09, 2045 – Sep 08, 2046)	104,745
27 (Sep 09, 2046 – Sep 08, 2047)	(484,334)

Year	Estimated GHG emission reductions or removals (tCO_2e)
28 (Sep 09, 2047 – Sep 08, 2048)	(630,385)
29 (Sep 09, 2048 – Sep 08, 2049)	(911,604)
30 (Sep 09, 2049 – Sep 08, 2050)	275,888
Total estimated ERs	**24,311,876**
Total number of crediting years	30
Average annual ERs	**810,396**

1.11 Description of the Project Activity

The Project main objective is to restore degraded land of Brazil's most impacted biome, the Atlantic Rainforest. This will be carried out through commercial reforestation activities, planned and executed by Symbiosis, initially at the first PAI – "Fazenda Novo Horizonte", a 669.28 hectares farm, located at Trancoso, a district of Porto Seguro Municipality, Bahia State, Brazil (see Section 1.12 – Project Location).

The Brazilian Atlantic Rainforest is the most threatened biome in the country. It is present in 17 Brazilian States, where around 72% of the population is located. Unfortunately, only 12.4% of its original area is still standing (SOS Mata Atlântica, 2021[3]). For that reason, activities that can preserve and restore the Brazilian Atlantic Forest are fundamental, to improve biodiversity protection, life quality, climate regulation, hydrological regulation, among other environmental services.

Symbiosis is a Brazilian company located at the District of Trancoso, founded in 2008, with the goal to implement the multispecies reforestation activity, as a strategy to implement sustainable wood harvesting and reduce the pressure that has been impacting regions as the Amazon, for example, which has seen the highest deforestation rates in the last decade.

Since its foundation, Symbiosis has started the implementation of reforestation activities, combining native and exotic species, initially at two other areas – Fazenda Symbiosis and Fazenda Água Branca, both located withing the same region. However, due to the high costs associated with the sustainable wood production, especially with native species, Symbiosis aims at scaling its production capacity, trough carbon finance. The first instance - "Fazenda Novo Horizonte" (PAI-01) - will serve as a model for the whole grouped project that is projected in its expansion plan.

[3] SOS Mata Atlântica. Relatório Anual 2021. Available at: https://cms.sosma.org.br/wp-content/uploads/2022/07/Relatorio_21_julho.pdf

Symbiosis is organized according to the chart in **Figure 1.**

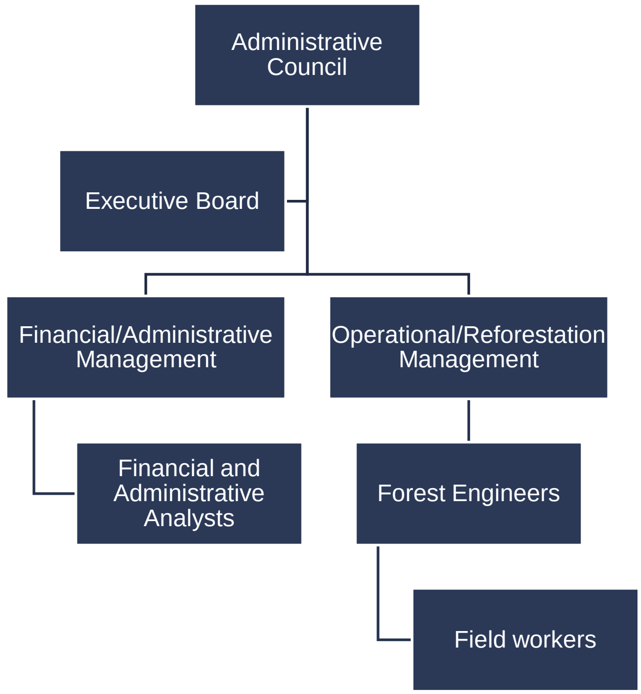


Figure 1 - Symbiosis organizational chart.

Symbiosis headquarters is the central location for all management activities, including administration offices, a nursery, and Research and Development facilities dedicated to genetic enhancements.

The operational activities that make up the Symbiosis model are currently being implemented at Fazenda Novo Horizonte and are projected to be expanded into the additional areas that will comprise the grouped project. These activities are described as follows.

<u>**Seedling Production**</u>

The activities carried out in the Symbiosis headquarters, before the actual forest implementation, are the ones described in

Table *2*.

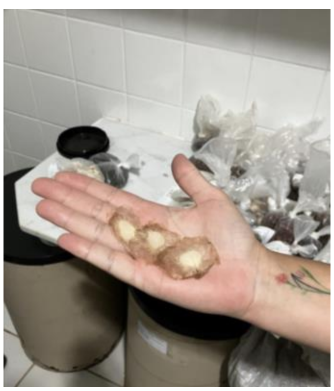
Table 2 - Seedling production process description.

Seedling	Seeds can come from suppliers or can be enhanced seeds from the internal Symbiosis process, which consists of the selective breeding of individuals. The seeds are stored at Symbiosis headquarters, at a room with temperature and humidity control. The seedling process

	itself happens at the nursery area, when they are planted with a substratum and move to the greenhouse, for the initial rooting process.
Capping	Consists of the process of transferring the seedlings to tubes, when they begin to grow.
Selecting	Before moving to next stage (sun exposition), the seedlings with better development are selected.
Adapting	The final phase of the growth, when the seedlings are exposed to more intense sun exposition and temperature conditions, in order to adapt to the situation that will be found in the field.

Other than seeding, Symbiosis also carries out the grafting technology, mostly for the cloning and genetic improvement process, which is consolidated, so far, for the species called “louro pardo” (popular name) -*Cordia thricotoma* (latim name). The plants (cuttings) that come through the grafting procedure also move to the adapting phase before planting in the field.

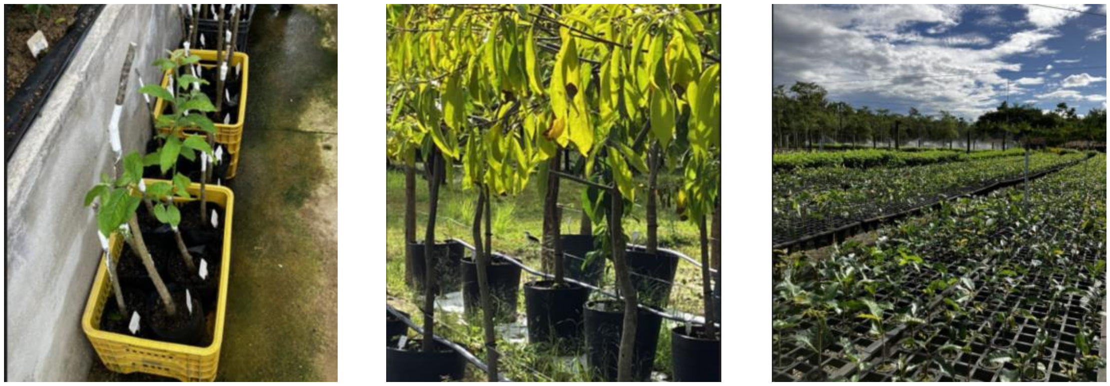
It is important to note that Symbiosis maintains quality control of all its production, selecting and recovering their seedlings, in order to guarantee the best conditions of each plant before the actual planting.



(a) Example of an enhanced seed.

(b) Indirect seeding.

(c) Mini cuttings - capping and selecting.



(d) Grafting. (e) Grafted seedlings. (f) Adaption of seedlings.

Figure 2 - Photos of the seedling production process.

<u>Implementation and Maintenance of the Production Forests</u>

Symbiosis has a defined implementation process, which is applied to Fazenda Novo Horizonte and will continue to be applied for the next PAIs of the grouped project. It consists of the steps presented in **Figure 3.**

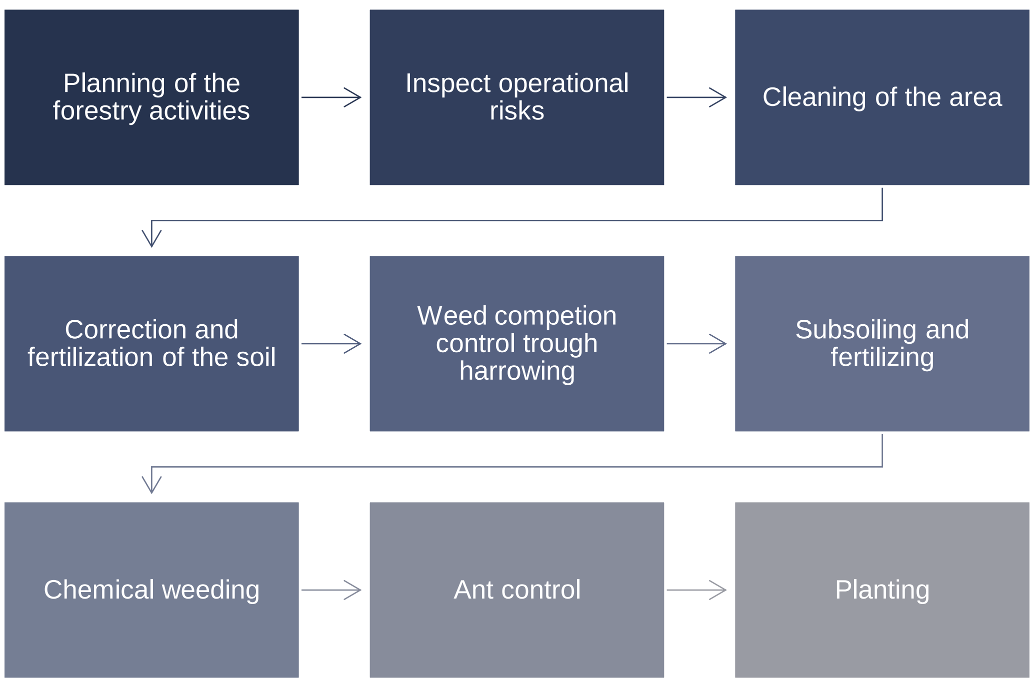


Figure 3 - Steps for the implementation of forestry areas.

Each new area is assessed, in order to understand its original conditions and what forestry activities can be implemented, depending on climate conditions and the history of the area. Operational risks are analyzed, such as the presence of stumps, holes, waste, bees and wasps, etc. If the area is cleared for operation, the cleaning process can start, when the machinery is used to level the area and remove part of the waste. The initial correction of the soil is carried out through liming, followed by subsoiling. After that, the remaining weed is controlled through harrowing, followed by the application of chemical inputs for weed control and ant control.

It is important to note that tilling activities are only projected for the implementation period of the areas and are not considered in maintenance or enrichment activities.

Some records of the above-mentioned operations are shown in **Figure 4**.

(a) Cleaning. *(b) Soil correction.* *(c) Subsoiling.*

(d) Transport of the seedlings. *(e) Planting.* *(f) Planting.*

Figure 4 - Records of the implementation operations.

As for the planting, maintenance and harvesting plans, the following is planned:

<u>**Planting Models**</u>

The Symbiosis planting scheme, which is applied to PAI-01, follows a mixed species plantation (**Figure 5.**) A total of 1388 trees per hectare are planted and the species used are divided into two groups: Accessory (555 trees/ha exotic – faster growth - light demanding) and End (833 trees/ha native – slower growth - shade tolerant). The combination of each stand considers the use of one accessory specie, one native leguminous end specie, plus three different end specie. Each tree line is planted with a single specie to improve operations, inventory monitoring and harvesting.

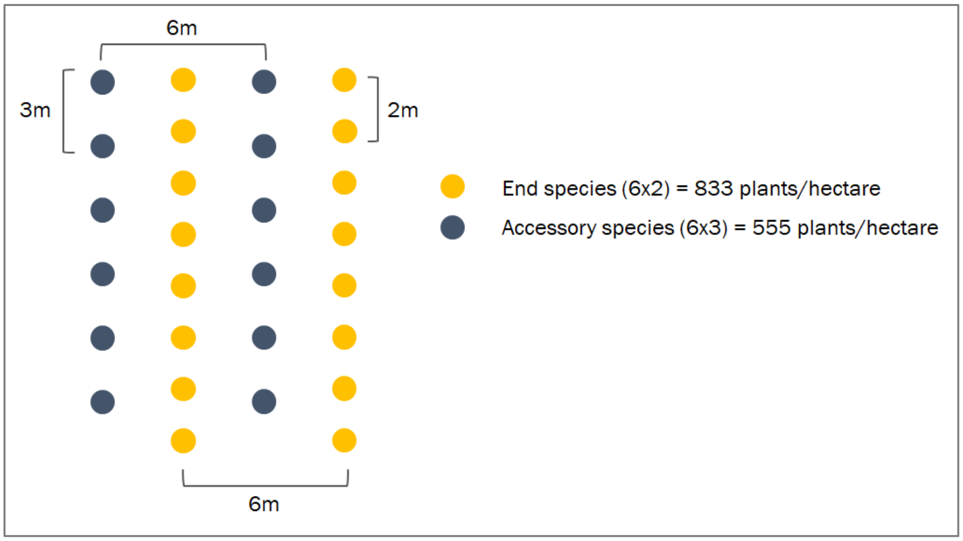


Figure 5 - Planting scheme illustration.

Each plot receives different species lines, varying between a line of native (end species) and a line of exotic (accessory species). The distance between plants is smaller for the end species lines (2 meters), while is larger for the accessory lines (3 meters). There is a 3 meters distance between each line. **Figure 6** presents an example of that arrangement.

Figure 6 - Example of tree lines in a plot.

The higher density of the native species is to mitigate the risks of mortality and productivity due to the little knowledge of these genetic materials until they undergo the complete program of genetic improvement. The native species adopted in the project are the listed in **Table 3.**

Table 3 - Native species used by Symbiosis.

Scientific name	Popular name
Plathymenia foliolosa Benth	Vinhático
Cordia Trichotoma	Louro Pardo

Scientific name	Popular name
Zeyheria tuberculosa	Ipê Felpudo
Dalbergia nigra	Jacarandá
Parapiptadenia pterosperma	Angico
Bowdichia virgilioides	Sucupira
Astronium graveolens	Aderne
Cariniana legalis	Jequitibá Rosa
Handroanthus serratifolius	Ipê Ovo de Macuco

All the plots of PAI-01 respect the presented arrangement, apart from specific areas where there is a different soil condition. Parts of the plots present a sandy soil type, in which the proposed species do not adapt. For that reason, for that specific parts, two different species will be used, because they are more suitable for that soil type: boleira (*Joannesia princeps*) and jenipapo (*Genipa americana*).

A spacing of 3 x 3 meters will be used for sandy areas, resulting in a density of 1,111 plants per hectare. Planting is scheduled to take place in late 2023. An example of a sandy area can be found in **Figure 7**. Additionally, **Figure 8** displays seeds of both jenipapo and boleira, which are currently being cultivated at the Symbiosis seedling production site.

Figure 7 - Example of a sand area.

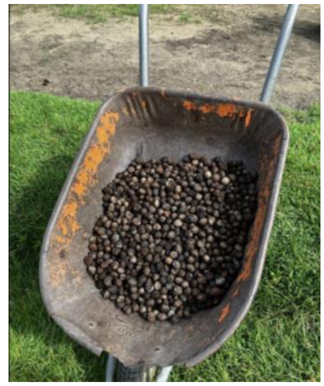



Figure 8 - Seeds of jenipapo and boleira.

For PAI-01, most of planting activities have already occurred, since September 9, 2020, which is the project start date. There are some plantings remaining for some of the parcels, especially for the sandy areas or where replanting will be still carried out. **Table 4** provides a summary of each parcel ID, the year of planting or replanting, and the corresponding total area. An illustration of the parcels can be found in **Figure 9.**

Table 4 - PAI-01 production plots description.

Parcel ID	Planting or Replanting Year	Area (ha)
FLP-01	2022	5.85
FLP-02	2022	15
FLP-07	2022	5.545
FLP-10	2020	7.99
FLP-11	2020	0.47
FLP-12A	2020	3.71
FLP-12B	2020	0.77
FLP-12C	2020	0.72
FLP-13	2020	0.47
FLP-14	2020	0.89
FLP-15	2020	18.92
FLP-16	2020	0.33
FLP-17	2023	1.29

Parcel ID	Planting or Replanting Year	Area (ha)
FLP-18A	2023	6.565
FLP-18B	2023	2.17
FLP-19	2021	11.47
FLP-20B	2023	16.02
FLP-21	2023	15.43
FLP-22	2023	23.55
FLP-23	2020	1.63
FLP-25	2020	7.73
FLP-27	2020	19.4
FLP-28	2020	13.64
FLP-29	2020	21.09
FLP-30	2020	14.67
FLP-31A	2020	0.66
FLP-31B	2020	2.37
Sand	2023	18.15
Total		**236.50**

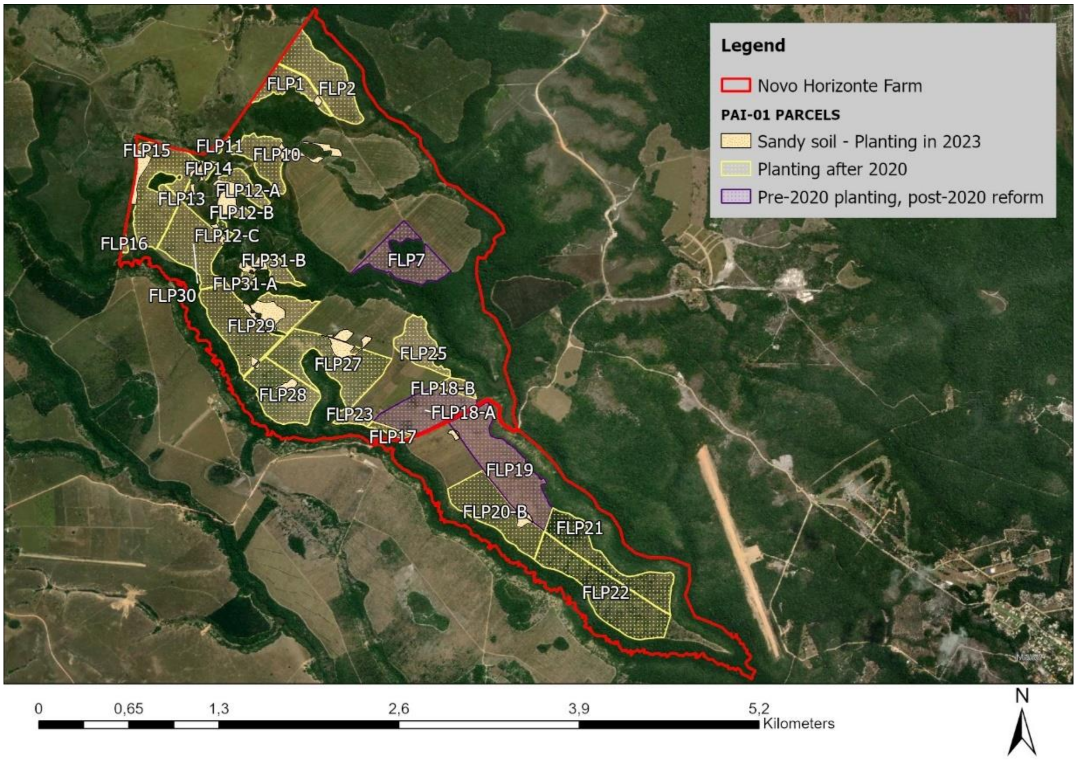


Figure 9 - Map of the PAI-01 parcels.

<u>Thinning and Harvesting Planning</u>

Following planting, sustainable management for commercial purposes is planned to be carried out at various intervals for accessory and native species, each with its own distinct cycles. Table 5 illustrates the management model for the combined systems, including initial thinning and projected enrichment activities.

Table 5 - Continuous Forest Cover management model.

Implementation	End - Native	Accessories - Exotic
Density	833	555
1st Thinning Age	12	12
2nd Thinning Age	18	18
3rd Thinning Age	30	
Final Harvest Date	36	24
Mean Annual Increment - MAI (m^3/ha/year)	**8.7**	**8.1**
Total Production (m^3)	**312.2**	**195.5**

Implementation	End - Native	Accessories - Exotic
1st Thinning Production	27.0	26.2
2nd Thinning Production	66.5	67.1
3rd Thinning Production	90.9	
Final Harvest Production	**127.8**	**102.2**
Enrichment – Continuous Forest Cover		**Only End - Native**
Enrichment	**At Year**	**Density**
1st Enrichment	24	555
2nd Enrichment	36	555
3rd Enrichment	60	555
Harvest	**At Year**	**Volume (m^3)**
1st Thinning Age	36	24.7
2nd Thinning Age	42	50.9
3rd Thinning Age	48	66.6
4th Thinning Age	54	46.6
5th Thinning Age	59	76.3
6th Thinning Age	65	56.4
7th Thinning Age	71	93.1
8th Thinning Age	78	46.1
Total	**54**	**461.3**
Mean Annual Increment - MAI (m^3/ha/year)		**8.3**

The forest management cycle is projected to continue until the year 2100, incorporating a mixed-species forest plantation. The cycle for the accessory species will conclude in year 24, when the first enrichment of the end species is planted in the tree lines where the accessory species have been removed. In year 36, the cycle for the first end species will come to an end, and a new enrichment will be implemented in the tree lines previously occupied by the end species."

The cycle of harvesting and enriching goes in perpetuity and management decisions are based on a basal area cap and floor, also allowing trees to reach over 30 cm of DBH.

Grouped Project Expansion Plans

This grouped project aims at forming a continuous forest cover. This decision was made based on previous studies developed by Symbiosis together with the World Resources Institute, which have mapped potential areas to expand, based on technical, environmental and financial criteria.

The strategy for expansion starts with the grouped carbon project and intends to implement new activities (instances) until 2031. The activities to be developed are shown in **Figure 10.**

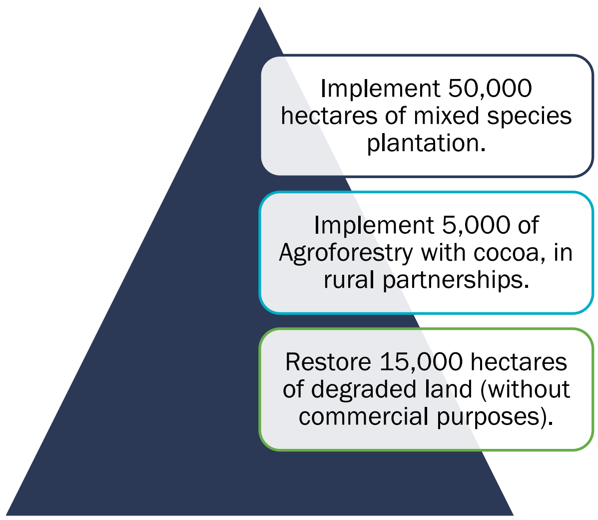


Figure 10 - Expansion plan strategy for the grouped project.

In the 50,000 hectares, the same management model is proposed, in addition to a 5,000 hectares agroforestry model with cocoa production, a typical species of the Southern Bahia, also associated with social development. **Table 6** presents the details on the expansion plan, year by year.

Table 6 - Details on the expasion plan.

Year	Mixed species plantation (ha)	Ecological restoration (ha)	Agroforestry (ha)	Total (ha)
2024	1,000	300	100	1,400
2025	2,000	600	200	2,800
2026	3,000	900	200	4,100
2027	4,000	1,200	500	5,700
2028	10,000	3,000	1,000	14,000
2029	10,000	3,000	1,000	14,000

Year	Mixed species plantation (ha)	Ecological restoration (ha)	Agroforestry (ha)	Total (ha)
2030	10,000	3,000	1,000	14,000
2031	10,000	3,000	1,000	14,000
Total	**50,000**	**15,000**	**5,000**	**70,000**

Every area included in this project will maintain or restore the preserved areas, as required per National Legislation[4], as already happened at PAI-01. Details on this specific matter are provided in Chapter 2 (Safeguards).

For the agroforestry model in the cocoa value chain, Symbiosis will partner with rural producers, by investing in the forestry component, in the form of inputs and technical assistance. The modeling projected is the one proposed by Arapyaú foundation in the region of southern Bahia, suitable for degraded pastures for large, medium, and small holder farmers (**Figure 11**).

Figure 11 - Agroforestry system proposed for the grouped project.

The agroforestry system is composed by 416 trees/ha from two native species and 833 cocoa plants/ha The cycle rotation is 30 years for the carbon project, forestry component and the renovation of the cocoa plants (**Table 7**).

[4] As per National Legislation, the Forest Code (Law 12,651/2012), which determines that 20% of every rural property located in the Atlantic Forest must be preserved as Legal Reserves, as well as the Areas of Permanent Protection, respecting a distance to any water body. More details in Section 1.14.

Table 7 – Agroforestry with cocoa management model.

Agroforestry Implementation	End - Native	Cocoa
Density	416	833
1st Thinning Age	12	
2nd Thinning Age	18	
Final Harvest Date	30	
Mean Annual Increment - MAI (m^3/ha/year)	**5.3**	
Total Production (m^3)	**160.5**	
1st Thinning Production	10.7	
2nd Thinning Production	31.3	
Final Harvest Production	**118.5**	

For the ecological restoration model in degraded areas, Symbiosis will plant native species in areas of environmental liabilities in permanent preservation and legal reserve areas, totaling 20% of the size of the rural property. Additionally, Symbiosis will plant in another 20% of degraded areas (excess legal reserve), reaching the end of the expansion cycle in 15,000 hectares of restoration surplus.

To compose the ecological restoration model, basically 35 native species of the Atlantic Forest, characteristic of the project expansion region, will be used (**Table 8**). The choice of species will depend, mainly, on the edaphoclimatic characteristics of the respective future PAI.

Table 8 - Species considered for the ecological restoration model in legal reserve surplus in the project areas.

Species	Common name	Function group	Group MAI	Group Steam
Basiloxylon brasiliensis	Pau-rei	Pioneer	High	High
Cariniana legalis	Jequitibá-rosa	Non-pioneer	High	High
Cordia trichotoma	Louro-pardo	Non-pioneer	High	High
Dalbergia nigra	Jacarandá	Non-pioneer	High	High
Hymenaea courbaril var. stilbocarpa	Jatobá	Non-pioneer	High	High

Species	Common name	Function group	Group MAI	Group Steam
Joannesia princeps	Boleira	Pioneer	High	High
Simarouba amara	Marupá	Pioneer	High	High
Tachigali vulgaris	Tachi-branco	Pioneer	High	High
Zeyheria tuberculosa	Ipê-felpudo	Non-pioneer	High	High
Bowdichia virgilioides	Sucupira	Non-pioneer	High	Low
Clarisia racemosa	Oiticica	Non-pioneer	High	Low
Myracrodruon urundeuva	Cabreúva	Non-pioneer	High	Low
Pachira endecaphylla	Castanha-do-maranhão	Pioneer	High	Low
Parkia pendula	Jueirana-vermelha	Pioneer	High	Low
Pterocarpus rohrii	Pau-sangue	Pioneer	High	Low
Spondias venulosa	Cajá	Pioneer	High	Low
Aspidosperma pyricollum	Guatambú-vermelho	Non-pioneer	Low	High
Astronium concinnum	Gonçalo-alves	Non-pioneer	Low	High
Astronium graveolens	Aderne	Non-pioneer	Low	High
Handroanthus serratifolius	Ipê-ovo-de-macucu	Non-pioneer	Low	High
Manilkara longifolia	Maçaranduba	Non-pioneer	Low	High
Paratecoma peroba	Peroba	Non-pioneer	Low	High
Terminalia mameluco	Peladão	Pioneer	Low	High
Amburana cearensis	Amburana	Non-pioneer	Low	Low
Barnebydendron riedelii	Guaribú	Non-pioneer	Low	Low
Centrolobium tomentosum	Putumujú	Non-pioneer	Low	Low
Copaifera langsdorffii	Copaíba	Non-pioneer	Low	Low
Goniorrhachis marginata	Guaribú-amarelo	Non-pioneer	Low	Low

Species	Common name	Function group	Group MAI	Group Steam
Lecythis pisonis	Sapucaia	Non-pioneer	Low	Low
Libidibia ferrea var. parvifolia	Pau-ferro	Non-pioneer	Low	Low
Moldenhawera papillanthera	Caingá	Non-pioneer	Low	Low
Paubrasilia echinata	Pau-brasil	Non-pioneer	Low	Low
Senegalia polyphylla	Monjoleiro	Non-pioneer	Low	Low
Vatairea heteroptera	Argelim-aracuí	Non-pioneer	Low	Low
Vataireopsis araroba	Argelim-amargoso	Non-pioneer	Low	Low

The spacing used for this model will be 3 x 3 meters, totaling 1,111 individuals in the year of planting. After the first year, a mortality rate will be applied according to **Table 9.**

Table 9 - Mortality rate and number of individuals over the 30 years of the project.[5]

Age	Mortality	Trees per ha
1		1111
2	10,0%	1000
3	9,0%	910
4	8,0%	837
5	7,0%	779
6	6,0%	732
7	5,0%	695
8	4,0%	667
9	3,0%	647
10	2,0%	634

[5] Based on 2006 IPCC Guidelines for National Inventories, Volume 4, Chapter 2, page 2.24. Available at: Microsoft Word - 02_V4_Ch2_Generic_final_v2.doc (iges.or.jp)

Age	Mortality	Trees per ha
11	1,0%	628
12	1,0%	622
13	1,0%	616
14	1,0%	609
15	1,0%	603
16	1,0%	597
17	1,0%	591
18	1,0%	585
19	1,0%	580
20	1,0%	574
21	1,0%	568
22	1,0%	562
23	1,0%	557
24	1,0%	551
25	1,0%	546
26	1,0%	540
27	1,0%	535
28	1,0%	529
29	1,0%	524
30	1,0%	519

The project does not relate to REDD+ activities, neither is located within a jurisdiction covered by a jurisdictional REDD+ program.

1.12 Project Location

Grouped Project

The Project Zone encompasses the southern region of the state of Bahia, in the Northeastern region of Brazil (**Figure 12**).

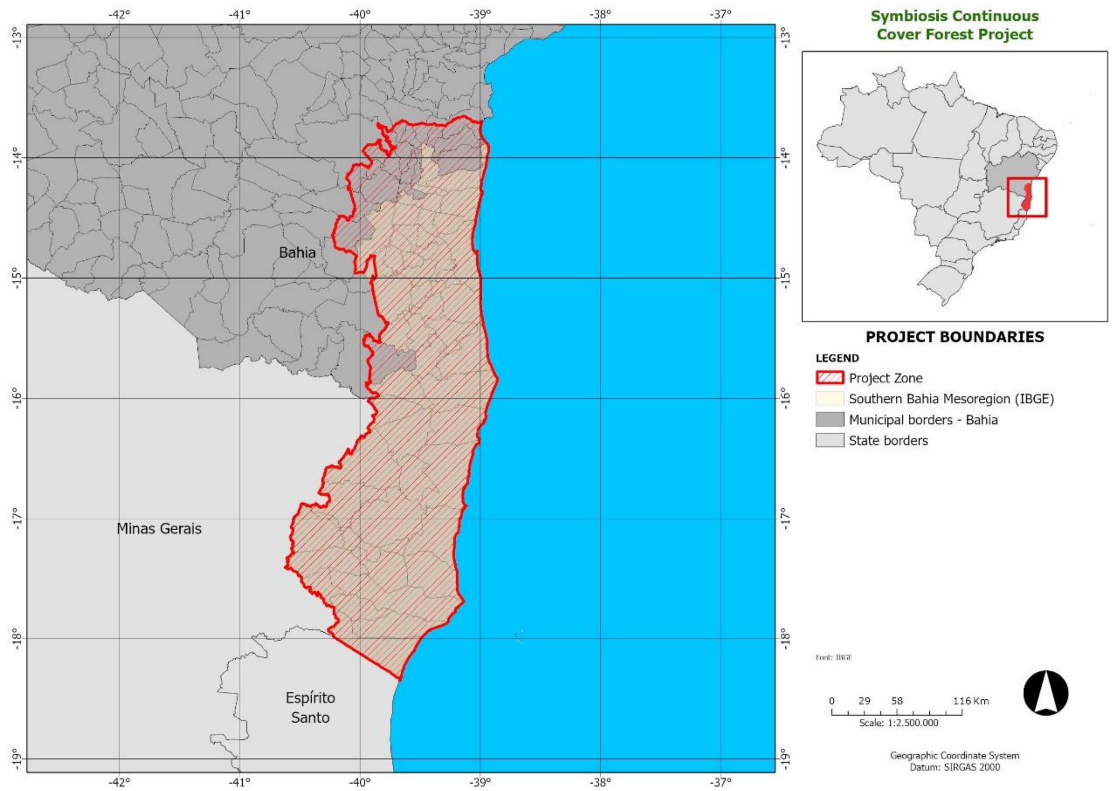


Figure 12 - Project Zone location.

The chosen region is entirely within the Atlantic Forest biome and is an extension of the Southern Bahia Mesoregion, according to IBGE's delineation. The area is located entirely within the state of Bahia. The northernmost municipality is Ituberá, the southernmost is Mucuri, to the west are the municipalities that have an annual average precipitation of 1,000 mm or more, according to the Geological Survey of Brazil (SGB/CPRM), and to the east it is bordered by the Atlantic Ocean (**Figure 13**).

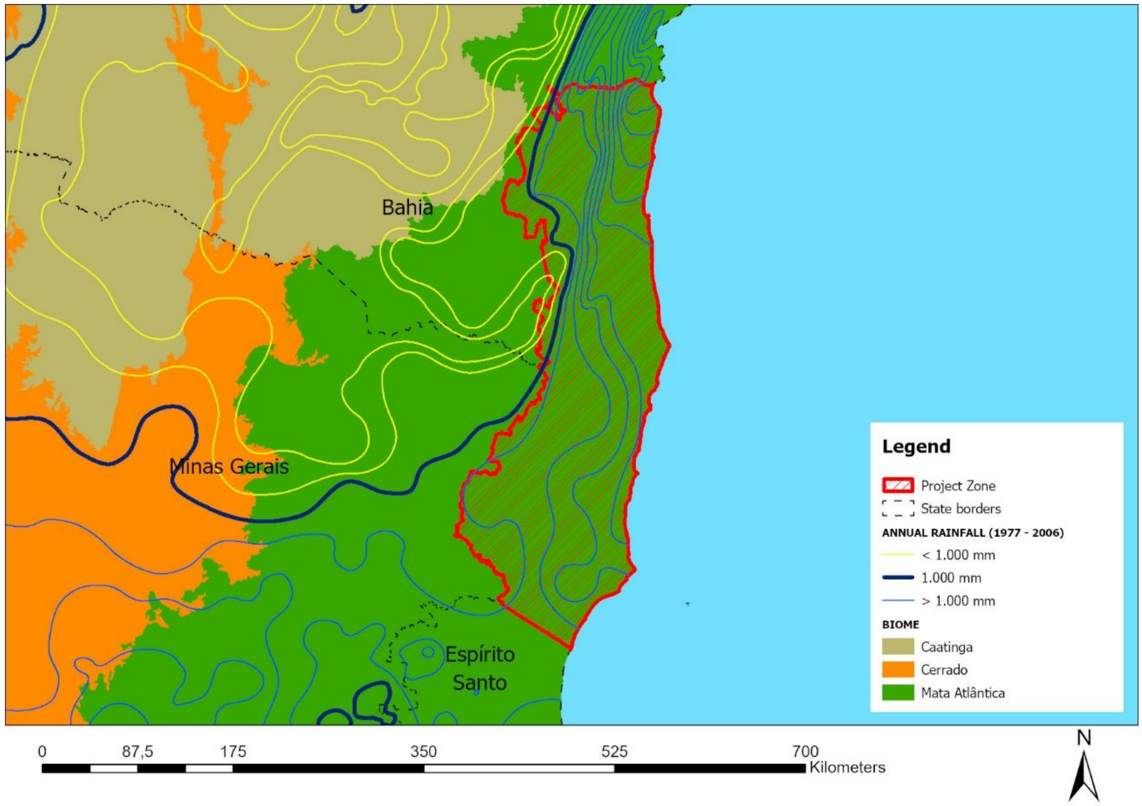


Figure 13- Project Zone location in relation to average annual precipitation and biomes.

PAI-01

The Novo Horizonte Farm is situated in the Trancoso district of Porto Seguro municipality, approximately 600 km from the capital city of Salvador. As per its Environmental Rural Registry (CAR), the farm covers a total area of 669.28 hectares and is divided into two parts.

The PAI-01 comprises 28 parcels where the project activities of reforestation started on September 9th, 2020. The PAI-01 total area is 236.50 ha (**Figure 14**).

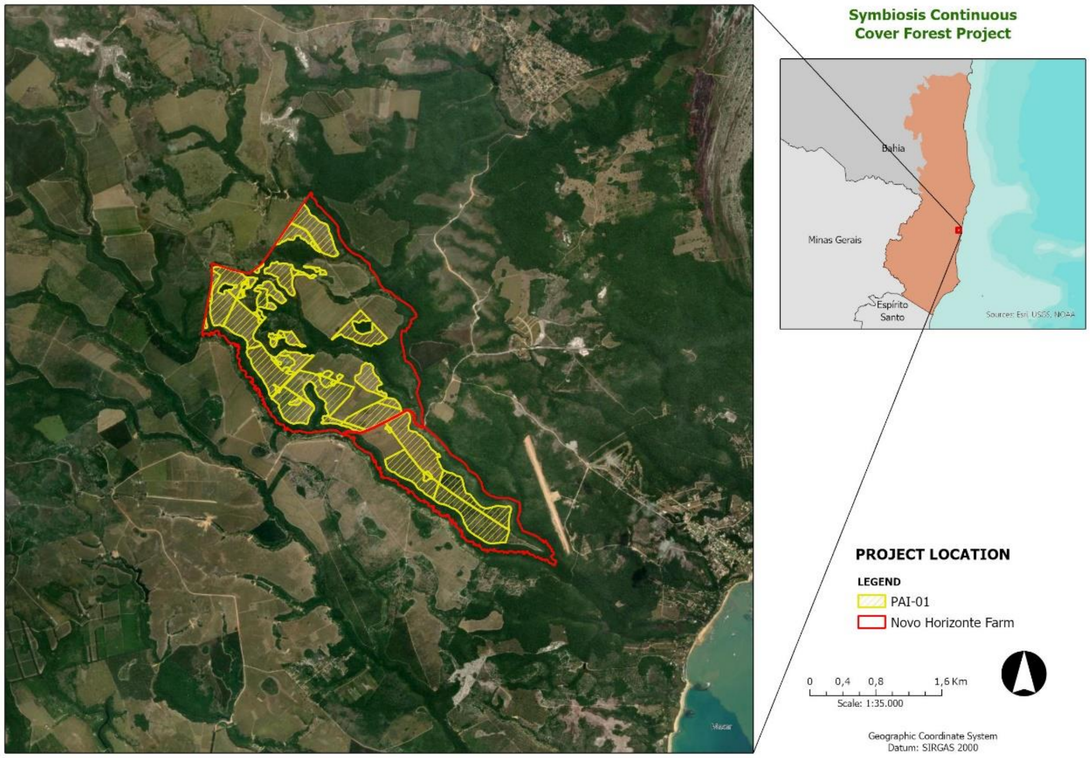


Figure 14 - PAI-01 location.

Table 10 - Central geodetic coordinates and total PAI-01 area

Instance	Coordinates (GCS SIRGAS 2000 – EPSG 4674)		Area (hectares)
	Long	Lat	
PAI-01	039° 09' 60" W	16° 41' 58" S	236.50

1.13 Conditions Prior to Project Initiation

The Project Zone is located in the south of the State of Bahia, in the northeastern region of Brazil. The project is fully inserted in the Atlantic Rainforest biome and aims at the recovery of pastures through reforestation with consortia of native species of commercial value.

The municipality of Porto Seguro and the south of Bahia as a whole carry the historical importance of having been the region where the first Portuguese landed, back in 1500, to start the colonization of the territory that we now call Brazil. In this way, the history of land-use change, deforestation, and predatory exploitation of natural resources in the region coincides with the beginning of the colonization of Brazil.

The Atlantic Rainforest biome covers around 15% of the national territory and, nowadays, is home to 72% of Brazilian population and concentrates 80% of the national GDP. Essential services such as water supply, climate regulation, agriculture, fishing, electric energy, and tourism depend on it. Today, only 24% of the original forest remains, of which only 12.4% are mature and well-preserved forests[6].

Land-Use Prior to Project Initiation

Based on data from MapBiomas[7], the primary land-use in the Project Zone in 2020 was *pasture*, which covered a total area of 2,291,857.33 hectares. *Forest cover* came in second place, with a total area of 1,871,838.16 hectares, while *mosaic of uses*, including small-scale agriculture mixed with pasture, accounted for 638,456.12 hectares. In 2020 (**Figure 15**), 43% of the pasture was considered to present severe or moderate degradation (MapBiomas).

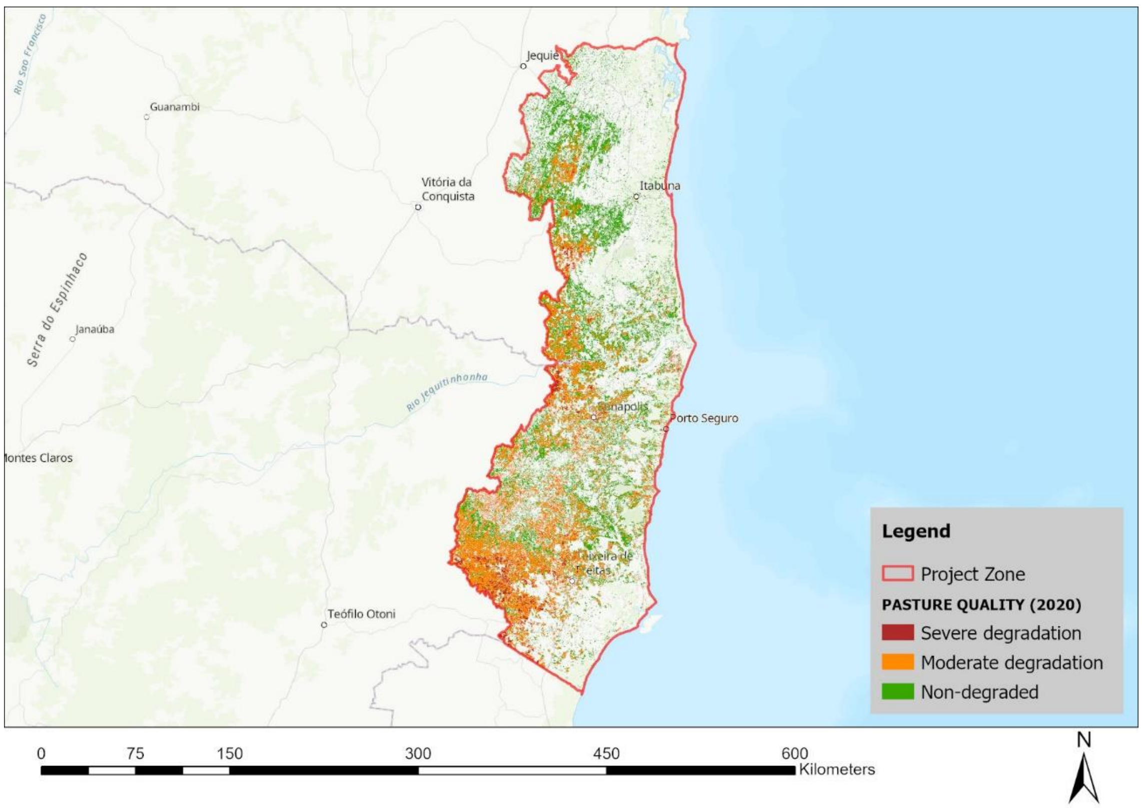


Figure 15 - Pasture quality in the Project Zone in 2020 (MapBiomas).

From 2010 to 2020, there was an increase of 105,239.84 ha in pasture area within the Project Zone, mainly resulting from the conversion of agriculture or forest cover, as reported by MapBiomas Transitions statistics (predefined time interval by the platform). Although the

[6] SOS Mata Atlântica: https://www.sosma.org.br/causas/mata-atlantica/

[7] MapBiomas Project - Collection 7 of the Annual Series of Land Use and Land Cover Maps of Brazil, accessed on March 2023 through the link: https://mapbiomas.org/en

increase represents less than 5% of the total pasture area in 2010, the data shows a stable trend in land use in the region, reaffirming low-tech cattle ranching as the main rural economic activity.

Figure 16 illustrates the changes in land use between 2011 and 2020[8]. The choice of 2011 as a reference year for comparison with 2020 aligns with the methodology's requirement for a ten-year interval from the project's start date. Since there has been a stable trend in land use in the region over the past decade, the slight difference between the 2010 and 2011 land use classification does not alter the overall distribution of land use categories.

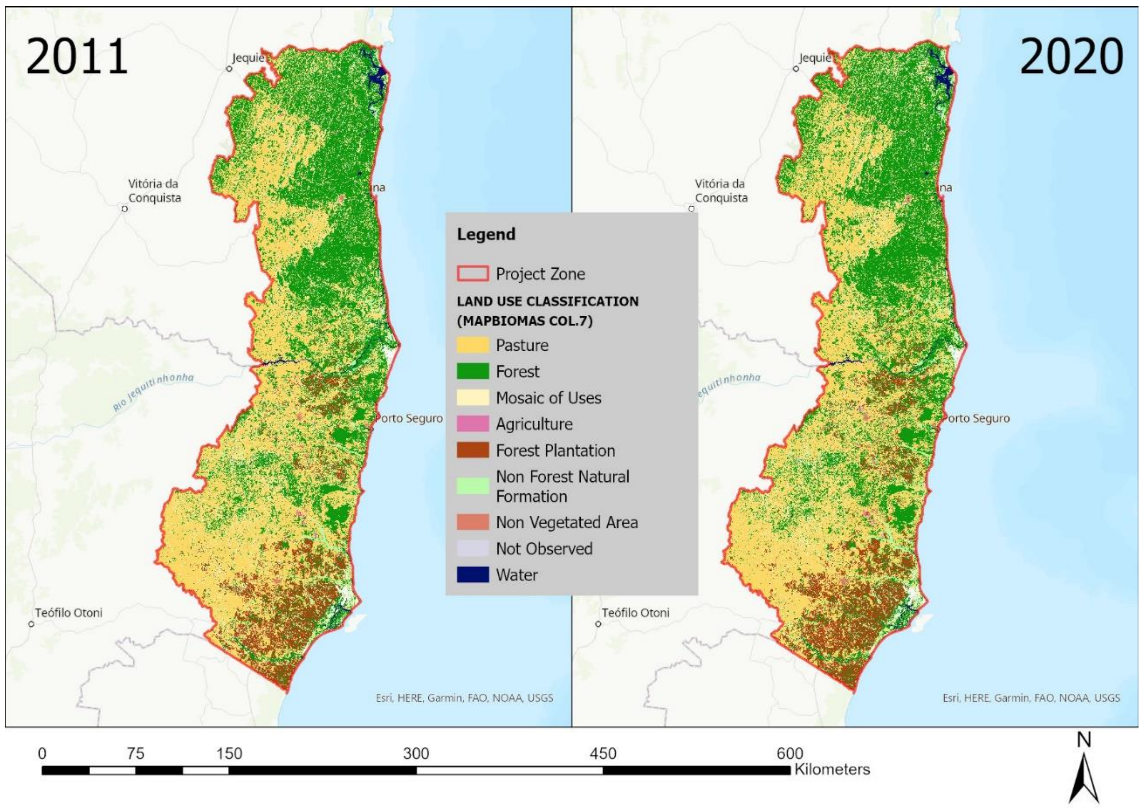


Figure 16 - Land Use in 2011 and 2020 in the Project Zone (MapBiomas).

The grouped project expansion will integrate new PAI prioritizing pastures within the Project Zone that have undergone conversion at least 10 years prior to the PAI incorporation. It is important to note that the project is not intended to generate GHG emissions for the purpose of subsequent reduction, removal, or destruction.

PAI-01

[8] MapBiomas Project - Collection 7 of the Annual Series of Land Use and Land Cover Maps of Brazil, accessed on March 2023 through the link: https://mapbiomas.org/en

The Novo Horizonte Farm was acquired by Symbiosis in 2015 [9]having pasture as its main land use along what is now the PAI-01. **Figure 17** shows the MapBiomas land use classification comparison between 2011 and 2020 to demonstrate that the area was deforested at least 10 years prior to project implementation.

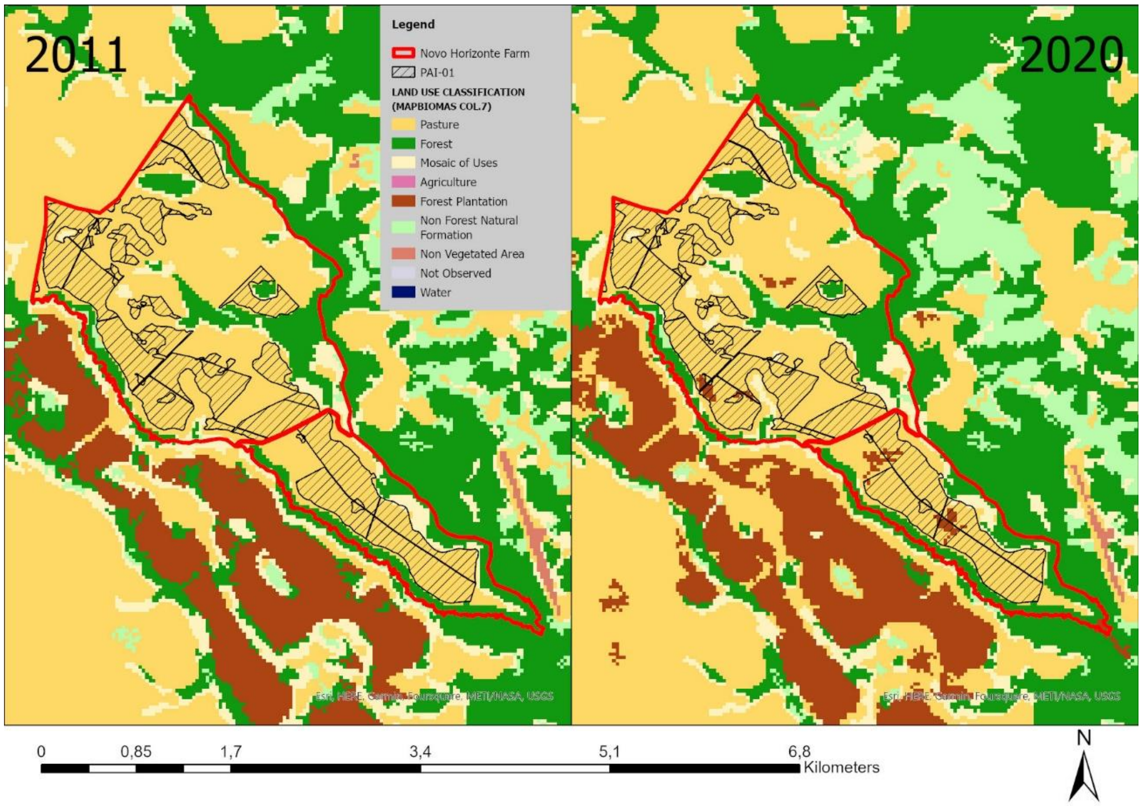


Figure 17 - Land Use in 2011 and 2020 in Novo Horizonte Farm and PAI-01(MapBiomas).

Climate

The Project Zone is situated between the Central Brazil Tropical Climate Zone and the Oriental Northeast Tropical Climate Zone, as per the classification of the Brazilian Institute of Geography and Statistics (IBGE) in 2002. These two climate zones share similar characteristics and descriptions in this region.

The whole Project Zone is characterized by warm temperatures, with an average temperature higher than 18ºC throughout the year (**Figure 18**). Nevertheless, there is a noticeable decline in moisture levels along an inland trajectory from the coast. Divided into five longitudinal bands, from the coast to the interior, we have: *a) Super-humid without dry season, b) Super-humid with sub-dry season c) Humid with 1 to 2 dry months, d) Humid with 3 dry months, and e) Semi-humid with 4 to 5 dry months.*

[9] Year in which first negotiations started. Documentations of the definitive acquisition are from March 24, 2017.

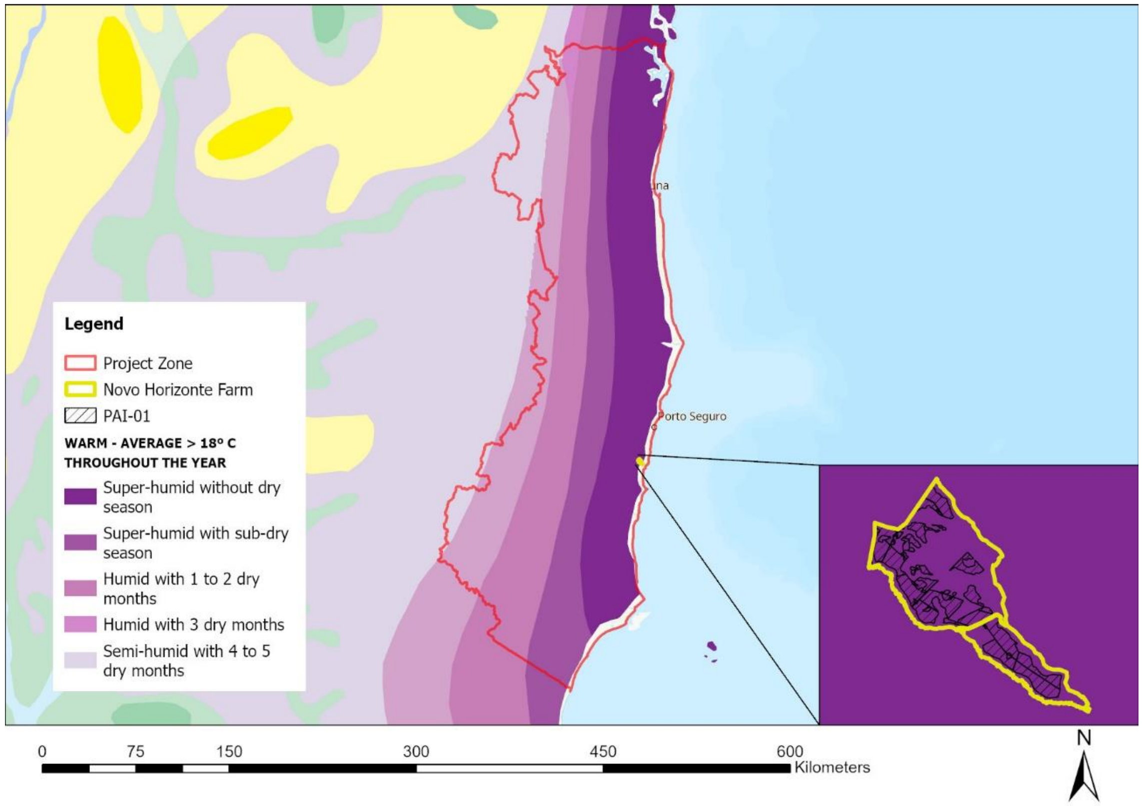


Figure 18 - Climate classification in the Project Zone and PAI-01 (IBGE).

PAI-01

The PAI-01 is located close to the shore, within the *Super-humid without dry season* zone (Figure 18). Data from a privately-owned rain gauge station located on the farm indicate an annual average of 1,382 mm of rainfall during the period from 2011 to 2022. The distribution of monthly averages during the same period indicates lower rainfall from January to March, followed by months with higher precipitation, all with an average above 120 mm. The only exception is September, when the average reaches 87 mm (Figure 19).

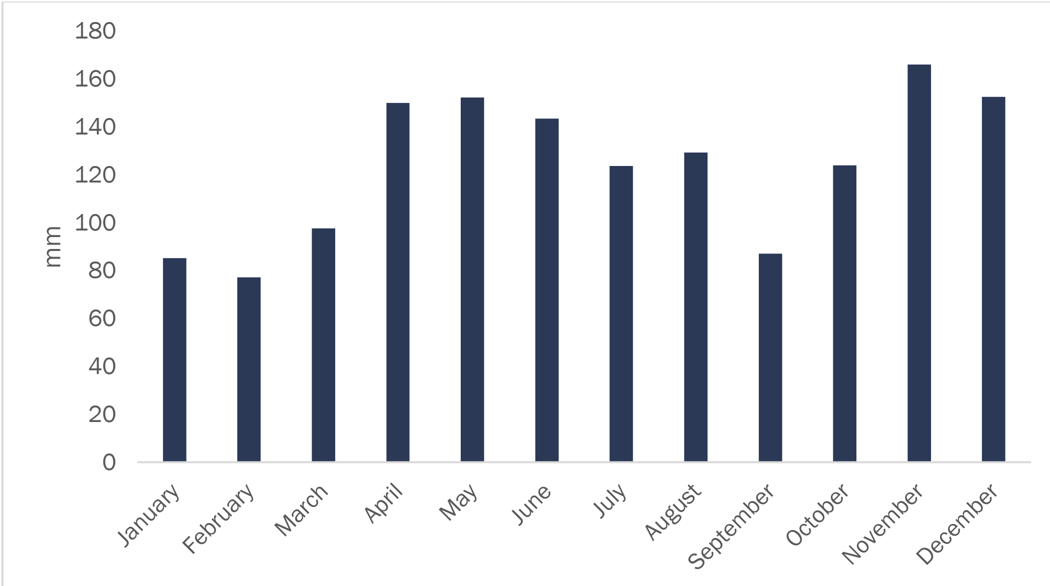


Figure 19. Average monthly precipitation 2011-2022 (rain gauge station in Symbiosis Farm).

Topography

Elevation data is derived from the SRTM mission with a spatial resolution of 30 m, made available by the Google Earth Engine platform. The altimetric values in the region range from 0 to 1,187 m above sea level, with an average altitude of 106 m (**Figure 20**).

The higher altitudes are located in the west of the Project Zone, which conditions the drainage network of the main rivers to run in a west-east direction towards the Atlantic Ocean.

In the eastern part of the Project Zone, the altitude remains relatively constant with a narrow range of only 200 meters, extending up to 100 kilometers inland from the coast.

PAI-01

The Novo Horizonte Farm is located close to the shoreline and its elevation varies from 5 to 60 m above sea level, with an average altitude of 41 m (**Figure 20).**

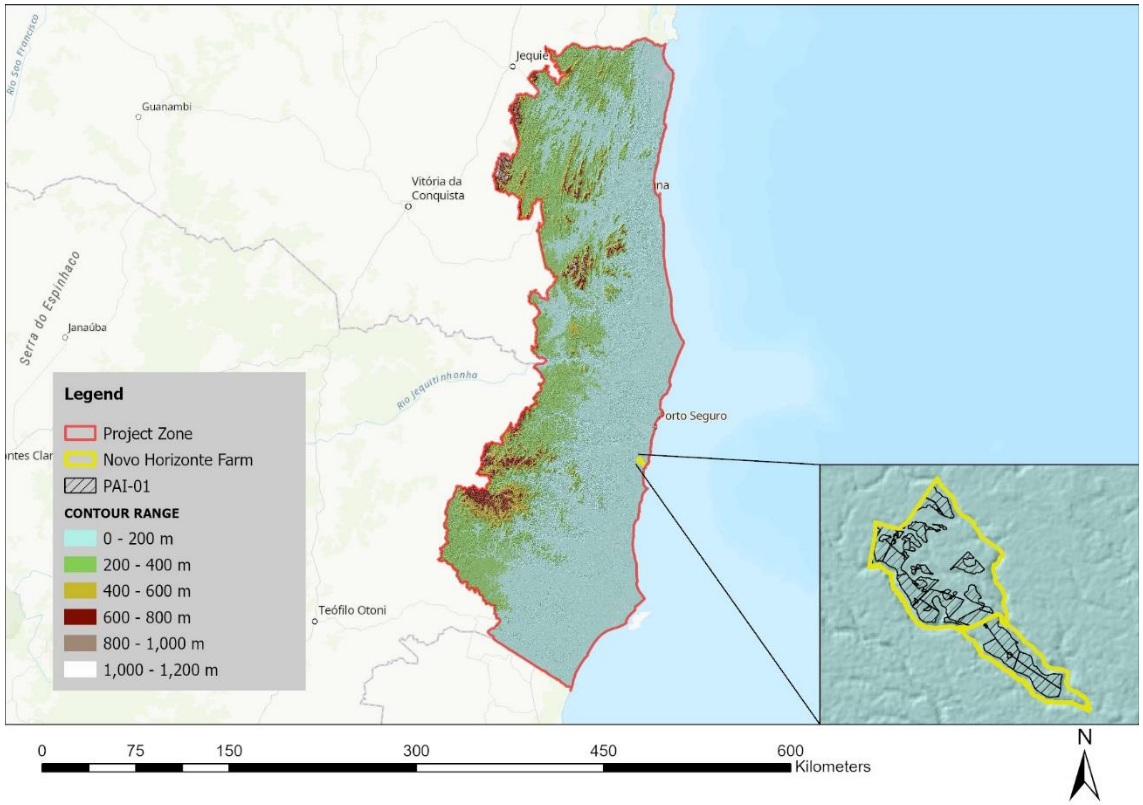


Figure 20 - Elevation in the Project Zone and PAI-01.

Slope

Even though the slope values range from 0 to more than 1,000%, the distribution of values is concentrated between *flat* (< 3%) to *undulating* (8 – 20%). The average slope for the entire region is 9.36% (**Figure 21**), considered *undulating* by the EMBRAPA slope classification for the national territory. The slope greater than 20% are concentrated in the higher zones with altitudes greater than 200 m and in river banks along the Project Zone.

PAI-01

The Novo Horizonte Farm conforms to the observed pattern in the Project Zone, with slope values ranging from 0% to 44% and a mean of 9% (*undulating*). The steepest areas of the farm are found along the river banks, while the productive zone, where the project is being carried out, has a generally *flat* (0-3%) to *gently undulating* (3-8%) terrain (**Figure 21**).

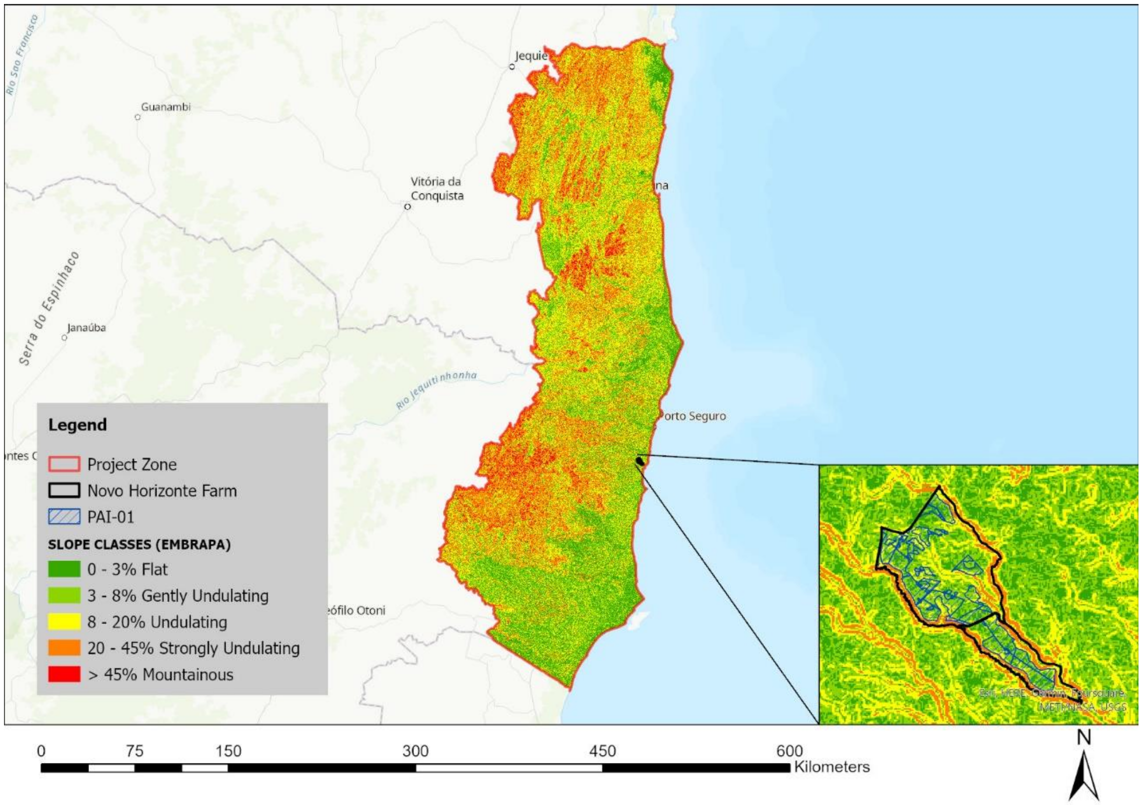


Figure 21 - Slope in the Project Zone and PAI-01.

Hydrology

The Project Zone is located within the East Atlantic Hydrographic Region as per the National Hydrographic Division (IBGE/ANA)[10]. The East Atlantic Hydrographic Region is not limited to the basin of a single main river, bringing together several watersheds such as the Jequitinhonha, Contas, Pardo, and Mucuri rivers. In general, the drainage pattern in the region follows the west-east direction, flowing into the Atlantic Ocean (**Figure 22**).

PAI-01

At Novo Horizonte Farm, Setiquara Stream serves as the main drainage system, running along the southern border of the property. An unnamed stream also flows along the northern border. In addition, there are other headwater and tributary streams within the farm's area that contribute to these larger streams (**Figure 22**).

[10] https://www.ibge.gov.br/geociencias/cartas-e-mapas/informacoes-ambientais/31653-bacias-e-divisoes-hidrograficas-do-brasil.html?=&t=o-que-e

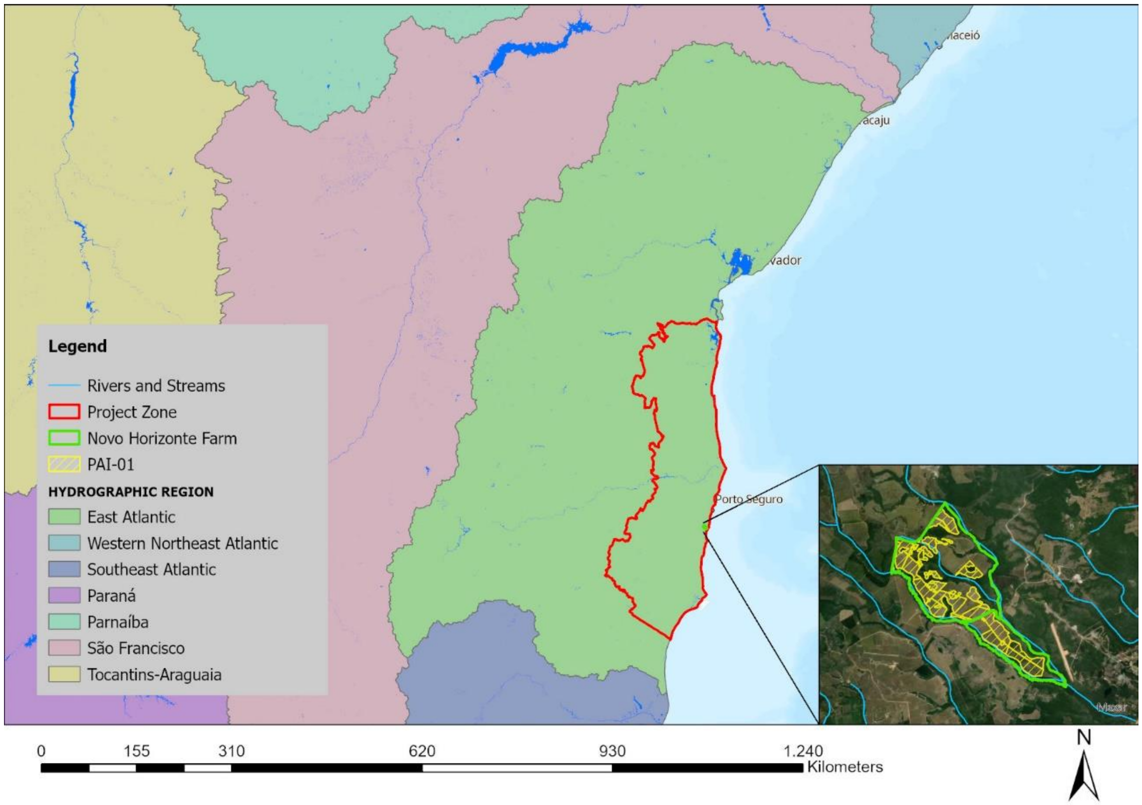


Figure 22 - National Hydrographic Division and hydrology in PAI-01

Soils

According to the soil mapping at a 1:250,000 scale by IBGE in 2021[11], the predominant soil class in the project region is Oxisol, also known as Latossolo in the Brazilian Soil Classification System (**Figure 23**). This soil class covers 45% of the project zone and is well-distributed throughout the area.

Oxisols are formed in intense and prolonged weathering environments, which conditioned the substantial disintegration of the matrix rock and almost total decomposition of the primary minerals. Although they usually have a low saturation of exchangeable cations (Ca, Mg, K), they can still sustain exuberant forests, such as the Atlantic Rainforest. This capacity resides in three factors: they exhibit an excellent physical structure, deep enough to provide robustness to rooting, good drainage to support aeration and water percolation (essential for root respiration), and reasonable retention of water on the surface of clay minerals (essential provision for plants).

Argisols are the second most abundant soil type in the Project Zone, comprising 28% of the total area. These soils are mostly concentrated in large patches in the southern parts of the project zone, as well as in the western central and northern areas. Argisols are characterized by a clay-

[11] https://bdiaweb.ibge.gov.br/#/consulta/pedologia

rich texture and high nutrient retention capacity, which can promote agricultural productivity in the region.

The third most prevalent soil type in the region is Luvissolos, which is equivalent to Alfisols in the US soil classification system. Luvissolos cover 12% of the total area and are mainly concentrated in the northern part of the Project Zone. Luvissolos are shallow to moderately deep soils with bright colors and high clay activity. They are moderately acidic to neutral, with high base saturation levels and high silt content. They are highly susceptible to erosion due to the significant textural difference between the A and B horizons. These soils have high nutritional potential due to the abundance of available nutrients and easily weathered primary minerals, particularly potassium.

Other soil types are distributed throughout the project zone in smaller proportions. Notable among these are Chernossol, concentrated in the northern area, which represents 7% of the total area, as well as Espodossol and Gleissol (each representing 3%). Chernossols are characterized by high organic matter content and a deep, dark-colored A horizon, which supports high agricultural productivity.

PAI-01

According to the 1:250,000 scale soil mapping by IBGE, the Novo Horizonte Farm is located in a region predominantly composed of Oxisols, although it is adjacent to patches of Argisols (**Figure 23**).

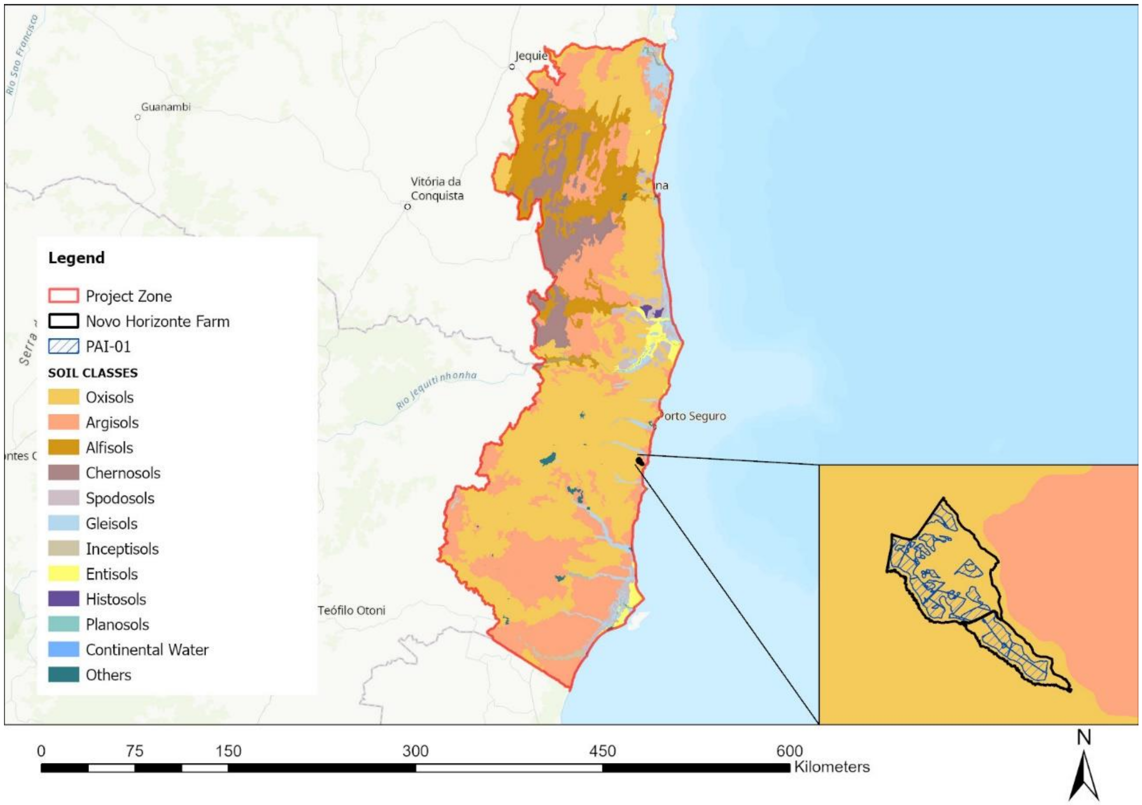


Figure 23 - Soils classification (IBGE) in the Project Zone and PAI-01

Vegetation

The Project Zone is situated entirely within the Atlantic Rainforest biome, with the Ombrophyllous Dense Forest being the predominant vegetation type. This is in accordance with the IBGE's 1:250,000 scale mapping for the entire country in 2021[12]. The Ombrophyllous Dense Forest is characterized by high rainfall and humidity levels. This forest type is considered one of the most important hotspots for biodiversity conservation in the world, with many endemic species and threatened ecosystems.

The Ombrophyllous Dense Forest covers 70% of the total area, while the Semideciduous and Deciduous Seasonal Forests, which are concentrated in the western part of the region, represent 16% and 6% of the area, respectively (**Figure 24**). The distribution of these forests corresponds to the precipitation averages, which decrease as one moves towards the west.

Pioneer formations can be observed along the coast and in areas near the mouth of important rivers, reflecting the influence of the marine or riverine environment. It represents 4% of the total area.

[12] https://bdiaweb.ibge.gov.br/#/consulta/vegetacao

PAI-01

The Novo Horizonte Farm is entirely located in a region with Ombrophyllous Dense Forest predominance (**Figure 24**).

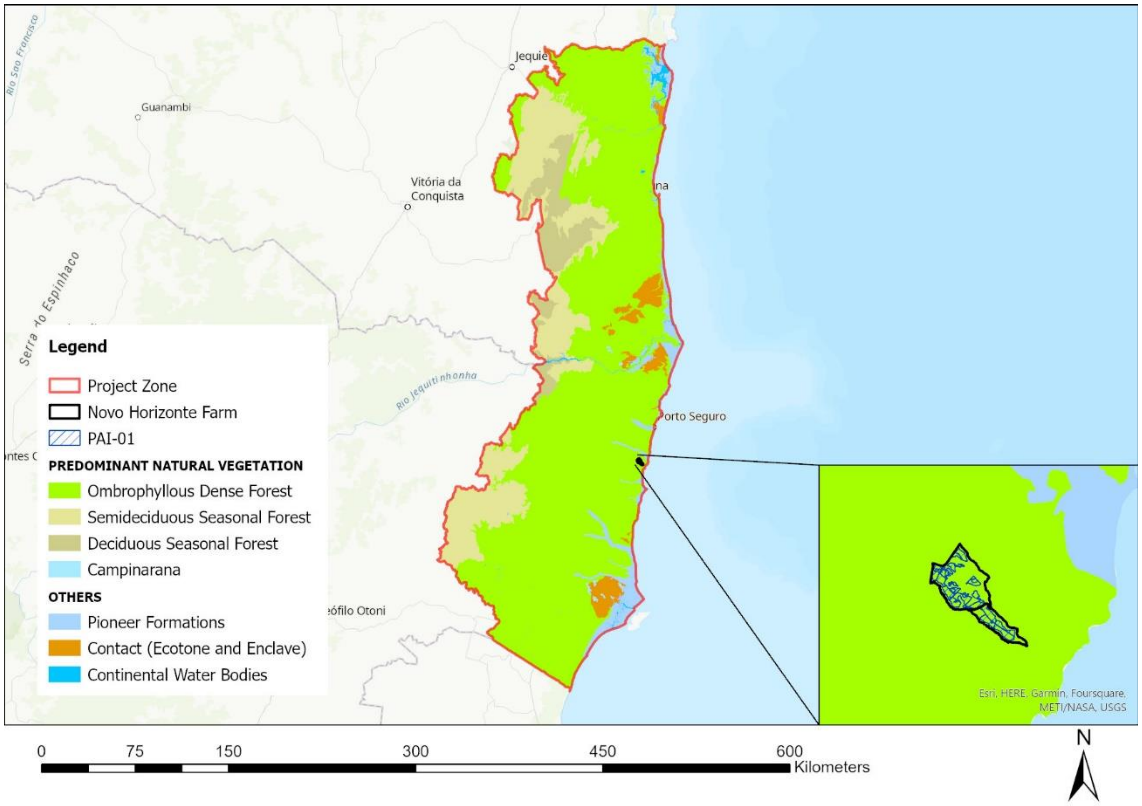


Figure 24 - Vegetation classification (IBGE) in the Project Zone and PAI-01

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Table 11 demonstrates how the project complies with Brazilian pertinent legislation.

Table 11 - Demonstration of legal compliance.

Law, statute, or regulatory framework	Compliance
Brazilian Constitution, Chapter 6, art. 225. The Brazilian Amazonian Forest, the Atlantic Forest, the Serra do Mar, the Pantanal Mato-Grossense and the coastal zone are part of the national patrimony, and are	The project goal is to restore degraded land in the Atlantic Forest and promote a continuous forest cover.

Law, statute, or regulatory framework	Compliance
applicable, as provided by law, under conditions which ensure the preservation of the environment.	
Brazilian Constitution, Chapter 2, arts. 7- 11 and art. 243. The Constitution codifies a wide range of Social Rights: minimum wage, regular working hours, guidance on vacation and weekly leave, guidance on maternity leave, recognition of collective bargaining; prohibition of any form of discrimination.	The Project and its activities already meet and will continue to meet all applicable labor laws and regulations and the Project Proponent will inform all workers of their rights.
***National Policy of Environment**,* Federal Law 6,938/81. Among the main guidelines of the Policy, is the preservation and restoration of environmental resources, and their rational use and permanent availability. It also recognizes the compatibility of economic and social development with ecological preservation.	The project will promote the restoration of environmental resources and sustainable forestry management.
***Forest Code**,* Federal Law 12,651/2012. All rural properties located in forest zones must have areas of permanent protection (APP). APPs are areas that are physically and ecologically fragile. All rural properties located in Atlantic Forest must keep at least 20% of the area as a Legal Reserve. LRs are areas where vegetation is protected. All rural properties must maintain an LR and register it in the CAR. Environmental Registry (CAR): The central tool for rural properties to become compliant with Forest Code requirements. All rural property owners must register their lands in CAR, including the location of APPs, Legal Reserves, and other elements.	The project has properly registered CAR, in which both Legal reserve and Permanent Protection Areas are indicated and preserved.
Ordinance 8,972/2017, establishing the National Plan for Native Vegetation Restoration (Planaveg). Planaveg focuses on the recovery of native vegetation, primarily in permanent preservation areas (PPA), legal reserves (RL) and degraded areas with low suitability for agriculture.	The project activity is aligned with what is proposed in Planaveg.

Law, statute, or regulatory framework	Compliance
In Planaveg, the most forest restoration programs are still in the planning phase, except for some pilot activities that are aimed at large-scale planting of native species, with the potential to multiply business opportunities and create jobs in rural areas.	
Atlantic Forest Law, Federal Law 11,428/2006. (Regulated by Ordinance 6,660/2008) Provides regulation over the use and protection of the native vegetation of the Atlantic Rainforest.	The Project activity complies with the sustainable use of the biome.
National Policy on Climate Change, Federal Law 12,187/2009, art. 4, VII. Establishes the National Policy on Climate Change - PNMC, which aims to establish mechanisms that support the mitigation of climate change. Aims at consolidating and expanding legally protected areas and reforestation activities in degraded land.	The project activity is aligned with what is proposed in the National Policy on Climate Change.

1.15 Participation under Other GHG Programs

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

This Project has not been registered, nor is seeking registration under any other GHG Programs.

1.15.2 Projects Rejected by Other GHG Programs

This Project has not been rejected by any GHG Programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

GHG emissions reduced/removed by the Project are not and will not be included in any emissions trading program or any other mechanism that includes GHG allowance trading.

1.16.2 Other Forms of Environmental Credit

The Project will not be seeking for any other form of environmental credit.

Supply Chain (Scope 3) Emissions

The project main activity is the restoration of degraded land, mostly through commercial reforestation of native species of the Atlantic Rainforest. So far, as per the project Start Date on September 9, 2020, no hardwood has been harvested and the first thinning cycle will only happen in year 12 of the project. For that reason, the project does not provide any good or service that could impact on any organization Scope 3 emissions. However, this will be considered in the project operations, so that there is a clear statement regarding double counting, when the project starts generating credits, as well as wood products.

1.17 Sustainable Development Contributions

Table 12 demonstrates the Sustainable Development Contributions which are directly or indirectly related to the project activities, based on the Sustainable Development Goals.

Table 12 - Contributions of the Project to the Sustainable Development Goals.

The project activity consists of reforestation of degraded land, in which soil and water quality are compromised. By using native species, the project will improve the overall environmental quality of the area.

In addition, all the areas to be included in grouped project will be properly restored, in accordance with the Brazilian Forest Code, including Legal Reserves and the Permanent Protection Areas, directly related to the presence of water streams or water springs at the areas. The projected restoration area if 15,000 ha.

Symbiosis already employes 17 local communitarians, at Fazenda Novo Horizonte. They are from Coqueiro Alto community, based on Trancoso District, Porto Seguro city, Bahia State.

With the proposed grouped project, Symbiosis will create opportunities in a disruptive activity – which is commercial reforestation with native Atlantic Forest species, what will generate more job positions, besides technical knowledge. In addition, with the agroforestry component, the grouped project can leverage the cocoa production. It has been historically developed at Southern Bahia, however, has lost space to cattle ranching, what has resulted in more degraded land, which the project intends to restore.[13]

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

Studies show that most of the native hardwood consumed in Brazil might come from illegal deforestation, especially in the Amazon.[14] The project will promote sustainable consumption and production patterns as it will carry out sustainable forestry management to provide wood products, while creating a continuous forest cover.

13 CLIMATE ACTION

TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS

20% of the world's GHG emissions come from land use change, especially deforestation and forest degradation. The project activity will provide emissions reductions and removals through reforestation activities. In a indirect way, by producing sustainable hardwood, it will reduce the pressure of wood that comes from deforestation in other biomes, such as the Amazon.

15 LIFE ON LAND

PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS

The project activities will provide several benefits to the ecosystem, by restoring degraded land with mixed species. Some of the environmental benefits are: i. genetic ex situ conservation bank of the most threatened and degraded biome of Brazil, ii. forest fragment connection and ecological corridors; improvement of soil and water conditions of the land.

1.18 Additional Information Relevant to the Project

Leakage Management

No leakage has been identified to the Project Activity, as per Section 4.3.

[13] Agroforestry with cocoa helps producers from Southern Bahia to restore: https://www.wribrasil.org.br/noticias/agrofloresta-com-cacau-ajuda-produtores-do-sul-da-bahia-restaurar

[14] Most part of the hardwood consumed in Brazil can come from illegal deforestation in the Amazon: https://infoamazonia.org/2021/09/21/maior-parte-madeira-consumida-ilegal-desmatamento-amazonia/

During the project crediting period and project expansion, if any implemented activities result in leakage, it will then be calculated through the latest version of the AR Tool 15 - Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity" or any other tools recommended by VCS at the that time.

Commercially Sensitive Information

There is no sensitive information that was excluded from this document. Financial statements, however. will be available only for validation purposes.

Further Information

There is no additional information to the Project that was not already presented in other sections.

2 SAFEGUARDS

2.1 No Net Harm

All the proposed Project Activities, including the mixed species plantation already implemented at PAI-01, as well as the ecological restoration and the agroforestry with cocoa, will replace a scenario of areas that have been degraded for years, mostly due to pasture. The sustainable management will promote many positive impacts to the ecosystem, such as: local biodiversity preservation, soil conservation, recovery of the ecological function of the areas, hydrological and climate regulation, among other.

Regarding the social aspect, the project already employs local workers, which is building capacity at the region, respecting health and safety legislations, increasing income and creating opportunity. Possible negative impacts are mostly associated with the phases of the project in which the wood will be removed, what could temporarily change the dynamics of the communities located close to the project areas. Those impacts relate to transport intensification and increase on the trucks' fluxes, mostly in the years in which those removals are predicted. Symbiosis has a specialized team already mapping those communities and implementing protocols that will guarantee a good communication during all the project, in order to ensure that any negative impact will be mitigated.

However, the positive benefits of recovering the most affected biome of Brazil, at the same time increasing the work opportunities at the region, surpass the potential negative impacts that might result from that project.

2.2 Local Stakeholder Consultation

Because of the different audiences that would be invited to the Stakeholder Consultation, Symbiosis has decided to carry out two different events – one in person and a second one held online, through a virtual conference.

<u>June 09, 2023 Consultation (Local Communities)</u>

The first Consultation was focused on the communities that live close to both Symbiosis headquarters and to the Novo Horizonte Farm itself: "Coqueiro Alto" Village and the Indigenous People of "Imbirimba". Symbiosis has already been working together with a company specialized at social engagement – "Etno Consultoria", which helped during the process of inviting representatives of the mentioned communities, as well as during the event itself.

87 in hand invitations were delivered to members of both communities, informing that a consultation would be held to inform about the carbon credit project in development. The invite had details on date (June 09, 2023), time (2 p.m.) and locations (Symbiosis headquarters). The invitations were realized a week before the event. A sample of one invite is shown at **Figure 25**, with details on name and telephone excluded.

CONVITE

A Symbiosis Investimentos e Participações S.A., uma empresa sediada no distrito de Trancoso, município de Porto Seguro/BA, cuja atividade principal é o reflorestamento com espécies nativas da Mata Atlântica, com fins comerciais, convida a comunidade em geral para participar da Consulta Pública para apresentação da empresa e do projeto de crédito de carbono conforme o padrão internacional Verified Carbon Standard (VCS, da Verra).

Local: Sede da Symbiosis, localizada na Comunidade Coqueiro Alto, 2.950, Trancoso, Porto Seguro/BA.

Data: 09 /06 / 2023
Horário: às 14 h.

Na ocasião, serão discutidos os seguintes itens:

- Apresentação da Symbiosis;
- Apresentação geral do projeto: finalidade, duração e descritivo geral das atividades;
- Apresentação dos princípios técnicos: linha de base, adicionalidade e estimativas de geração de créditos de carbono;
- Apresentação geral de salvaguardas socioambientais;
- Momento de escuta para dúvidas e sugestões.

A sua presença é importante para contribuição no projeto.

Cordialmente,

Bruno Mariani
Symbiosis Investimentos e Participações S.A.

Recebido em: 08/06/2023

Nome: [redacted]

Telefone: [redacted]

Figure 25 - Example of invitation sent to the June 09 Stakeholder Consultation.

During the Consultation, a reception was organized at Symbiosis headquarters (Comunidade Coqueiro Alto, 2.950, Coqueiro Alto-Trancoso, Porto Seguro/BA). According to the Meeting Minutes, 63 people participated in the event. Among them, the following representatives were present:

- Representatives of the employees: José Prudêncio dos Santos and Mavio Aderne Cruz.
- Imbiriba Indigenous Community: Cacique Renivaldo Brás Correia Filho.

- Coqueiro Alto Community: Administrator Frankle Ribeiro Souza.
- Canta Galo School: Director Raimundo Domingos Soares.
- City Hall of Porto Seguro: Flamarion Souza.

The direct actors received information about the project through a PowerPoint presentation and visual aids. During the meeting, aspects related to forest carbon projects, specific project activities and participants were explained. Concepts such as climate change, carbon markets and the carbon certification process were addressed providing information in simple language so that it could be understood by all participants. The presentation also included a description of the companies involved in the certification of the project (Radicle, Verra and validator). General aspects such as the reforestation area, planted species and how carbon credits will allow the inclusion of new areas and native species were also communicated.

The interactions during the event are summarized below:

- Cacique Renivaldo Brás Correia Filho, who addressed the importance of Symbiosis in involving the company Etno Consultoria in the carbon project, represented by Eunice Brito, which works to promote the relationship between the company and traditional and rural communities, dealing with conflict management, preparing and executing social projects, about the ills of public power with traditional communities and the importance of the private sector for social projects.
- Frankle Ribeiro Souza, administrator of the Coqueiro Alto community, who addressed the importance of the project in the positive impact of the local economy and the opportunity that the company offers to local residents.
- Valdivio Souza Olivera, resident of the Coqueiro Alto Community, who spoke about the transformation of the local landscape, where 13 years ago there was only pasture, and today we have a forest and that, when managed correctly, will bring benefits to the community and the community. fauna.

At the end of the local consultation, participants were briefed on the process for following up on queries, concerns and/or comments raised at the meeting; that would be incorporated into the Project Description. They were informed that once the project document is ready, it would be posted on the Verra Registry for public comments. At the end, refreshments were served.

Figure 26 presents photos of the event.


symbiosis

Figure 26 - Records from the June 09 Consultation.

Signed invites, meeting minutes, attendance lists, photos and slides presentations are available for consultation at **Appendix 2.**

June 26, 2023 Consultation (Other Stakeholders)

A second consultation was organized, with the goal to make room for more institutions and individuals to participate and engage in the project. For that occasion, the Stakeholders identified were the environmental and governmental entities and organizations that were involved during the process of regulating the activities developed by Symbiosis Investimentos to carry out the reforestation of the areas, research and support. Those organizations are: the Porto Seguro City Hall, the Porto Seguro City Environmental Agency, the Environment and Water Resources Intitute of Bahia State (INEMA), the Environmental Secretary of Bahia State, the Brazilian Environment and Natural Renewable Resources Institute (IBAMA), the Ministry of Agriculture, Livestock and Supply, the Chico Mendes Institute for the Biodiversity Conservation (ICMBio), the Pau Brasil National Park, the Brazil Climate Coalition (Forests and Agriculture: Pact for the Restoration of the Atlantic Rainforest), the Conservation International (CI), the World Resources Institute (WRI), the Estação Veracel RPPN, the Rio do Brasil RPPN, the Federal University of Southern Bahia (UFSB), the Universidade Estadual Paulista (UNESP), the Universidade Federal de Lavras (UFLA) and Aspex: Association of the producers of eucalyptus of the extreme south of Bahia.

The invites were sent through email on June 17th. At the invitation, the link to the Microsoft Teams was informed, as well as date (June 26, 2023) and time (2 p.m. – 4 p.m.).

The Consultation was held on the stablished date, with the participation of Symbiosis members and Radicle members. The meeting initiated at approximately 2:20 p.m., in order to wait for more participant to join. The explanations were carried out through slides, by both teams. From Symbiosis, Bruno Mariani, the company's CEO, gave a brief context about the company, followed by Alan Batista (CFO), which explained the overall business model. Elisa Guida and Susian Martins, from Radicle, explained the carbon project itself – Type, duration, start date, methodology and tools, location, applicability, baseline, additionality, quantifications, safeguards, and monitoring. Examples of the slides are presented in **Figure 27.**

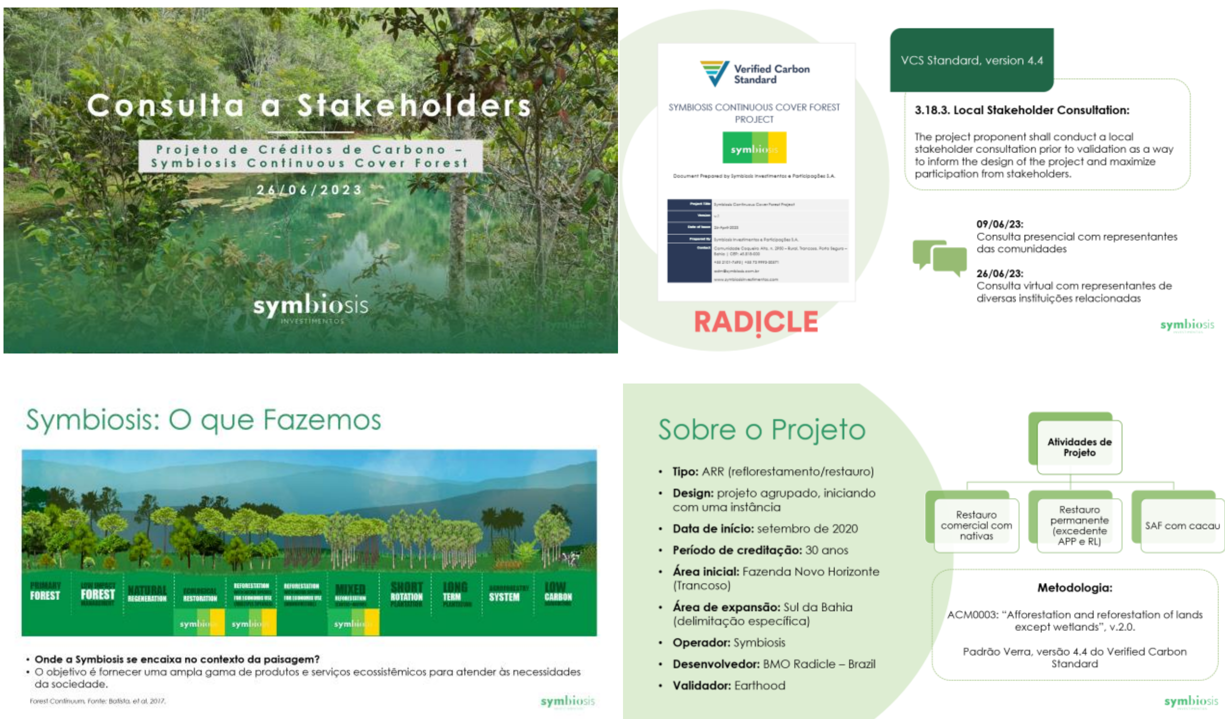


Figure 27 - Examples of the slides used on the video conference Consultation (June 26).

During the video conference, apart from Symbiosis and Radicle's teams, the event had 05 participants:

- Ricardo Aguilar Galeno - Conservation International (CI);
- Pedro Bevilaqua - Atlas Florestal;
- Elder Rodrigues, Atlas Florestal;
- Ana Carolina Gonsalez, Saracura Institute;
- Alex Fernando Mendes, Global Pact.

No concerns were raised; however, the participants had some questions:

- How is soil carbon quantified and monitored?
- If the plants are removed for commercial purposes, how is that explained in the quantifications?
- To include new areas in the project, how does that work? Is the project obliged to meet the proposed expansion of 70,000 ha?

All the doubts were answered during the meeting, which records is available for consultation. Email addresses were also informed for further doubts. However, by the time that this version of the PD was finished, no other questions were raised.

Figure 28 presents a screenshot of the event.

Figure 28 - Screenshot of the videoconference on June 26.

Invites and the recording of the video conference are available for consultation at **Appendix 2.**

<u>Ongoing Communication – Concerns and Complaints - Procedures</u>

With respect to the ongoing communication, Symbiosis is finalizing the development of three internal protocols for social engagement, with the support of "Etno Consultoria".

The protocol for ongoing engagement and receiving concerns and complaints is explained in **Figure 29.**

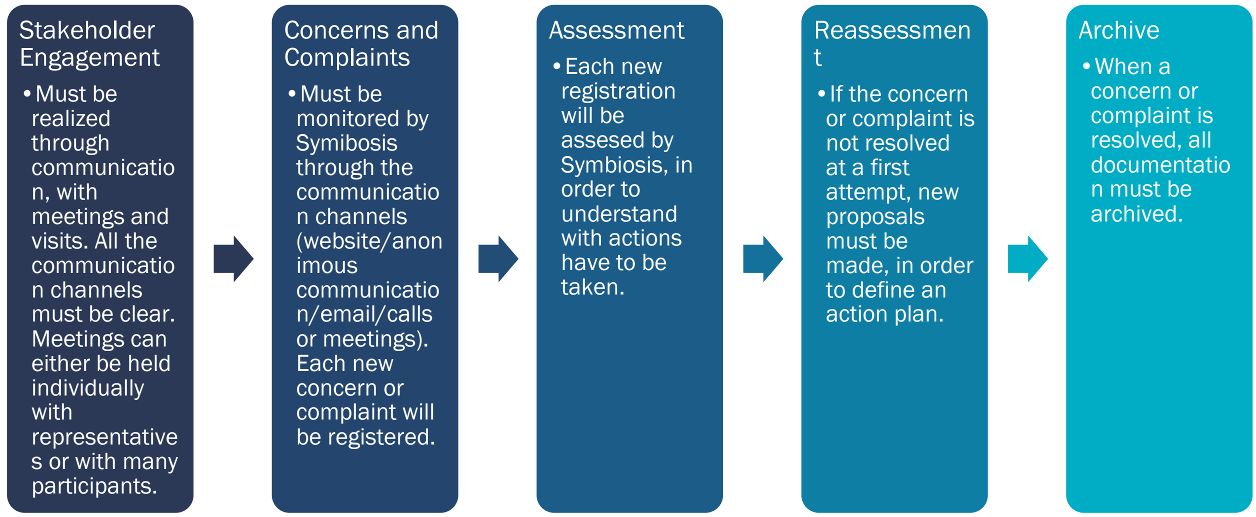


Figure 29 - Concerns/complaints protocol - Symbiosis.

In relation to the relevant laws and regulations covering workers' rights in the host country, they are all strictly followed by Symbiosis, and summarized below:

- National Constitution (1988): covers the basic rights assured to Brazilian workforce.
- Consolidation of Labor Laws (Decree n. 5.454 of 1943): covers detailed rights assured to Brazilian workforce.
- Law n. 6.019 of 1974: covers the rights assured to temporary and outsourced workers.
- Law n. 8.036 of 1990: covers the Severance Indemnity Fund ("FGTS")
- Law n. 8.213 of 1991: covers social security benefits to which Brazilian workforce is entitled to.

2.3 Environmental Impact

According to national and regional legislation, the Project Activities do not require Environmental Impact Assessments to be carried out. Symbiosis does meet all the requirements that are needed in order to develop the proposed activities. A summary of existing the licenses/authorizations currently issued to Symbiosis are presented in **Table 13.** Documents are available for consultation at **Appendix 3.**

Table 13 - Environmental licenses/authorizations issued to Symbiosis.

Agency	Document	Purpose
IBAMA (Brazilian Institute of the Environmental and of the Natural Renewable Resources)	ADA (Environmental Declatory Act).	Registration document of the rural property areas with IBAMA and the areas of environmental interest that integrate it for purposes of exemption from the Tax on Rural Territorial Property (ITR).
	CTF (Federal Technical Registration)	Legal entities carrying out activities under environmental control are obliged to register in the Federal Technical Register.
SICAR (National System for the Environmental Rural Certificate Registry)	CAR (Environmental Rural Certificate).	National electronic public record, mandatory for all rural properties, with the purpose of integrating the environmental information of rural properties and possessions, composing a database for control, monitoring, environmental and economic planning and combating deforestation.
INEMA Institute for the Environment and Water Resources	Proof of registration of the planted production forest.	Required for legal entities that produce, collect, extract, benefit, unfold, industrialize, commercialize, store, consume, transform or use products, by-products or raw materials originating from any forest formation, including those installed in other federation units that consume or use forest products or by-products originating in the State of Bahia, as well as those they supply to the State.
	State registration of potentially polluting activities and users of natural resources.	Instrument for control and inspection purposes of activities capable of causing environmental degradation or that use natural resources in some of the stages of the production process.
	RAF (Certificate of registration of individuals and legal companies performing related activities to the forest production chain.	Mandatory for individuals and legal entities that produce, collect, extract, benefit, unfold, industrialize, commercialize, store, consume, transform or use products, by-products or raw materials originating from any forest formation, including those installed in other states of the federation that consume or use forest products or by-products originating in the State of Bahia, as well as those that supply the State.

The activities carried out by Symbiosis at PAI-01 (Fazenda Novo Horizonte) and to be expanded during the project crediting period will promote the restoration of Brazil's most impacted biome – the Atlantic Rainforest. That will generate a series of positive impacts that will, overall, improve the environmental quality of the region.

However, negative impacts are also related, for example, related to soil fertilization and preparation (use of machinery), especially at the implementation phase. Other types of impacts are foreseen for the future phases, in which there will be wood removal, mainly regarding machinery displacement.

Hence, the summary of the environmental impacts associated with the project is presented at **Table 14.**

Table 14 - Summary of the identified environmental impacts related to the project.

Impact	Type	Expected Duration
GHG Emissions due to the use of fossil fuels (machinery)	Negative	Short (temporary)
GHG emissions due to the use of fertilizers	Negative	Short (temporary)
Increase of the native forest cover	Positive	Long (permanent)
Local fauna and flora improvement and preservation	Positive	Long (permanent)
Connections of fragmented landscapes	Positive	Long (permanent)
Improvement of soil conditions	Positive	Long (permanent)
Water quality improvement and hydrological cycles regulation	Positive	Long (permanent)
Climate change mitigation	Positive	Long (permanent)

During the project duration, Symbiosis will develop environmental checklists, in order to monitor and guarantee the environmental conditions of all areas, as well as ensure that all environmental related requirements are met.

2.4 Public Comments

This section will be completed after the Public Comments period.

2.5 AFOLU-Specific Safeguards

According to the VCS Standard, v.4.4, Section 3.18.11: "Where AFOLU project activities do not impact local stakeholders, projects are not required to meet the requirements set out in Sections

3.18.12 – 3.18.20 below. The project proponent shall provide evidence that project activities do not impact local stakeholders at validation and each verification".

So far, Symbiosis operations at PAI-01 (Fazenda Novo Horizonte) do not result in impacts to local stakeholders, apart from positive the impact of employment. No local people have had any type of land dispute, natural resource dispute or whatsoever.

A study has been conducted in March, 2022 by a specialized company (2tree), with purpose of understanding the social diagnostic of the Symbiosis Operations region. According to the referred study, Symbiosis is located in the village of Coqueiro Alto, in Trancoso, which is a district of Porto Seguro – Bahia. Its radius of action is around the unit, in the villages of Sapirara, Coqueiro Alto and Itaporanga - Imbiriba, the latter is declared indigenous. In addition, a 20km buffer from Novo Horizonte Farm confirms that the project has no direct impact on points of interest (Figure 30).

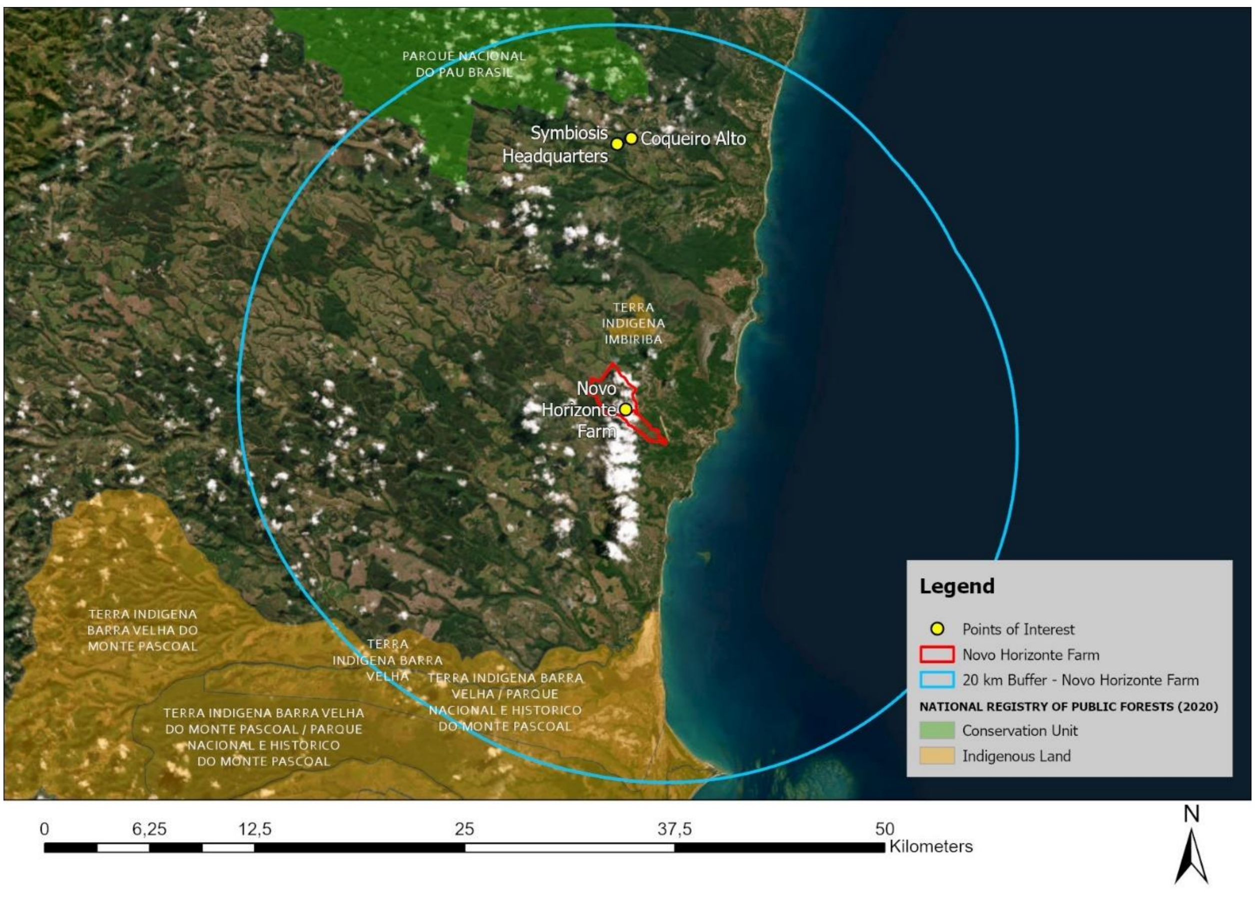


Figure 30 - 20km buffer from PAI-01.

The closest community from the project area is the Imbiriba Indigenous Community, which has its rights assured by National Laws[15]. The People of Coqueiro Alto, located closer to the Symbiosis

[15] Law nbr. 6,001 (1973) - Indigenous People Statute; Decree no. 1775 (1996), regarding the procedures for the demarcation of indigenous land.

headquarters than to the Novo Horizonte Farm, also does not suffer from any impact due to the project implementation.

Because this is a grouped project, next PAIs will all be assessed before implementation, ensuring social engagement, if there are local stakeholders identified, and, at any time, if there are impacts observed, they will go through assessment, in partnership with Symbiosis specialized team.

Symbiosis is already working with another specialized company for social engagement, “Etno Consultoria”, which has developed three protocols for relationship with communities (**Table 15**).

Table 15 - Procedures developed in Symbiosis for Social Engagement.

Procedure Name	Description
Social Impact Assessment Procedure for Forestry Operations	This procedure describes the steps to be carried out by Symbiosis, aiming to mitigate, reduce, compensate or enhance the aspects and impacts, with adverse or beneficial effects, generated by the enterprise's operations for the communities as well as the individual interested parties.
Relationship with the Communities	Establish methods for managing relationships, ensuring the minimization of impacts on the development of its activities, with the communities located in the areas of influence of Symbiosis' forest management.
Resolution of conflicts and disputes with interested parties	This Management procedure is aimed at resolving Conflicts, disputes and possible compensations. It will establish the internal norms that must be complied with in all relations with interested parties, establishing criteria for the systematic amicable or judicial solution of conflicts, disputes and compensations that involve rights of use, possession and domain of land, between Symbiosis and owners of real estate, local community, institutions, social movements and others, allowing the continued pretense of maintaining ownership and domain of these lands, enabling the continuous carrying out of the company's activities.

In respect to ongoing communication, risks identification and receiving concern and complaints, the procedures explained in Section 2.2 apply (please see **Figure 29**).

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The Project was developed under a CDM approved methodology, which is currently authorized by Verra:

- AR-ACM0003: Afforestation and reforestation of lands except wetlands --- Version 02.0[16]

In addition, the following CDM tools[17] were applied:

1) A/R Methodological tool (AR-AM Tool 02): Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (version 1).
2) A/R Methodological tool (AR-AM Tool 08): estimation of non-CO2 greenhouse gas (GHG) emissions resulting from burning of biomass attributable to an A/R CDM project activity (version 4.0.0).
3) A/R Methodological tool (AR Tool 12): Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities (version 3.1.).
4) A/R Methodological tool (AR-AM Tool 16): Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities (version 1.1.0).
5) A/R Methodological tool (AR Tool 14): estimation of carbon stocks and the change in carbon stocks of trees and shrubs in A/R CDM project activities (version 4.2.).
6) A/R Methodological tool (AR Tool 15): estimation of the increase in GHG emissions attributable to the displacement of pre- project agricultural activities in A/R CDM project activities. (version 2.0.).

3.2 Applicability of Methodology

Table 16 demonstrates how the methodology and its tools are applicable.

[16] This methodology is available at: https://cdm.unfccc.int/methodologies/DB/C9QS5G3CS8FW04MYYXDFOQDPXWM4OE

[17] These tools are available at: https://cdm.unfccc.int/methodologies/DB/C9QS5G3CS8FW04MYYXDFOQDPXWM4OE

Table 16 - Demonstration of the applicability of the methodology.

Methodologies and tools	Applicability Conditions	Compliance
AR-ACM0003: Afforestation and reforestation of lands except wetlands	The land subject to the project activity is not categorized as ‘wetland’.	There are no permanently flooded areas that can fall into the wetlands category within PAI-01 (see **Figure 32**). New project instances will not be included if they are located in permanently flooded areas.
	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 soil. (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 areas to be reforested in this Grouped Project do not include land with organic soil (see**Figure 23** in Section 1.13). Values well above 60 g/dm^3 indicate accumulation of organic matter in the soil due to localized conditions, generally due to poor drainage or high acidity. The results of the soil analysis of the PAI-01 plots did not show soil organic matter levels representative of organic soils, not exceeding 26 g/dm^3 in the 0-20 cm layer. Furthermore, the project will implement its activities on lands that are currently non-native ecosystems, especially degraded pastureland without inputs and with a low percentage of organic matter. This condition will be verified by crossing the project area with the pasture quality survey carried out periodically by MAPBIOMAS, in addition to questionnaires or declarations from landowners (PAI's) confirming the degradation condition without any input. In the absence of the project activity, it is expected that the areas, composed in the baseline scenario mostly of unmanaged and degraded pasture, will

Methodologies and tools	Applicability Conditions	Compliance
		remain without management and/or improvement initiatives (and, in this sense, without use and management practices and receipt of inputs listed in Appendices 2 and 3 of methodology AR-ACM0003). As for project activities, the most common practice of soil preparation and disturbance for implementation of project activities involves subsoiling in the planting row or, often, just opening the planting pits. However, it is important to point out that depending on the state of soil degradation or the amount of grass biomass in the area, due to the absence of management practices in the baseline scenario, harrowing activities are carried out during soil preparation. It is also important to emphasize that these soil disturbing activities only occur during soil preparation for planting and are not repeated throughout the project.
A/R Methodological tool (AR-AM Tool 02): Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (Version 01)	(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 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 afforestation and reforestation project activities.	(a) Project forestation activity will not lead to violation of any applicable law, as established in Section 1.14. (b) The Symbiosis Continuous Cover Forest Project is a Large-Scale project (see Section 1.10).
A/R Methodological tool (AR-AM Tool 08): estimation of non-CO2 greenhouse gas (GHG) emissions resulting from burning of biomass	The tool is applicable to all occurrence of fire within the project boundary. Non- CO2 GHG emissions resulting from any occurrence of fire within the project	No burning of biomass is attributable to the Project activity (see Section 4.2). However, if fire incidence occurs within the Project area boundaries during the Project lifetime, this tool will be applied.

Methodologies and tools	Applicability Conditions	Compliance
attributable to an A/R CDM project activity (Version 04)	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.	
A/R Methodological tool (AR-AM Tool 16): Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities (Version 01.1.0)	This tool is applicable when the areas of land, the baseline scenario, and the project activity meet the following conditions: (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 project activity meets the following conditions: (i) Litter remains on site and is not removed in the A/R project activity; (ii) Soil disturbance attributable to the A/R project activity, if any, is:	(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. (b) The litter remain on site and will not be removed on any site. Besides the soil disturbance is done by following appropriate soil conservation practices, including planting along contour lines. In addition, soil revolving for project implementation only occurs in the year of planting and this revolving will occur again 24 years after planting, due to the first enrichment of the commercial restoration model.

Methodologies and tools	Applicability Conditions	Compliance
	• 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.	
A/R Methodological tool (AR Tool 14): estimation of carbon stocks and the change in carbon stocks of trees and shrubs in A/R CDM project activities. Version 04.2	The tool has no internal applicability criteria.	The tool has no internal applicability criteria.
A/R Methodological tool (AR Tool 15): estimation of the increase in GHG emissions attributable to the displacement of pre- project agricultural activities in A/R CDM project activities. Version 02.0	This tool is not applicable if the displacement of agricultural activities is expected to cause, directly or indirectly, any drainage of wetlands or peat lands.	The Project activity does not cause, directly or indirectly, any drainage of wetlands or peat lands and does not expect any 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). Project activities will be implemented in degraded pasture areas. Thus, the displacement of pre-project activities is not foreseen in the Grouped Project. Complementarily, the project will carry out annual monitoring of the native forest cover in each rural property involved in the project.
A/R Methodological tool (AR Tool 12): Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities	The tool has no internal applicability criteria.	The tool has no internal applicability criteria.

Wetlands

According to Junk, et al. (2013), the following definition and delineation of Brazilian wetlands is described below:

"Wetlands are ecosystems at the interface between aquatic and terrestrial environments; they may be continental or coastal, natural or artificial, permanently or periodically inundated by shallow water or consist of waterlogged soils. Their waters may be fresh, or highly or mildly saline. Wetlands are home to specific plant and animal communities adapted to their hydrological dynamics. The extent of a wetland can be determined by the border of the permanently flooded or waterlogged area, or in the case of fluctuating water levels, by the limit of the area influenced during the mean maximum flood. The outer borders of wetlands are indicated by the absence of hydromorphic soils and/or hydrophytes and/or specific woody species that are able to grow in periodically or permanently flooded or waterlogged soils. The definition of a wetland area should include, if present, internal permanently dry areas as these habitats are of fundamental importance to the maintenance of the functional integrity and biodiversity of the respective wetland."

The distribution of wetlands currently mapped in Brazil can be seen in Figure 31. Note that the Northeast region of Brazil, including the state of Bahia, does not have such wetlands.

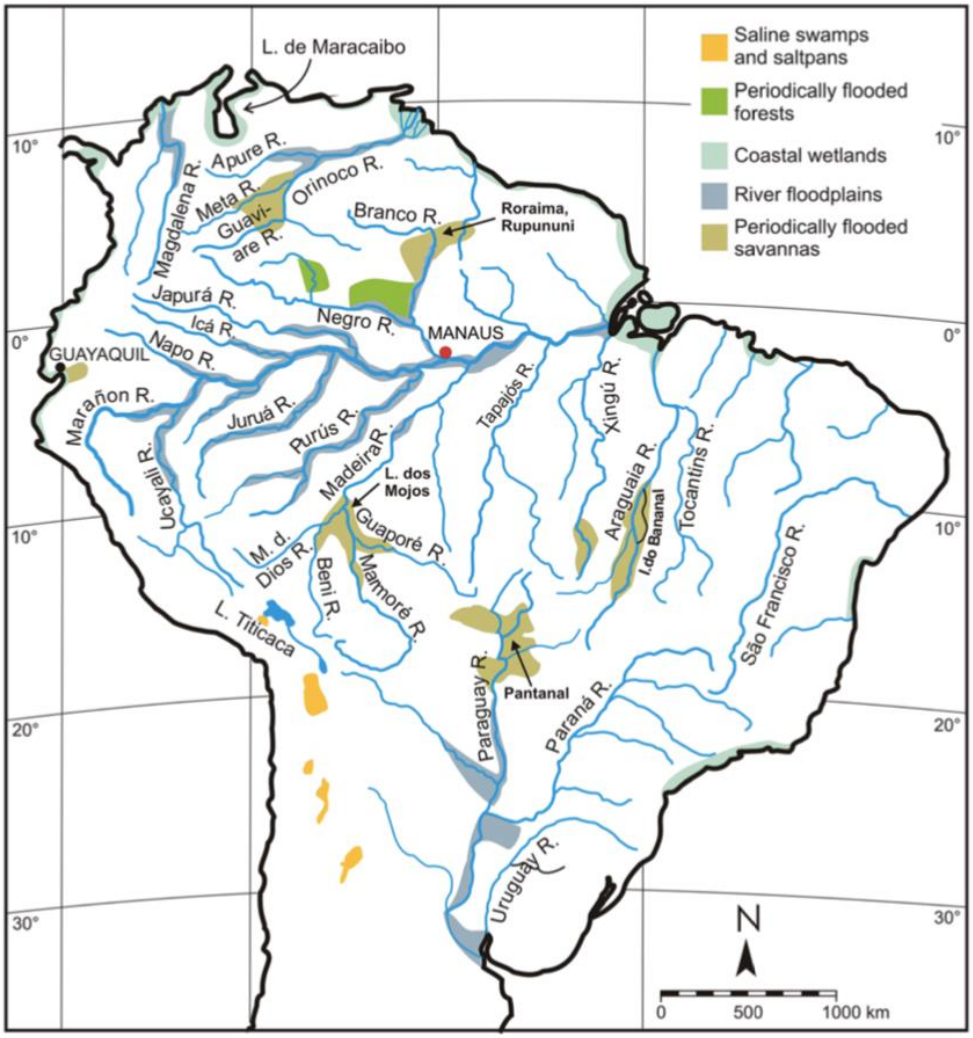


Figure 31 - Distribution of wetlands in northern South America (Junk, et al., 2007).

In addition, it is possible to observe that PAI-01 does not present wetlands, as shown in Figure 32. This classification refers to the year 2020, the same year the project started.

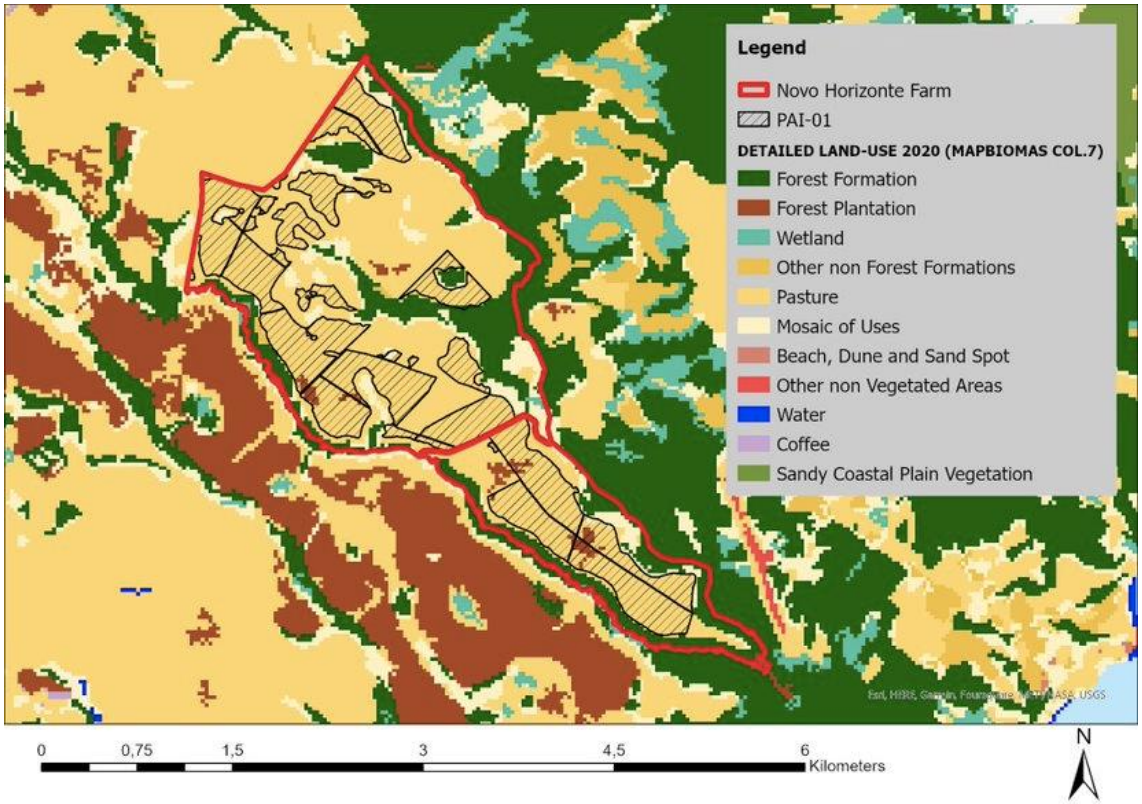


Figure 32 - Classification of land use in PAI 01 in the year 2020.
Source: (Mapbiomas: Col. 7[18]).

3.3 Project Boundary

The relevant GHG sources, sinks and reservoirs for the Project and baseline scenarios are presenting in **Table 17.**

Table 17 - Project GHG sources, sinks and reservoirs.

Source		Gas	Included?	Justification/Explanation
Baseline	Above and below ground (roots) biomass in trees and shrubs	CO_2	Yes	As baseline is pasture, it is considered that carbon stock in these pools will zero.
		CH_4	No	This is not a requirement of the methodology.
		N_2O	No	This is not a requirement of the methodology.
		Other	No	This is not a requirement of the methodology.

[18] https://mapbiomas.org/colecoes-mapbiomas-1

Source		Gas	Included?	Justification/Explanation
	Dead wood, Litter and Soil Organic Carbon	CO_2	Yes	As baseline is pasture, it is expected that carbon stock in these pools will not increase due to the implementation of the baseline activity.
		CH_4	No	This is not a requirement of the methodology.
		N_2O	No	This is not a requirement of the methodology.
		Other	No	This is not a requirement of the methodology.
Project	Above and below ground (roots) biomass in trees	CO_2	Yes	Carbon stock in above ground biomass is the major carbon pool subjected to Project activity and it is expected to increase due to the implementation of the Project activity. 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.
		Other	No	This is not a requirement of the methodology.
	Dead wood, Litter and Soil Organic Carbon	CO_2	Yes	It is expected that carbon stock in these pools will increase due to the implementation of the restoration activities.
		CH_4	No	This is not a requirement of the methodology,
		N_2O	No	This is not a requirement of the methodology,
		Other	No	This is not a requirement of the methodology,

Both the initial instance (PAI-01) and the Project Zone boundaries are presented in Section 1.12 of this document. Each new PAI included in this Grouped Project will have a specific and georeferenced boundary to be presented in the Verification process.

3.4 Baseline Scenario

The baseline scenario will be justified in Section 3.5 - Additionality, by applying the A/R CDM Methodological tool AR-Tool 02 - “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 PAI-01 was characterized by degraded pasture with sparse trees in landscape, as occurs in the same region and municipality of the PAI-01.

In the absence of the project, the project areas would remain dominated by land-uses with low-carbon stock and continue to be occupied by non-native ecosystems as a consequence of anthropic activities practices (for example: pastureland).

The "Scenario 1: Continuation of the pre-project land use: degraded pastures without management" was identified as the baseline scenario for each PAI included in the Grouped Project (see Section 3.5)[19].

3.5 Additionality

Regulatory Surplus

According to the VCS Standard, v.4.4, the project shall demonstrate regulatory surplus at validation and each project crediting period. The proposed activities are not mandated by any law, statute, or other regulatory framework, or for UNFCCC non-Annex I countries, any systematically enforced law, statute, or other regulatory framework. Every one of the three activities carried out and proposed by Symbiosis meet this condition.

Additionality Demonstration

The assessment and demonstration of additionality and the identification and justification of the baseline scenario are described using the CDM "Combined tool to identify baseline scenario and demonstrate additionality in A/R CDM project activities (AR-AM Tool 02 - Version 01)" - 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.

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

The two requirements of STEP 0 are demonstrated in **Table 18.**

[19] The baseline will be reassessed in the sixth year of the project.

Table 18 - Demonstration of STEP 0 compliance.

Requirement	Compliance demonstration
Provide evidence that the starting date of the A/R project activity was after 31 December 1999.	The project start date is September 09, 2020, as per Section 1.8.
Provide evidence that the incentive from the planned sale of credits 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 credits was seriously considered in the decision to proceed with the project activity is evidenced in the in the business plans prepared by Symbiosis. This business plan considers the expansion of the commercial restoration model with planting cycles and enrichment with native species until the year 95 after the first planting, in addition to the potential for carbon removal and its respective revenue throughout the project.

Step 1. Identification of alternative scenarios

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

Scenario 1: Continuation of the pre-project land use: degraded pastures without management.

As pointed out in Section 1.13, according to MapBiomas, in 2020, the Project Zone main land-use was pasture, summing up to 2,291,857.33 ha, followed by Forest Cover (1,871,838.16 ha) and Mosaic of Uses (638,456.12 ha), which means small scale agriculture mixed with pasture. Almost 50% of the pasture (1,030,807.80 ha) was considered to present severe or moderate grade of degradation.

From 2010 to 2020 there was an increase of 105,239.84 ha in pasture area, mostly coming from the conversion of agriculture or forest cover (MapBiomas) (Section 1.13). Although the increase represents less than 5% of the total pasture area in 2010, the data show stability in land use in the region, reaffirming low-tech cattle ranching as the main rural economic activity.

The Grouped Project will integrate new PAI prioritizing pastures within the Project Zone that have undergone conversion at least 10 years prior to the PAI incorporation. It is important to note that the project is not intended to generate GHG emissions for the purpose of subsequent reduction, removal, or destruction.

Scenario 2: afforestation of the land within the Project Zone performed without being registered as the A/R VCS project activity.

As described in the item on common practices, commercial restoration with native species in Brazil, and especially in the state of Bahia, is still very incipient. Therefore, while this scenario is feasible, it is very unlikely to occur on a large scale in the project zone.

Also, this scenario in large scale is unlikely due to the barriers presented in Step 2. In short, the reforestation/restoration activity has high investment costs, back ended cash flows, long payback and breakeven period, lack of specialized labor and lack of access to necessary materials and barriers related to distance from sawmills, incurring high transport costs.

Scenario 3: Project activity somewhere within the project zone.

This scenario is unlikely to happen on a large scale due to the justifications already presented in scenario 2.

Outcome of sub-step 1a:

List of credible alternative land use scenarios that would have occurred on the ground within the boundaries of the project activity:

- Scenario 1: Continuation of pre-project land use: degraded pastures without management.
- Scenario 2: Project activity on the ground within the Project Zone conducted without being recorded as an ARR VCS project activity: forest restoration.
- Scenario 3: Project activity somewhere within the Project Zone.

<u>Sub-step 1b. Coherence of credible alternative land use scenarios with applicable mandatory laws and regulations</u>

According to the Additionality tool, all the alternative land use scenarios are legal and enforced by mandatory applicable laws and regulations considering the enforcement in Brazil and Atlantic Rain Forest region. These alternative land uses scenarios in the Project Zone that follow all mandatory applicable legal and regulatory requirements. More information on legal regulation were described in <u>Section 1.4</u>. In short, two Brazilian public policies concerning the agricultural sector and land use are relevant to comply with NDCs: The Sectoral Plan for Mitigation and Adaptation to Climate Change for a Low-Carbon Emission Agriculture (ABC Plan) and the National Plan for Native Vegetation Recovery (Planaveg).

Outcome of sub-step 1b:

- Cattle ranching.
- Forest plantations (without being registered as a carbon project).
- Forest plantations (with being registered as a carbon project).

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

The commercial forest restoration activity has high technical viability and opportunities, and wood from native species is well accepted by the market, mainly for civil construction, in addition to presenting several co-benefits for soil, water, biodiversity and communities.

Its costs, on the other hand, are extremely high due to great effort needed for implementation and monitoring. Another barrier to overcome this pathway, is the high opportunity cost of land due to the high financial returns expected from agricultural commodities, mainly cattle and soy, both, in general, with lower investment costs, thus reducing restoration costs and monetizing the removed carbon are essential to upscale restoration to be viable.

During 2021, the difficulty in obtaining raw materials raised the production costs of some chains, this global scenario has even created bottlenecks in the production of several segments. In the case of the cultivated trees sector, all inputs used in production increased throughout the year, however, the greatest impact was urea, fertilizers and chemical fertilizers. The wood production cost index accumulated an increase of 94% in 2021. The index built from information from the FGV IPA was well above the inflation measured by the Extended Consumer Price Index (IPCA) of 10.06% in 2021 (IBÁ, 2022)[20].

The Ordinance No. 118, of October 3, 2022, of the Ministry of the Environment / Brazilian Institute of the Environment and Renewable Natural Resources (MMA/IBAMA), presents a Standard Operating Procedure for Estimating the Costs of Implementation and Maintenance of Project of native vegetation restoration in Brazilian Biomes, considering the parameters below:

Operating costs = fencing costs + deployment costs + maintenance costs.

In general, operating costs encompass several actions and items, such as:

a) Fencing to isolate the area: availability, quantity and unit and total price of materials to be used in making the fence (wire, posts, stretchers, rockers, etc.).

[20] IBÁ. Indústria Brasileira de Árvores. Annual Report 2022. 49p. Available in: https://iba.org/eng/datafiles/publicacoes/relatorios/relatorio-iba2022-en-2022-12-06-compressed.pdf

b) Soil collection and analysis in the laboratory.
c) Seedlings and seeds.
d) Miscellaneous inputs (limestone, fertilizers, agrochemicals, fuel, etc.).
e) Tools, machinery, implements and various equipment.
f) Labor employed for implementation activities (making firebreaks; soil preparation; leasing, crowning and opening pits or cradles; distribution of inputs; sowing; planting seedlings, etc.) and maintenance (combating leaf-cutting ants, weeding and mowing, replanting, topdressing fertilization, etc.).
g) Other operating costs.
h) Monitoring, evaluation and subsequent preparation of reports, that is, project administration by qualified technician(s); management,

According to Ordinance No. 118, of October 3, 2022[21], the estimate of minimum costs of the restoration of native vegetation in the Atlantic Forest can be seen in the **Table 19.**

Table 19 - Minimum costs estimates for native vegetation restoration at the Atlantic Forest.

Technique	Minimum cost/ha[22]
Nucleation	BRL 24,302.00/ha
Planting of seedlings (including nucleation)	BRL 19,382.87/ha
Planting seedlings (excluding nucleation)	BRL 17,743.17/ha
Natural regeneration	BRL 1,521.00/ha

Source: MMA/IBAMA (2022)[23].

Furthermore, it is necessary to consider transaction costs (diagnosis, negotiations, planning, etc.), which are not included in **Table 19**. Such costs refer to the opportunity cost; greater or lesser degree of difficulty in accessing the area; elaboration of the diagnosis and the project; hiring costs and conflict resolution costs.

Brancalion et al. (2019)[24] conducted detailed restoration cost assessments for the Brazilian biomes, include Atlantic Forest, considering several existing projects. Most surveys (60–90%) reported using the costly methods of planting seedlings or sowing seeds throughout the site,

[21] Available n: https://www.ibama.gov.br/component/legislacao/?view=legislacao&legislacao=139171

[22] On April 28, 2023, a BRL was worth 4.98.

[23] Ordinance No. 118, of October 3, 2022. Available in: https://www.ibama.gov.br/component/legislacao/?view=legislacao&legislacao=139171

[24] Brancalion et al. (2019). What makes ecosystem restoration expensive? A systematic cost assessment T of projects in Brazil. Biological Conservation 240 (2019). https://doi.org/10.1016/j.biocon.2019.108274

regardless of the biome. Natural regeneration and assisted regeneration approaches were an order of magnitude cheaper but were reported in < 15% of projects. Most of the tree planting and direct seeding costs were incurred during the implementation phase, and nearly 80% of projects ended maintenance within 30 months (Figure 33).

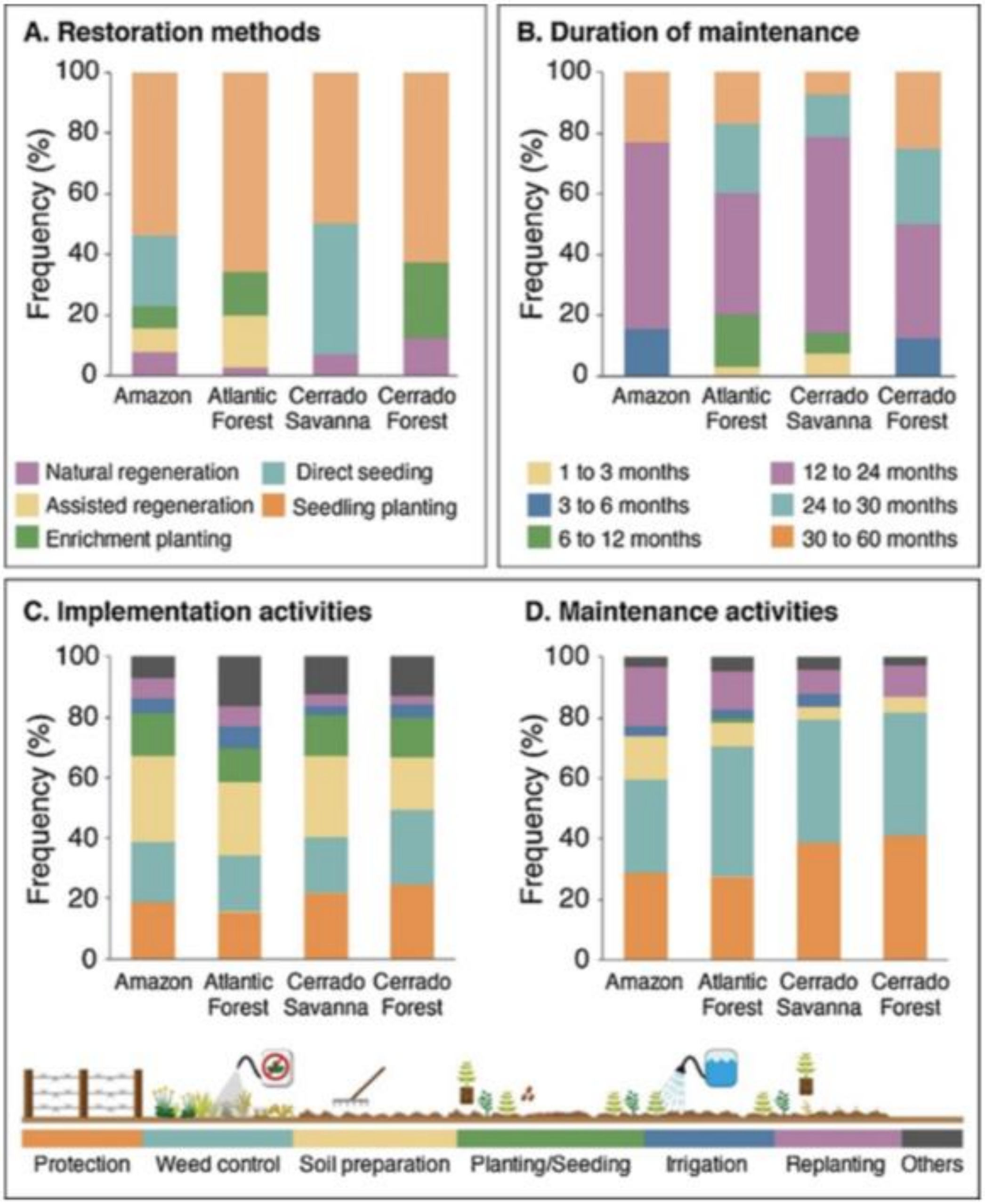


Figure 33 - Characterization of restoration methods and activities employed in Brazilian biomes.

Source: Brancalion et al. (2019).

In addition, technical studies on the economic viability analysis of forestry with native species corroborate the high values required for investment in such activity, regardless of the input parameters of the applied modeling such as productive arrangements and regional and agricultural peculiarities (Coalizão, 2021[25], TNC, 2017[26]).

For native species silviculture models, especially for wood production, revenues occur in large volumes, but generally after 20 years of implantation (post-harvest); thus, the period necessary to capitalize on the investment is long-term, as it depends on the age required for the plantations to reach the volume and/or quality demanded by the market.

BARRIER RELATED TO LOCAL LAND USE TRADITION

As presented in Section 1.13, the region in which the Project Zone is located carries the historical importance of having been the region where the first Portuguese landed, back in 1500, to start the colonization of the territory that we now call Brazil. In this way, the history of land-use changes, deforestation, and predatory exploitation of natural resources in the region coincides with the beginning of the colonization of Brazil.

The Atlantic Rainforest biome covers around 15% of the national territory and, nowadays, is home to 72% of Brazilian population and concentrates 80% of the national GDP. Essential services such as water supply, climate regulation, agriculture, fishing, electric energy, and tourism depend on it. Today, only 24% of the original forest remains, of which only 12.4% are mature and well-preserved forests.

According to the last Brazilian Agricultural Census (IBGE, 2017), in the state of Bahia there are 762,800 agricultural establishments, covering a total area of 28 million hectares. Of this total, only 2% corresponds to planted forests (including eucalyptus and pine), while pastures and crops occupy approximately 60% of rural properties.

Regarding the number of farms in the state of Bahia, only 181 rural properties are dedicated, in the most varied ways, to commercial forest restoration with native species (IBGE, 2017) (**Table 20**).

Table 20 - Number of agricultural establishments with forestry species.

Region	Economic activity groups	Number of farms
Brazil	Total	299.698
	Forest production - native forests	2.370

[25] Available in: https://www.coalizaobr.com.br/home/phocadownload/2021/Reflorestamento-com-especies-nativas-estudo-de-casos.pdf

[26] Available in https://www.nature.org/media/brasil/economia-da-restauracao-florestal-brasil.pdf

Region	Economic activity groups	Number of farms
Bahia State	Total	4.613
	Forest production - native forests	181

Source: Censo Agropecuário IBGE, 2017.[27]

Figure 15 in Section 1.13 reinforces the land use situation in the Project Zone, in which 43% of the pasture was considered to present severe or moderate degradation (MapBiomas), besides reporting an increase of 105,239.84 ha in pasture area within the Project Zone (since 2010), mainly resulting from the conversion of agriculture or forest cover.

Outcome of Sub-step 2a:

List of barriers that may prevent one or more land use scenarios identified in Step 1b:

- Investment barrier.
- Barrier related to local land use tradition.

Sub-step 2b. Elimination of land use scenarios that are prevented by the identified barriers

Both Reforestation without carbon revenues and the project activity face the two identified barriers. Extensive cattle farming is the only land use alternative that does not face the identified barriers. **Table 21** shows the list of land use scenarios and the list of the faced barriers.

Table 21 - Summary of barriers faced for alternative use scenarios.

Scenario	Identified Barrier
Scenario 1: Continuation of the pre-project land use: degraded pastures without management	None
Scenario 2: Reforestation of the land within the Project boundary performed without being registered as the A/R VCS project activity.	- Investment barrier - Barrier related to local land use tradition
Scenario 3: Project activity somewhere within the project zone.	- Investment barrier - Barrier related to local land use tradition

Outcome of Sub-step 2b:

List of land use scenarios that are not prevented by any barrier:

[27] Available at: https://sidra.ibge.gov.br/tabela/6945

Scenario 1: *Continuation of the pre-project land use*: degraded pastures without management

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 with and 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 with and 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.
- Continuation of the pre-project land use: degraded pastures without management is the baseline scenario.

Step 3. Investment analysis (if needed)

No necessary – optional.

The investment analysis was not carried out because Step 2 was conclusive to determine the Grouped Project additionality, according to AR-AM Tool 02 "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project (Version 01)".

Step 4. Common practice analysis

As described in Step 2, mainly in item "Barrier related to local land use tradition" and also in Section 1.13, it is possible to conclude that the recovery of pre-project land use through reforestation/restoration activities is not a common practice in the Project region.

In 2021, the total area of planted trees totaled 9.93 million hectares (Brazil), an increase of 1.9% compared to 2020 (9.75 million hectares). Among the species, 75.8% of the area is made up of eucalyptus cultivation, with 7.53 million hectares, and 19.4% of pine, with approximately 1.93

million hectares. In addition to these crops, there are about 475,000 hectares planted with other species, including rubber trees, acacia, teak and paricá (IBÁ[28], 2022).

Considering that there are 351,289,816 hectares of rural properties in Brazil, the area destined for forest production does not reach 3%, while areas destined for native forest species do not reach 0.2% in Brazil (IBGE, 2017[29]).

In the state of Bahia, in 2021, the area destined for forest production represents only 648,143 ha, considering eucalyptus, and only 13,431 ha for other species (including native species) (IBA, 2022).

Table 22 quantify forestry production in Brazil and Bahia state over the last five years. It is noted that, in fact, production with native species (included in the history of the area planted with trees of other species) is still very low in the national territory, especially in the state of Bahia.

Table 22 - Historical area planted with eucalyptus trees and trees of other species, in hectares.

Region	2017	2018	2019	2020	2021
	Eucalyptus + Pinus trees				
Brazil	7,254,386	8,427,750	9,242,044	9,313,337	9,458,203
Bahia	608,781	585,258	589,336	637,765	648,143
	Trees of other species				
Brazil	585,825	427,232	389,218	438,210	475,658
Bahia	34,000	8,146	10,226	1,907	13,431

Source: IBÁ (2022).

3.6 Methodology Deviations

No deviation of methodology was applied in this Project.

[28] The Brazilian Tree Industry (Ibá) is the association responsible for institutional representation of the planted tree production chain, from the field to industry.

[29] Available in: https://censoagro2017.ibge.gov.br/

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

According to the methodology AR-ACM0003 - A/R Large-scale Consolidated Methodology Afforestation and reforestation of lands except wetlands (Version 02.0 - Sectoral scope 14),

The net anthropogenic GHG removals by sinks are calculated according to the Equation 5 (Section 5.8. of AR-ACM0003).

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

Where:

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

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

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

LK_t = GHG emissions due to leakage, in year t; t CO2-e

The following sections present and discuss each parameter of the equation,

4.1 Baseline Emissions

Baseline net GHG removals by sinks are calculated using the Equation 1 (section 5.4) of AR-ACM0003, as described below:

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

Where:

$\Delta C_{BSL,t}$ = Baseline net GHG removals by sinks in year t; t CO2-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 AR Tool 14 - “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities” (version 4.2.); t CO2-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 AR Tool 14 - “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities” (version 4.2.); t CO2-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 AR Tool 12 - “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities" (version 3.1.); t CO2-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 AR Tool 12 - "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities" (version 3.1.); t CO2-e

Quantifications were carried out in accordance with the abovementioned tools, for each parameter.

In relation to the parameters $\Delta C_{TREE\_BSL,t}$ and $\Delta C_{SHRUB\_BSL,t}$, paragraphs 5.11 and 5.12 of the AR Tool 14 – "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" (version 4.2.) present the following:

5.11. Carbon stock in trees in the baseline can be accounted as zero if all of the following conditions are met:

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

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

c. The pre-project 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.

According to Section 3.4., the chosen baseline scenario is the maintenance of degraded pastures without management. In those areas, scattered trees and shrubs can be observed in some situations. In the case that pre-project trees and shrubs are observed in the area, they will be maintained the system and their carbon stock will not be accounted (e.g. they will be left out of inventories). Therefore, conditions (a), (b) and (c) are met.

5.12. Changes in carbon stocks in trees and shrubs in the baseline may be accounted as zero for those lands for which the project participants can demonstrate, through documentary evidence or through participatory rural appraisal (PRA), that one or more of the following indicators apply:

a. Observed reduction in topsoil depth (e.g., as shown by root exposure, presence of pedestals, exposed sub-soil horizons);

b. Presence of gully, sheet or rill erosion; or landslides, or other forms of mass movement erosion;

c. Presence of plant species locally known to be indicators of infertile land;

d. Land comprises of bare sand dunes, or other bare lands;

e. Land contains contaminated soils, mine spoils, or highly alkaline or saline soils;

f. Land is subjected to periodic cycles (e.g. slash-and-burn, or clearing-regrowing cycles) so that the biomass oscillates between a minimum and a maximum value in the baseline;

g. Conditions (a), (b) and (c) under previous paragraph apply.

As mentioned before, conditions (a), (b) and (c) of paragraph 5.11. apply, due to the chosen baseline scenario. For that reason, both carbon stock in trees and changes in carbon stocks in trees and shrubs in the baseline were accounted as zero.

Therefore:

$$\Delta C_{TREE\_BSL,t} = 0 \text{ and } \Delta C_{SHRUB\_BSL,t\ t} = 0.$$

In relation to the parameters $\Delta C_{DW\_BSL,t}$ and $\Delta C_{LI\_BSL,t}$, they are both calculated by The AR Tool 12 – Methodological tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities” (version 3.1.). Tables 5 and 6 of that methodology define deadwood and litter carbon stocks as percentages of the carbon stocks in living trees. Because those stocks were considered zero, deadwood and litter carbon stocks in the baseline were also considered to be zero.

Therefore:

$$\Delta C_{DW\_BSL,t} = 0 \text{ and } \Delta C_{LI\_BSL,t} = 0.$$

Because all of the parameters of the Equation 1 (section 5.4) of AR-ACM0003 may be accounted as zero, baseline net GHG removals by sinks ($\Delta C_{BSL,t}$) is equal to zero.

4.2 Project Emissions

According to the AR-ACM0003 - A/R Large-scale Consolidated Methodology Afforestation and reforestation of lands except wetlands (Version 02.0 - Sectoral scope 14):

> *“GHG emissions resulting from removal of herbaceous vegetation, combustion of fossil fuel, fertilizer application, use of wood, decomposition of litter and fine roots of N-fixing trees, construction of access roads within the project boundary, and transportation attributable to the project activity shall be considered insignificant and therefore accounted as zero.”*

4.2.1. Actual net GHG removals by sinks

The actual net GHG removals by sinks are calculated in accordance with the AR-ACM0003 - A/R Large-scale Consolidated Methodology Afforestation and reforestation of lands except wetlands (Version 02.0 - Sectoral scope 14), section 5.5., paragraph 15 (Equation 2 of the methodology):

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

Where:

$\Delta C_{ACTUAL,t} =$	Actual net GHG removals by sinks, in year t; t CO2-e
$\Delta C_{P,t} =$	Change in the carbon stocks in the project, occurring in the selected carbon pools, in the year t; t CO2-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 project activity, in year t, as estimated in the AR Tool 08 - "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity"; t CO2-e

According to AR-ACM003 Methodology (version 2.0), changes in carbon stocks in the project are calculated using Equation 3 in section 5.5, as follows:

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

Where:

$\Delta C_{P,t} =$	Change in the carbon stocks in project, occurring in the selected carbon pools, in the year t; tCO2-e
$\Delta C_{TREE\_PROJ,t} =$	Change in carbon stock in tree biomass in project in year t, as estimated in the AR Tool 14 - "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO2e
$\Delta C_{SHRUB\_PROJ,t} =$	Change in carbon stock in shrub biomass in project in year t, as estimated in the AR Tool 14 - "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO2e
$\Delta C_{DW\_PROJ,t} =$	Change in carbon stock in dead wood in project in year t, as estimated in the AR Tool 12 - "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO2e
$\Delta CL_{I\_PROJ,t} =$	Change in carbon stock in litter in project in year t, as estimated in the AR Tool 12 - "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; tCO2e
$\Delta SOC_{AL,t} =$	Change in carbon stock in SOC in project, in year t, in areas of land meeting the applicability conditions of the AR Tool 16 - "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 CO2e

The parameters of the presented equation are calculated in the following items.

4.2.1.1. CHANGE IN THE CARBON STOCKS IN PROJECT OCCURRING IN THE SELECTED CARBON POOLS, IN THE YEAR T

Step 1: Stratification

According to the AR-ACM0003 methodology (section 5.3), for actual net GHG removals by sinks, the stratification for ex ante estimations is based on the project planting/management plan and the stratification for ex post estimations is based on the actual implementation of 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.

The stratification procedures are explained as follows:

For stratification, this project activity considers three reforestation models:

- Tropical tree planting for timber production;
- Agroforestry system with cocoa;
- Ecological restoration.

Those reforestation models have different planting schedules withing each Project Activity Instance.

The Tropical tree planting for timber production is the only reforestation model implemented at PAI-01 (Novo Horizonte), where there is a different proportion of species already established at each year. For that reason, three different strata were considered for the area: NH2020, NH2021, HH2022 and NH2023.

For the area to join the grouped project in the expansion plan, the Tropical tree planting for timber production follow a standardized composition of species and will form a single stratum each year called "Symbiosis Model". The same will happen for Agroforestry system with cocoa and Ecological restoration. So, the strata were defined considering a <u>combination of reforestation model and year of implementation.</u>

Table 23 presents details of the stratification for initial project activity instances and the projected expansion capacity of project activities for the next years.

Table 23 - Stratification of the Project Area for PAI-01 (2020, 2021, 2022 and 2023) and expansion project activities for the next years.

Year	Symbiosis Model – Timber (ha)	Ecological Restoration (ha)	Agroforestry System (ha)	Total (ha)
2020 (NH2020)	115.12	-	-	115.12
2021 (NH2021)	11.47	-	-	11.47
2022 (NH2022)	15.97	-	-	15.97
2023 (NH2023)	93.94	-	-	93.94
2024	1,000	300	100	1,400
2025	2,000	600	200	2,800
2026	3,000	900	200	4,100
2027	4,000	1,200	500	5,700
2028	10,000	3,000	1,000	14,000
2029	10,000	3,000	1,000	14,000
2030	10,000	3,000	1,000	14,000
2031	10,000	3,000	1,000	14,000
Total	**50,236.5**	**15,000**	**5,000**	**70,236.5**

Step 2: Change in carbon stock in trees between two points of time

Section 6 of the AR Tool 14 defines that the change in carbon stock in trees between two points of time is estimated by using Equation 1 (section 6.2):

$$\Delta C_{TREE} = C_{TREE,t2} - C_{TREE,t1}$$

Where the carbon stock in trees at a point of time (t) is estimated as per explained in section 8:

Change in carbon stock in tree biomass in project in year t

The estimates of the carbon stock in tree biomass at a point of time were carried out according to the 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). Section 8.1. of the tool indicates that the estimative of carbon stock in trees can be done by modelling tree growth and stand development. This method was used for ex-ante estimation (projection) of carbon stock in tree biomass.

The ex-ante estimation (projection) of carbon stock in tree biomass is not subjected to uncertainty control (paragraph 48 of AR Tool 14).

Carbon stock in trees at a point of time is estimated by using the following method: Estimation by measurement of sample plots. Under this method, carbon stock in trees is based of measurements of sample plots. Sample plots are installed in one or more strata. The sampling design is this case is: Stratified random sampling.

Mean carbon stock in trees within the tree biomass estimation strata and the associated uncertainty are estimated based on Equations 12, 13 14 and 15, as follows (all time-dependent quantities relate to the time of measurement):

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

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

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

$$u_C = \frac{t_{VAL}\ x\ \sqrt{\sum_{i=1}^{M} w^2{}_i\ x\ \frac{s_i^2}{n_i}}}{b_{TREE}}$$

Where:

C_{TREE} =	Carbon stock in trees in the tree biomass estimation strata; t CO2e
CF_{TREE} =	Carbon fraction of tree biomass; t C (t d.m.)-1. A default value of 0.47 is used unless transparent and verifiable information can be provided to justify a different value.
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
w_i =	Ratio of the area of stratum i to the sum of areas of tree biomass estimation strata (i.e.$w_i = A_i/A$); dimensionless
$b_{TREE,i}$ =	Mean tree biomass per hectare in stratum I; t d.m. ha-1

u_C Uncertainty in C_{TREE}

t_{VAL} = Two-sided Student's t-value for a confidence level of 90% and degrees of freedom equal to n – M, where n is total number of sample plots within the tree biomass estimation strata and M is the total number of tree biomass estimation strata;

s_i^2 = Variance of tree biomass per hectare across all sample plots in stratum i; (t d.m. ha-1)2

n_i = Number of sample plots in stratum i.

In the next step, mean tree biomass per hectare in a stratum and the associated variance are estimated using the will Equations 16 and 17 of the AR Tool 14, as follows:

$$b_{TREE,i} = \frac{\sum_{p=1}^{n_i} b_{TREE,p,i}}{n_i}$$

$$s_i^2 = \frac{n_i \ x \ \sum_{p=1}^{n_i} b_{TREE,p,i}^2 - \left(\sum_{p=1}^{n_i} b_{TREE,p,i}\right)^2}{n_i x (n_i - 1)}$$

Where:

$b_{TREE,i}$ = Mean tree biomass per hectare in stratum i; t d.m. ha-1

$b_{TREE,p,i}$ = Tree biomass per hectare in plot p of stratum i; t d.m. ha-1

s_i^2 = Variance of mean tree biomass per hectare in stratum i; (t d.m. ha-1)2

n_i = Number of sample plots in stratum i

The plot biomass value (i.e., per-hectare tree biomass at the centre of the plot) is estimated as follows (all time-dependent variables relate to the time of measurement) using the Equations 1, 2 and 3 of the AR Tool 14 - Appendix 1:

$$b_{TREE,p,i} = \frac{B_{TREE,p,i}}{A_{PLOT,i}}$$

$$B_{TREE,p,i} = \sum_{j} B_{TREE,j,p,i}$$

$$B_{TREE\,j,p,i} = \sum_{l} B_{TREE,l,j,p,i}$$

Where:

$b_{TREE,p,i}$ =	Tree biomass per hectare in sample plot p of stratum i; t d.m. ha-1
$B_{TREE,p,i}$ =	Tree biomass in sample plot p of stratum i; t d.m.
$A_{PLOT,i}$ =	Size of sample plot in stratum i; ha
$B_{TREE\,j,p,i}$	Biomass of trees of species j in sample plot p of stratum i; t d.m.
$B_{TREE,l,j,p,i}$	Biomass of tree l of species j in sample plot p of stratum i; t d.m.

Biomass of a tree in a sample plot can be estimated using two different approaches represented by the following equations (Equations 4 and 5 of the AR Tool 14 - Appendix 1):

$$\mathrm{B}_{TREE,\,\mathrm{l,j,p,i}} = f_j(x_{1,j}, x_{2,j}, x_{3,j}, \dots) \times (1 + Ri)$$

$$\mathrm{B}_{TREE,\mathrm{l,j,p,i}} = \mathrm{V}_{\mathrm{Tree,i}}\,(x_{1,j}, x_{2,j}, x_{3,j}, \dots)\ \mathrm{x}\ \mathrm{D_j}\ \mathrm{x}\ \mathrm{BEF_{2,j}}\ \mathrm{x}\ (1 + Ri)$$

Where:

$\mathrm{B}_{TREE,\mathrm{l,j,p,i}}$ =	Biomass of tree l of species j in sample plot p of stratum i; t d.m.
$f_j(x_{1,j}, x_{2,j}, x_{3,j}, \dots) =$	Above-ground biomass ($AGBi$) of the tree returned by the allometric equation for species j relating the measurements of tree l to the above-ground biomass of the tree; t d.m.
R_{j} =	Root-shoot ratio for stratum i; dimensionless
$\mathrm{V}_{\mathrm{Tree,i}}\,(x_{1,j}, x_{2,j}, x_{3,j}, \dots) =$	Stem volume of tree l of species j in sample plot p of stratum i, estimated from the tree dimension(s) as entry data into a volume equation; m3
$\mathrm{D_{j}}$ =	Density (over-bark) of tree species j; t d.m. m-3
$\mathrm{BEF_{2,j}}$	Biomass expansion factor for conversion of tree stem biomass to above-ground tree biomass, for tree species j; dimensionless

Tree belowground biomass will be calculated by multiplying the estimated tree biomass by 1 + Rj, where Rj is the root shoot ratio of trees calculated by:

$$R_j = \frac{e^{(-1.085+0.9256\ x\ ln\ b)}}{b}$$

This equation is proposed in AR Tool 14, where *b* is the above-ground tree biomass per hectare (t d.m. ha-1).

The allometric equation developed by Rollin & Piotto (2019)[30] was used for the estimates of individual aboveground biomass (ABG_j) and volume ($V_{Tree,j}$) of native tree species. This equation was developed based on samples obtained from plantations of these species in the same region where the project activities will be implemented.

These authors developed a specific equation to estimate the diameter at breast height (DBH) of trees per age, for a set of 35 different species. Once the mean annual increment (MAI) of DBH is known, this variable is applied in other equations developed by the authors to estimate the merchantable height (Hs) and total height (Ht) of the tree (hypsometric relationship). These variables were utilized to estimate the volume of the merchantable stem (Vs) and the total biomass of the trees (AGB) through equations also developed by them.

The stem biomass in the "Tropical tree planting for timber production" model, where trees are harvested in different cutting cycles, was achieved by multiplying the stem volume and the Basic Wood Density of tree species. The biomass of the crowns was estimated by calculating the difference between the total biomass and the stem biomass of the trees. Consequently, a variable BEF value was obtained for each age and species.

In the above ground biomass estimation, the equation adjusted by Rolim & Piotto (2019) used DBH, Ht, and Basic Wood Density (D or WD) as predictor variables. Most of the D values were obtained from the authors' own study. In the absence of information for any of the species, average values per species available in Zane et al. (2009)[31] were utilized.

For species of exotic timber trees (*Khaya ssp* and *Toona ciliata*), specific volume equations developed for this species, available in relevant scientific publications made by EMBRAPA (Brazilian Agricultural Research Corporation) were used. For these exotic timber species, Embrapa provides a software that provides estimates of mean annual diameter increment (DBH), merchantable height (Hs), and total height (Ht). In the software, a equation is used to estimate the merchantable volume (Vs) of the trees. These estimates consider differentiated productivity by region, based on climatic and environmental factors. By multiplying the stem volume (Vs or V_{Tree}) by the basic wood density of the species, the stem biomass is obtained. For the estimation

[30] ROLIM, Samir Gonçalves; PIOTTO, Daniel (Ed.). Silviculture and Wood Properties of Native Species of the Atlantic Forest of Brazil. Rupestre, 2019, 160 p.

[31] Zanne AE, Lopez-Gonzalez G, Coomes DA, Ilic J, Jansen S, Lewis SL, Miller RB, Swenson NG, Wiemann MC, Chave J (2009) Data from: Towards a worldwide wood economics spectrum. Dryad Digital Repository. doi:10.5061/dryad.234

of the total above-ground biomass of the tree (AGB), is applied the default biomass expansion factor (BEF = 1.15) proposed in the AR Tool 14.

In the "Tropical tree planting for timber production" model, the total biomass of the system in each year depends on the proportion of timber species used in commercial planting. The averages of the estimated parameters are all weighted according to these proportions, allowing for an appropriate and reliable result for the model used in each stratum (defined by the planting year). Starting from 2024, a single and specific model of Tropical tree planting for timber production called the Symbiosis Model was considered (Table 24).

Table 24 - Composition of species by stratum and planting years of Tropical tree for timber production Model.

Stratum	NH2020	NH2022	NH2023	Symbiosis
Year of planting	2020	2022	2023	2024- 2031
Area of stratum (ha)	115.125	15.97	105.41	50.000
Species weight composition				
Native (End) Species (60% of planting - 6 x 2 m - 833 tree ha^{-1})				
Zeyheria tuberculosa	14.1%	14.8%	15.7%	20.0%
Dalbergia nigra	13.3%	11.7%	3.5%	5.0%
Handoanthus serratifolius	23.2%	13.1%	9.2%	10.0%
Cordia trichotoma	13.7%	16.6%	15.2%	20.0%
Cariana legalis	18.2%	15.9%	15.5%	20.0%
Astronium graveoleons	2.5%	15.8%	14.2%	20.0%
Bowdichia virgilioides	0.1%	1.5%	3.5%	5.0%
Joanesia princips	0.0%	0.0%	11.2%	--
Anadenanthera (var.) macrocarpa	13.5%	10.6%	0.7%	--
Plathymenia reticulata	1.4%	0.0%	0.0%	--
Genipa americana	0.0%	0.0%	11.2%	--
Exotic (Accessories) Species (40% of planting - 6 x 3 m - 555 tree ha^{-1})				
Toona Ciliata	42.6%	0.0%	5.4%	10.0%
Khaya spp	57.4%	100.0%	94.6%	90.0%

Regarding the ecological restoration activity, a practical approach to formulate planting models involves the classification of species into functional groups. The 35 species analyzed in Rolim and Piotto (2019) were divided into 2 major groups: high MAI species group and low MAI species group. These groups may include other species not analyzed in the study by these authors, but that exhibit similar characteristics and behavior. These groups are planted in equal proportions in the area, with 50% each, adopting a planting spacing of 3 x 3 m (1,111 trees per hectare). The average basic wood density of the high MAI species group is 0.549 g cm-3, for the low MAI species group is 0.690 g cm-3, and the overall average for all species is 0.625 g cm-3.

Finally, to quantify the above-ground biomass for cocoa trees used in the Agroforest Systems, a biomass prediction equation developed by Gerrero & Chalapud (2006)[32] was applied. This equation incorporates the planting age as a predictor variable for estimating biomass at a specific age of cocoa plants. In this model, *Cordia trichotoma* and *Cariana legalis* plants are planted at a density of 208 trees per hectare, resulting in a total of 416 timber species trees per hectare. The biomass estimates for this group of species are consistent with those generated by the "Tropical tree planting for timber production" model.

To estimate the below-ground biomass (BGB) of trees in all models, the R_j factor proposed by AR-Tool 14, as previously described, was applied. The total tree biomass (B_{TREE}) is the sum of above-ground biomass (AGB) and below-ground biomass (BGB).

In a conservative approach, for models that consider timber harvesting activities, during the wood cutting year, due to thinning, it was assumed that all the carbon present in the biomass of these trees is extracted from the system, although some of this material may remain as residual material (branches, leaves, bark and roots of the trees). Thus, this carbon stock of the residual material must be monitored and accounted for in the dead wood and litter during the project crediting period.

At the end of 30 years, the estimated carbon stock of living tree biomass for the Tropical tree for timber production Model of Symbiosis is 279.4 CO_2e ha-1 or 9.3 CO_2e ha-1 year-1. For the Agroforest Model, the estimated of carbon stock is 239.8 CO_2e ha-1 or 8.0 CO_2e ha-1 year-1. For the Ecology Restoration Model, the estimated is 393.9 CO_2e ha-1 or an average of 8.0 CO_2e ha-1 year-1.

Table 25 presents the main parameters used for AGB and BGB estimates for the three project activities.

[32] Guerrero, A. M. O.; Chalapud, L. D. R. 2006. Almacenamiento Y Fijacion De Carbono Del Sistema Agroforestal Cacao Theobroma Cacao L Y Laurel Cordia Alliodora (Ruiz & Pavón) Oken En La Reserva Indígena De Talamanca, Costa Rica.

Table 25 - Main parameters used for living tree biomass (AGB and BGB) estimates for the 3 project activities.

Data/Parameter	Description	Unit	Value	Justification
CF_{Tree}	Carbon fraction in tree biomass	t C t-1 dry matter (t. d. m.)	0.47	IPCC default value to all parts of tree - Tropical and Subtropical 0.47 (0.44 - 0.49). IPCC (2006). Good Practice Guidance for LULUCF. Chapter 4. Forest Land. Table 4.3.
CO_2	Factor applied to convert the carbon in carbon dioxide (C -> CO_2)	CO_2e	3.667	IPCC default value 44/12.
AGB (tree native species) or $f_j(x_{1,j}, x_{2,j}, x_{3,j}, \ldots)$	Above-ground biomass (AGBi) of the tree returned by the allometric equation for species j relating the measurements of tree I to the above-ground biomass of the tree	tC	AGB = (0,1009*('DBH^2.2472)*('Ht^0.4333)*(D^0.7865))/1000	Biomass equation for species of the Atlantic Forest adjusted with data from forests similar to the present PD (see Rolim & Piotto, 2019).
AGB (tree accessory species) or $V_{Tree,i}$	Above-ground biomass (AGB_i) estimates, by Stem volume of tree - V_{Tree} (m^3; t d.m) multiplied for $BEF_{2,j}$	t C	AGB = $V_{Tree,i}$ ($x_{1,j}$, $x_{2,j}$, $X_{3,j}$...) x D_j x $BEF_{2,j}$ x (1 + Ri)	Biomass equation (applied to accessory species Khaya spp and Toona ciliata) Software EMBRAPA – Sis Cedro[33] e Sis Mogno[34].
AGB (cocoa tree)	To calculate the Above-ground biomass (AGB_i) of	t C	AGB = a+b*X-c*X^2	Biomass equation for cocoa tree (see Guerrero & Chalapud, 2006). This

[33] Available in: https://www.embrapa.br/en/florestas/busca-de-solucoes-tecnologicas/-/produto-servico/4156/siscedro---sistema-de-manejo-de-cedro-australiano

[34] https://www.embrapa.br/en/busca-de-publicacoes/-/publicacao/1113166/softwares-para-manejo-de-precisao-e-analise-economica-de-mogno-africano-em-plantios-puros-e-em-ilpf

Data/Parameter	Description	Unit	Value	Justification
	cocoa trees, the allometric equation proposed by Ortiz Guerrero and Riascos Chalapud (2006) was used.		a; b; c: regression coeficients X: age (months)	biomass prediction equation developed by Gerrero & Chalapud (2006) was applied. This equation incorporates the planting age as a predictor variable for estimating biomass at a specific age of cocoa plants.
DBH	Diameter at breast height (DBH)	cm year-1	Variable depending on the species	Specific value per year based on the adjustment of diameter growth equation for each tree species.
Hs	The height of the stem of a tree	m year-1	Hs = (DBH/(0.215*DBH+2.5188))^2	The stem height (Hs) is determined using hypsometric models that correlate the tree diameter with this variable.
Ht	The total height of the tree	m year-1	Ht = (DBH/(0.1749*DBH+1.608))^2	The total height (Ht) is determined using hypsometric models that correlate the tree diameter with this variable.
Vs	Volume of the stem	m3 year-1	Vs = (1.11*10^-4)*(DBH^2.0479)*(Hs^0.6352)	The stem volume was adjusted considering (Hs) stem height and DBH (diameter at breast height) as predictor variables.
Dj	Basic Wood density	g cm^3	Variable depending on the species	Specific value for each tree species - data provided of Rolim and Piotto (2019). For species not found in this study, values available

Data/Parameter	Description	Unit	Value	Justification
				in Global Density Database[35] was used.
$BEF_{2,j}$	Biomass expansion factor for conversion of tree stem biomass to above-ground tree biomass	dimensionless	*Khaya spp* and *Toona ciliata* =1.15 End species = 1.53	For accessory species, the value proposed to BEF_{2j}: AR- Tool 14 (estimation the conservative default value of 1.15 is used, unless transparent and verifiable information can be provided to justify a different value) For end species is based in Rolim and Piotto, 2019.
R_j	Root-shoot ratio for tree species j	dimensionless	Rj = e^((-1.085+0.9256*ln(b))/b) Accessory species = 0.25 End species = 0.24	AR-TOOL 14 Methodological tool

Step 3: Change in carbon stock in shrub in project in year t

Change in carbon stock in shrubs between two points of time is estimated to according to Equation 24 of the AR Tool 14, as follows:

$$\Delta C_{SHRUB} = C_{SHRUB,t2} - C_{SHRUB,t1}$$

Where:

$\Delta C_{SHRUB} =$	Change in carbon stock in shrub biomass during the period between times t_1 and t_2; t CO_2e
$C_{SHRUB,t2} =$	Carbon stock in shrub biomass at time t_2; t CO2e
$C_{SHRUB,t1} =$	Carbon stock in shrub biomass at time t_1; t CO2e

Carbon stock in shrubs at a point of time is estimated on the basis of the shrub crown cover. The area within the project boundary is stratified by the shrub crown cover. Those areas where the

[35] https://www.worldagroforestry.org/output/wood-density-database

shrub crown cover is less than 5 per cent are treated as a single stratum and the shrub biomass in this stratum is estimated as zero. For the strata with a shrub crown cover of greater than 5 per cent, carbon stock in shrub biomass in project at a point of time is estimated by using the Equations 26 and 27 of the AR Tool 14, as follows:

$$C_{SHRUB,t} = \frac{44}{12} x\, CF_S\, x\, (1 + R_S)\, x \sum_i A_{SHRUB,i}\, x\, b_{SHRUB,i}$$

$$b_{SHRUB,i} = BDR_{SF}\, x\, b_{FOREST}\, x\, CC_{SHRUB,i}$$

Where:

$C_{SHRUB,t}$ =	Carbon stock in shrubs within the Project boundary at a given point of time in year t; tCO_2e
CF_S =	Carbon fraction of shrub biomass; t C (t.d.m.)-1
R_S =	The default value of 0.4 is used unless transparent and verifiable information can be provided to justify a different value
$A_{SHRUB,i}$ =	Area of shrub biomass estimation stratum I; ha
$b_{SHRUB,i}$ =	Shrub biomass per hectare in shrub biomass estimation stratum I; t d.m. ha-1
BDR_{SF} =	Ratio of shrub biomass per hectare in land having a shrub crown cover of 1.0 (i.e., 100 per cent) and the default above-ground biomass content per hectare in forest in the region/country where the A/R project activity is located; dimensionless
b_{FOREST} =	Default above-ground biomass content in forest in the region/country where the A/R project activity is located; t d.m. ha-1
$CC_{SHRUB,i}$ =	Crown cover of shrubs in shrub biomass estimation stratum *i* at the time of estimation, expressed as a fraction (e.g. 10 percent crown cover implies $CC_{SHRUB,i}$ = 0.10); dimensionless

As per the AR Tool 14, for the purpose of ex-ante estimation of carbon stock and change in carbon stock in the project scenario, change in carbon stock of shrubs may be estimated as zero. During the project, carbon stocks of shrubs will be only identified for the ecological restoration model and it will be monitored, if significant.

Step 4: Change in carbon stock in dead wood and litter in project in year t

Carbon stocks of litter and dead wood are calculated in accordance with the AR Tool 12 - “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities (Version 03.1)”.

Dead Wood

As per section 6.2 of the AR Tool 12, the “Conservative default-factor based method for estimation of carbon stock in dead wood” was chosen, calculated through Equation 9 of the tool.

For all strata to which the default-factor based method is applied, the carbon stock in dead wood is estimated as:

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

Where:

$C_{DW\_PROJ,i,t}$ =	Carbon stock in dead wood in stratum i at a given point of time in year t; t CO_2e
$C_{TREE\_PROJ\ ,i,t}$ =	Carbon stock in trees biomass in stratum i at a point of time in year t, as calculated in AR Tool 14 - “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; 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

The value of the conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass (DF_{DW}) was selected according to the guidance provided in Table 5 of Section 8 of the AR Tool 12, (what can change if transparent and verifiable information can be provided to justify a different value in the inclusion in this project activities this PD). The default-factor based method is applicable only if dead wood remains *in situ* and is not removed from the project boundary through any type of anthropogenic activities.

The rate of change of deadwood biomass over a period of time was calculated assuming a linear change. Therefore, the rate of change in carbon stock in deadwood over a period of time is calculated as follows (section 6.3. of the AR Tool 12):

$$dC_{DW(t1,t2)} = \frac{C_{DW,t2} - C_{DW,t1}}{T}$$

Where:

$dC_{DW(t1,t2)}$ =	Rate of change in carbon stock in dead wood within the project boundary during the period between a point of time in year t_1 and a point of time in year t_2; t CO_2e yr-1
$C_{DW,t2}$=	Carbon stock in dead wood within the project boundary at a point of time in year t_2; t CO_2e
$C_{DW,t1}$=	Carbon stock in dead wood within the project boundary at a point of time in year t_1; t CO_2e
T =	Time elapsed between two successive estimations (T= t_2 – t_1); yr

The change in carbon stock in deadwood within the project boundary in year t ($t_1 \leq t \leq t_2$) is given by Equation 11 of the applied tool:

$$\Delta C_{DW,t} = dC_{DW,(t1,t2)} \times 1\ year\ for\ t_1 \leq t \leq t_2$$

Where:

$\Delta C_{DW,t}$ =	Change in carbon stock in dead wood within the project boundary in year t; t CO_2e
$dC_{DW,(t1,t2)}$ =	Rate of change in carbon stock in dead wood within the project boundary during the period between a point of time in year t1 and a point of time in year t_2; t CO_2e yr^{-1}

Litter

As per section 7.2 of the AR Tool 12, the “Conservative default-factor based method for estimation of carbon stock in litter” was chosen, calculated through Equation 15 of the tool.

For all strata to which this default method is applied, the carbon stock in litter is estimated as:

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

$C_{LI,i,t}$ =	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 the tool 'Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R 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

The rate of change of litter biomass over a period of time was calculated assuming a linear change. Therefore, the rate of change in carbon stock in litter over a period of time is calculated as described below (section 7.3, Equation 16 of the tool):

$$dC_{LI(t1,t2)} = \frac{C_{LI,t2} - C_{LI,t1}}{T}$$

Where:

$dC_{LI(t1,t2)}$ =	Rate of change in carbon stock in litter within the project boundary during the period between a point of time in year t1 and a point of time in year t_2; t CO_2e yr^{-1}
$C_{LI,t2}$=	Carbon stock in litter within the project boundary at a point of time in year t2; t CO_2e
$C_{LI,t1}$=	Carbon stock in litter within the project boundary at a point of time in year t1; t CO_2e
T =	Time elapsed between two successive estimations ($T = t_2 - t_1$); yr

The change in carbon stock in litter within the project boundary in year t ($t_1 \leq t \leq t_2$) is given by Equation 17 of the applied tool:

$$\Delta C_{LI,t} = dC_{LI,(t1,t2)} \times 1\ year\ for\ t_1 \leq t \leq t_2$$

Where:

$\Delta C_{LI,t}$ =	Change in carbon stock in litter within the project boundary in year t; t CO_2e
$dC_{LI,(t1,t2)}$ =	Rate of change in carbon stock in litter within the project boundary during the period between a point of time in year t1 and a point of time in year t_2; t CO_2e yr-1

The main parameters used for dead wood and litter estimates for the three project activities are presented in **Table 26.**

Table 26 - Main parameters used for dead wood and litter estimates for the 3 project activities.

Data/Parameter	Description	Unit	Value	Justification
DF_{LI}	Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass; percent	%	1%	Despite being aware of values higher than the default presented in AR-AM-tool 12, a conservative approach was applied for the ex-ante estimation, which is expected to change with field-collected data for ex-post estimates. Biome: tropical Elevation: <2,000m Precipitation: 1,000-1,600 mm.yr-
DF_{DW}	Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass; percent	%	1%	
CF_{LI}	Carbon fraction of dry matter of litter	t C t-1 dry matter (t. d. m.)	0.37	IPCC default value
CF_{Tree}	Carbon fraction of dead wood	t C t-1 dry matter (t. d. m.)	0.47	IPCC default value to all parts of tree - Tropical and Subtropical 0.47 (0.44 - 0.49). IPCC (2006). Good Practice Guidance for LULUCF. Chapter 4. Forest Land. Table 4.3.

Step 5: Change in carbon stock in soil in project in year t

Estimates of the soil organic carbon (SOC) stocks were carried out in accordance with the AR Tool 16 - "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". The initial SOC stock at the start of the project is estimated by Equation 1 this tool, as follows:

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

Where:

$SOC_{INITIAL,i}$ = SOC stock at the beginning of the A/R 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 $SOC_{REF,i}$, $f_{LU,i}$, $f_{MG,i}$, and $f_{IN,i}$ were taken from the Tables 3 and 6 of this tool, unless transparent and verifiable information can be provided to justify different values in project activities this PD.

The rate of change in SOC stock in the Project scenario until the steady-state is reached is estimated Equation 6 of the tool, as follows:

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

Where:

$dSOC_{t,i}$	The rate of change in SOC stock in stratum i of the areas of land in year t; t C ha-1 yr-1
$t_{PREP,i}$	The year in which first soil disturbance takes place in stratum i of the areas of land
$SOC_{REF,i}$	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 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 project activity, in stratum i of the areas of land; t C ha-1
i = *1, 2, 3*	Strata of areas of land; dimensionless
t = *1, 2, 3*	Years elapsed since the start of the A/R project activity

For each stratum of the areas of land which is subjected to soil disturbance attributable to project activity and for which the total area disturbed, over and above the area disturbed in the baseline (if any), is greater than 10% of the area of the stratum, the following carbon loss is accounted, a carbon loss equation must be applied. However, because in the project case this is less than 10%, it is assumed to be zero (Equation 3 of the AR Tool 16).

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 this tool:

$$\Delta SOC_{AL,t} = \frac{44}{12} x \sum_{i} A_i \; x \; dSOC_{t,i} x \; 1 year$$

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
$dSOC_{t,i} =$	The rate of change in SOC stocks in stratum i of the areas of land; t C ha-1 yr-1
i = 1, 2, 3...	Strata of areas of land; dimensionless

The application of these equations results in an estimated rate of 0.495 t C ha yr-1 in soil organic carbon.

Table 27 presents the main parameters used for SOC estimates for the three project activities.

Table 27 - Main parameters used for SOC estimates for the 3 project activities.

Data/Parameter	Description	Unit	Value	Source/Justification
$SOC_{INITIAL,i}$	SOC stock at the beginning of the A/R project activity in stratum i of the areas of land	t C ha-1	50.1	$SOC_{INITIAL,i} = SOC_{REF,i} \times f_{LU,i} \times f_{MG,i} \times f_{IN,i}$
$SOC_{REF,i}$	Reference SOC stock corresponding to the reference condition in native lands (i.e., non-degraded, unimproved lands under native vegetation - normally	t C ha-1	60	Tropical Wet - LAC (Table 3 AR Tool 16 v1.1.0)

Data/Parameter	Description	Unit	Value	Source/Justification
	forest) by climate region and soil type applicable to stratum i of the areas of land			
$f_{LU,i}$	Relative stock change factor for baseline land-use in stratum i of the areas of land	dimensionless	1	Table 6 AR Tool 16 (v1.1.0)
$f_{MG,i}$	Relative stock change factor for baseline management regime in stratum i of the areas of land	dimensionless	0.835	Table 6 AR Tool 16 v1.1.0) - Average between Level Moderately degraded grassland and Severely degraded
$f_{IN,i}$	Relative stock change factor for baseline input regime (e.g. crop residue returns, manure) in stratum i of the areas of land	dimensionless	1	Table 6 AR Tool 16 (v1.1.0) Level Low/Medium
$SOC_{LOSS,i}$	Loss of SOC caused by soil disturbance attributable the A/R project activity, in stratum i of the areas of land	t C ha-1	0	For each stratum of the areas of land which is subjected to soil disturbance attributable to project activity and for which the total area disturbed, over and above the area disturbed in the baseline (if any), is greater than 10% of the area of the stratum, the following carbon loss is accounted (AR Tool 16)
$dSOC_{t,i}$	Rate of change in SOC stocks in stratum i of the areas of land	tC ha-1 yr-1	0.495	$dSOC_{t,i} = (SOC_{REF,i} - (SOC_{INITIAL,i} - SOC_{LOSS,i}))/20$ years; for $t_{PREP,i} < t \leq t_{PREP,i} + 20$

4.2.1.2. CHANGE INCREASE IN NON-CO2 GHG EMISSIONS WITHIN THE PROJECT BOUNDARY AS A RESULT OF THE IMPLEMENTATION OF THE A/R PROJECT ACTIVITY, IN YEAR T

The increase in non-CO2 GHG emissions, within the Project boundary as a result of the implementation of the A/R VCS project activity, is calculated through AR Tool 08 - “Estimation of non-CO2 greenhouse gas (GHG) emissions resulting from burning of biomass attributable to an A/R CDM project activity (Version 04.0.0)”, as described below (Equation 1 of the tool):

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

Where:

$GHG_{E,t}$ =	Emission of non-CO_2 GHGs resulting from burning of biomass and forest fires within the project boundary in year t; t CO2-e
$GHG_{SPF,t}$	Emission of non-CO_2 GHGs resulting from use of fire in site preparation in year t; t CO2-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 the year t; t CO_2-e
$GHG_{FF,t}$	Emission of non-CO_2 GHGs resulting from fire in the year t; t CO_2-e

Regarding these parameters, the following considerations are shown:

The project activities do not include biomass burning for site preparation. 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, both equation parameters $GHG_{SPF,t}$ and $GHG_{FMF,t}$ can be conservatively estimated to be zero.

The project activities consider the installation of protective actions to prevent the occurrence of forest fires, such as firebreaks and fire brigade. Thus, the incidence of this type of emissions can be considered a rare event, and the null value can be adopted. In summary, it should be considered that $GHG_{E,t}$ is also estimated as zero. However, it is important to recognize that natural or accidental fires can occur within the project area. In such cases, it is necessary to monitor and report these incidents as described in Equation 6 of the tool:

$$GHG_{FF,t} = GHG_{FF\_\mathrm{tree,\,t}} + GHG_{FF\_\mathrm{DOM,t}}$$

Where:

$GHG_{FF,t}$	Emission of non-CO_2 GHGs resulting from fire in the year t; t CO_2-e
$GHG_{FF\_\mathrm{tree,\,t}} =$	Emission of non-CO2 GHGs resulting from the loss of aboveground biomass of trees due to forest fire, in year t; tCO_2-e
$GHG_{FF\_\mathrm{DOM,t}} =$	Emission of non-CO_2 GHGs resulting from the loss of aboveground biomass of trees due to forest fire, in year t; tCO_2-e
$GHG_{FF\_\mathrm{DOM,t}} =$	Emission of non-CO_2 GHGs resulting from the loss of dead organic matter due to forest fire, in year t; tCO_2-e

t = 1, 2, 3… years counted from the start of the A/R project activity

Procedures to calculate the parameters these equations are described in the aforementioned methodology tool. For the validation period, emission of non-CO_2 GHGs resulting from the loss of trees due to natural or anthropogenic forest fire, or the loss of dead organic matter due to fire, is assumed to be zero. Where dead organic matter is accounted, for the validation period, emission of non-CO_2 GHGs resulting from the loss of dead organic matter due to fire is also assumed to be zero.

4.3 Leakage

The Equation 4 of the AR-ACM0003 - A/R Large-scale Consolidated Methodology Afforestation and reforestation of lands except wetlands (Version 02.0 - Sectoral scope 14) defines how to estimate leakage:

$$LK_t = LK_{AGRIC,t}$$

Where:

LK_t =	GHG emissions due to leakage in the year t; t CO2-e
$LK_{AGRIC,t}$ =	Leakage due to the displacement of agricultural activities in year t, as estimated in the AR Tool 15 - “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R project activity”; t CO_2-e

The AR Tool 15 - “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R project activity” specifically defines how to estimate the parameter $LK_{AGRIC,t,}$ in which leakage emissions are the ones attributable to the displacement of agricultural activities due to implementation of an A/R project activity and are estimated as the decrease in carbon stocks in the affected carbon pools of the land receiving the displaced activity.

Two considerations are made in this methodological tool regarding this subject:

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

Note 2: Increase in GHG emission occurring outside the project boundary attributable to the secondary effects of the A/R project activity (e.g. changes in demand, supply or price of goods) is considered insignificant for the purpose of this tool and hence accounted as zero.

In addition, paragraph 6 of section 6 of the AR Tool 15 informs that, leakage emissions attributable to the displacement of grazing activities under the following conditions can be considered insignificant and hence accounted as zero in some conditions:

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

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

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

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

e. Animals are displaced to zero-grazing system.

The project activities will be carried out in areas previously occupied by pastures established for several decades and with some level of degradation. Symbiosis purpose is to reforest those are that would most probably be abandoned, due the level of degradation. Thus, it is unlikely that there will be animals in the chosen project areas, as there were not any in the first project instance (PAI-01), at the project start date.

Anyway, during the grouped project expansion, if, for some reason, there is cattle present in the new PAIs, some of the following actions will be taken: i. selling the animals to slaughterhouses or other rural properties engaged in this activity; ii. temporarily relocation of the cattle to other areas within the same property that has sufficient land-carrying capacity to sustain them until they are sold to slaughterhouses.

Considering those notes, leakage emissions attributable to the displacement of cattle raising in the Project Area are considered insignificant and hence measured as zero ($LK_{AGRIC,t}$ = 0).

If, for any reason, new instances qualify for the calculation of leakage emissions, they will be estimated in accordance with the AR Tool 15 - "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R project activity, as per Equations 1, 2 and 3 of that Tool.

4.4 Net GHG Emission Reductions and Removals

According to the methodology AR-ACM0003, the net anthropogenic GHG removal by sink is:

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

Where:

$\Delta C_{AR-CDM,t_t}$ = 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 = Leakage GHG emissions, in year t; t CO_2-e

$\Delta C_{BSL,t}$ can be considered as zero according to Section 4.1 and LK_t can be considered as zero according to Section 4.3. Thus, $\Delta C_{AR-CDM,t}$ = $\Delta C_{ACTUAL,t}$.

The period over which the long-term average GHG benefit is calculated is 30 years.

Detailed quantification is available at Symbiosis_Quantifications_v1.xlsx (Appendix 5). A summarized quantification is available at Annex 1.

For the Net Emissions Reductions and Removals, a buffer value of 12.50 % was applied, in accordance with the Risk Tool Assessment (available for consultation at Appendix 6).

The total GHG benefit, calculated as the sum of stock changes along the 30-year period, is 24,311,876 tCO2e (**Table 28**), with an average annual GHG emission of 810,396 tCO2e.

Table 28 -Net GHG Removals

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Buffer Account (tCO_2e) – 12.50%	Estimated net GHG emission reductions or removals (tCO_2e)
01 (Sep 09, 2020 – Sep 08, 2021)	0	847	0	106	741
02 (Sep 09, 2021 – Sep 08, 2022)	0	1,169	0	146	1,023
03 (Sep 09, 2022 – Sep 08, 2023)	0	2,644	0	330	2,313
04 (Sep 09, 2023 – Sep 08, 2024)	0	5,337	0	667	4,670
05 (Sep 09, 2024 – Sep 08, 2025)	0	27,188	0	3,398	23,789
06 (Sep 09, 2025 – Sep 08, 2026)	0	63,035	0	7,879	55,155
07 (Sep 09, 2026 – Sep 08, 2027)	0	123,568	0	15,446	108,122

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Buffer Account (tCO_2e) – 12.50%	Estimated net GHG emission reductions or removals (tCO_2e)
08 (Sep 09, 2027 – Sep 08, 2028)	0	223,811	0	27,976	195,834
09 (Sep 09, 2028 – Sep 08, 2029)	0	474,023	0	59,253	414,770
10 (Sep 09, 2029 – Sep 08, 2030)	0	717,502	0	89,688	627,814
11 (Sep 09, 2030 – Sep 08, 2031)	0	1,071,924	0	133,990	937,933
12 (Sep 09, 2031 – Sep 08, 2032)	0	1,513,078	0	189,135	1,323,943
13 (Sep 09, 2032 – Sep 08, 2033)	0	1,832,054	0	229,007	1,603,047
14 (Sep 09, 2033 – Sep 08, 2034)	0	2,278,434	0	284,804	1,993,630
15 (Sep 09, 2034 – Sep 08, 2035)	0	2,618,451	0	327,306	2,291,145
16 (Sep 09, 2035 – Sep 08, 2036)	0	2,768,487	0	346,061	2,422,426
17 (Sep 09, 2036 – Sep 08, 2037)	0	2,784,681	0	348,085	2,436,596
18 (Sep 09, 2037 – Sep 08, 2038)	0	2,707,387	0	338,423	2,368,963
19 (Sep 09, 2038 – Sep 08, 2039)	0	2,583,856	0	322,982	2,260,874
20 (Sep 09, 2039 – Sep 08, 2040)	0	1,918,966	0	239,871	1,679,095
21 (Sep 09, 2040 – Sep 08, 2041)	0	1,513,831	0	189,229	1,324,602
22 (Sep 09, 2041 – Sep 08, 2042)	0	1,170,577	0	146,322	1,024,255
23 (Sep 09, 2042 – Sep 08, 2043)	0	720,389	0	90,049	630,340
24 (Sep 09, 2043 – Sep 08, 2044)	0	1,254,972	0	156,872	1,098,101

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Buffer Account (tCO_2e) – 12.50%	Estimated net GHG emission reductions or removals (tCO_2e)
25 (Sep 09, 2044 – Sep 08, 2045)	0	1,289,582	0	161,198	1,128,384
26 (Sep 09, 2045 – Sep 08, 2046)	0	119,709	0	14,964	104,745
27 (Sep 09, 2046 – Sep 08, 2047)	0	(553,525)	0	(69,191)	(484,334)
28 (Sep 09, 2047 – Sep 08, 2048)	0	(720,440)	0	(90,055)	(630,385)
29 (Sep 09, 2048 – Sep 08, 2049)	0	(1,041,834)	0	(130,229)	(911,604)
30 (Sep 09, 2049 – Sep 08, 2050)	0	315,301	0	39,413	275,888
Total	0	**27,785,001**	0	115,771	**24,311,876**

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	CF_{tree}
Data unit	t C (t.d.m.) -1
Description	Carbon Fraction of dry matter in trees. Carbon fraction is the amount of carbon in biomass components
Source of data	AR Tool 14, version 4.2: “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities” e 2006 IPCC Guidelines for National Greenhouse Gas Inventories - Volume 4: Agriculture, Forestry and Other Land Use, Chapter 4: Forest Land
Value applied	0.47
Justification of choice of data or description of measurement methods and procedures applied	As indicated in AR Tool 14, “a default value of 0.47 is used unless transparent and verifiable information can be provided to justify a different value”.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	N/A

Data / Parameter	CFs
Data unit	t C (t.d.m.) -1
Description	Carbon Fraction of dry matter in shrubs. Carbon fraction is the amount of carbon in biomass components
Source of data	AR Tool 14, version 4.2: “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities” e 2006 IPCC Guidelines for National Greenhouse Gas Inventories - Volume 4: Agriculture, Forestry and Other Land Use, Chapter 4: Forest Land
Value applied	0.47

Justification of choice of data or description of measurement methods and procedures applied	As indicated in AR Tool 14, "a default value of 0.47 is used unless transparent and verifiable information can be provided to justify a different value".
Purpose of Data	• Calculation of project emissions
Comments	N/A

Data / Parameter	Mean annual Increment in Volume (I_V)
Data unit	$m^3ha^{-1}yr^{-1}$
Description	It is the average annual net increment in volume suitable for industrial processing
Source of data	Volumes for Native (End) species were based on the Equations of Rolim & Piotto 2019 (Silviculture and Wood Properties of Native Species of the Atlantic Forest of Brazil). It was used the average of the most planted species in Symbiosis that is common to Reserva da Vale in Linhares (Ipe Felpudo, Ipe Ovo de Macuco, Jequitibá, Louro Pardo and Jacarandá). For the Accessory (Exotic) species it was used Sis Cedro and Sis Mogno, The Volume was the average from both.
Value applied	Variable according to species of each stratum.
Justification of choice of data or description of measurement methods and procedures applied	The source of the data used presents the same native and exotic species used in the project activities.
Purpose of Data	• Estimation of GHG Emission Reductions and Removals
Comments	N/A

Data / Parameter	Rj
Data unit	dimensionless
Description	Root-shoot ratio for stratum i
Source of data	Calculated according to the methodological tool AR Tool 14, version 4.2: "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities"

	$Rj = e(-1.085+0.9256 \times \ln b)/b$ Where: b = above-ground biomass per hectare (t d.m. ha^{-1})
Value applied	End Species (natives): D Average = 0.24 Accessory Species (exotic): D Average = 0.25
Justification of choice of data or description of measurement methods and procedures applied	For the Root-to-shoot ratio, the equation proposed by the AR Tool 14 - used for all species. This equation correlates root biomass with aboveground biomass.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	N/A

Data / Parameter	Rs
Data unit	dimensionless
Description	Root-shoot ratio for shrubs
Source of data	AR Tool 14, version 4.2: “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities”
Value applied	0.4
Justification of choice of data or description of measurement methods and procedures applied	Default value proposed by the AR Tool 14.
Purpose of Data	• Calculation of project emissions
Comments	N/A

Data / Parameter	BDR_{SF}
Data unit	dimensionless
Description	Ratio of shrub biomass per hectare in land having a shrub crown cover of 1.0 (i.e. 100 per cent)

Source of data	AR Tool 14, version 4.2: “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities”
Value applied	0.10
Justification of choice of data or description of measurement methods and procedures applied	Default value proposed by the AR Tool 14.
Purpose of Data	• Calculation of project emissions
Comments	N/A

Data / Parameter	D
Data unit	$g.cm^3$ or $t.m^3$
Description	Basic wood density
Source of data	Reference for wood density check Rolim & Piotto 2019 and Embrapa Platform: SisCedro and SisMogno
Value applied	End Species (natives): D Average = 0.64 Accessory Species (exotic): D Average = 0.45
Justification of choice of data or description of measurement methods and procedures applied	These databases were chosen because they are the best wood density databases available, considering the proposed commercial planting model as a project activity.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	N/A

Data / Parameter	Biomass Expansion Factor (BEF2)
Data unit	Dimensionless
Description	Ratio of aboveground oven-dry biomass to oven-dry biomass of the steam.
Source of data	Accessory Species (exotic): AR Tool 14
Value applied	Accessory Species (exotic): BEF Average = 1.15

Justification of choice of data or description of measurement methods and procedures applied	Value proposes to BEF2j – AR Tool 14- v4.2 (estimation the conservative default value of 1.15 is used, unless transparent and verifiable information can be provided to justify a different value)
Purpose of Data	• Estimation of GHG Emission Reductions and Removals.
Comments	N/A

Data / Parameter	SOC_{REF}
Data unit	t C ha-1
Description	Reference SOC stock corresponding to the reference condition in native lands (i.e. non-degraded, unimproved lands under native vegetation ñ normally forest) by climate region and soil type applicable to stratum i of the areas of land.
Source of data	Default values provided in the AR-TOOL 16 “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities” are used, unless transparent and verifiable information can be provided to justify different values. Table 3: Default reference SOC stocks (SOCREF) for mineral soils (tC ha-1 in 0-30 cm depth)
Value applied	47
Justification of choice of data or description of measurement methods and procedures applied	Default reference of SOC_{REF}, i for Tropical Moist Climate Region and LAC Soils.
Purpose of Data	• Estimation of GHG Emission Reductions and Removals
Comments	N/A

Data / Parameter	Land Use Factor ($f_{LU,i}$)
Data unit	Dimensionless
Description	Relative stock change factor for baseline land use in stratum i of the areas of land.
Source of data	Default values provided in Table 6 of AR Tool 16 - “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”.

Value 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 grasslands.
Purpose of Data	• Estimation of GHG Emission Reductions and Removals
Comments	N/A

Data / Parameter	Management Factor ($f_{MG,i}$)
Data unit	Dimensionless
Description	Relative stock change factor for baseline management regime in stratum i of the areas of land
Source of data	Default values provided in Table 6 of AR-TOOL 16 “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”.
Value applied	0.835
Justification of choice of data or description of measurement methods and procedures applied	Default reference of fMG,i assigned to lands severely degraded (0.70) and Moderately degraded grassland (0.97). The value of 0.835 is the average.
Purpose of Data	• Estimation of GHG Emission Reductions and Removals
Comments	N/A

Data / Parameter	Input Factor ($f_{IN,i}$)
Data unit	Dimensionless
Description	Relative stock change factor for baseline input regime (e.g. crop residue returns, manure) in stratum i.
Source of data	Default values provided in Table 6 of AR-TOOL 16 “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”.
Value applied	1

Justification of choice of data or description of measurement methods and procedures applied	Default reference of fIN,i assigned to all grasslands without input of fertilizers.
Purpose of Data	• Estimation of GHG Emission Reductions and Removals
Comments	N/A

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.
Value 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	N/A

Data / Parameter	A
Data unit	ha
Description	Project Area of *Project Activity Instance (PAI-01) – Fazenda Novo Horizonte*
Source of data	Monitoring of strata and stand boundaries, using Geographical Information Systems (GIS).
Value applied	236.50
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	N/A

Data / Parameter	Ai
Data unit	ha
Description	Area of stratum i
Source of data	Projected planting areas by stratum and year (see Table 23)
Value applied	see Table 23
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	N/A

Data / Parameter	DF_{LI}
Data unit	percent
Description	Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass
Source of data	Value of the conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass is selected according to the guidance provided in the AR-TOOL 12 "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities".
Value applied	1%
Justification of choice of data or description of measurement methods and procedures applied	The default value of the AR-TOOL 12 is used unless transparent and verifiable information can be provided to justify a different value. Considering tropical regions, elevation less than 2000m and precipitation between 1000-1600 mm/year.

Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	*N/A*

Data / Parameter	DF_{DW}
Data unit	percent
Description	Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass
Source of data	Value of the conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass is selected according to the guidance provided in the AR-TOOL 12 “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”.
Value applied	1%
Justification of choice of data or description of measurement methods and procedures applied	The default value of the AR-TOOL 12 is used unless transparent and verifiable information can be provided to justify a different value. Considering tropical regions, elevation less than 2000m and precipitation between 1000-1600 mm/year.
Purpose of Data	• Calculation of baseline emissions • Calculation of project emissions
Comments	N/A

5.2 Data and Parameters Monitored

Data / Parameter	Ai
Data unit	ha
Description	The area of stratum i of the areas of land of Project Area (planted area)
Source of data	Survey databases of each polygon that is part of the Project using GPS, and/or from geo-referenced remote sensing data (e.g., satellite image and/or drone) and software.

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. During crediting period, GPS, satellite images and/or drone flights will be conducted to monitor restoration activities and any correction needed in the area of each stratum is made.
Frequency of monitoring/recording	At the beginning of the site preparation, in final establishment of the Project and each time a verification is conducted.
Value applied	*Ex-post*
Monitoring equipment	GPS equipment (high precision), Remote Sensing data, ArcGIS, QGIS, Drone and/or Google Earth
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 emissions
Calculation method	Measurement
Comments	The stratification for ex-post estimations is based on the actual implementation of the project management plan. When necessary, the stratums of the project boundary may be updated, according to the development of the stand models. All changes will be monitored, and the justification of the change will be presented in each verification event.

Data / Parameter	Aplot,i
Data unit	ha
Description	Area of sample plot in stratum i
Source of data	Field measurement
Description of measurement methods and procedures to be applied	The area shall be delineated either on the ground, using GPS or from geo-referenced remote sensing data.
Frequency of monitoring/recording	At each verification
Value applied	Ex-post

Monitoring equipment	GPS equipment (high precision), Remote Sensing data, ArcGIS, QGIS, Drone and/or Google Earth
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 emissions
Calculation method	Measurement
Comments	See Section 5.3 for more detail

Data / Parameter	n
Data unit	Dimensionless
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	Measurement
Comments	N/A

Data / Parameter	DBH (diameter at breast height)
Data unit	cm

Description	Diameter at breast height of trees within the plot presenting DBH ≥5 cm.
Source of data	Field measurements in sample plots.
Description of measurement methods and procedures to be applied	Typically measured 1.3 m aboveground. Measure DBH of all trees above 5cm of DBH in the sample plots using a measuring tape and/or a probe.
Frequency of monitoring/recording	At each verification
Value applied	Ex-post
Monitoring equipment	Measuring tape and/or probe.
QA/QC procedures to be applied	Persons 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 emissions
Calculation method	Measurement according to monitoring plan
Comments	See Section 5.3 for more detail

Data / Parameter	H
Data unit	m
Description	Total height of trees
Source of data	Field measurements in sample plots.
Description of measurement methods and procedures to be applied	Measure all the trees height in the permanent sample plots that result in the Project activity.
Frequency of monitoring/recording	At each verification
Value applied	Ex-post
Monitoring equipment	Clinometer, measuring tape.
QA/QC procedures to be applied	Persons 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 emissions
Calculation method	Measurement according to monitoring plan
Comments	See Section 5.3 for more detail

Data / Parameter	T
Data unit	years
Description	Time elapsed between two successive estimations (T=t2 – t1)
Source of data	Verification records
Description of measurement methods and procedures to be applied	Counting years since project starts and/or last verification events occur.
Frequency of monitoring/recording	At each verification
Value applied	Ex-post
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	• Calculation of project emissions
Calculation method	T = t2 – t1
Comments	If the two successive estimations of carbon stock in a carbon pool are carried out at different points of time in year t2 and t1, (e.g., in the month of September in year t1 and in the month of July in year t2), then a fractional value will be assigned to T.

Data / Parameter	CC_{SHRUB}
Data unit	Fraction
Description	Crown cover of shrubs in shrub biomass estimation stratum i at the time of estimation, expressed as a fraction.
Source of data	Field measurement
Description of measurement methods	For woody shrub species, all individuals with their crowns intercepting the transect line installed within the sample plot will

and procedures to be applied	have their crown measured using a measure tape. The measure must be taken according to the crown length intercepting the transect. The total length of interception is then summed up and calculated as a proportion of the total transect length.
Frequency of monitoring/recording	At each verification
Value applied	Ex-post
Monitoring equipment	Measuring tape
QA/QC procedures to be applied	Persons 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 emissions
Calculation method	Measurement
Comments	N/A

Data / Parameter	$A_{,p,i}$
Data unit	m^2
Description	Area of litter sampling frame used in plot p in stratum i
Source of data	Field measurements in sample plots / calculated
Description of measurement methods and procedures to be applied	Standard operating procedures (SOPs) prescribed under national forest inventory will be applied in case this method is chosen. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied.
Frequency of monitoring/recording	At each verification
Value applied	Ex-post
Monitoring equipment	GPS and/or GIS
QA/QC procedures to be applied	Persons 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. 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, may be applied

Purpose of data	• Calculation of project emissions
Calculation method	Measurement according to monitoring plan
Comments	A litter sampling frame of 0.50 or 1 m^2 is commonly used

Data / Parameter	$B_{LI\_WET,p,i}$
Data unit	*kg*
Description	Wet weight of the composite litter sample collected from plot p of stratum i; kg
Source of data	Field measurements in sample plots / calculated
Description of measurement methods and procedures to be applied	Standard operating procedures (SOPs) prescribed under national forest inventory will be applied in case this method is chosen. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied.
Frequency of monitoring/recording	At each verification
Value applied	Ex-post
Monitoring equipment	GPS and/or GIS
QA/QC procedures to be applied	Persons 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. 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, may be applied
Purpose of data	Calculation of project emissions
Calculation method	Measurement according to monitoring plan
Comments	N/A

5.3 Monitoring Plan

The monitoring plan has been developed based on VCS Standard, v.4.4. requirements, combined with the AR-ACM0003 – “A/R Large-scale Consolidated Methodology Afforestation and reforestation of lands except wetlands", version 02.0., and all related tools. The goal of the monitoring plan is to determine procedures and responsibilities to verify the implementation of the project activities and quantify the GHG removal resultant from the three proposed actions, at PAI-01 and every new PAI to be included at this Grouped Project.

The specific objectives of the plan are:

- Verify carbon stock changes in each of the selected pools, for each area and specific reforestation model.
- Monitor project strata, by year of plantation and reforestation model;
- Verify project emissions and leakage emissions (if applicable);
- Determine operation, data collection, management and record procedures, as well as define roles and responsibilities.

The processes and schedule for obtaining, recording, compiling and analyzing the monitored data and parameters, as well as the methods for measuring, recording, storing, aggregating, collating and reporting data and parameters are presented as follows:

<u>Stratification</u>

Satellite imagery (GIS software) will be used to identify the "Area of stratum i of the areas of land" for each new assessed PAI. For each new PAI, strata will be named in accordance with the reforestation model and the plantation year. Geographic coordinates will be assigned both to the new PAI and the new strata. Data collection and monitoring referring to the "Area of stratum i of the areas of land" parameter refer to the size of the area (ha).

If any changes are to be observed during the project duration, regarding reforestation models, strata must be reassessed. This parameter will be monitored annually and presented at each verification period.

<u>Mean aboveground tree and shrub biomass per hectare in stratum</u>

For PAI-01, Symbiosis has already implemented its permanent forestry inventory, which monitors the annual current increment and annual average increment of the planted areas, in addition to checking density, frequency, dominance, volume, vertical and horizontal structure, diameter class.

At PAI-01, systematized and random sampling was carried out in plots of 20 m x 30 m, installed at each production plots ("FLP"). Each plot was demarcated with four wooden pickets. A map with PAI-01 monitored parcels, with individual central coordinates, is available at Annex 2.

The sampling plan, which is compatible both with PAI-01 and future project instances, is presented in **Table 29.**

Table 29 - Proposed sampling plan.

Type of sample plot	Permanent sample plots
Sample plot shape	rectangular
Sample plot size	Approximately 600 m2
Number of sample plots	To be calculated according to forest variability using accepted formulas
Sample plot location	Sample plot coordinates, location, number, and other registration information will be stored.
Monitoring frequency	Sample plots will be monitored for each crediting period
Assessment of carbon stock changes over time	Changes will be estimated based on DHB and Ht
Monitoring of GHG emissions due to the project activity	Monitoring of accidental fires according to AR Tool 08 (section 4.2 Emission of non-CO2 GHG resulting from burning of biomass)

For the continuance of the project, both for PAI-01 and for every new PAI to be included at the Grouped Project, field data collection will continue to be performed by a third-party specialized company, such as the existing contractor or any other.

Because the grouped project will move to new areas, if a new contractor is needed, he must be selected based on the previous assessment of its technical capacity to carry out the work. The teams and data collected will be audited by Symbiosis, as specified in contract. Upon receipt of the data, Symbiosis will check whether the data meets the parameters determined in the project. If so, Symbiosis will be responsible for collecting, processing, and archiving the data for at least 2 years after the end of the project verification period using inventory system, databases or spreadsheets.

Symbiosis may conduct the instances' verifications in different periods according to the purpose of the forest and/or planting species, "such that a systematic coincidence of verifications and peaks in carbon stocks is avoided". This may be done by grouping instances' according to their age range, optimizing resources.

Quality Assurance/Quality Control and Data Archiving Procedures

Symbiosis will address any QA/QC procedures through its internal protocols for forestry inventory (to be developed for the grouped project also based on commonly accepted principles and practices of forest inventory and forest management in the host country or an adaptation of SOPs available from published handbooks (Technical Manual of the Brazilian vegetation – IBGE) or scientific literature or from the "IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry 2003", as per the methodology AR- ACM0003 version 02.0 provisions.

To ensure consistency and quality results, spatial analysts carrying out the imagery processing, interpretation, and change detection procedures will strictly adhere to best practices and good practice guidelines. In addition, all data sources and analytical procedures will be documented and archived. Service providers for field measures will be assessed periodically, in order to guarantee if they meet the best practices.

Every employee involved in field operations will be properly trained to carry our or support field measurements. Every training will be recorded through photos or attendance lists.

Annual reporting will be carried out by Symbiosis and its contractors and submitted to Verra at each verification period or at any time information is required. Every verification will be carried out along with a site visit, in addition to corrective action rounds, in order to address every finding pointed out by the VVB.

All documents related to the verification will be properly stored, with record keeping for at least two years after the end of the project crediting period.

The data accumulated in previous years will guide the continuous improvements in operations. Continuous process of observation, verifications, checks, comparations and analyses, aiming at identifying needs for corrections, improvements of procedures and their execution at all levels are to be carried out.

Aiming at assuring the continued operation of the Project, considering listed aspects and related impacts, as well as compliance with laws and regulations (including specific requirements from VCS Standards), the monitoring plan shall go through internal annual verifications.

The verification process will be carried out through internal audits that will be done both remotely (desktop review) and in the field, in order to understand if the requirements set out in the monitoring plan are being met. Details shall be provided at each assessment, indicating Conformities, Non-Conformities and/or Attention Points.

Internal Audit results will be taken to the Executive Manager who will coordinate Action Plans to solve any nonconformities or attention points and review the Monitoring Plan

Revising the baseline for future project crediting periods

The baseline will be revised every 06 years from the project start date, as per VCS Standard v.4.4. requirements. That means that the next previewed baseline revision is on September 9, 2026.

Organization as responsibilities

For all aspects of project monitoring, Symbiosis staff will ensure that data collection, processing, analysis, management, and archiving are conducted in accordance with the monitoring plan (Table 30).

Table 30 - Monitoring and responsibilities of the project.

Variables to be monitored	Responsible	Frequency
Area of stratum i of the areas of land	Symbiosis	Annually, or at new PAI inclusion
Carbon stock changes in each of the selected pools, for each area and specific reforestation model	Field measurements – specialized contractor Quantification updates – project developer/manager	Annually, reported at each verification period
Revision of the baseline	Symbiosis, with the assistance of the project developer/manager	At least every 06 years.

APPENDIX

Available for consultation:

Appendix 1 – Ownership evidence (land titles and support documents).

Appendix 2 – Stakeholder engagement evidence (presentations slides, invitations, minute meetings, attendance lists, video conference record, photos).

Appendix 3 – Environmental licenses.

Appendix 4 – Forestry inventories and field documents.

Appendix 5 – Quantification spreadsheet.

Appendix 6 – Risk Tool Assessment.

ANNEX 1

Symbiosis Continuous Cover Forest Project - Carbon Generation Summary											
Year	Age	AGB	BGB	BTREE (AGB + BGB)	Dead Wood	Litter	SOC	Σ	VCUS before Buffer (tCO2e)	Buffer	VCUs
2021	1	475	151	627	6	5	209	847	847	12.50%	741
2022	2	1,184	365	1,549	15	12	439	2,016	1,169	12.50%	1,023
2023	3	3,010	882	3,892	39	31	697	4,659	2,644	12.50%	2,313
2024	4	6,795	1,918	8,714	87	69	1,127	9,996	5,337	12.50%	4,670
2025	5	25,307	7,204	32,511	322	253	4,097	37,184	27,188	12.50%	23,789
2026	6	67,291	19,255	86,546	852	671	12,150	100,218	63,035	12.50%	55,155
2027	7	149,995	42,765	192,759	1,893	1,490	27,644	223,786	123,568	12.50%	108,122
2028	8	302,078	85,252	387,330	3,795	2,987	53,485	447,597	223,811	12.50%	195,834
2029	9	627,186	175,647	802,833	7,861	6,188	104,738	921,620	474,023	12.50%	414,770
2030	10	1,121,965	310,705	1,432,670	14,016	11,034	181,402	1,639,121	717,502	12.50%	627,814
2031	11	1,873,776	512,089	2,385,866	23,333	18,368	283,478	2,711,045	1,071,924	12.50%	937,933
2032	12	2,952,246	795,409	3,747,655	36,650	28,852	410,965	4,224,123	1,513,078	12.50%	1,323,943
2033	13	4,288,595	1,134,337	5,422,932	53,039	41,754	538,453	6,056,177	1,832,054	12.50%	1,603,047
2034	14	5,982,580	1,554,291	7,536,870	73,745	58,055	665,940	8,334,611	2,278,434	12.50%	1,993,630
2035	15	7,953,392	2,031,561	9,984,953	97,738	76,943	793,428	10,953,062	2,618,451	12.50%	2,291,145
2036	16	10,050,368	2,530,136	12,580,504	123,168	96,962	920,915	13,721,549	2,768,487	12.50%	2,422,426
2037	17	12,166,378	3,025,640	15,192,017	148,727	117,083	1,048,403	16,506,230	2,784,681	12.50%	2,436,596
2038	18	14,225,927	3,501,721	17,727,648	173,496	136,582	1,175,890	19,213,617	2,707,387	12.50%	2,368,963
2039	19	16,191,463	3,950,464	20,141,928	197,046	155,121	1,303,378	21,797,472	2,583,856	12.50%	2,260,874
2040	20	17,626,427	4,276,533	21,902,960	214,081	168,532	1,430,865	23,716,439	1,918,966	12.50%	1,679,095
2041	21	18,739,038	4,527,143	23,266,181	227,136	178,809	1,558,144	25,230,269	1,513,831	12.50%	1,324,602
2042	22	19,577,325	4,714,838	24,292,163	236,836	186,445	1,685,402	26,400,846	1,170,577	12.50%	1,024,255
2043	23	20,054,638	4,821,201	24,875,840	242,142	190,622	1,812,630	27,121,235	720,389	12.50%	630,340
2044	24	20,962,844	5,022,123	25,984,968	252,653	198,897	1,939,689	28,376,207	1,254,972	12.50%	1,098,101
2045	25	21,901,808	5,228,697	27,130,505	263,579	207,499	2,064,206	29,665,789	1,289,582	12.50%	1,128,384
2046	26	21,902,723	5,228,837	27,131,561	263,142	207,155	2,183,641	29,785,498	119,709	12.50%	104,745

Symbiosis Continuous Cover Forest Project - Carbon Generation Summary											
Year	Age	AGB	BGB	BTREE (AGB + BGB)	Dead Wood	Litter	SOC	Σ	VCUS before Buffer (tCO2e)	Buffer	VCUs
2047	27	21,369,231	5,109,240	26,478,472	256,188	201,680	2,295,633	29,231,973	- 553,525	12.50%	- 484,334
2048	28	20,708,758	4,962,761	25,671,519	247,721	195,014	2,397,280	28,511,534	- 720,440	12.50%	- 630,385
2049	29	19,810,884	4,762,852	24,573,735	236,371	186,079	2,473,515	27,469,700	- 1,041,834	12.50%	- 911,604
2050	30	20,029,311	4,805,092	24,834,403	238,503	187,757	2,524,338	27,785,001	315,301	12.50%	275,888
Total											**24,311,876**

ANNEX 2

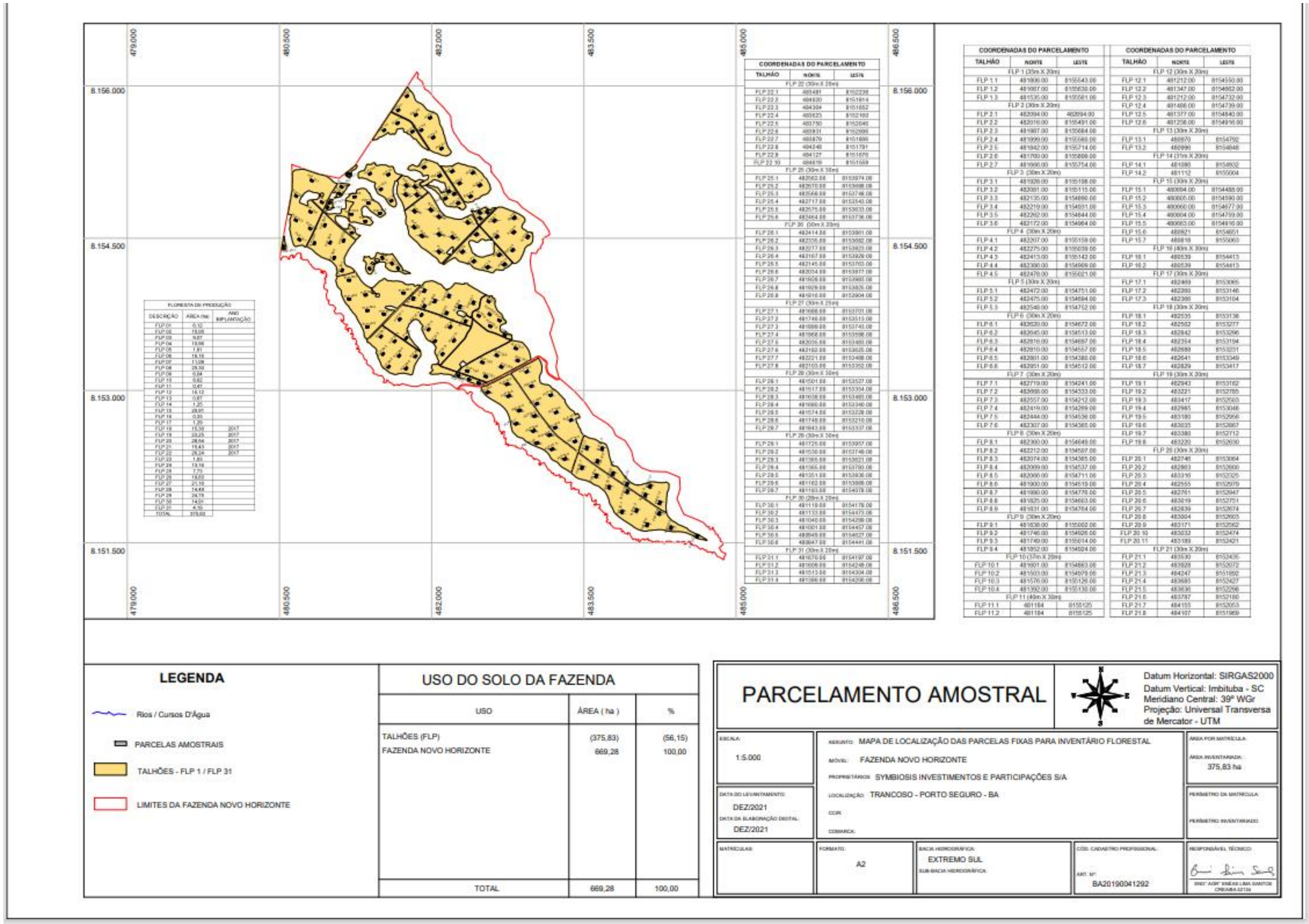


Figure 34 - PAI-01 (Novo Horizonte Farm) inventory plots location.