



# Verified Carbon Standard

## CONSERVATION STRATEGY FOR THE BRAZILIAN PAMPA BIOME: "PALMAS CAMAQUÃ" PROJECT



<b>Project title</b>	<i>Conservation strategy for the Brazilian Pampa biome: "Palmas Camaquã" project</i>
<b>Project ID</b>	4752
<b>Crediting period</b>	21-December-2022 to 21-December-2062
<b>Date of issue</b>	<i>DD-Month-YYYY is the date of submission</i>
<b>Version</b>	2.0
<b>VCS Standard Version</b>	V4.7
<b>Project location</b>	Brazil, Rio Grande do Sul, Bagé
<b>Project proponent(s)</b>	Coomysa - Cooperativa Mista Santa Bárbara do Sul Ltda. Av. Cel. Victor Dumoncei, 1293 - Centro, Santa Bárbara do Sul - RS, Brazil, Postal Code: 98240-000. internacional@coomysa1.com.br, +55 55 9166-2599
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# CONTENTS

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<b>1</b>	<b>PROJECT DETAILS .....</b>	<b>4</b>
1.1	Summary Description of the Project .....	4
1.2	Sectoral Scope and Project Type .....	5
1.3	Project Eligibility.....	5
1.4	Project Design.....	6
1.5	Project Proponent.....	7
1.6	Other Entities Involved in the Project .....	7
1.7	Ownership .....	8
1.8	Project Start Date .....	8
1.9	Project Crediting Period.....	10
1.10	Project Scale and Estimated GHG Emission Reductions or Removals .....	10
1.11	Description of the Project Activity .....	11
1.12	Project Location .....	13
1.13	Conditions Prior to Project Initiation .....	15
1.14	Compliance with Laws, Statutes and Other Regulatory Frameworks.....	31
1.15	Double Counting and Participation under Other GHG Programs .....	34
1.16	Double Claiming, Other Forms of Credit, and Scope3 Emissions.....	35
1.17	Sustainable Development Contributions.....	35
1.18	Additional Information Relevant to the Project .....	37
<b>2</b>	<b>SAFEGUARDS AND STAKEHOLDER ENGAGEMENT .....</b>	<b>38</b>
2.1	Stakeholder Engagement and Consultation.....	38
2.2	Risks to Stakeholders and the Environment.....	42
2.3	Respect for Human Rights and Equity .....	44
2.4	Ecosystem Health .....	44
<b>3</b>	<b>APPLICATION OF METHODOLOGY .....</b>	<b>50</b>
3.1	Title and Reference of Methodology .....	50
3.2	Applicability of Methodology.....	50
3.3	Project Boundary .....	52
3.4	Baseline Scenario and Additionality .....	57
3.5	Methodology Deviations.....	65

<b>4</b>	<b>QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS</b>	<b>66</b>
4.1	Baseline Emissions	66
4.2	Project Emissions	101
4.3	Leakage Emissions	107
4.4	Estimated GHG Emission Reductions and Carbon Dioxide Removals	109
<b>5</b>	<b>MONITORING</b>	<b>112</b>
5.1	Data and Parameters Available at Validation	112
5.2	Data and Parameters Monitored	116
5.3	Monitoring Plan	121
	<b>APPENDIX1: LAND USE AND LAND COVER MAP</b>	<b>127</b>
	<b>APPENDIX2: OWNERSHIP AND ENVIRONMENTAL COMPLIANCE DOCUMENTS</b>	<b>128</b>

# 1 PROJECT DETAILS

## 1.1 Summary Description of the Project

In Brazil, the Pampa biome is one of the richest in biodiversity, home to a wide variety of plant and animal species, many of which are unique to this region. In addition to its remarkable biological value, the Pampa also has a remarkable cultural relevance, rooted in the history and traditions of the people of Rio Grande do Sul. However, it faces serious threats due to the conversion of its native vegetation for agriculture. In recent years, the proportion of converted areas has significantly exceeded <sup>protected</sup> areas<sup>1</sup>, placing the Pampa among the most neglected regions <sup>globally</sup><sup>2</sup>. Currently, only 2.9% of its territory is protected by specific <sup>legislation</sup><sup>3</sup>, forming the smallest network of protected areas in both Brazil and the <sup>world</sup><sup>4</sup>. More recent data from <sup>MapBiomias</sup><sup>5</sup>, based on satellite images between 1985 and 2021, reveals that the Pampa was the biome that lost the most native vegetation in relation to its total area over the last 37 years, with a reduction of 29.5%. This puts the Pampa ahead of other biomes such as the Cerrado (-20.9%), Pantanal (-12.1%), Amazon -11.5%), Caatinga (-10.1%) and Atlantic Forest (-5.9%).

The Palmas Camaquã project has emerged as a response to these challenges, especially by showing that livestock farming, being a natural economic activity in the Pampa, can be developed sustainably, preserving both the landscape and the associated ecosystem services. This is possible by offering landowners, who are the main agents of conversion, an economic alternative through the sale of carbon credits. These credits are generated from 1,367.6 hectares of private land covered by native vegetation, which plays a crucial role in maintaining regional biodiversity and carbon stocks, helping to reduce greenhouse gas emissions and mitigate the impact of global warming.

The project has established a partnership with the Federal University of Santa Maria (UFSM), which plays a crucial role in several relevant areas, such as raising awareness among landowners of the importance of conserving the

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<sup>1</sup> Overbeck et al., 2015. Available at: <https://onlinelibrary.wiley.com/doi/10.1111/ddi.12380>

<sup>2</sup> Fonseca & Venticinqu, 2018. Available at: <https://www.sciencedirect.com/science/article/pii/S2530064417301487?via%3Dihub>

<sup>3</sup> Jenkins et al, 2015. Available at: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0145064>

<sup>4</sup> Lima et al., 2020. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0264837719301255?via%3Dihub>

<sup>5</sup> Available at: [https://brasil.mapbiomas.org/wp-content/uploads/sites/4/2023/11/MapBiomias\\_PAMPA\\_2022\\_11.10\\_1\\_.pdf-.pdf](https://brasil.mapbiomas.org/wp-content/uploads/sites/4/2023/11/MapBiomias_PAMPA_2022_11.10_1_.pdf-.pdf)

native vegetation of the Pampa and its associated benefits. Actions such as satellite image monitoring, surveillance and territorial patrolling, firebreak maintenance prevent fires, the installation of educational signs and regular control of a low load of grazing animals, with balanced mineral supplementation, are also planned. In the long term, initiatives will be introduced such as monitoring and recording local fauna and flora species, expanding plant biomass inventories and environmental education activities to strengthen engagement with resident employees, including training on fire prevention and the identification of species of relevant ecological interest, such as the Pampean pampas cat (*Leopardus munoai*) and the stone lizard (*Homonota uruguayensis*), the only lizard native to Rio Grande do Sul and restricted to the Pampa region.

With a carbon credit period of 40 years, starting in December 2022 and ending in December 2062, the project aims to achieve its objectives by generating Verified Carbon Credits (VCUs). The average annual estimate is 3,441 tCO<sub>2e</sub>/year, which totals 137,662 tCO<sub>2e</sub> over the credit period.

## 1.2 Sectoral Scope and Project Type

<b>Sectoral scope</b>	14. Agriculture, forestry and other land use (AFOLU)
<b>AFOLU project category</b>	Reduced Emissions from Deforestation and Degradation (REDD)
<b>Project activity type</b>	Avoided Unplanned Deforestation (AUD)
<b>Grouped Project</b>	No (single project)

## 1.3 Project Eligibility

The main activity of the project is to prevent the unplanned conversion of native vegetation in the Pampa biome to a non-native state on private properties, offering direct compensation to the main agent of conversion, the landowner. Land use in the baseline is geared towards agricultural activities, with an emphasis on planted pastures and monocultures of temporary crops, the main crop being soybeans. This makes the project eligible under the VCS Standard v4.7. Below are some of the requirements met by the project in the AFOLU category:

- The project complies with the standards and requirements established by the VCS Program;

- The project adopts a methodology eligible for the VCS Program;
- The implementation of the project activities does not infringe any applicable laws;
- The project falls under the AFOLU category of the VCS Program: Reduced Emissions from Deforestation and Degradation (REDD);
- The project is not located in a jurisdiction covered by a jurisdictional REDD+ program
- The land does not have legal authorization to be converted into a non-forest area, so the project activity is characterized as Avoided Unplanned Deforestation (AUD);
- The project did not convert or degrade native ecosystems to generate carbon credits for GHG emission reductions, as shown throughout the document;
- The actual project area contains only native vegetation for a minimum period of 10 years prior to the start of the project, which is demonstrated throughout the document;
- The project does not occur in wetlands, does not drain native habitats and does not compromise hydrological functions, as indicated on the land use map in section 1.12.

## 1.4 Project Design

The Palmas Camaquã project has been designed as:

- Single location or installation
- Multiple locations or project activity instances (but not a grouped project)
- Grouped project

Table 1: Initial set of project activities.

Name of property	Location	Property size (ha)	Useful project area (ha)
Camaquã Farm	Bagé, Rio Grande do Sul	1.615,5	1.367,6

Table 2: Land uses on the property in 2022.

Land use	Camaquã Farm (ha)
Total area	1.615,5
Useful project area	1.367,6
Pasture	209,2
Rock outcrop	38,4
Water	0,3

## 1.5 Project Proponent

<b>Organization name</b>	Coomysa - Cooperativa Mista Santa Bárbara do Sul Ltda.
<b>Contact person</b>	Paulo Roberto Bechert
<b>Title</b>	Manager
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## 1.6 Other Entities Involved in the Project

<b>Organization name</b>	Santa Maria Federal University - UFSM Forest Economy and Policies Laboratory - LEPF
<b>Role in the project</b>	Technical support to prepare the project design document
<b>Contact person</b>	Jorge Antonio de Farias
<b>Title</b>	Research professor
<b>Address</b>	Av. Roraima, 1000 - Prédio 44B, Santa Maria - RS, Brazil. Postal Code: 97105-340.
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<b>Email</b>	<a href="mailto:economiaflorestal@ufsm.br">economiaflorestal@ufsm.br</a>

## 1.7 Ownership

The project area is part of a private rural property (Fazenda Camaquã) belonging to Jorge Luiz Herter and Luiz Carlos Herter, who have a land registration or deed issued by the competent bodies in the country (Table 3). These owners have the right to conduct project activities on the farm. During the audit, these documents will be made available as they contain personal information.

Table 3: Ownership documentation.

Property	Enrollment <sup>(a)</sup>	INCRA code <sup>(b)</sup>	CAR registration <sup>(c)</sup>	Total area (ha)	Useful project area (ha)
Camaquã Farm	33694	8050250110703	RS - 4301602 - 546E.04E1.610A. 4D1B.9BDE.E385. D5F4.8817	1.615,5	1.367,6

<sup>(a)</sup> Each property has a unique license plate registered with a real estate registry office, which includes detailed information about the property and its owner.

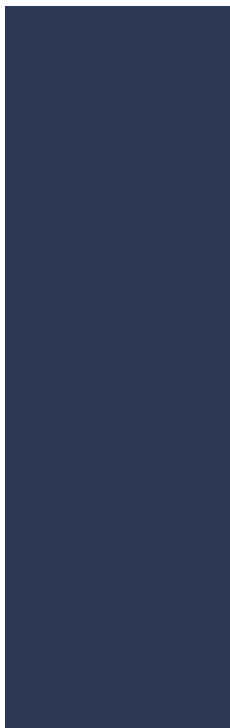
<sup>(b)</sup> This register is a unique identifier for rural properties in Brazil, assigned by INCRA (National Institute for Colonization and Agrarian Reform), and is fundamental for regulating these properties.

<sup>(c)</sup> The Rural Environmental Registry (CAR) is the official register with the federal environmental authorities, which documents all the important environmental information on the property, such as areas of Permanent Preservation, restricted use and Legal Reserve.

The project proponent, Coomysa - Cooperativa Mista Santa Bárbara do Sul Ltda., is fully responsible for the administration, management and marketing of the Verified Carbon Credits (VCUs), as established in an agreement between the parties.

## 1.8 Project Start Date

<b>Project start date</b>	21 - December - 2022
<b>Justification</b>	In accordance with the criteria specified in the VCS Standard v4.7, "The project start date of an AFOLU project is the date on which activities that lead to the generation of reductions or removals are implemented (e.g., preparing land for seeding, planting, changing agricultural or forestry practices, rewetting, restoring hydrological functions, or implementing management or protection plans)."



Despite the owners' previous involvement and interest in conserving the native vegetation areas under their ownership, the date of December 21, 2022 marks the effective start of the project's implementation, with new strategies aimed at achieving a positive carbon balance in the area under the management of Fazenda Camaquã. Carrying out an inventory of carbon stocks and GHG emissions was essential in this initial transition to carbon management in the project area. This initiative was followed by the search for a collaborative partnership with the Forest Economics and Policy research group at the Federal University of Santa Maria (UFSM), which conducted complementary technical support activities to help quantify greenhouse gas emission reductions and draw up project design documents.

Protecting natural ecosystems is essential not only to mitigate the impacts of emissions by sequestering carbon from the atmosphere, but also to provide a range of additional benefits for the environment, society and the global economy. Investing in the conservation and sustainable management of these ecosystems is crucial for a resilient and sustainable future for all.

Seeking funding for carbon-focused projects requires time, resources and detailed research. In the Pampa biome, where there are no previous initiatives aimed at monetizing the carbon resulting from avoided conversion of natural areas, the partnership with UFSM is an essential step for the progress and continuity of the project. In summary, the activities of the Palmas Camaquã project will begin with the following stages/milestones:

Milestone	Date
Coomysa and the landowners have formed a partnership to assess the viability of the project with a view to raising funds.	2021
The owners of the rural property undertake to conserve the native vegetation and other environmental areas associated with Fazenda Camaquã.	2022
An inventory of carbon stocks and greenhouse gas (GHG) emissions is carried out for green CPR and carbon assets.	2022
Coomysa is looking for collaborations with universities to support carbon studies.	2022
Search for financing through the commercialization of carbon stock.	2022
The research partnership with Professor Jorge Farias from the Federal University of Santa Maria (UFSM) is being strengthened to provide technical support in preparing the project documents and assessing the real benefits of reducing GHG emissions and the potential to generate carbon credits from this.	2024

### 1.9 Project Crediting Period

<b>Crediting period</b>	<input type="checkbox"/> <i>Seven years, twice renewable</i> <input type="checkbox"/> <i>Ten years, fixed</i> <input checked="" type="checkbox"/> <i>Other</i>
<b>Start and end date of first or fixed crediting period</b>	<p>Following the specifications of the VCS Standard v4.7 (Section 3.9) for AFOLU projects and the Non-Permanence Risk Tool v4.2, the project's accreditation period is initially 40 years and can be renewed for up to 100 years.</p> <p>21-December-2022 to 21-December-2062</p>

### 1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals (ERRs) of the project are:

- < 300,000 tCO<sub>2</sub>e/year (project)
- ≥ 300,000 tCO<sub>2</sub>e/year (large project)

The following table shows the crediting period and the estimated reductions or removals of GHG emissions for the Palmas Camaquã project.

Calendar year of crediting period	Estimated GHG emissions reductions or removals (t CO <sub>2</sub> e)
2023	4.081,65
2024	4.090,03
2025	4.099,20
2026	4.109,15
2027	4.119,82
2028	4.131,19
2029	4.143,22
2030	4.155,88
2031	4.169,15
2032	4.182,98
2033	4.123,36
2034	4.066,51

2035	4.012,33
2036	3.960,71
2037	3.911,56
2038	3.864,77
2039	3.820,26
2040	3.777,93
2041	3.737,71
2042	3.699,50
2043	3.602,41
2044	3.508,67
2045	3.418,15
2046	3.330,75
2047	3.246,34
2048	3.164,81
2049	3.086,07
2050	3.010,00
2051	2.936,52
2052	2.865,52
2053	2.796,91
2054	2.730,61
2055	2.666,53
2056	2.604,59
2057	2.544,72
2058	2.486,83
2059	2.430,85
2060	2.376,73
2061	2.324,38
2062	2.273,74
<b>Total estimated ERRs during the first or fixed crediting period</b>	<b>137.662,01</b>
<b>Total number of years</b>	<b>40</b>
<b>Average annual ERRs</b>	<b>3.441,55</b>

### 1.11 Description of the Project Activity

The Palmas Camaquã project aims to conserve 1,367.6 hectares of native vegetation in the Pampa biome, focusing mainly on preventing the conversion of areas and unplanned deforestation by landowners, who are the main agents of action. It is estimated that in the first 10 years the project will prevent the conversion of 318.0 hectares,

and could reach 819.7 hectares over the 40-year period, which would result in avoided emissions of approximately 137,662 tons of CO<sub>2</sub>e.

Among the main initial activities the project to achieve GHG emission reductions, we highlight the formalization of a contract between the proponent and the landowners, with the aim of avoiding the conversion of native vegetation during the project's term. In addition, a financial proposal has been drawn up for the estimated annual payments from the sale of carbon credits once the avoided conversion has been verified. This agreement is the project's main approach to preventing the conversion of native Pampas vegetation on Fazenda Camaquã, providing financial compensation to the landowner for conservation efforts, which offsets the opportunity costs commercial agriculture.

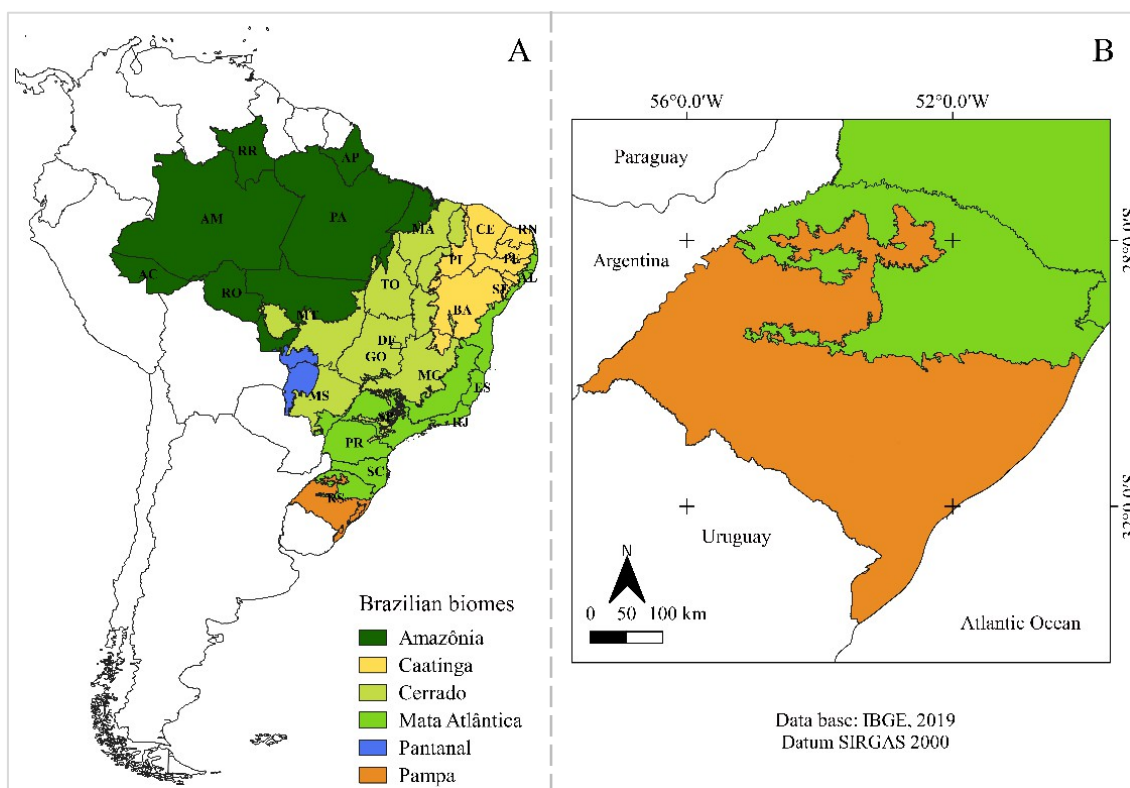
The project has signed a partnership with the Federal University of Santa Maria (UFSM), which is playing a crucial role in several important areas, such as raising awareness among landowners about the importance of conserving the Pampa's native vegetation and its associated benefits. Actions are also planned, such as monitoring by satellite images, surveillance and territorial patrols, maintenance of firebreaks to prevent fires, installation of educational signs and regular control of a low load of grazing animals, with balanced mineral supplementation. In the long term, initiatives will be introduced such as monitoring and recording local fauna and flora species, expanding plant biomass inventories and environmental education activities to strengthen engagement with resident employees, including training on fire prevention and the identification of species of relevant ecological interest, such as the Pampean pampas cat (*Leopardus munoai*) and the stone lizard (*Homonota uruguayensis*), the only lizard native to Rio Grande do Sul and restricted to the Pampa region.

The Palmas Camaquã project is not linked to any other GHG emission reduction or carbon credit program, which means that the annual revenue from credits is crucial for its continuity. Although some Brazilian states are developing jurisdictional REDD+ programs, there is currently no specific program for the Pampa biome in Rio Grande do Sul, which obviates the need to consider jurisdictional approaches in its planning. In addition, the Brazilian government encourages and recognizes the importance of the voluntary carbon market, particularly for forestry and native vegetation projects such as REDD, according to Portaria n. 518, of September 29, 2020, of the Ministry of the Environment.

## 1.12 Project Location

The Palmas Camaquã project is located in the Brazilian Pampa biome, which is in the southernmost region of Brazil (see Figure 1). This biome is one of the smallest in terms of land area in the country (2.1%), surpassed only by the Pantanal (1.8%). The Brazilian Pampa is restricted to a single state, Rio Grande do Sul, where it occupies an area of 176,496 km<sup>2</sup>, corresponding to 63% of the state's territory<sup>6</sup>. Beyond the national political boundaries, the Pampa extends into the territory of Uruguay and Argentina, forming the largest area of temperate grassland in South America<sup>7</sup>.

Figure 1: Location of the Pampa biome in Brazil (A) and its distribution in the state of Rio Grande do Sul (B).



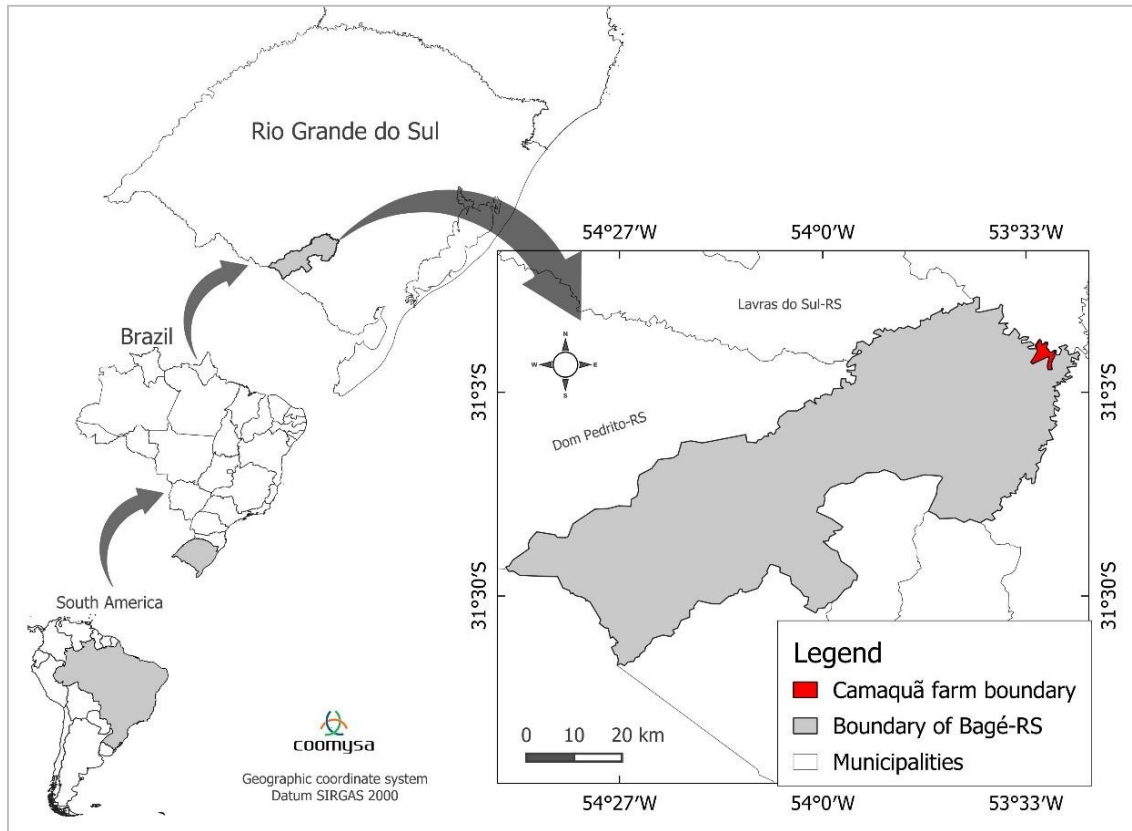
The project is being implemented at Fazenda Camaquã, a rural property with a total area of 1,615.5 ha, of which 1,367.6 ha are dedicated to actual project area. Located in the municipality of Bagé, in the south of the state of Rio Grande do Sul, Brazil, the

<sup>6</sup> IBGE, 2004. Available at: <https://antigo.mma.gov.br/biomas/pampa.html>

<sup>7</sup> Chomenko & Bencke, 2016. Available at: <https://www.sema.rs.gov.br/upload/arquivos/201708/25130950-nosso-pampa-desconhecido.pdf>

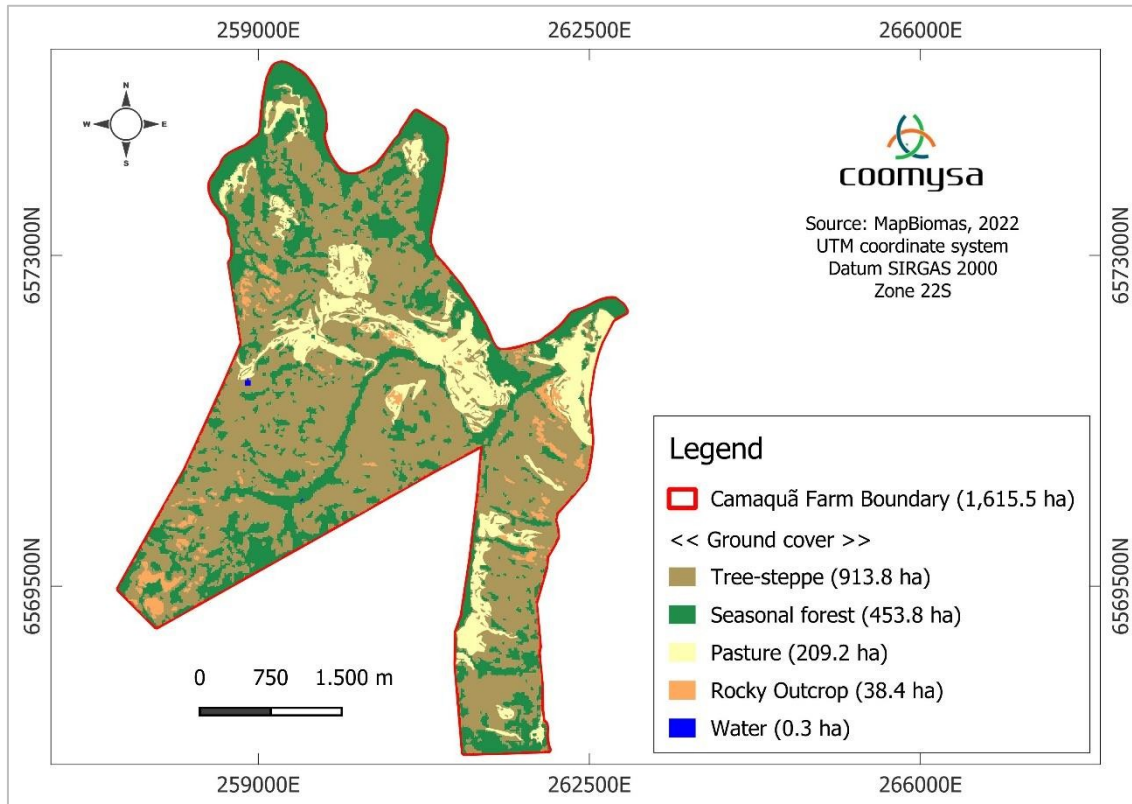
The central coordinates of Fazenda Camaquã are  $-30.961748^\circ$  latitude and  $-53489462^\circ$  longitude. The property boundaries are detailed in the vector data shown in Figure 2. A KML file containing the polygon that precisely defines the effective area of the project will be provided separately.

Figure 2: Location map of the Fazenda Camaquã rural property, which includes the project area.



The project's effective area of operation covers 84.6% of Fazenda Camaquã, an extension covered by mosaics of vegetation made up of natural fields and forests (additional information is in the section on vegetation). For more details, see Figure 3, which shows land use and land cover in the project area. The same high-resolution map will be attached to this document (Appendix 1 - Land use and land cover map).

Figure 3: Land use and occupation map of Fazenda Camaquã, which covers the project area (Tree-steppe+ Seasonal forest).



### 1.13 Conditions Prior to Project Initiation

In order to structure and outline the project, alternative land use practices were analyzed in the regional context (reference area), which could lead to unplanned conversion in the area. These practices make up the project's base scenario, which is detailed in Section 2.4. The following are aspects related to environmental characteristics, such as climate, hydrography, ecosystem types, topography, soil, vegetation, fauna and relevant historical conditions, which are essential to understanding the environment in which the project is located.

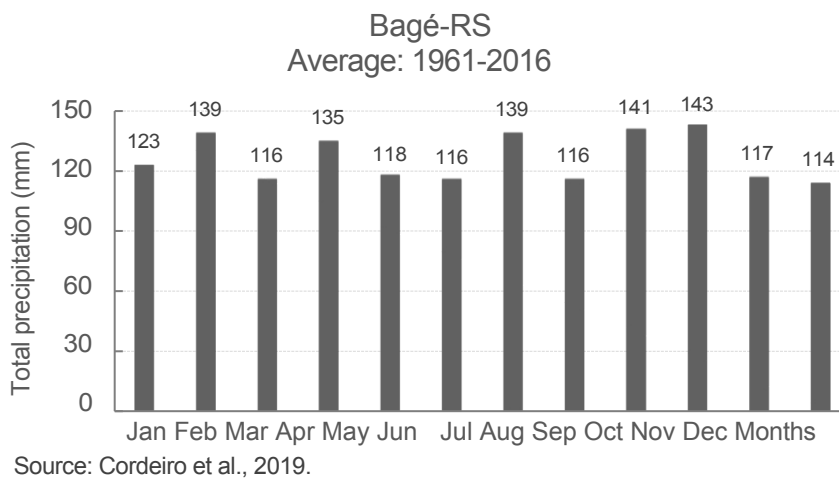
- **Climate**

According to the Brazilian Institute of Geography and Statistics (IBGE)<sup>8</sup>, the predominant climate in the Pampa is the mild mesothermal temperate type, with an average annual temperature of between 10°C and 15°C and no prolonged periods of drought. This data is corroborated by

<sup>8</sup> IBGE, 2002. Available at: [https://geoftp.ibge.gov.br/informacoes\\_ambientais/climatologia/mapas/brasil/Map\\_BR\\_clima\\_2002.pdf](https://geoftp.ibge.gov.br/informacoes_ambientais/climatologia/mapas/brasil/Map_BR_clima_2002.pdf)

according to Maluf's classification (2000)<sup>9</sup>, which describes the climate as humid temperate (TE UM), with an average annual rainfall of 1,504 mm, with no significant water deficit throughout the year. More recent studies, covering a historical series of climate data for the municipality of Bagé/RS<sup>10</sup>, concluded that rainfall in the region is relatively well distributed throughout year (Figure 4), with a monthly average of 127 mm. , low water availability was observed in the months with the highest atmospheric demand (summer, from November to March), resulting in prolonged periods of drought, during which crops may not receive the necessary amount of water.

Figure 4: Monthly variation in average rainfall (mm) in the project region.



The following are other variables that help to understand the climate in the region where the project operates, according to Cordeiro et al., 2019:

- The annual amount of sunshine is 2,233 hours, with a monthly average of 186 hours, the highest being in December (253) and the lowest in June (124);
- The average annual air temperatures (minimum, average and maximum) are 13.3, 18.5 and 23.8°C, with the highest temperatures recorded in January (18.4, 24.2 and 30.1°C) and the lowest in July (8.3, 13.0 and 17.6°C);

<sup>9</sup> Maluf, 2000. A new climatic classification for the State of Rio Grande do Sul, Brazil. Revista Brasileira de Agrometeorologia, 8(1), 141-150.

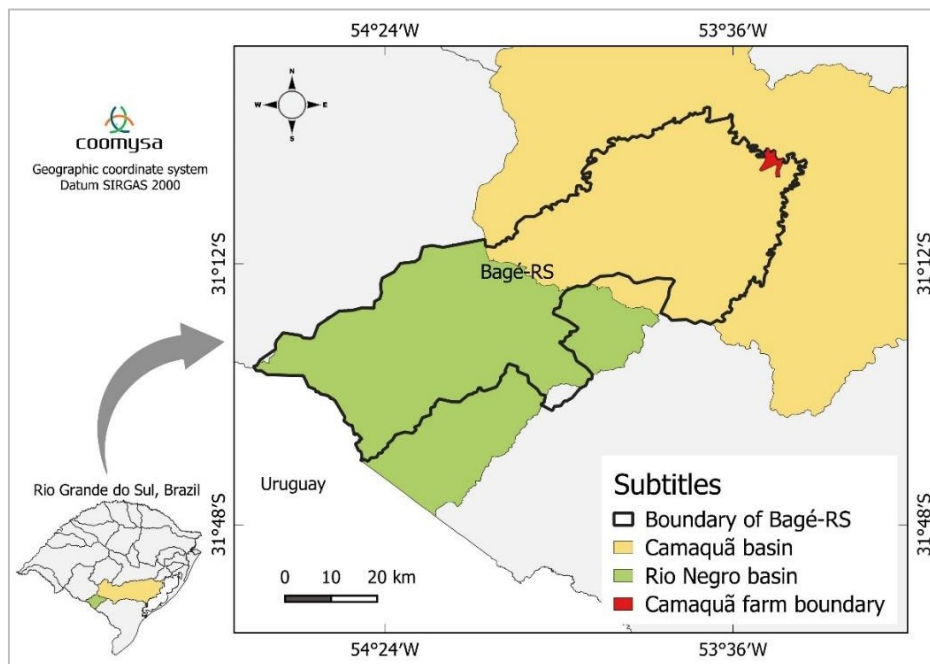
<sup>10</sup> Cordeiro et al., 2019. Available at: <https://seer.sct.embrapa.br/index.php/agrometeoros/article/view/26470>

- The annual relative humidity is 72%, ranging from 64% in December to 78% in June;
- The average annual wind speed is 3.1 m/s, with peaks in September, October and November (3.5 m/s) and the lowest speed in May (2.5 m/s).

- **Hydrography**

The state of Rio Grande do Sul is divided into three major hydrographic regions<sup>11</sup>: Rio Uruguai, which corresponds to the national basin; the Guaíba; and the Litoral, which aligns with the national Southeast Atlantic basin. Decree 53.<sup>885/2018</sup><sup>12</sup> defines the subdivision of these regions into 25 river basins. As far as the Pampa is concerned, it is drained by several of these basins, whose geological and climatic characteristics influence the dynamics of the region's rivers and streams, forming a relatively complex river network, albeit on a small scale compared to other regions of Brazil. For the municipality of Bagé-RS, the hydrographic system is made up of two main basins: the Rio Negro, which covers the southwestern part, and the Camaquã, which occupies the northeastern part, as illustrated in the map of hydrographic basins in Figure 5.

Figure 5: Main watersheds in the municipality of Bagé-RS, with red highlighting the location of Fazenda Camaquã, which covers the project area.

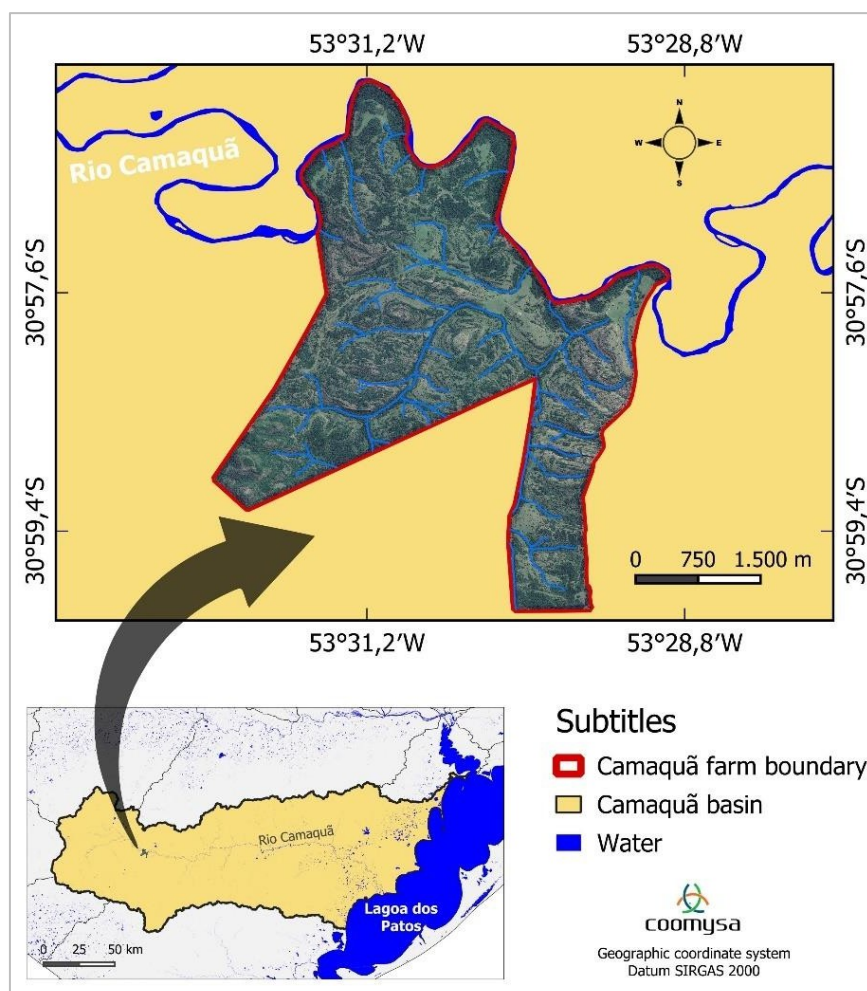


<sup>11</sup> <https://www.sema.rs.gov.br/bacias-hidrograficas>

<sup>12</sup> <https://www.sema.rs.gov.br/upload/arquivos/201803/08095109-decreto-53885-2017.pdf>

The project area is located in the Camaquã river basin (Figure 6), which covers 21,657 km<sup>2</sup> and has the Camaquã River as its main watercourse. The Camaquã River rises in the western part of basin, in the municipality of Bagé-RS, borders the project area to the north and flows into Lagoa dos Patos to the east. The main uses of water in this basin are for agricultural irrigation and public supply.

Figure 6: Location the Camaquã hydrographic basin, highlighting the boundary of Fazenda Camaquã, its network of watercourses and the Camaquã River, the main river in the region.



- **Ecosystem type**

The Brazilian Pampa biome, which is found exclusively in the state Rio Grande do Sul, represents one of the most peculiar and ecologically complex ecosystems in Brazil. It is characterized by grassland vegetation that is associated with gallery forests, coxilhas and scattered shrub and tree formations, as well as rocky outcrops with

frequency. In mixed native grasslands, in addition to grasses, there are legumes and cacti, with the latter being particularly common on rocky outcrops<sup>13</sup> (Figure 7). Although it shares some representatives with the Atlantic Forest biome, the Pampa is home to most cactaceous species<sup>14</sup>.

Figure 7: Typical cacti found on rocky outcrops in the project area.



Image: LEPF

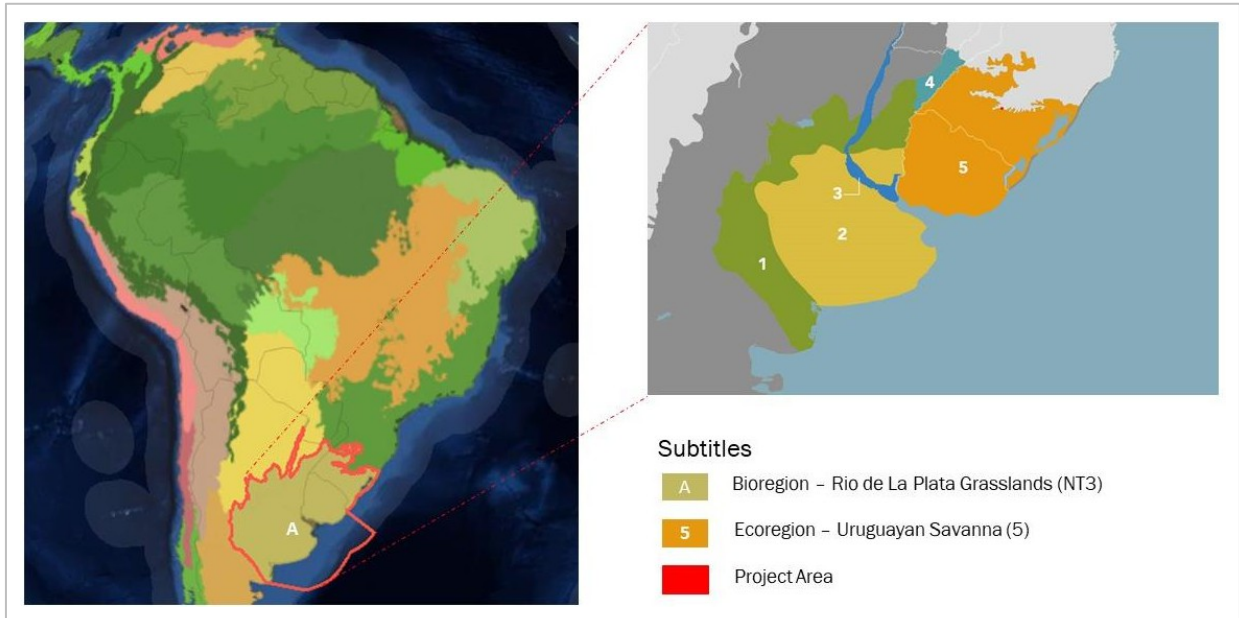
According to the international classification system, the project area belongs to the Rio de La Plata Grasslands bioregion (NT3) and the Uruguayan Savanna ecoregion<sup>15</sup> (Figure 8). The Rio de La Plata bioregion is located in the realm of South America, encompassing the humid grasses of the Argentine and Brazilian Pampas. It is characterized by the presence of gallery forests along the rivers on the eastern rocks and by medium-high pastures, with more than 400 species perennial grasses<sup>13, 15</sup>.

<sup>13</sup> Available at: <https://antigo.mma.gov.br/biomas/pampa.html>

<sup>14</sup> Carneiro et al, 2016. Available at: <https://www.sema.rs.gov.br/upload/arquivos/201708/25132604-cactos-do-rio-grande-do-sul-compressed.pdf>

<sup>15</sup> One Earth. Available at: <https://www.oneearth.org/navigator/>

Figure 8: Schematic representation of the ecosystem division by bioregions and ecoregions in the project's area of influence.



Source: <https://www.oneearth.org/navigator/>

- **Topography**

The natural landscapes of the Pampa are very diverse, including mountains, plains, rocky hills and coxilhas. In Bagé-RS, the average altitude 217 meters, ranging from 107 to 464 meters. In the project area, the topography is predominantly flat to slightly undulating, with some places showing small elevations or hills (less than 0.1%), with altitudes that mostly do not exceed 240 meters, as shown in Figure 9. According to the map of relief units in <sup>Brazil</sup><sup>16</sup>, the project area is part of the South Rio Grande Plateau geomorphological unit, more specifically the Caçapava do Plateau. This unit is configured as an extensive north-south corridor, with a predominance of reliefs with very broad and gentle hills, known as <sup>coxilhas</sup><sup>17</sup>. To facilitate visualization, Figure 10 shows the slope map of the area, using the slope classes suggested by Embrapa (2018)<sup>18</sup>. Around 89% of the property has a low slope ( $\leq 20\%$ ), which facilitates the use of agricultural equipment, especially mechanized equipment.

<sup>16</sup> IBGE, 2006. Available at: <https://www.ibge.gov.br/geociencias/informacoes-ambientais/geomorfologia/15827-unidades-de-relevo.html>

<sup>17</sup> Viero & Silva, 2010. Available at: [http://rigeo.cprm.gov.br/bitstream/doc/16774/1/Geodiversidade\\_RS.pdf](http://rigeo.cprm.gov.br/bitstream/doc/16774/1/Geodiversidade_RS.pdf)

<sup>18</sup> Santos et al, 2018. Available at: <https://www.agroapi.cnptia.embrapa.br/portal/assets/docs/SiBCS-2018-ISBN-9788570358004.pdf>

Figure 9: Altimetry of the project intervention area in Bagé-RS.

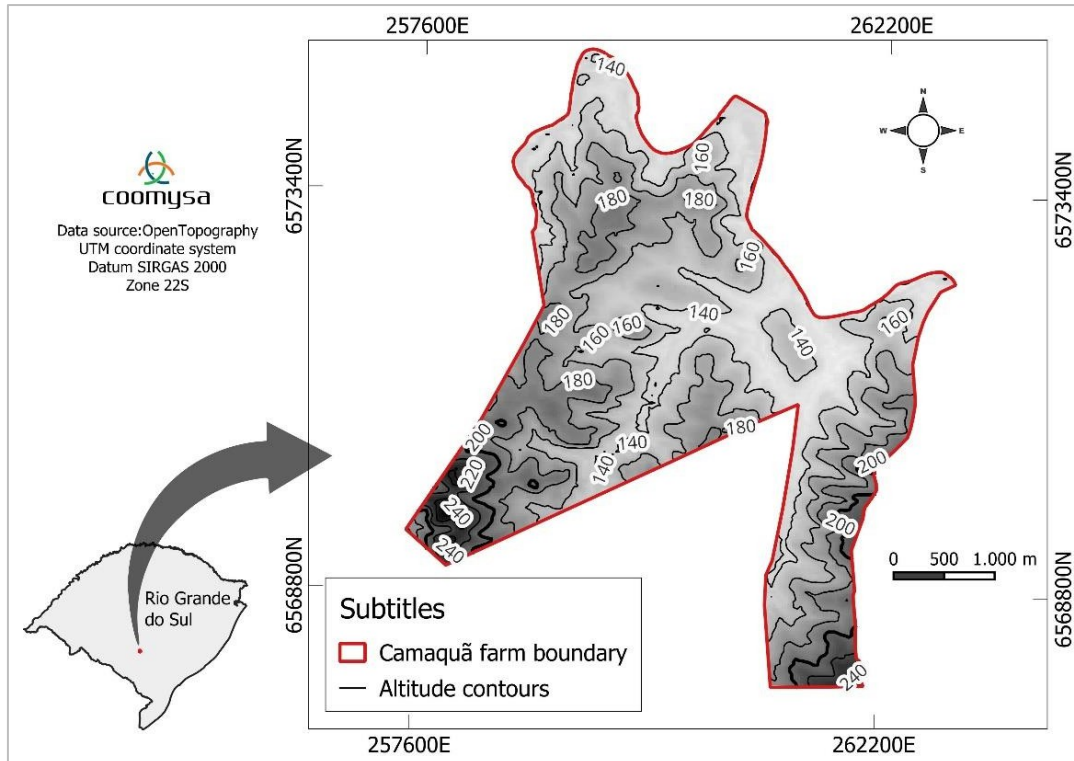
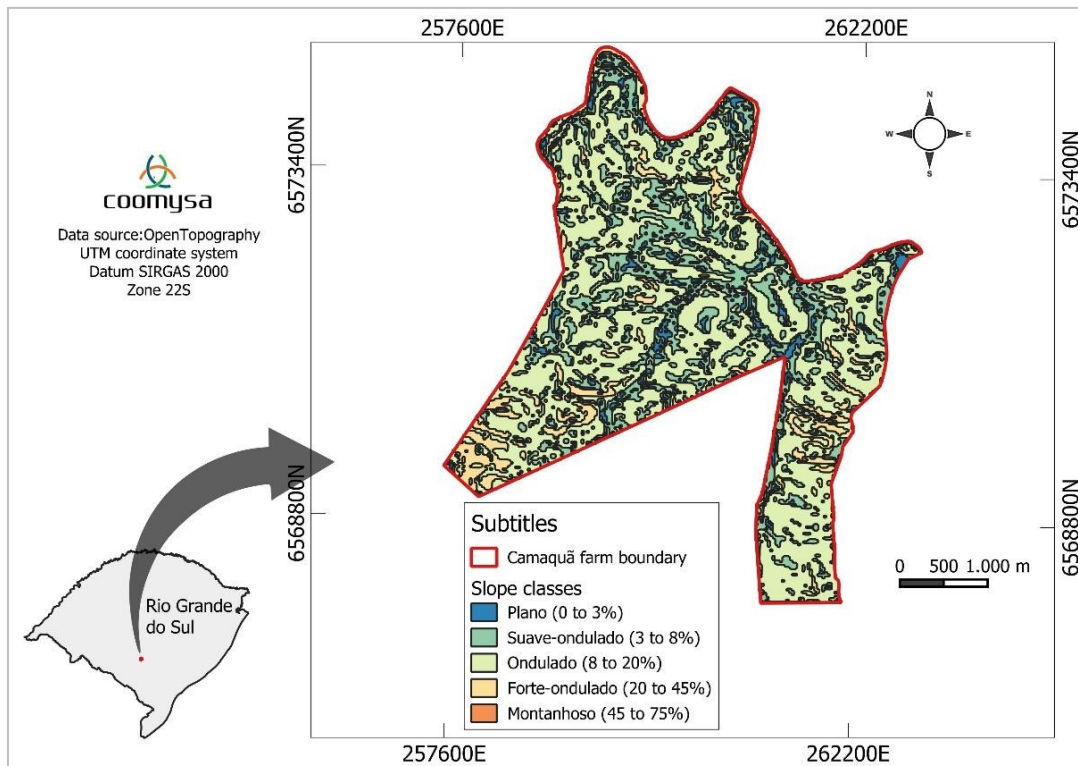


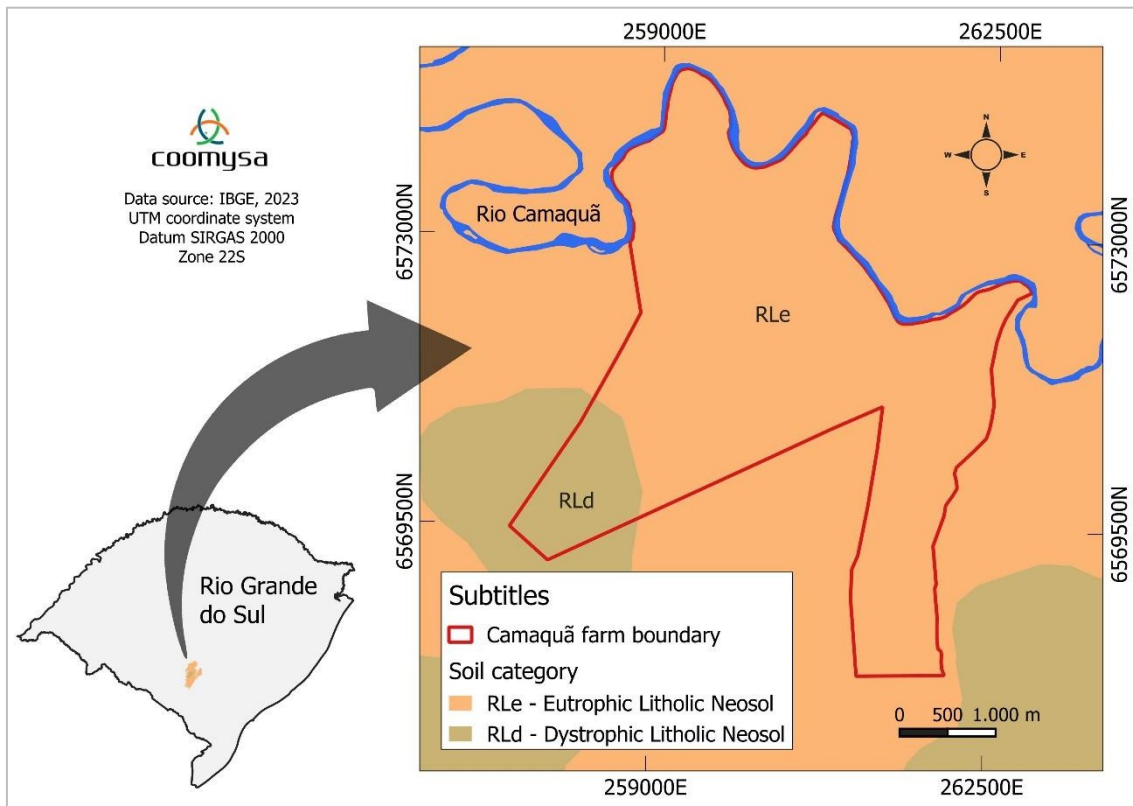
Figure 10: Slope of the project intervention area in Bagé-RS.



- **Soils**

According to information from the IBGE<sup>19</sup>, the soils in the project area are predominantly classified as Eutrophic Lithic Neosols (RLe), with a small portion being Dystrophic Lithic Neosols (RLd) (Figure 11). In the American classification system, these soils correspond to Lithic Entisols (Soil Taxonomy, 2014), and in the WRB system they are classified as Leptosols (WRB, 2015).

Figure 11: Soil map of the project intervention area in Bagé-RS.



Lithic Neosols are soils with little pedogenic development, and are therefore shallow, with a marked presence of rocky outcrops or exposure of the parent rock in subsurface layers. They are characterized by having lithic contact in the first 50 cm of the layer, with the A horizon directly on the parent rock, or on material with more than 90% coarse fragments, such as quartz gravel. The dystrophy in the third categorical level is due to base saturation < 50% most horizons<sup>20</sup>.

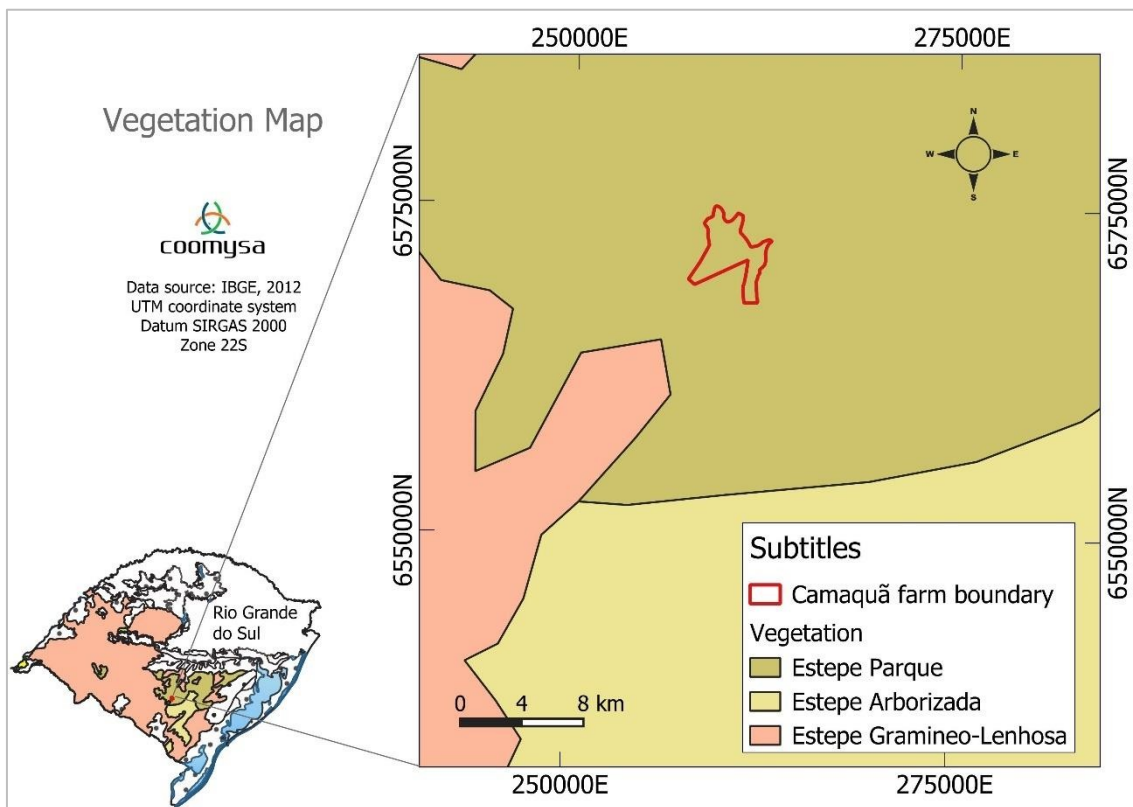
<sup>19</sup> IBGE. Available at: [https://geoftp.ibge.gov.br/informacoes\\_ambientais/pedologia/](https://geoftp.ibge.gov.br/informacoes_ambientais/pedologia/)

<sup>20</sup> Embrapa, 2018. Available at: <https://www.embrapa.br/solos/sibcs>

- **Vegetation**

The predominant vegetation in the project area belongs to the floristic domain classified as Park <sup>Steppe</sup><sup>21</sup> (Figure 12). The Park Steppes are characterized by the presence two clear strata: an upper arboreal one, made up of low, sparse trees from the Lythraceae and Anacardiaceae families; and a lower grassland one, made up of grasses from the *Paspalum*, *Axonopus* and *Stipa* genera, as well as annual plants. The steppes are typically grassland plant formations found in temperate regions, characterized by a regular distribution of rainfall throughout the year (IBGE, 2012).

Figure 12: Vegetation mentioned in the literature as being present in the project intervention area in Bagé-RS.

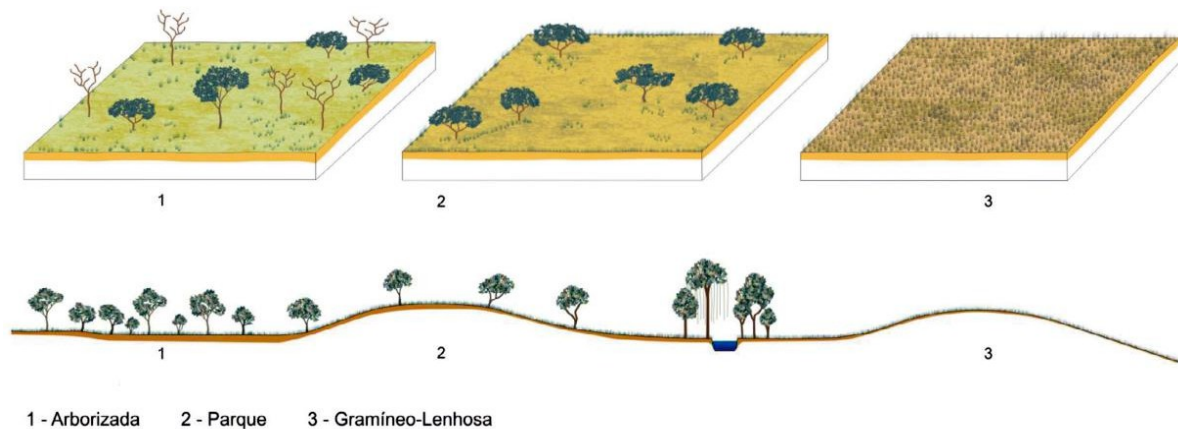


However, the project area is located in a transition zone between two other important vegetation types typical of the Pampa: the Grass-Lyme Steppe and the Wooded Steppe (Figures 12 and 13). The Grass-Lyme Steppe is characterized by phytophysionomic monotony, with the dominance of grasses and the absence, or little relevance, of the element

<sup>21</sup> IBGE, 2012. Available at: <https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=263011>

(IBGE, 2012), unlike what is observed in the project area. On the other hand, the Wooded Steppe is common in the watershed areas of the Camaquã River basin, where the project area is located, and is characterized by two well-defined strata: a first made up of low trees and shrubs, and a second predominantly made up of grasses, similar to what is found in the Park Steppe (IBGE, 2012). Due to this ecological contact, the vegetation in the project area has a floristic mix and phytosociological structure that combines characteristics of the Park Steppe and the Wooded Steppe. These arboreal plant formations, which are not necessarily associated with the gallery zones in the Pampa biome, are also known locally as subtropical shrub forests, generally associated with <sup>dystrophic</sup> lithic soils<sup>22</sup>, such as those found in the project area (see section 1.13 Soils).

Figure 13: Schematic profiles of the steppe's ecological physiognomies.



Adapted from IBGE, 2012.

- **Fauna**

The fauna of the Pampa is remarkably rich, with more than 500 species of birds, including the *rhea* (*Rhea americana*), the partridge (*Nothura maculosa*), the quer-queró (*Vanellus chilensis*) and the red-cockaded woodpecker (*Colaptes campestris*), among others. In the Uruguayan savannah ecoregion, where the project area is located, more than 100 species of terrestrial mammals have been recorded<sup>23,24</sup>, including four species of marsupials, 17 bats, 17 carnivores and more.

<sup>22</sup> Embrapa, 1984. Available at: <https://www.embrapa.br/busca-de-publicacoes/-/publicacao/219834/levantamento-de-reconhecimento-dos-solos-do-municipio-de-bage-rs>

<sup>23</sup> Available at: <https://antigo.mma.gov.br/biomas/pampa.html>

<sup>24</sup> One Earth. Available at: <https://www.oneearth.org/navigator/>

of 20 rodents, as well as other subgroups such as hoofed mammals and placentals<sup>22</sup>. Although many mammals prefer gallery forests and ravines, there are species adapted to grasslands, such as the roe deer (*Ozotoceros bezoarticus*) and medium-sized felines<sup>21,22</sup>.

The Pampa's fields and forests are home to several endemic species, such as the red-bellied toad (*Melanophryniscus atroluteus*), the blue-bearded hummingbird (*Heliomaster furcifer*), the Tuco-tuco (*Ctenomys flamarioni*) and the Pampean pampas cat (*Leopardus munoai*), the latter of which is critically endangered<sup>25,26</sup> (Figure 14). Other threatened species include the pampas deer, the green-bellied cabbage (*Sporophila hypoxantha*) and the weeping woodpecker (*Picooides mixtus*).

Figure 14: *Leopardus munoai*, the Pampa cat. Endemic to the Pampas grasslands of Uruguay, western Argentina and southernmost Brazil. One of the most threatened cats in the world.



Image: Felipe Peters

<sup>25</sup> Pro-Carnivores. Available at: <https://procarnivoros.org.br/animais/gato-palheiro-pampeano/>

<sup>26</sup> Sema, 2017. Available at: <https://www.sema.rs.gov.br/upload/arquivos/201708/25134422-folder-bioma-pampa.pdf>

In addition to the field areas , there are places where the outcrop of the rocks of the Sul-Rio-Grandense Shield creates unique habitats, sheltering species with a restricted distribution, especially the stone lizard (*Homonota uruguayensis*) (Figure 15), the only lizard native to Rio Grande do Sul, which is restricted to this type of environment and to the Campanha region.

Figure 15: Stone lizard (*Homonota uruguayensis*), a species restricted to rocky outcrops in the Pampa biome.



Photo: Vinicius Santos

The intrinsic relationship between the local fauna and the native grasslands and steppe forests, together with the significant endemic diversity and the rarity some species, makes the Pampa a place of special interest for conservation worldwide. However, the intense anthropogenic pressure on the biome, especially due to the conversion of natural ecosystems into agricultural areas, highlights the fragility and uniqueness of biological relationships in the Pampa, making it urgent to implement strategies to protect native biodiversity, encourage sustainable grassland management and protect forests from deforestation.

- **Relevant historical conditions**

Historically, the Pampa biome has been associated with extensive cattle ranching, using the native grasslands as a natural resource available for grazing. In the study region, which includes the project area, extensive cattle ranching on native grasslands has been the main economic activity since the beginning of Iberian <sup>colonization</sup><sup>27</sup>.

Throughout the history of the state's colonization, the sustainable management of native grasslands for cattle ranching has provided significant economic benefits and contributed to the conservation of natural grasslands. This management is also linked to an important transnational cultural tradition, represented by the gaucho, the emblematic figure of the rural man in southern <sup>Brazil</sup><sup>25</sup>.

Currently, more than 50% of the cattle herd and almost the entire sheep herd in Rio Grande do Sul are raised using the native grassland management system. However, contrary to what one might assume, low-intensity grazing is environmentally multifunctional and performs various ecological <sup>functions</sup><sup>28</sup>. In addition, it is supported by state legislation (Decree No. 52.431 of 2015), which allows the use of the Legal Reserve animal on properties in the Pampa biome. Thus, the countryside, the steppe forests, the cattle and the gaucho form the biological, social, cultural and economic identity of the Pampa. Therefore, any action to conserve natural resources in the Pampa that disregards cattle grazing on native grasslands as a strategy for local social, economic and ecological perpetuation is out of context and mistaken, and is doomed to failure.

The Pampa has significant biodiversity, with many endemic species (see 1.13 Vegetation and Fauna), and is considered one of the most important temperate grassland areas in the world. However, it is the biome with the least representation in the National System of Conservation Units (SNUC), covering only 0.4% of the Brazilian continental area protected by conservation units, despite the fact that the survey of "Priority Areas for the Conservation, Sustainable Use and Benefit Sharing of Brazilian Biodiversity" identified more than 41 areas in the Pampa with extremely high biological <sup>importance</sup><sup>29</sup> (Figure 16).

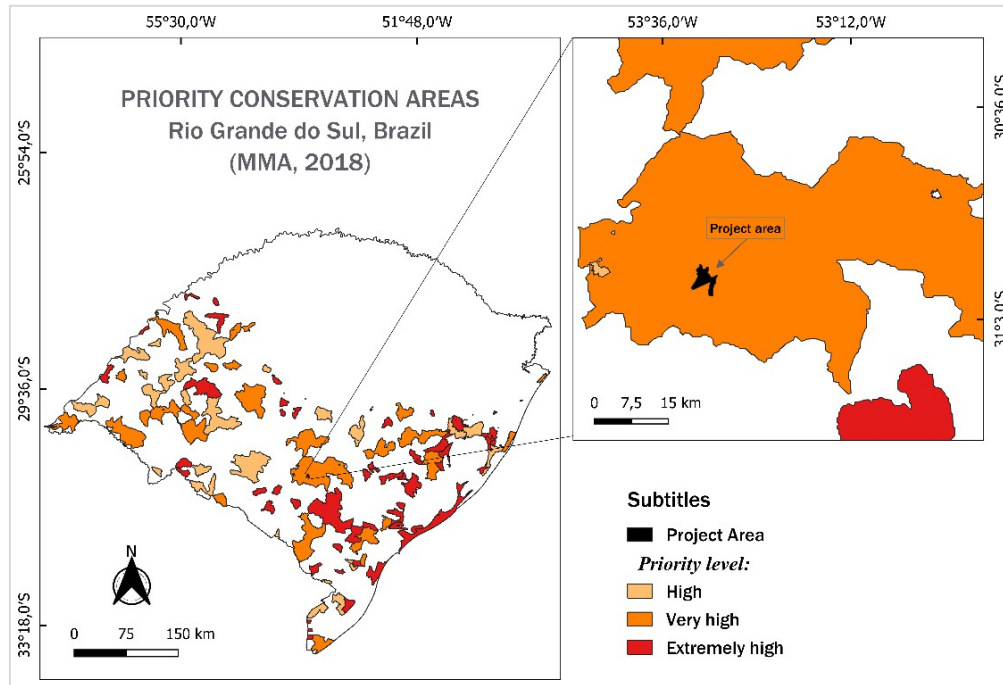
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<sup>27</sup> Available at: <https://antigo.mma.gov.br/biomas/pampa.html>

<sup>28</sup> Volk et al., 2020. Available at: <https://ainfo.cnptia.embrapa.br/digital/bitstream/item/222576/1/Volk-et-al.pdf>

<sup>29</sup> MMA, 2018. Available at: <https://drive.google.com/file/d/1db449E7Y2i7yGM7Ma01kWJ-mDZZvssRZ/view>

Figure 16: Map of priority areas for conservation in the Pampa biome, Rio Grande do Sul, Brazil, showing the overlap with the project area.

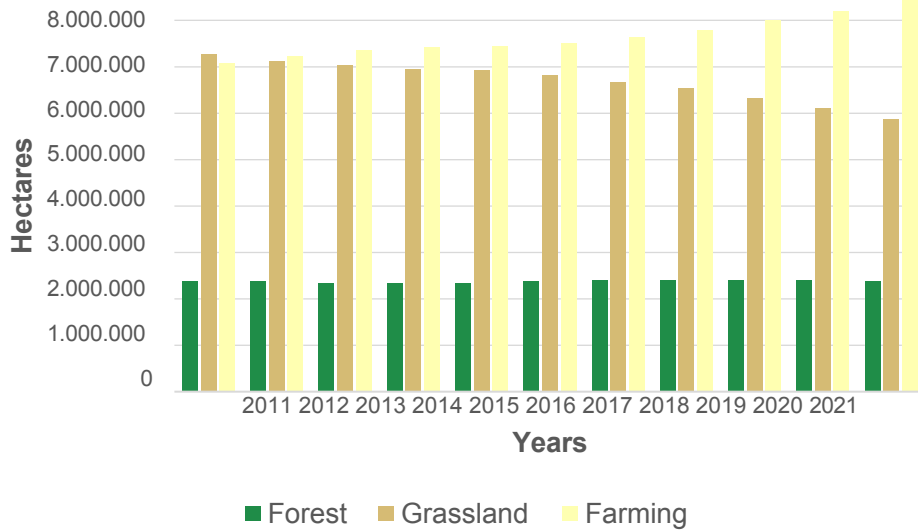


Despite the significant diversity, the increase in intensive agriculture, with the introduction of monocultures, has drastically reduced the natural vegetation cover, both grassland and forest, leading to the fragmentation of the biome. The expansion of monocultures and pastures with exotic species has caused rapid degradation and loss of the Pampa's natural landscapes. In proportional terms, the Pampa was the biome that lost the most native vegetation between 1985 and 2021 (29.5% reduction)<sup>30</sup>. The conservation of the remaining areas is crucial to preserving the genetic diversity of natural populations, the culture of the gaúcho people and the perpetuity of local economic-productive systems.

The shallow depth and scarce natural fertility of many of the Pampa's soils limit the potential for agricultural management, sensitizing and de-characterizing the natural grasslands through the conversion process. So while historically fire and forestry were considered threats to the biome, today it is the expansion of agricultural crops, especially soya, that threatens the Pampa's biodiversity. The area dedicated to agricultural activities already exceeds the area of forests and natural grasslands in the Pampa (Figure 17), with agriculture being the main activity (Figure 18) and soya the main vector of conversion (Figure 19).

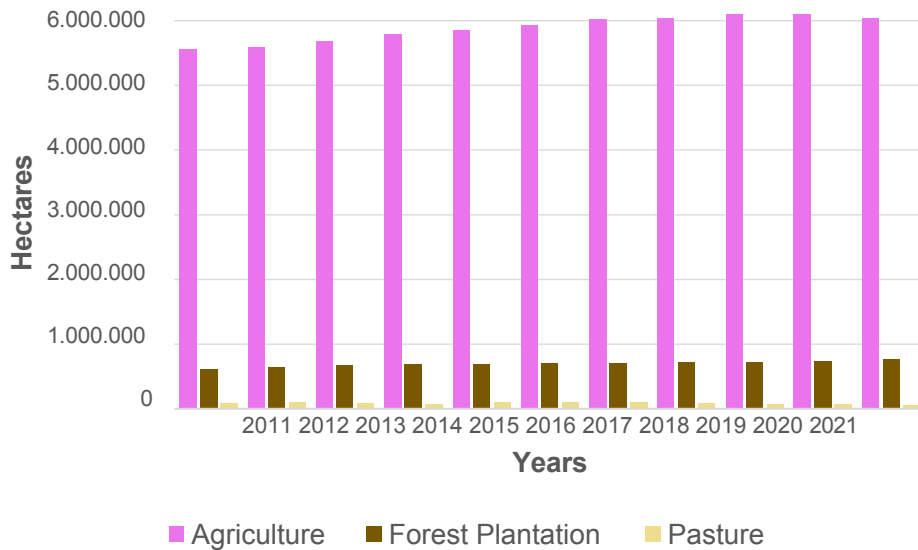
<sup>30</sup> MapBiomias, 2023. Available at: [https://brasil.mapbiomas.org/wp-content/uploads/sites/4/2023/11/MapBiomias\\_PAMPA\\_2022\\_11.10\\_1\\_.pdf](https://brasil.mapbiomas.org/wp-content/uploads/sites/4/2023/11/MapBiomias_PAMPA_2022_11.10_1_.pdf)

Figure 17: Distribution of land cover classes in the Pampa biome, Rio Grande do Sul, Brazil, for the historical period from 2011 to 2021.



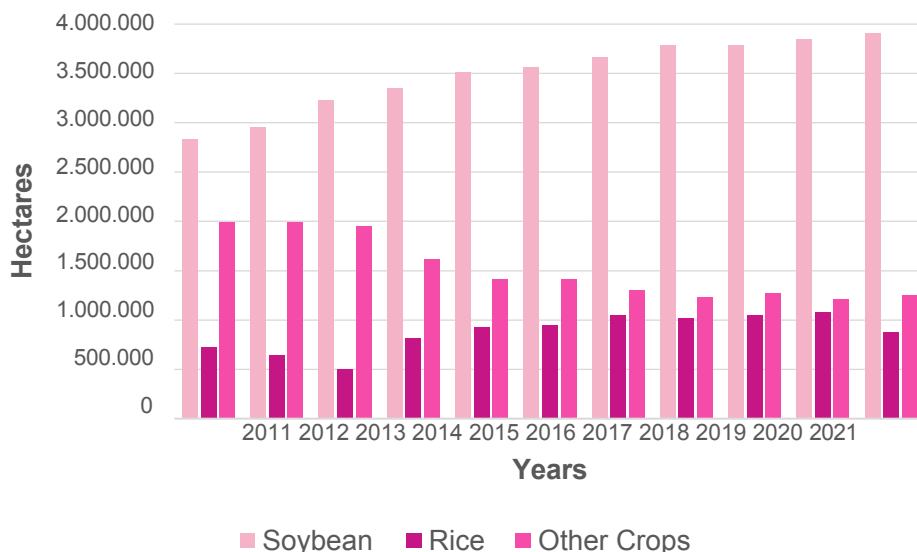
Data source: <https://brasil.mapbiomas.org/>

Figure 18: Distribution of agricultural land use classes in the Pampa biome, Rio Grande do Sul, Brazil, for the historical period from 2011 to 2021.



Data source: <https://brasil.mapbiomas.org/>

Figure 19: Area occupied by the main agricultural crops in the Pampa biome, Rio Grande do Sul, Brazil, for the historical period from 2011 to 2021.



Data source: <https://brasil.mapbiomas.org/>

With the growing impact of human activities on the ecosystems of the Pampa biome, local biodiversity is being de-characterized, resulting in a potentially incalculable loss due to the large number of endemic plant and animal species and the significant fraction of species that are still unknown. The loss of biodiversity in the Pampa affects the region's potential for sustainable development, either by reducing the number of species with forage, food, ornamental and medicinal value, or by reducing the environmental services provided by grassland vegetation, such as erosion control in the Pampa's fragile <sup>neosols</sup><sup>31</sup>.

The natural grasslands and tree vegetation of the Pampa also play a crucial role in carbon sequestration. Recent studies show that the proper management of native grasslands in livestock activities leads to an increase in root production and organic C and N stocks (Volk et al., 2020). This management also helps to maintain botanical diversity. Native grasslands depend on cattle grazing. In addition, greenhouse gas emissions in soils under pasture in the extensive and low-intensity management system in the Pampa are very low (0-250g C/ha/day)<sup>32</sup>, much lower than the emissions recorded in areas converted to agriculture. Regardless of the type of soil, grazing on native grassland, even in the traditional system, tends gradually increase greenhouse gas stocks.

<sup>31</sup> Roesch et al., 2009. Available at: <https://www.mdpi.com/1424-2818/1/2/182>

<sup>32</sup> Volk et al., 2020. Available at: <https://ainfo.cnptia.embrapa.br/digital/bitstream/item/222576/1/Volk-et-al.pdf>

carbon in the soil, while areas converted to crops, even in a crop rotation system, are unable to keep the carbon in the soil, resulting in its release into the atmosphere<sup>33</sup>.

Given this scenario, it is essential to implement actions to prevent deforestation of steppe forests in the Pampa and the conversion of native grasslands. These measures are crucial to preserving local biodiversity, protecting native vegetation and endemic species, ensuring the economic sustainability of the production chain in the Pampa, and making a significant contribution to maintaining carbon stocks and reducing GHG emissions at a regional level.

### 1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The conservation of native vegetation plays a fundamental role in Brazil's environmental agenda and is strongly shaped by constitutional and regulatory norms, both federal and state. The Palmas Camaquã project is in line with all applicable legislation by protecting native vegetation, biodiversity, soil, water resources and the integrity of the climate system, for the well-being of present and future generations. All the relevant local, state and national laws listed below:

- Brazil's 1988 Federal Constitution<sup>34</sup>: from an environmental point of view, it represents a significant advance in the protection of natural resources and the promotion of sustainable development. The law recognizes the importance of native vegetation areas for biodiversity and the global climate, and establishes the need to reconcile economic growth and environmental preservation, demonstrating a concern for future generations and the country's ecological balance. The current project is in line with this approach by seeking to generate VCS for commercialization, an essential measure for balancing economic interests with the conservation of natural resources.
- Law for the Protection of Native Vegetation, or "Brazilian Forest Code" (Law 12.651/2012)<sup>35</sup>: based on the federal constitutional perspective, this law establishes general rules for the protection of vegetation, including Permanent Preservation Areas and Legal Reserve Areas. It regulates forest exploitation, the supply of forest raw materials, control of the origin of forest products, and fire prevention and control

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<sup>33</sup> Santos, 2011. Available at: <https://repositorio.ufpel.edu.br/handle/123456789/2463?locale-attribute=es>

<sup>34</sup> [https://www.planalto.gov.br/ccivil\\_03/constituicao/constituicao.htm](https://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm)

<sup>35</sup> [https://www.planalto.gov.br/ccivil\\_03/\\_ato2011-2014/2012/lei/L12651compilado.htm](https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/L12651compilado.htm)

forestry, as well as foreseeing the need for economic and financial instruments to achieve its objectives.

- State Environmental Code (Law No. 15.434/2020)<sup>36</sup>: Establishes rules for environmental protection and management in the state of Rio Grande do Sul. According to Article 219 of this law, in the Pampa biome, the following activities are exempt from authorization by the competent state agency:
  - i) The introduction of herbaceous forage species with an annual or perennial life cycle native vegetation, as long as it does not characterize the suppression of native vegetation for alternative land use.
  - ii) The mowing or cutting of the aerial parts of grassland herbaceous vegetation to reduce biomass.
  - iii) The clearing of successor native vegetation formed mainly by pioneer species up to three (3) meters in height and provided that: a) it is carried out with the aim of maintaining grassland vegetation for pastoral activity; b) it does not involve the suppression of vegetation for alternative land use; c) the successor native vegetation is not associated with secondary formations; and d) it is not carried out on areas considered to be Permanent Preservation, Legal Reserve or restricted use.
  - iv) Extensive pastoral activity on areas of remaining native vegetation or rural areas consolidated by the suppression of native vegetation with pastoral activities, outside Permanent Preservation Areas and Legal Reserves, as long as it does not involve the suppression of native vegetation for alternative land use.
  - v) Pastoral activity on areas remaining native vegetation or rural areas consolidated by the suppression of native vegetation with pastoral activities, in Permanent Preservation Areas and Legal Reserves, provided that the owner adopts good environmental practices and has registered with the Rural Environmental Registry (CAR).
- Decree No. 52.<sup>431/2015</sup><sup>37</sup>: provides for the implementation of the CAR and defines concepts and procedures for the application of Federal Law No. 12.651/2012 in the state of Rio Grande do Sul. With regard to the Pampa biome, for the purposes of registering properties in the CAR, it is understood that:
  - i) rural area consolidated by suppression of native vegetation for alternative land use: area with anthropic occupation prior to July 22, 2008, in which cutting took place,

<sup>36</sup> <https://ww3.al.rs.gov.br/filerepository/replegiscomp/Lei%20n%C2%BA%2015.434.pdf>

<sup>37</sup> <https://www.sema.rs.gov.br/upload/arquivos/201610/14115105-decreto52431.pdf>

destruction, uprooting, desiccation, devitalization by any means, or any other practice that promotes the conversion of land use, with the exclusion of species native to the environment, for the purpose of introducing buildings, improvements or agroforestry activities, in the latter case admitting the adoption of the fallow regime.

ii) rural area consolidated by suppression of native vegetation with pastoral activities: area with anthropic occupation prior to July 22, 2008, with pastoral activities in which part of the native vegetation was maintained.

iii) remnant area of native vegetation: area covered by native vegetation of the forest, grassland or any other plant physiognomy type, with no anthropogenic occupation prior to July 22, 2008.

**Sole paragraph.** The presence of herbaceous forage species with an annual or perennial life cycle introduced into native grassland vegetation, as well as exotic species in native grassland vegetation, does not de-characterize it as a rural area consolidated by the suppression of native vegetation with pastoral activities for the purposes of the CAR.

- National Policy on Climate Change (Law 12.187/2009)<sup>38</sup>: formalizes Brazil's voluntary commitment to protecting the global climate system and sets targets for reducing greenhouse gas (GHG) emissions. It provides for the creation of the National Climate Change Fund - FNMC (Law 12.114/2009)<sup>39</sup>, regulated by Decrees 9.<sup>578/2018</sup><sup>40</sup> and 11.<sup>549/2023</sup><sup>41</sup>. It institutes the National Plan on Climate Change (Law 14.904/2024)<sup>42</sup>, which establishes guidelines for drawing up climate change adaptation plans. And it establishes the Action Plans for the Prevention and Control of Deforestation in the biomes, regulated by Decree 11.<sup>367/2023</sup><sup>43</sup>.
- National Policy for Payment for Environmental Services (Law 14.119/2021)<sup>44</sup>: establishes a regulatory framework for the implementation of financial compensation mechanisms aimed at maintaining, recovering or improving environmental conditions. Although this law establishes a fundamental legal framework that gives legal certainty to many types of projects, such as REDD projects, it does not create any enforceable mechanism that pays farmers for environmental services and therefore does not guarantee a viable financial flow for the necessary nature protection activities.

<sup>38</sup> [https://www.planalto.gov.br/ccivil\\_03/\\_ato2007-2010/2009/lei/l12187.htm](https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/l12187.htm)

<sup>39</sup> [https://www.planalto.gov.br/ccivil\\_03/\\_Ato2007-2010/2009/Lei/L12114.htm](https://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2009/Lei/L12114.htm)

<sup>40</sup> [https://www.planalto.gov.br/ccivil\\_03/\\_Ato2015-2018/2018/Decreto/D9578.htm#art25](https://www.planalto.gov.br/ccivil_03/_Ato2015-2018/2018/Decreto/D9578.htm#art25)

<sup>41</sup> [https://www.planalto.gov.br/ccivil\\_03/\\_Ato2023-2026/2023/Decreto/D11549.htm#art1](https://www.planalto.gov.br/ccivil_03/_Ato2023-2026/2023/Decreto/D11549.htm#art1)

<sup>42</sup> [http://www.planalto.gov.br/ccivil\\_03/\\_ato2023-2026/2024/lei/L14904.htm](http://www.planalto.gov.br/ccivil_03/_ato2023-2026/2024/lei/L14904.htm)

<sup>43</sup> [https://www.planalto.gov.br/ccivil\\_03/\\_Ato2023-2026/2023/Decreto/D11367.htm#art14](https://www.planalto.gov.br/ccivil_03/_Ato2023-2026/2023/Decreto/D11367.htm#art14)

<sup>44</sup> [https://www.planalto.gov.br/ccivil\\_03/\\_ato2019-2022/2021/lei/l14119.htm](https://www.planalto.gov.br/ccivil_03/_ato2019-2022/2021/lei/l14119.htm)

It is important to note that, despite a robust set of environmental regulations, the practical application of these laws still faces considerable challenges. Problems such as illegal deforestation, the degradation and conversion of ecosystems, as well as climate change, show that although the legislation is solid, the implementation of environmental policies needs to be improved<sup>45</sup>. It is essential to engage civil society and local communities in the management and protection of natural resources, ensuring that the benefits of conservation are widely shared.

One of the main limitations is the lack of effective enforcement. Although there are agencies responsible for environmental supervision at federal and state level, they often face restrictions due to a lack of resources, personnel and appropriate technology. This compromises the ability to monitor extensive areas of native vegetation, identify infractions and apply sanctions effectively<sup>46</sup>.

## 1.15 Double Counting and Participation under Other GHG Programs

### 1.15.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

Yes  No

### 1.15.2 Registration in Other GHG Programs

Has the project registered under any other GHG programs?

Yes  No

Is the project active under the other program?

Yes  No

### 1.15.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

Yes  No

<sup>45</sup> UN Environment, 2019. Available at: <https://www.unep.org/resources/assessment/environmental-rule-law-first-global-report>

<sup>46</sup> Schmitt & Scardua, 2015. Available at: <https://www.scielo.br/j/rap/a/LjyN7XcZM9JNPQVv6Br7M9P/?format=pdf&lang=pt>

## 1.16 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

### 1.16.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit?

Yes  No

*VCS is the only program with which the project will be involved or trade emissions credits.*

### 1.16.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system?

Yes  No

### 1.16.3 Supply Chain (Scope 3) Emissions

Do the project activities specified in Section 1.11 affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

Yes  No

## 1.17 Sustainable Development Contributions

By promoting environmental conservation, improving quality of life, stimulating sustainable economic development and tackling climate change, the Palmas Camaquã project can have a significant impact on the Sustainable Development Goals (SDGs) in <sup>Brazil</sup><sup>47</sup>. Below, we present how the project can be aligned with the SDGs:

- Poverty Eradication (SDG 1) and Zero Hunger (SDG 2): By implementing a VCS project, local communities can receive financial compensation for conservation practices. This can generate an additional source of income and contribute to poverty eradication. In rural areas especially, these payments can improve families' economic conditions by promoting sustainable practices that also protect essential resources such as water and soil.
- Health and well-being (SDG 3): Projects that preserve grasslands and forests can improve air quality and reduce air pollutants, benefiting public health. A

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<sup>47</sup> <https://brasil.un.org/pt-br/sdgs>

Ecosystem conservation can also improve water quality and reduce the risk of water-borne diseases.

- Quality Education (SDG 4): VCS projects can fund training initiatives for the communities involved, raising awareness of sustainable practices and promoting skills development.
- Drinking Water and Sanitation (SDG 6): VCS projects often include the protection of springs and groundwater recharge areas, which are vital for ensuring a clean and healthy water supply. Conserving vegetation around water bodies helps prevent pollution and erosion.
- Responsible Consumption and Production (SDG 12): Encourages the adoption of low-carbon practices and the reduction of emissions associated with consumption and production.
- Action Against Global Climate Change (SDG 13): The central aim of the project is to reduce greenhouse gas (GHG) emissions by conserving areas of native vegetation. In this way, its activities already constitute effective action against climate change and its impacts.
- Terrestrial Life (SDG 15): Contributes to the protection of natural areas of grasslands and forests that are essential for wildlife and the maintenance of healthy ecosystems.

Reducing land conversion and promoting sustainable development in the Pampa are also essential elements of action plans to reduce greenhouse gas emissions and adapt to climate change, as established by the Paris Agreement<sup>48</sup>. In its Nationally Determined Contribution (NDC), the Brazilian government pledged to reduce greenhouse gas emissions by 37% by 2025, with a subsequent indicative target of a 43% reduction by 2030, compared to estimated emission levels in 2005.

An essential contribution to guaranteeing the effective conservation and sustainable use of natural resources, highlighted by the project, is the consideration of priority areas for biodiversity in territorial planning (Decree 5.092/2004)<sup>49</sup>. In the Pampa biome, this means integrating these areas into land use strategies that respect and promote conservation. Adopting conservation practices for grasslands and forests in these priority areas helps to balance the needs of socio-economic development with environmental protection.

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<sup>48</sup> [https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/publicacoes/acordo-de-paris-e-ndc/files/pdf/agreement\\_paris.pdf](https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/publicacoes/acordo-de-paris-e-ndc/files/pdf/agreement_paris.pdf)

<sup>49</sup> [https://www.planalto.gov.br/ccivil\\_03/\\_ato2004-2006/2004/decreto/d5092.htm](https://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/decreto/d5092.htm)

## 1.18 Additional Information Relevant to the Project

### 1.18.1 Leakage Management

Deforestation within the leakage zone can be considered leakage from activity displacement due to the implementation of the VCS AFOLU project. This zone will be monitored in the same way as the project area. The latest VCS guidelines on the subject will be applied. If deforestation in the leakage zone is identified and not related to the project, appropriate measures will be taken to ensure that the environmental impact is properly monitored and managed. In addition, a detailed analysis will be carried out to distinguish the causes of the deforestation and assess the need for adjustments to mitigation strategies. If the leak is confirmed as a consequence of the project's activities, corrective actions will be implemented in accordance with VCS standards in order to minimize negative impacts and ensure compliance with conservation and emission reduction commitments.

### 1.18.2 Commercially Sensitive Information

All the information presented in the document complies with transparency and public access requirements, ensuring that any interested party can clearly and fully assess the project. The project proponent undertakes to provide all relevant information to guarantee the integrity and credibility of the certification process, in accordance with the guidelines established by the VCS standards. In this way, the public version of project description faithfully reflects the data and conditions associated with the execution and monitoring of the project, without withholding data crucial to understanding the environmental impact and proposed actions.

### 1.18.3 Further Information

There is no additional information to be disclosed. Should new relevant information arise during project implementation, it will be shared as required by applicable guidelines and regulations. The project proponent remains committed to transparency and providing information as necessary to ensure compliance and the success of the project.

# 2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

## 2.1 Stakeholder Engagement and Consultation

The following table provides an overview of the multidiverse scenario covering the local and/or regional context in which this project is located, covering aspects such as stakeholder identification, cultural engagement, localization, consultation and ongoing participatory monitoring.

<p><b>Stakeholder Identification</b></p>	<ol style="list-style-type: none"> <li><b>1. Initial mapping:</b> Survey of local communities, neighboring landowners, government agencies, environmental and academic organizations.</li> <li><b>2. Consultation of public records:</b> Analysis of environmental and socio-economic documents to understand the impact of the project.</li> <li><b>3. Direct engagement:</b> Community meetings and interviews with farmers and local associations.</li> <li><b>4. Institutional partnerships:</b> Collaboration with UFSM for technical support and awareness-raising.</li> <li><b>5. Continuous monitoring:</b> Periodic updating of stakeholder mapping to incorporate new demands.</li> </ol> <p>Identified Stakeholders:</p> <ul style="list-style-type: none"> <li>• Local communities and .</li> <li>• Governmental and regulatory bodies (Department of the Environment, IBAMA, city halls).</li> <li>• Federal University of Santa Maria (UFSM).</li> <li>• Agricultural sector and rural associations.</li> <li>• Environmental organizations and NGOs.</li> <li>• Carbon market and investors.</li> </ul> <p>The project maintains an ongoing dialog with these groups to ensure transparency and alignment with local needs.</p>
<p><b>Legal or customary tenure/access rights</b></p>	<p>The <b>Palmas Camaquã</b> project is located in a private, legally registered area, with no overlap with indigenous territories or traditional communities. , the local dynamics of ownership and use of natural resources were taken into account to ensure that there were no conflicts or negative impacts on groups that traditionally use the region.</p>

	<p>The main aspects identified include:</p> <ul style="list-style-type: none"> <li>• <b>Legal rights:</b> The property where the project takes place is duly registered and complies with current land and environmental legislation.</li> <li>• <b>Customary rights:</b> Small cattle ranchers and neighboring rural communities have traditional practices of agricultural land use (farming and/or grazing) and natural resource collection, which were taken into account when planning the project.</li> <li>• <b>Territorial conflicts:</b> No litigation or disputes over land ownership have been identified, but the project maintains an open channel of dialogue with local communities to mitigate any potential concerns.</li> </ul> <p>The project fully respects local groups' rights to access and use natural resources and reinforces its commitment to transparency and social participation, ensuring that its activities do not restrict historically established rights.</p>
<p><b>Stakeholder diversity and changes over time</b></p>	<p>The stakeholders of the Palmas Camaquã project are socially, economically and culturally diverse, reflecting the dynamics of the Pampa biome region. The main groups identified :</p> <ul style="list-style-type: none"> <li>• <b>Local communities and livestock farmers:</b> Small and medium-sized rural producers who depend on extensive livestock farming, a central cultural and economic element in the region.</li> <li>• <b>Governmental and regulatory bodies:</b> the Department of the Environment, IBAMA and other entities responsible for environmental and land management.</li> <li>• <b>State government (RS):</b> Interested in implementing the project due to the ABC Program (Low Carbon Agriculture), which encourages sustainable practices in the agricultural sector.</li> <li>• <b>Municipal administration (Bagé City Hall):</b> An essential partner in supporting local conservation and sustainable development policies, facilitating regulatory actions and promoting the integration of the project with municipal initiatives.</li> <li>• <b>Academic sector (UFSM):</b> Works on environmental monitoring, scientific research and training producers in sustainable practices.</li> <li>• <b>Agricultural cooperatives:</b> Linked to the production system, they promote technical assistance, the supply of inputs and incentives for more sustainable practices in local livestock farming.</li> <li>• <b>Rural unions:</b> Responsible for representing and defending the rights of rural producers, ensuring that sustainable practices are economically viable and socially fair.</li> <li>• <b>Environmental organizations and NGOs:</b> Groups focused on the preservation of the Pampa, with active participation in raising awareness and technical support for the project.</li> <li>• <b>Carbon market and investors:</b> Companies interested in buying carbon credits, boosting the economic viability of conservation.</li> </ul>

## Expected changes in well-being

The implementation of the **Palmas Camaquã** project will bring positive impacts for stakeholders compared to the baseline scenario, which is characterized by continued pressure on the ecosystems of the Pampa biome due to the conversion of native vegetation to intensive farming activities. The expected changes include environmental, social and economic benefits.

### 1. Improvements in Economic and Social Well-Being

- **Livestock farmers and local communities:** The project generates a new source of income through the sale of carbon credits, offering an economic alternative to converting native vegetation. It also encourages sustainable practices that can increase productivity in the long term.

- **Cooperatives and rural unions:** By encouraging sustainable livestock farming, cooperatives can provide technical support for producers to adapt to the new practices, while unions can ensure that the transition takes place in a fair and beneficial way for rural workers.

- **Municipal and state government:** The project contributes to meeting the environmental goals of the municipality and the state of Rio Grande do Sul, in line with initiatives such as the ABC Program (Low Carbon Agriculture).

### 2. Preservation and Improvement of Ecosystem Services

The project maintains 1,367.6 hectares of native vegetation, guaranteeing essential benefits for local ecosystems and their stakeholders:

- **Climate regulation and carbon stock:** Conserving vegetation helps to capture and retain carbon, reducing greenhouse gas emissions.

- **Water availability:** Maintaining vegetation protects springs and watercourses, which are essential for agricultural activities and use by local communities.

- **Erosion control and soil fertility:** Preserving vegetation cover prevents soil degradation, benefiting nearby productive areas.

- **Biodiversity:** The project strengthens the natural habitats of endangered species such as the Pampean pampas cat (*Leopardus munoai*) and the stone lizard (*Homonota uruguayensis*), promoting ecological balance.

### 3. Strengthening Environmental Education and Awareness

- UFSM plays a central role in disseminating technical and scientific knowledge, training producers and the community about the benefits of conservation.

- The installation of educational signs, training and environmental education activities encourages rural workers and their families to get involved in protecting the biome.

**Location of stakeholders**

**1. Stakeholders with Customary Rights in the Project Area**

- **Small livestock farmers and rural workers:** Some families living or working in the project area may maintain traditional land use practices for extensive grazing and the collection of natural resources, such as firewood and medicinal plants. These uses are culturally rooted and form part of the Pampa's socio-economic identity.
- **Traditional rural communities:** There may be family groups that maintain native field management practices, such as community grazing, which has been practiced for generations without formal records of ownership, but with social recognition of the occupation and use of the land.

**2. Indigenous Peoples and Traditional Communities Outside the Project Area**

- **Indigenous communities:** Although the project is not located within recognized indigenous lands, it is possible that there are indigenous peoples in nearby regions with cultural and historical links to the Pampa territory.
- **Other traditional communities in the region:** Some groups of peasants and family farmers have ways of life that depend on the sustainable use of the forest and native grassland, and the project's actions could influence their ability to maintain these practices.

**3. Impacted Areas Outside the Project Area**

- **Shared use territories:** Even if land rights are private, some traditional practices can have an influence on neighboring areas, especially with regard to forest conservation, the use of native pastures and access to sustainable natural resources.
- **Ecosystem services and cultural connectivity:** The project can have a positive impact on traditional communities by preserving biodiversity and guaranteeing the maintenance of ecosystems that are essential to their culture and livelihoods.

**Location of resources**

The stakeholders of the Palmas Camaquã project, including cattle ranchers, rural communities and groups with customary rights, own or habitually access territories and natural resources in and around the project area. The location of these territories and the way they are used vary according to the group involved.

**1. Territories and Resources within the Project Area**

- **Extensive cattle ranching:** Small and medium-sized ranchers traditionally use the native grasslands for extensive cattle grazing, a practice that is culturally rooted in the Pampa biome.
- **Use of natural resources:** Some local families may have regular access to resources such as firewood, water and medicinal plants for subsistence.
- **Rural workers:** They may live within the project area or on neighboring farms, depending on natural resources and the local economy

based on the traditional practice of agricultural land use for extensive livestock farming and/or temporary crops.

**2. Territories and Resources Outside the Project Area**

- **Neighboring farms:** Properties around the project also use extensive livestock farming and can benefit from the conservation of the region's ecosystem services.
- **Watersheds:** The project influences the preservation of water resources used by nearby rural communities, guaranteeing water quality and reducing erosion processes.
- **Traditional communities:** In some regions of the Pampa, groups maintain historical land and livestock management practices, with access to common fields and shared natural resources.
- **Indigenous peoples:** Although there are no demarcated indigenous lands within the project area, indigenous peoples may have cultural and historical connections with the Pampa's territory and natural resources.

**2.2 Risks to Stakeholders and the Environment**

Coomysa (Cooperativa Mista Santa Bárbara do Sul Ltda.) is responsible for the administration, management and marketing of Verified Carbon Credits (VCUs), as agreed between the parties and as mentioned above. Coomysa was created with aim of integrating economy and conservation in a profitable way, bringing benefits to companies, producers and society as a whole. Its purpose is to connect landowners to the global market for environmental assets, creating a new source of income that encourages the preservation of ecosystems. Coomysa's internal team is made up of qualified professionals with expertise in issues related to environmental assets. In addition, the cooperative has dedicated itself to constantly improving the management team involved in implementing the carbon project at Fazenda Camaquã. An example of this is the partnership established with the Federal University of Santa Maria (UFSM), through the Forest Economics and Policy research group, coordinated by Professor Dr. Jorge Antonio de Farias. The UFSM has played a crucial role in disseminating technical and scientific knowledge, offering support to the project in various areas, such as awareness among rural producers about the importance of conserving the Pampa's native vegetation and its associated benefits.

The following table shows the identification of potential risks to stakeholders and the environment, and the mitigation measures adopted to prevent or mitigate these risks.

	Risks identified	Mitigation or preventative measure(s) taken
<p><b>Natural and human-induced risks to stakeholders' wellbeing</b></p>	<p>No risk identified.</p>	<p>As the project aims to promote the conservation of native vegetation in the Pampa biome, maintaining the landscape and associated ecosystem services, which brings social benefits to local communities, there are no actions that could pose risks to the well-being of these communities. On the contrary, the activities aim to improve local well-being.</p>
<p><b>Risks to stakeholder participation</b></p>	<p>i) Risks associated compromising project integrity and reputation, impacting stakeholders.</p> <p>ii) Lack of understanding of the benefits of the project on the part of the local community.</p>	<p>As the project is being carried out in an open-air laboratory, there is a certain amount of risk involved. However, it should be emphasized that the proponent has earmarked resources and established strategic partnerships with teaching and research institutions, with the aim of improving the qualifications of the team involved and guaranteeing continuous environmental monitoring of the area and effective reporting throughout the duration of the project.</p> <p>The project is located in a private, legally registered area, with no overlap with indigenous territories or traditional communities. However, the local dynamics of ownership and use of natural resources were taken into account to ensure that there were no conflicts or negative impacts on groups that traditionally use the region. The project fully respects local groups' rights to access and use natural resources and reinforces its commitment to transparency and social participation, ensuring that its activities do not restrict historically established rights.</p>
<p><b>Working conditions</b></p>	<p>No risk identified.</p>	<p>The project does not present risk conditions for the workers, nor direct nor indirectly, in addition to those associated with conventional management activities, a practice culturally rooted in the Pampa biome. However, if a risk does arise, it can be adequately mitigated by through of training in safety preventive e continuous monitoring.</p>
<p><b>Safety of women and girls</b></p>	<p>No risk identified.</p>	<p>The project does not engage in activities that expose women and girls to any form of risk.</p>

<p><b>Safety of minority and marginalized groups, including children</b></p>	<p>No risk identified.</p>	<p>The project does not engage in activities that expose vulnerable groups, regardless of gender or age, to any form of risk.</p>
<p><b>Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)</b></p>	<p>No risk identified.</p>	<p>The project does not engage in activities that create or aggravate environmental issues related to pollutants. The use of fossil fuels on the property is minimal, restricted to routine activities within the farm. It should be noted, however, that air pollution can occur due to natural disturbances, such as forest fires or other catastrophic events. Mitigation measures include monitoring actions (via satellite and in person), firebreak maintenance and environmental education activities (to be carried out), with the aim of strengthening the engagement of resident employees, including training on fire prevention.</p>

### 2.3 Respect for Human Rights and Equity

The project proponent supports universally recognized human rights and is committed to not engaging in any form of violence or violation of human rights, as set out in the Universal Declaration of Human Rights, the United Nations Declaration on the Rights of Indigenous Peoples, ILO Convention No. 169 on Indigenous and Tribal Peoples and the ILO Declaration on Fundamental Principles and Rights at Work. In addition, the project follows a code of conduct that prohibits discrimination and sexual harassment, reflecting the company's commitment to professional culture and ethics.

### 2.4 Ecosystem Health

The Palmas Camaquã project makes a positive contribution to mitigating global climate change by preventing greenhouse gas emissions through avoided deforestation, as well as supporting biodiversity conservation and associated ecosystem services. By preserving native vegetation, the project retains carbon, promotes biodiversity and generates a new source income by selling carbon credits, offering an economic alternative to converting native vegetation. It also encourages sustainable practices that can increase productivity in the long term.

Table 4: Risks associated with ecosystem health.

	Risks identified	Mitigation or preventative measure(s) taken
<b>Impacts on biodiversity and ecosystems</b>	i) The project makes a positive contribution to biodiversity conservation, especially by strengthening the natural habitats of endangered species, promoting ecological balance. , there is a risk of intensified hunting of these species due to increased visibility and population growth.	To deal with potential risks related to long-term environmental co-benefits, strategic decisions will be made with an emphasis on monitoring and recording local fauna and flora species. In addition, environmental education activities will be carried out to strengthen engagement with resident employees, including training on the identification of species of relevant ecological interest, such as the Pampean pampas cat ( <i>Leopardus munoai</i> ) and the stone lizard ( <i>Homonota uruguayensis</i> ), the only lizard native to Rio Grande do Sul, which occurs exclusively in the Pampa region.
	iii) Risks may arise from deforestation or vegetation degradation not directly caused the project, due to natural disturbances such as forest fires or other catastrophic events.	The project allocates Buffer credits, which act as insurance to deal with unexpected events that result in a loss of carbon stock. If the risks are properly managed, the system ensures that the credits can be reintegrated into the project's credit.
<b>Soil degradation and soil erosion</b>	There is no considerable risk of soil degradation or erosion directly associated with the project.	Maintaining vegetation cover prevents soil degradation, bringing benefits to nearby productive areas.
<b>Water consumption and stress</b>	The project activities do not imply a significant risk increased water consumption or water stress.	The preservation of vegetation protects springs and watercourses, which are essential for agricultural activities and use by local communities.

2.4.1 Rare, Threatened, and Endangered Species

Is the project located in or adjacent to habitats for rare, threatened, or endangered species?

- Yes                       No

If yes, list such species and habitats in the table below and provide evidence that the project will not adversely impact these areas.

The table below shows the species classified as endangered in the Pampa biome, which require priority actions to mitigate their threats and improve their current conservation status. It is worth noting that, in addition to these species, others in the region will also benefit from the conservation actions implemented by the project.

Table 5: List of endangered species.<sup>50,51,52</sup>

Species and habitat	Amphibians:
	Horned toad ( <i>Ceratophrys ornata</i> ) - CR
	Darwin's toad ( <i>Melanophryniscus montevidensis</i> ) - VU Red-bellied toad ( <i>Melanophryniscus dorsalis</i> ) - VU San Martín toad ( <i>Melanophryniscus sanmartini</i> ) - NT
	<b>Birds:</b>
	<i>Coryphistera alaudina</i> - CR <i>Gubernatrix cristata</i> - CR <i>Leptasthenura platenses</i> - CR <i>Porzana spiloptera</i> - EN
	Macuquinho-da-várzea ( <i>Scytalopus iraiensis</i> ) - EN
	Gray eagle ( <i>Urubitinga coronata</i> ) - EN
	Cockatoo ( <i>Alectrurus tricolor</i> ) - VU Greater hiker ( <i>Anthus nattereri</i> ) - VU Lesser sparrowhawk ( <i>Asthenes hudsoni</i> ) - VU
	Grey hawk ( <i>Circus cinereus</i> ) - VU
	Coperete ( <i>Pseudoseisura lophotes</i> ) - VU
	Pawpaw ( <i>Sporophila beltoni</i> ) - VU
	Red-bellied goshawk ( <i>Sporophila hypoxantha</i> ) - VU Black-bellied goshawk ( <i>Sporophila melanogaster</i> ) - VU White-bellied goshawk ( <i>Sporophila palustres</i> ) - VU Dark-bellied goshawk ( <i>Sporophila ruficollis</i> ) - VU
	Yellow warbler ( <i>Xanthopsar flavus</i> ) - VU
	Black-tailed godwit ( <i>Xolmis dominicanus</i> ) - VU

<sup>50</sup> ICMBio, 2021. Available at: <https://www.gov.br/icmbio/pt-br/assuntos/biodiversidade/pan/pan-aves-dos-campos-sulinos/2-ciclo/pan-aves-dos-campos-sulinos-sumario.pdf>

<sup>51</sup> ICMBio, 2025. Available at: <https://salve.icmbio.gov.br>

<sup>52</sup> Sema, 2021. Available at: <https://www.sema.rs.gov.br/upload/arquivos/202306/02165631-sumario-executivo-pat-campanha.pdf>

**Mammals:**

giant anteater (*Myrmecophaga tridactyla*) - VU marsh  
 deer (*Blastocerus dichotomus*) - VU big cat (*Leopardus geoffroyi*) - VU  
 Pampean pampas cat (*Leopardus munoai*) - CR  
 Maracajá cat (*Leopardus wiedii*) - VU  
 Tuco-tuco (*Ctenomys minutus*) - VU  
 Tuco-tuco (*Ctenomys lami*) - EN  
 Maned wolf (*Chrysocyon brachyurus*) - VU  
 Mole cat (*Herpailurus yagouaroundi*) - VU

**Reptiles:**

Dune lizard (*Liolaemus arambarensis*) - EN Blue  
 iguana (*Stenocercus azureus*) - EN Dune lizard  
 (*Liolaemus occipitalis*) - VU Stone lizard (*Homonota uruguayensis*) - VU

**Freshwater fish:**

Uruguayan Rivule (*Austrolebias arachan*) - CR  
*Austrolebias bagual* - NE  
 Bluebat Rivulet (*Austrolebias camaquensis*) - NE  
*Austrolebias cheradophilus* - CR  
*Austrolebias* aff. *gymnoventris* - NE  
*Austrolebias juanlangi* - CR *Austrolebias melanoorus* - EN  
 Blue-bellied Rivule (*Austrolebias nachtigalli*) - CR  
*Austrolebias quirogai* - NE  
*Austrolebias* aff. *reicherti* - NE  
*Austrolebias univentripinnis* - CR  
*Austrolebias cinereus* - CR

**Flora**

*Mangonia tweediana* - CR  
*Trixis pallida* - CR *Tillandsia bella* - CR  
*Dyckia domfelicianensis* - CR  
*Frailea mammifera* - CR *Parodia gaucha* - CR

	<p><i>Parodia neoarechavaletae</i> - CR</p> <p><i>Parodia rudibuenekeri</i> - CR <i>Senna nana</i> - CR</p> <p><i>Cypella magnicristata</i> - CR</p> <p><i>Cypella pusilla</i> - CR <i>Herbertia zebrina</i> - CR</p> <p><i>Sphaeralcea bonariensis</i> - CR</p> <p><i>Chascolytrum parodianum</i> - CR</p> <p><i>Pavonia secreta</i> - CR</p> <p><i>Petunia secreta</i> - CR</p>
<p><b>Areas needed for habitat connectivity</b></p>	<p>Several factors act together to cause a reduction in size population of species. Most of the threats derive directly from anthropogenic activities, with habitat loss and degradation being the pressure factor more significant. In this scenario, this project has a positive impact, since there has been no habitat fragmentation due to land conversion, ensuring connectivity between remnants of native vegetation and offering suitable habitats for wildlife. It is worth noting that this project also benefits migratory species, whose life cycles depend on international cooperation agreements for their preservation.</p>

Where: CR= Critically Endangered; VU= Vulnerable; NT= Near Threatened; EM= Endangered; NE= Not evaluated

Table 6: Risks related to species and habitat connectivity.

	Risks identified	Mitigation or preventative measure(s) taken
<p><b>Habitats for rare, threatened, and endangered species</b></p>	<p>i) Illegal deforestation</p> <p>ii) Illegal hunting activities</p> <p>iii) Forest fires</p>	<p>Implement continuous monitoring (by satellite and in person) and patrolling of the property to identify possible illegal activities.</p> <p>Environmental education activities will be developed to strengthen engagement with local residents, including awareness campaigns on the importance of protecting native species and training on the identification of endangered species and/or species of relevant ecological interest. In addition to the installation of educational signs.</p> <p>Adopt fire prevention strategies, such as the maintenance of firebreaks, and promote a participatory approach with educational guidance on the periods of greatest risk.</p>

<b>Areas for habitat connectivity</b>	i) Illegal deforestation	Implement continuous monitoring (by satellite and in person) and patrolling of the property to identify possible illegal activities.
	ii) Forest fires	Adopt fire prevention strategies, such as the maintenance of firebreaks, and promote a participatory approach with educational guidance on the periods of greatest risk.

#### 2.4.2 Introduction of Species

This section is not relevant to this project, as there are no planned planting activities or species introductions.

#### 2.4.3 Ecosystem Conversion

The project area consists solely of native vegetation, preserved for at least 10 years before the start of activities, as shown in the various thematic maps throughout the document. This confirms that the area's forest and grassland ecosystems have been maintained in their natural state, without any conversion to alternative land use.

## 3 APPLICATION OF METHODOLOGY

### 3.1 Title and Reference of Methodology

The main methodology adopted by the Palmas Camaquã project is based on VCS Methodology VM0015 (Methodology for Avoided Unplanned Deforestation, v1.2). The list below refers to the methodologies with which the project team assessed the suitability and set up the support tools used to develop the project scope.

Type	Reference ID	Title	Version
Methodology	VM0015	Methodology for Avoided Unplanned Deforestation	1.2
Module (Carbon pool)	VMD0001	Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools (CP-AB)	1.2
	VMD0004	Estimation of stocks in the soil organic carbon pool (CP-S)	1.1
Tools	VT0001	Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities	3.0

### 3.2 Applicability of Methodology

All applicability conditions were fulfilled as specified by the VM0015 methodology and the VT0001 Tool for Additionality. The other tools used did not have any specific applicability conditions. This methodology applies to projects that prevent Avoided Unplanned Deforestation (AUD). The baseline includes land conversion for agricultural or pasture activities. The following statements are provided to demonstrate how the methodology applies to the project:

- a) The factors driving conversion in the baseline scenario are in line with those described in section 6 of the VM0015 methodology. This methodology estimates the greenhouse gas emissions of the areas affected by unplanned conversion and quantifies the emission reductions achieved by reducing this conversion.
- b) In this project, there are no land areas registered in any other GHG program, which guarantees that there will be no duplication in the counting of carbon credits.
- c) The description of the baseline scenario is supported by evidence such as previous studies, maps and field research.

- d) The project's activities are designed to prevent the conversion of the ecosystem, focusing on the main agent of conversion, the private landowner. The project will offer annual financial payments from the sale of carbon credits to encourage the conservation of the Pampa's native vegetation, rather than converting the area to agriculture in order to generate income.
- e) The baseline projections must be revisited at the frequency set out in the most recent version of the VCS Standard and adjusted, as necessary, based on land use and land cover changes observed during the past period and changes at the level of agents, drivers and underlying causes of deforestation, which are subject to monitoring.
- f) All emissions from project activities that are not classified as "minimal" will be monitored and subtracted from the emission reductions. Initial project activities do not result in significant GHG emissions.
- g) The project area does not include any wetlands, as demonstrated by an analysis of all the wetlands identified by FEPAM (Henrique Luis Roessler State Foundation Environmental Protection)<sup>53</sup>, the technical body of the Rio Grande do Sul State Environmental Protection System.
- h) All the areas covered by the project have been classified as native vegetation of the Pampa biome for at least 10 years prior to the start of the project, as shown in the thematic maps included in this document.
- i) To carry out the project, we chose the types woody vegetation that best align with the definition of forest established by the United Nations Framework Convention on Climate Change (UNFCCC)<sup>54</sup>, as well as the vegetation categories used by the Brazilian Forest Service<sup>55</sup> in its studies and reports on Brazil's forest resources, both nationally and internationally. Although we have adopted the UNFCCC's definition of forests, we recognize that it cannot cover all the diversity of Brazilian forests. Some forest types, such as those found in specific ecosystems like the Pampa, do not fully meet the criteria of this definition. In order to better reflect the complexity of forest resources in Brazil, it would be necessary to adopt a definition that takes land use into account, which would make it possible to include other forms of vegetation that are not strictly forests.

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<sup>53</sup> Fepam, RS. Available at: [http://ww3.fepam.rs.gov.br/biblioteca/geo/bases\\_geo.asp](http://ww3.fepam.rs.gov.br/biblioteca/geo/bases_geo.asp)

<sup>54</sup> Available at: [http://unfccc.int/cop7/documents/accords\\_draft.pdf](http://unfccc.int/cop7/documents/accords_draft.pdf)

<sup>55</sup> Available at: <https://snif.florestal.gov.br/pt-br/florestas-e-recursos-florestais/167-definicao-de-floresta>

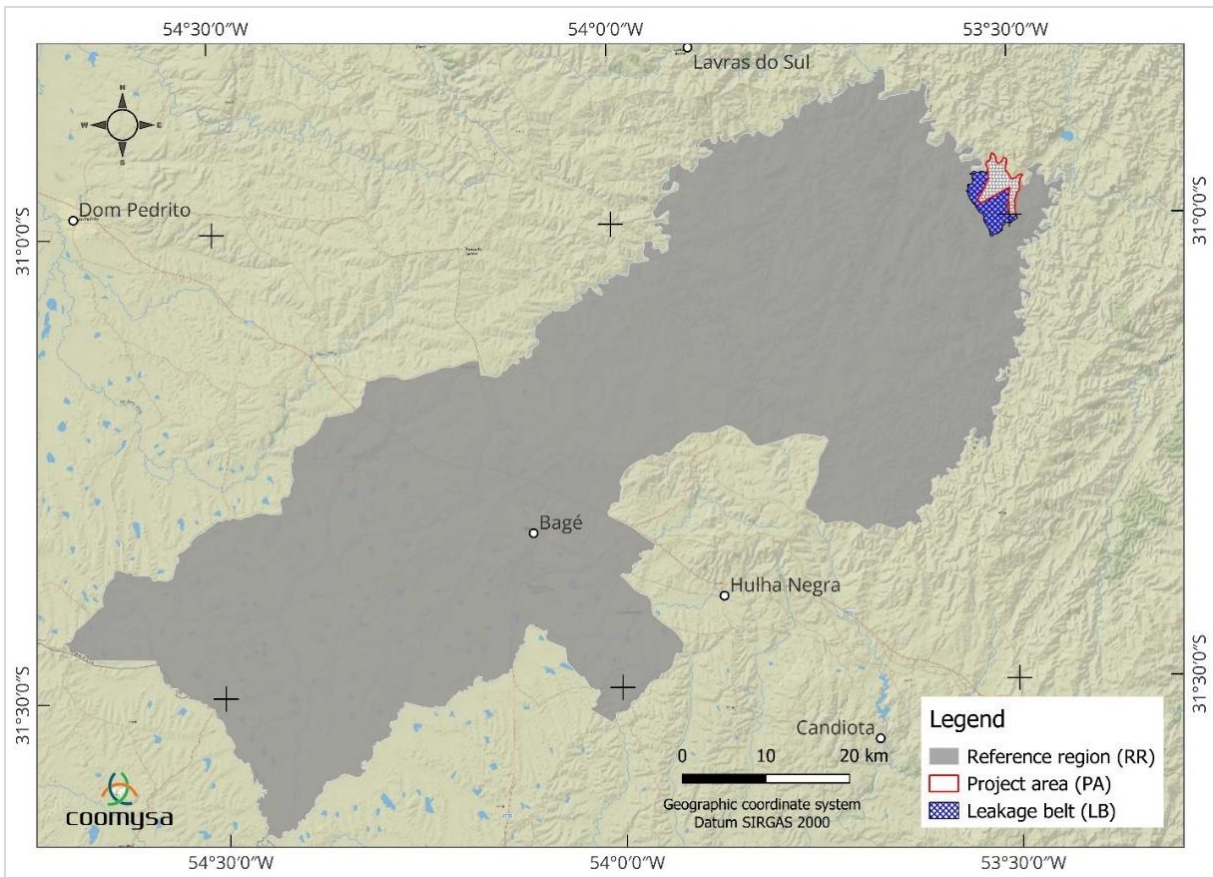
### 3.3 Project Boundary

The project area consists of multiple contiguous and non-contiguous patches of native vegetation in the Brazilian Pampa. A thematic map of the accounting area, along with documentation of the rural property involved, is available in the appendices. Additional details about the area can be found throughout this project description document.

#### 3.3.1 Spatial boundaries

Defining the spatial limits of the analytical domain provides access to important information on the historical rate of deforestation and the projection of future deforestation. Within these parameters, three definitions of areas are essential: reference region (RR), project area (PA) and leakage zone (LB), as illustrated in Figure 20.

Figure 20: Spatial boundaries defined for the VCS AFOLU project.



- Reference region (RR)

The municipality of Bagé/RS was defined as the reference region (RR) because it is where the project is located and offers a more specific scale of environmental planning, focused on regional needs and characteristics, especially with regard to management and monitoring. This ensures that the area is similar to that of the project. Regionalization through Regional Development Councils (COREDEs) and Functional Planning Regions (RFs) uses larger scales, which serve as a basis for creating state instruments for sustainable <sup>planning</sup><sup>56</sup>, in contrast to the narrower delimitation proposed in this study. The RR covers a total area of 409,036.0 hectares, encompassing both the project area and the leakage zone. The main agents of deforestation in the RR are rural producers, who often clear the land to establish or expand their areas under agriculture, especially for growing soybeans and livestock, resulting in the conversion of native vegetation into agricultural land.

- Project area (PA)

The project area (PA) refers to the actual area of the property, which, despite the owner's intention to comply with the legislation, is exposed to pressure from illegal deforestation. It is in this area that the project activities will be carried out and the GHG emission reductions accounted for, and it may therefore not correspond exactly to the total boundaries of the property. The PA covers 1,367.6 hectares of native vegetation belonging to "Fazenda Camaquã", which has a total area of 1,615.5 hectares. The boundaries of the property were established and geo-referenced on the basis of a topographical survey carried out previously, with the aim of regularizing the rural property for registration and titling.

- Leakage belt (LB)

The leakage zone (LB) corresponds to the adjacent forest area, where unplanned deforestation avoided in the project area may be displaced due to project implementation. The vegetation conditions and other factors that impact land use change patterns should be similar to those in the project area, and its size should be at least 90% of the project area. Table 7 summarizes this information, comparing it with that of the project area (PA).

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<sup>56</sup> SPGG-RS, 2024. Available at: <https://atlassocioeconomico.rs.gov.br/regioes-funcionais-de-planejamento>

Table 7: Ratio of the conditions obtained for leakage area (LB) compared to the project area (PA).

Factors evaluated	Category	LB	PA
Accounting area (ha)	Spatial boundary	1,679.7	1,367.6
Total area (%)	Forest	83.8	84.7
	Non-forest	16.2	15.3
Forest formation (%) *	Seasonal forest	35.2	33.2
	Tree-steppe	64.8	66.8
Non-forest area (%)	Farming	89.6	84.4

\* For additional information on the subdivision of the forest formation according to the different classes established, see item 4.1.2 Definition of Classes of Land Use and Land Cover.

### 3.3.2 Temporal boundaries

With regard to the time limits set, the main milestones defined by the AFOLU project are as follows:

- From January 1, 2011 to December 31, 2021 - Historical reference period, with a defined start and end date.
- From December 21, 2022 to December 21, 2062 - Project credit period, with start and end dates.
- December 21, 2032 - Date set for the revision of the project baseline, which must be updated every 10 years after the start of the project.

### 3.3.3 Carbon Pools

The following table shows the main carbon pools that have been included or excluded from the proposed project boundaries.

Table 8: Carbon pools included/excluded in the VCS AFOLU project.

Carbon pools		Included?	Justification/Explanation
Baseline	Aboveground biomass	Yes	It is in this reservoir that the greatest change in carbon stock will occur.
	Belowground biomass	Yes	It is expected that the carbon stock of this compartment will increase as the above-ground biomass increases.
	Dead wood	In	The presence of dead wood accumulated on the soil surface is not expected in the baseline scenario.
	Harvested wood products	In	Conservatively, it is omitted that products wood harvesting are part of the forest conversion process.
	Litter	In	The formation of a layer of accumulated organic material on the soil surface is not expected in the baseline scenario.
	Soil organic carbon	Yes	Inadequate soil management in agricultural areas can limit the contribution of plant residues to the soil and reduce soil organic carbon stocks.
Project	Aboveground biomass	Yes	It is in this reservoir that the greatest change in carbon stock will occur.
	Belowground biomass	Yes	It is expected that the carbon stock of this compartment will increase as the above-ground biomass increases.
	Dead wood	In	Conservatively omitted.
	Harvested wood products	In	No wood products are expected in the context of the project.
	Litter	In	Conservatively omitted.
	Soil organic carbon	Yes	Recommended where forests are converted into agricultural land. The stock of organic carbon in the soil is expected to increase due to the implementation of the project.

### 3.3.4 Sources of GHG Emissions

The main sources of GHG emissions related to the baseline and the project are shown in the table below, along with the justification for including or excluding each one.

Table 9: Identified sources of GHG emissions.

Sources	Gas	Included?	Justification/Explanation of choice
Biomass burning	CO <sub>2</sub>	In	Counted as carbon stock change
	CH <sub>4</sub>	In	Generally, during land clearing, vegetation is buried and not burned. Thus, the exclusion does not result in an overestimation of the project's net GHG emission reductions.
	N <sub>2</sub> O	In	Considered insignificant according to the VCS Methodology Requirements
Fossil fuel burning	CO <sub>2</sub>	In	Conservatively, it is omitted that the burning of fossil fuels is part of the forest conversion process.
	CH <sub>4</sub>	In	Emissions are minimal and irrelevant.
	N <sub>2</sub> O	In	
Use of fertilizers	CO <sub>2</sub>	In	Emissions are minimal and irrelevant.
	CH <sub>4</sub>	In	
	N <sub>2</sub> O	In	Conservatively, we chose not to consider it. Although it is recognized that the use of fertilizers in agriculture is a common practice to improve land productivity and correct its acidity.
Livestock emissions	CO <sub>2</sub>	In	Emissions are minimal and irrelevant.
	CH <sub>4</sub>	Yes	Emissions mainly from the enteric fermentation of animals.
	N <sub>2</sub> O	Yes	Emissions resulting from the deposition of manure on pasture.

### 3.4 Baseline Scenario and Additionality

In this chapter, the analysis of the baseline scenario and the demonstration of additionality are approached in an integrated manner, following the procedures set out in VT0001: "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities, v3.0". This tool is adapted from the CDM "Tool for the Demonstration and Assessment of Additionality in A/R CDM Project Activities" (Version 02).

#### **Step 1: Identification of alternative land use scenarios to the proposed VCS AFOLU project activity**

##### Sub-step 1a(a). Identify credible alternative land use scenarios to the proposed VCS AFOLU project activity

Based on the requirements of the tool used, considering the information available from stakeholders and the literature, and analyzing the history of land use in the project region, three potential alternative scenarios were identified:

- i. Conservation of surplus native vegetation in the Pampa without registration as a VCS AFOLU project
- ii. Conservation of surplus native vegetation in the Pampa through Legal Reserve compensation
- iii. Land conversion for agricultural activities

##### Sub-step 1a(b): Credibility of identified land use scenarios

**Scenario i** is credible, although highly unlikely, since the majority of landowners in the Pampa biome see the maintenance of surplus native vegetation as a burden, as they do not perceive direct financial compensation to justify restricting high-yield productive activities such as agriculture. There is a lack of funding for conservation in the region, and commercial agriculture is much more profitable than philanthropic conservation. Without attractive economic incentives, landowners who have surplus vegetation on their properties end up deforesting eventually.

**Scenario ii** is also considered credible, although highly unlikely to happen, given that the Legal Reserve compensation market in Brazil is still at a very early stage, which makes liquidity difficult in negotiations between buyers and sellers.

In addition, prices can vary considerably between regions within the same state, affected by the opportunity cost of the land or the time horizon of the contracts. On consulting the databases of some of the main platforms that facilitate this type of negotiation in Brazil, we found no offers related to the Pampa biome. On a purely speculative basis, the prices of these Legal Reserve compensation transactions range from 240 to 350/ha/year for the Caatinga and from 100 to 650/ha/year for the Atlantic Forest.

**Scenario iii** is credible and highly likely to occur, since the high profitability generated by commodity prices has stimulated the expansion of grain cultivation in Rio Grande do Sul, especially soybeans. According to an IBGE <sup>survey</sup><sup>57</sup>, between 2020 and 2022, the state produced an average of 13.7 million tons of soybeans, making it the fourth largest producer in Brazil. This increase in production is partly the result of the adoption of modern agricultural technologies that increase efficiency and productivity, such as precision agriculture and biotechnology. However, high international prices have led to the expansion of soybean cultivation in areas unsuitable for sustainable practices, which can result in environmental degradation. Rio Grande do Sul ranks second in loss of native vegetation due to conversion to agriculture, with the Pampa emerging as a new agricultural frontier. Figure 21 illustrates the annual evolution of the planted area and production of soybeans in Brazil and Rio Grande do Sul between 2011 and 2021.

Figure 21: Annual evolution of the area planted and the quantity produced of soybeans in Brazil and Rio Grande do Sul (2011-2021).

Year	Brazil		Rio Grande do Sul	
	Area planted (hectares)	Production (ton)	Area planted (hectares)	Production (ton)
2011	24,032,410	74,815,447	4,075,389	11,717,548
2012	25,090,559	65,848,857	4,269,247	5,945,243
2013	27,948,605	81,724,477	4,727,833	12,756,577
2014	30,308,231	86,760,520	4,990,042	13,041,720
2015	32,206,387	97,464,936	5,263,899	15,700,264
2016	33,339,305	96,394,820	5,464,084	16,209,892
2017	34,004,361	114,732,101	5,541,860	18,744,186
2018	34,838,351	117,912,450	5,709,084	17,538,725

<sup>57</sup> Available at: <https://atlassocioeconomico.rs.gov.br/soja>

2019	35,944,094	114,316,829	5,843,533	18,498,119
2020	37,205,462	121,820,949	5,996,371	11,307,760
2021	39,143,946	134,799,179	6,107,620	20,420,501

Source: IBGE - Municipal Agricultural Production.< <https://sidra.ibge.gov.br/tabela/5457>>

#### Sub-step 1a(c): List of credible alternative land use scenarios

- i. Conservation of surplus native vegetation in the Pampa without registration as a VCS AFOLU project
- ii. Conservation of surplus native vegetation in the Pampa through Legal Reserve compensation
- iii. Land conversion for agricultural activities

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

- i. Conservation of surplus native vegetation in the Pampa without registration as a VCS AFOLU project

The project proponent is not aware of any mandatory and applicable law or regulation that prohibits the alternative land use identified in this scenario. Many rural properties in Brazil have a surplus of conserved vegetation that exceeds the minimum legal requirements. In the specific case of Rio Grande do Sul, according to the report on the forest code, 33% (7.19 million hectares)<sup>58</sup> of the areas of native vegetation associated with rural properties registered in the Rural Environmental Registry (CAR) have a surplus of vegetation. However, as mentioned earlier, there is a lack funding for conservation in the region, which makes the scenario conversion to agricultural use significantly more lucrative than philanthropic conservation.

<sup>58</sup> Available at: <https://observatorioflorestal.org.br/boletim-do-balanco-do-codigo-florestal-1a-edicao/>

ii. Conservation of surplus native vegetation in the Pampa through Legal Reserve compensation

This scenario is consistent, as it represents a valid alternative for compensating the Legal Reserve through the creation of Environmental Reserve Quotas (CRA), a legal mechanism established by Law No. 12,<sup>65159</sup> of May 25, 2012, and regulated by Decree No. 9,<sup>64060</sup> of December 27, 2018. However, it is not a legal requirement for landowners with surplus vegetation, and the commercialization market still needs the development of robust regulatory structures for its full implementation in Brazil.

iii. Land conversion for agricultural activities

The scenario is consistent, feasible and complies with laws, regulations and policies, since the Brazilian forestry code (Federal Law No. 12,651 of May 25, 2012) allows the conversion of native vegetation in excess of the minimum legal requirements, which in Rio Grande do Sul is 20% of the rural property area. For the Pampa biome, this context is even more favored by the recent update of the state forestry code (Law No. 15.434, of January 9, 2020)<sup>61</sup>, which, in Art. 219, deals with activities that do not require authorization from the competent body. Among these activities are the introduction of herbaceous forage species with an annual or perennial cycle into native vegetation, mowing or cutting the aerial parts of vegetation to reduce biomass, clearing vegetation up to three meters high, and the practice of grazing in an extensive system on remaining areas of native vegetation or rural areas consolidated by the suppression of vegetation, including grazing in Permanent Preservation Areas (APP) and Legal Reserves (RL), provided that the owner adopts good environmental practices and is registered with the CAR.

A detailed analysis of the reference region that is part of the project, based on historical data from MapBiomass, reveals that soybean cultivation in Bagé-RS has expanded significantly (Figure 22), from 30% in 2011 to 65% in 2021, and reaching around 72% according to the most recent data from 2023. This growth could jeopardize the targets set in Brazil's climate agreements for reducing greenhouse gas emissions, since soy continues to be one of the main drivers of the conversion of native <sup>areas</sup><sup>62</sup>.

<sup>59</sup> Available at: [https://www.planalto.gov.br/ccivil\\_03/\\_ato2011-2014/2012/lei/L12651compilado.htm](https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/L12651compilado.htm)

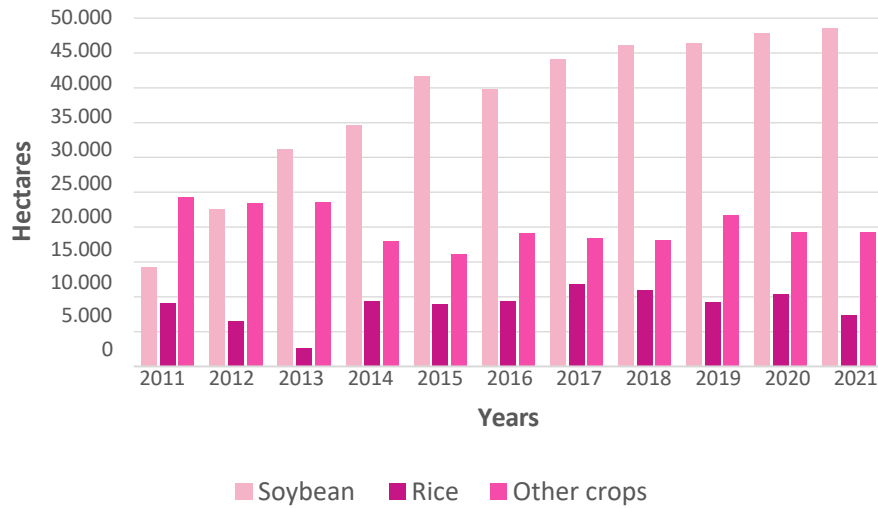
<sup>60</sup> Available at: [https://www.planalto.gov.br/ccivil\\_03/\\_Ato2015-2018/2018/Decreto/D9640.htm](https://www.planalto.gov.br/ccivil_03/_Ato2015-2018/2018/Decreto/D9640.htm)

<sup>61</sup> Available at:

[http://www.al.rs.gov.br/legis/m010/M0100099.asp?Hid\\_Tipo=TEXTO&Hid\\_TodasNormas=65984&hTexto=&Hid\\_IDNorma=65984](http://www.al.rs.gov.br/legis/m010/M0100099.asp?Hid_Tipo=TEXTO&Hid_TodasNormas=65984&hTexto=&Hid_IDNorma=65984)

<sup>62</sup> Kuplich et al, 2018. Available at: <https://revistas.planejamento.rs.gov.br/index.php/boletim-geografico-rs/article/view/4102>

Figure 22: Evolution of the area devoted to agriculture in the municipality of Bagé-RS from 2011 to 2021, highlighting the growth of soya as the predominant crop in this period.



Source: MapBiomias

Evidence that soybean cultivation is expanding goes beyond the municipality covered by the project. A study by Torres et al. (2023)<sup>63</sup>, which investigates changes in the production of various agricultural crops as a result of changes in the distribution of the area, concludes that between 2011 and 2020, only soya had a positive substitution effect in all the mesoregions of the state of Rio Grande do Sul (Table 10).

Table 10: Substitution effect attributed to the crops that gave way to soy, in hectares, in the mesoregions of Rio Grande do Sul between 2011 and 2020.

Mesoregions	Rice	Grassland	Corn	Total
Western Center	14,783	283,561	27,053	325,398
Eastern Center	15,502	50,784	106,235	172,522
Metropolitan	15,949	100,642	14,772	131,364
North East	49	88,368	30,703	119,120
Northwest	5,849	212,437	120,381	338,668
South East	30,072	333,313	32,503	395,889
South West	23,517	514,551	4,882	542,951
Total	105,671	1,583,656	336,529	2,025,912

Data source: Torres et al., 2023

<sup>63</sup> Torres et al, 2023. Available at: <http://dx.doi.org/10.21527/2237-6453.2023.59.14086>

Outcome of Sub-step 1b: List of plausible alternative land use scenarios to the VCS AFOLU project activity

- i. Conservation of surplus native vegetation in the Pampa without registration as a VCS AFOLU project
- ii. Conservation of surplus native vegetation in the Pampa through Legal Reserve compensation
- iii. Land conversion for agricultural activities

Sub-step 1c. Selection of the baseline scenario

The most plausible base scenario is the one that presents the most cost-effective land use alternative, making it the most financially attractive. The following table shows a comparison of the financial returns of the three alternative base scenarios.

Table 11: Comparison of the financial return potential of the three alternative base scenarios.

Scenarios	Average return	Justification
i. Conservation of native vegetation in the Pampa without VCS AFOLU project	R\$0,0 (ha/year)	There are no financial incentives for the conservation of native vegetation in the Brazilian Pampa biome.
ii. Conservation of native vegetation the Pampa through Legal Reserve compensation	R\$418,0 (ha/year)	Based on data from Ambipar Environment <sup>64</sup> 's Biofilica platform on the average price for Legal Reserve compensation in the Atlantic Forest biome, which is also present in the state of Rio Grande do Sul (RS), since there is no specific information for the Pampa.
iii. Commercial agriculture	R\$2.805,4 (ha/year)	Calculated based on the following data obtained for soybeans in the 2023/2024 harvest: - Productivity in Bagé-RS: 2,725 kg/ha (Emater/RS-Ascar, 2024, page 16) <sup>65</sup> ; - Average marketing price: R\$125.8/ha (Emater/RS-Ascar, 2024, page 1) <sup>66</sup> ;

<sup>64</sup> Available at: <https://compensacaodereservalegal.com.br/blog/44/precos-de-areas-para-compensacao-de-reserva-legal>

<sup>65</sup> Available at: [https://www.emater.tche.br/site/arquivos\\_pdf/safra/safraTabela\\_05032024.pdf](https://www.emater.tche.br/site/arquivos_pdf/safra/safraTabela_05032024.pdf)

<sup>66</sup> Available at: [https://www.emater.tche.br/site/arquivos\\_pdf/precos/preco\\_24102024.pdf](https://www.emater.tche.br/site/arquivos_pdf/precos/preco_24102024.pdf)

- Cost of production: R\$2,908.9/ha (Conab, 2024; average variable costs for São Gabriel-RS, 2023-2024)<sup>67</sup>; information for São Gabriel was used due to its proximity to the study area and the lack of specific data for Bagé.

Based on the above, the most likely and plausible baseline scenario in the absence of the VCS AFOLU project is **scenario iii**, where private landowners convert the land to agricultural activities, in particular soybean cultivation. This scenario is 6.7 times more financially attractive than the second most likely scenario, which involves compensating for the Legal Reserve.

## Step 2: Investment analysis

The objective at this stage is to determine that the proposed project activity, without the revenue from the sale of carbon credits, is financially less attractive than the identified reference scenario.

### Sub-step 2a. Determine appropriate analysis method

The AFOLU VCS project does not generate any financial or economic benefits other than VCS-related income, so the simple cost analysis (Option I) is applied.

### Sub-step 2b. - Option I. Apply simple cost analysis

From a preliminary analysis of the data presented so far, it is possible to conclude that even with the generation of revenue from carbon credits over the 40-year duration of the project, the average annual carbon payment per hectare is lower than the potential return obtained in the alternative scenario of land use for commercial agriculture. In Brazil, the acquisition of land under native vegetation tends to be cheaper, which in some cases can offset the costs of conversion<sup>68</sup>.

It is therefore concluded that the proposed project, without the financial benefits of the VCS, is not financially more attractive. For the record, the costs associated with the AFOLU VCS project result from the following activities:

<sup>67</sup> Available at: <https://www.conab.gov.br/info-agro/custos-de-producao/planilhas-de-custo-de-producao/itemlist/category/824-soybean>

<sup>68</sup> TNC, 2019. Available at: [https://www.nature.org/content/dam/tnc/nature/en/documents/TNC\\_IncentivesforSustainableSoyinCerrado\\_Nov2019.pdf](https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_IncentivesforSustainableSoyinCerrado_Nov2019.pdf)

- Surveillance and patrolling by staff living in the project area;
- Maintenance of firebreaks to prevent fires;
- Activities to monitor and record regional animal and plant species;
- Placing identification and information signs in the project area;
- Satellite monitoring of deforestation;
- Environmental education work;
- Support for activities linked to the Federal University of Santa Maria (UFSM);
- Project design, monitoring and review;
- Registration;
- Validation and verification.

### Step 3. Barrier Analysis

This step is not necessary when step 2 is described.

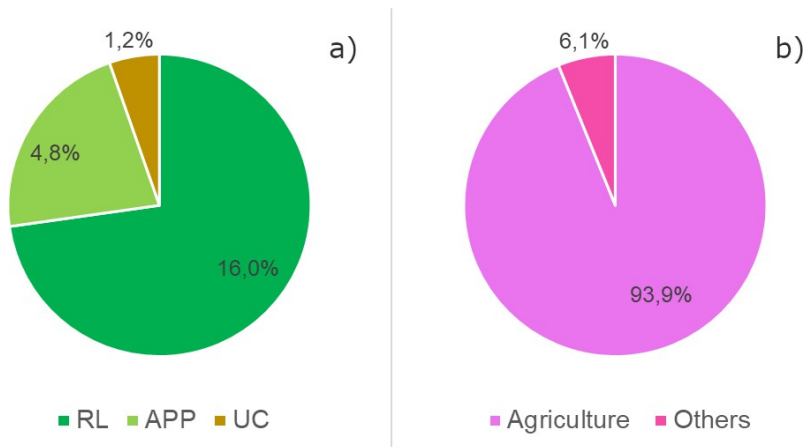
### Step 4. common practice analysis

In general, the preservation of native vegetation on private properties in the Pampa biome is not a common practice, even when provided for by law. This is evident when analyzing the evolution of deforestation alerts over the last five years, where it can be seen that 100% of the cases occurred without proper authorization to cut, and that 22% of these deforestations took place in legally protected areas (Figure 23a), with agriculture being the main vector of pressure (93.9%) responsible for deforestation (Figure 23b). Another critical point is the economic pressure to exploit natural resources. According to data from *MapBiomias*<sup>69</sup>, in the last 37 years, 46.7% (3.4 million hectares) of the native vegetation of the Brazilian Pampa has been converted for human use, with temporary farming accounting for around 80% of this area. The demand for land for agriculture, driven by internal and external markets, often outstrips the capacity to protect areas of native vegetation. Therefore, the creation of economic incentives that favor conservation, such as payments for environmental services and carbon credits, is essential to balance economic interests with the protection of natural resources.

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<sup>69</sup> MapBiomias, 2022. Available at: [https://brasil.mapbiomas.org/wp-content/uploads/sites/4/2023/11/MapBiomias\\_PAMPA\\_2022\\_11.10\\_1\\_.pdf-\\_pdf](https://brasil.mapbiomas.org/wp-content/uploads/sites/4/2023/11/MapBiomias_PAMPA_2022_11.10_1_.pdf-_pdf)

Figure 23: Average percentage of deforestation alerts for the Pampa between 2020 and 2024. a) in areas under legal protection; b) the main pressure activities responsible for the evolution of deforestation.



Source: <https://plataforma.alerta.mapbiomas.org/mapa>

Where: RL= Legal reserve; APP= Permanent preservation area; UC= Conservation unit.

Conservation efforts in the Pampa biome include several areas under conservation units (UCs), including environmental protection areas, ecological stations, state parks and private natural heritage reserves. However, this represents only 2.9% of its territory protected by specific legislation<sup>70</sup>. In recent years, the number of converted areas has significantly exceeded the number of protected areas<sup>71</sup>, making the Pampa one of the most neglected regions in the world<sup>72</sup>. This problem is further exacerbated by the lack of incentives for projects financed by the private sector, with the aim of preventing the conversion of areas on private properties, especially without the support of financing through carbon credits. The Fazenda Camaquã initiative stands out as the first carbon project focused on *in situ* conservation of native vegetation in the Pampa biome, carrying out actions to prevent deforestation to date with its own resources, in addition to various activities mentioned in previous stages.

### 3.5 Methodology Deviations

There are no methodological deviations in this project.

<sup>70</sup> Jenkins et al, 2015. Available at: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0145064>

<sup>71</sup> Overbeck et al, 2015. Available at: <https://onlinelibrary.wiley.com/doi/10.1111/ddi.12380>

<sup>72</sup> Fonseca & Venticinque, 2018. Available at: <https://www.sciencedirect.com/science/article/pii/S2530064417301487?via%3Dihub>

## 4 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

### 4.1 Baseline Emissions

The aim of this stage is to collect and analyze spatial data to identify current land use and land cover conditions, as well as to assess changes over the historical period, in order to obtain information on deforestation rates, agents, factors and patterns of change in land use and land cover.

#### 4.1.1 Data collection

In order to access the information needed to analyze the changes in the reference region during the historical series from 2011 to 2021, annual data on land use and cover, as well as forest suppression (deforestation), from Collection 9 of the [MapBiomass<sup>73</sup>](https://brasil.mapbiomas.org/) project were used. All MapBiomass thematic maps are produced from the pixel-by-pixel classification of Landsat images with a spatial resolution of 30m. MapBiomass data is public, open and free under the CC-BY-SA license, and has an overall accuracy of 87.07% for the Pampa area, exceeding the minimum accuracy of 80% required by VM0015. More information on the MapBiomass methodology can be found at: <https://brasil.mapbiomas.org/visao-geral-da-metodologia/>.

#### 4.1.2 Definition of Classes of Land Use and Land Cover

At this stage, we identified and described the land use and land cover classes present in the reference region at the start of the project, with the aim of improving the accuracy of the carbon stock estimates. To do this, we used the categories defined by the MapBiomass platform, adapting them to the specific context of the study. Table 12 shows the details of the land use and land cover classes initially established and Figure 24 shows the distribution of these classes in the reference region.

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<sup>73</sup> Available at: <https://brasil.mapbiomas.org/>

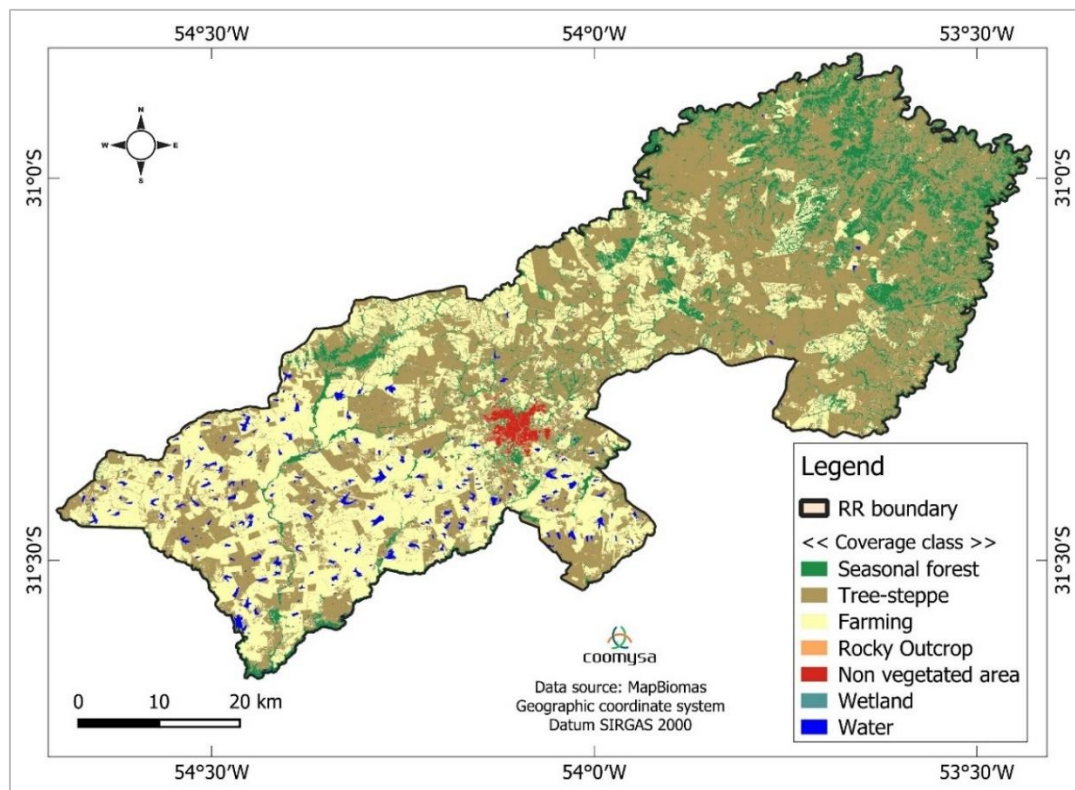
Table 12: Land use and land cover classes present in the reference region.

ID	Class	Description
Forest lands	Seasonal forest	<p>With regard to the area covered by forests, which includes vegetation classes with different vegetation characteristics and, consequently, different carbon stock densities, two specific strata were created to standardize forest cover:</p> <p>i) Seasonal forest: The region's vegetation is influenced by seasonal climate variation, with a rainy season (usually in spring) followed by dry period. Although there is no period of intense drought, there is a physiological drought due to the intense cold of winter, which causes some of the vegetation to lose its leaves. This type of forest is often found on the banks of rivers, but can also occur in capões de mato. In the vegetation classifications mapped by MapBiomias in the Pampa biome, the Seasonal Forest class is identified as 'Forest Formation', with raster code number 3.</p> <p>ii) Tree-steppe: The steppe is characterized by vegetation that undergoes a double seasonality: one physiological, caused by the cold of the polar fronts, and the other dry, short-lived, with a water deficit. In this type of formation, the plants are organized into two well-defined strata. The upper stratum is mainly made up of low trees and sparse shrubs, while the lower stratum is dominated by cespitose grasses. MapBiomias identifies this vegetation in the "Herbaceous and Shrubby Vegetation" category, more specifically, as "Grassland", and the same authors associate this term with IBGE's (2012)<sup>74</sup> . definition of "Steppe tree" Although we understand that this category may contain grassy-ligneous pastures, as suggested by the name itself, we decided to keep the classification as "Steppe-Arboreal", which we consider to be the most appropriate for this study. We therefore used the information on coverage and area conversion for this class, which is identified by raster code number 12.</p>
	Tree-steppe	
Non-forest lands	Farming	<p>It refers to areas used for human activities, including agricultural cultivation (agriculture) and animal husbandry (livestock) in cultivated or artificial pastures. According to the MapBiomias identification, the "Farming" class also includes areas with tree species planted for commercial purposes (such as pine and eucalyptus, in forestry) and mosaics of use, which are areas of agricultural use in which it was not possible to distinguish between pasture and agriculture.</p>
	Rocky outcrop	<p>These are areas where the rocks are naturally exposed on the surface, without the presence of soil. These environments play a crucial role as refuges for biodiversity, but are being threatened by factors such as the expansion of agriculture and overgrazing.</p>

<sup>74</sup> Available at: <https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=263011>

Non-vegetated areas	These are areas devoid of vegetation cover, such as urban and mining areas.
Wetland	Swampy areas, regionally known as marshes. Typically hygrophilous vegetation, with emergent, submerged or floating aquatic plants. They occupy plains and depressions of the land with waterlogged soil and also the shallow margins of ponds or water reservoirs.
Water	A body of water that occupies a certain geographical area, such as rivers, streams, lakes and reservoirs.

Figure 24: Distribution of land use and land cover classes in the reference region.



#### 4.1.3 Estimated annual areas of deforestation

The approach adopted to estimate the annual areas of unplanned deforestation in the reference area was "simple history", as it does not identify a trend pattern bias. To do this, satellite images from MapBiomias' deforestation module were used to analyze the evolution over the time series from 2011 to 2021. Deforestation events are defined based on an analysis of the trajectory of each pixel, as summarized in Table 13.

Table 13: Description of the classes mapped in the annual vegetation dynamics time series produced by the MapBiomas method.

Class *	Description	Raster value
Loss of Primary Vegetation	Indicates a Deforestation event, in a given year $t$ , in a pixel previously allocated to the Primary Vegetation class, after which the pixel is allocated to the Anthropic class (in $t+1$ ).	4
Loss of Secondary Vegetation	Indicates a Deforestation event, in a given year $t$ , in a pixel previously allocated to the Secondary Vegetation class, after which the pixel is allocated to the Anthropic class (in $t+1$ ).	6

\* Here are only the classes of interest related to deforestation. To consult all the other classes established as a MapBiomas product, visit the website: <https://brasil.mapbiomas.org/>

For clarification, Table 14 below shows the definition and persistence rules associated with each of the vegetation classes that include the deforestation mentioned above.

Table 14: Description and persistence rules related each of the classes involving vegetation suppression.

Class *	Description	Rule
Primary Vegetation	Natural vegetation that persisted from the start of the series (1987) up to the year of analysis. All natural vegetation classes in the input dataset were considered.	Persistent classification as Natural in the input dataset, from the beginning of the series up to the year of analysis.
Secondary Vegetation	Areas presenting a history of anthropic use followed by change to Natural vegetation prior to the year of analysis.	Classified as Natural in the input dataset in the year of analysis and classified as either regrowth of secondary vegetation in the previous iterative step (i.e. in map produced for the previous year).

\* Here are only the classes of interest related to deforestation. To consult all the other classes established as a MapBiomas product, visit the website: <https://brasil.mapbiomas.org/>

According to VM0015, the annual deforestation area of the baseline, applicable to year  $t$  for stratum  $i$  within the reference region, can be calculated as follows:

$$ABSLRR_{i,t} = ARR_{i,t-1} \times RBSLRR_{i,t} / 100 \tag{1}$$

Where:

$ABSLRR_{i,t}$  = Annual area of baseline deforestation in stratum  $i$  within the reference region at year  $t$  (ha/yr)

$ARR_{i,t-1}$  = Area with forest cover in stratum  $i$  in the reference region at year  $t - 1$  (ha)

$RBSLRR_{i,t}$  = Deforestation rate applicable to stratum  $i$  within the reference region at year  $t$  (%)

$t$  = 1, 2, 3, ..., T, a year of the proposed project crediting period (dimensionless)

$i$  = 1, 2, 3, ...,  $IRR$ , a stratum within the reference region (dimensionless)

Simplifying this formula, we can obtain the following expression to calculate the deforestation rate applied to each stratum:

$$RBSLRR_{i,t} = ABSLRR_{i,t} / ARR_{i,t-1} \tag{2}$$

The results of the areas converted annually in the reference region over the time series are obtained by combining the suppression of primary and secondary vegetation, and can be consulted in Table 15, which details these values by year and vegetation type (stratum). The spatial location of the conversion of areas recorded during this period is shown on the map in Figure 25. The area with vegetation cover in year  $t-1$  is shown in Table 16, and the conversion rate calculated for each stratum is shown in Table 17.

Table 15: Annual area of baseline deforestation in stratum  $i$  within the reference region.

Year $t$	Deforestation (ha)	
	Stratum $i$	
	Seasonal Forest	Arboreal steppe
2011	133.76	13,360.09
2012	382.98	12,807.52
2013	301.74	9,919.11
2014	74.77	6,197.61
2015	162.97	8,337.00

2016	123.01	5,156.22
2017	484.49	7,380.97
2018	418.95	8,186.64
2019	636.11	8,736.04
2020	466.22	6,226.37
2021	1,021.82	8,051.59
Average	382.44	8,578.11

Figure 25: Mapping of deforestation in the reference region between 2011 and 2021.

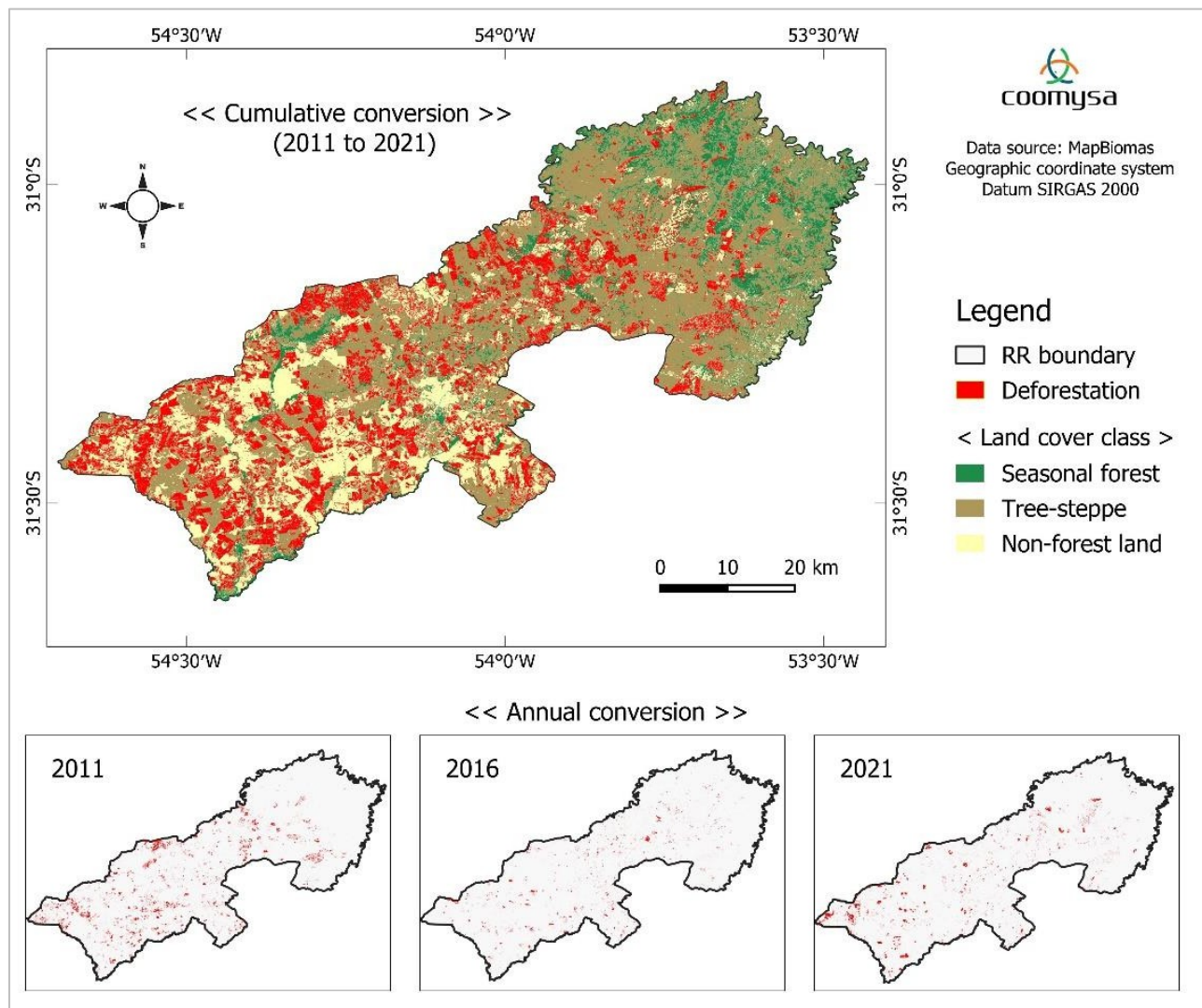


Table 16: Area with forest cover in stratum  $i$  in the reference region at year  $t - 1$ 

Year $t-1$	Forest cover (ha)	
	Stratum $i$	
	Seasonal Forest	Arboreal steppe
2010	52,966.71	264,525.68
2011	53,135.79	252,307.50
2012	55,307.48	239,116.27
2013	54,956.86	233,406.97
2014	55,855.06	230,572.53
2015	55,612.52	227,197.17
2016	57,639.26	224,568.96
2017	59,133.64	217,611.32
2018	59,406.70	211,280.65
2019	59,405.48	206,445.70
2020	59,910.05	200,932.96
Average	56,666.32	227,996.88

Table 17: Deforestation rate applicable to stratum  $i$  within the reference region.

Year $t$	Deforestation rate (%)	
	Stratum $i$	
	Seasonal Forest	Arboreal steppe
2011	0.25%	5.05%
2012	0.72%	5.08%
2013	0.55%	4.15%
2014	0.14%	2.66%
2015	0.29%	3.62%
2016	0.22%	2.27%
2017	0.84%	3.29%
2018	0.71%	3.76%
2019	1.07%	4.13%
2020	0.78%	3.02%
2021	1.71%	4.01%
Average	0.66%	3.73%

In this context, it can be concluded that the average area deforested annually in the different strata of the reference region was 382.44 hectares for the Seasonal Forest class and 8,578.11 hectares for the Steppe class. This results in an annual deforestation rate of 0.66% and 3.73%, respectively. This average rate is used to project deforestation in future years.

#### 4.1.4 Projection of Future Deforestation

The aim of this step is to identify the deforestation expected to occur in the reference region, project area and leakage zone during the first period of validity of the baseline, and optionally for the project's crediting period. Demonstrating the baseline scenario is challenging, as it involves predicting what the rate of deforestation will be in the future, in the absence of the project. This type of prediction is known in metaphysics and the field of logic as a counterfactual, which is the prediction of a future that will not necessarily come true. To demonstrate a baseline scenario, it is necessary to analyze what has happened in the past and what is happening in the areas close to the project (i.e. the reference region), to ensure that the projected future is reliable and, among the plausible scenarios, the most likely.

The VM0015 methodology proposes two approaches to predicting the amount of future deforestation: one based on the historical average and the other as a function of time, using modeling (such as linear, logarithmic or exponential regression). We opted for the historical average approach, since no clear trend was identified (whether increasing, decreasing or constant deforestation), and the models did not meet the fundamental principles of analysis, such as the need for a coefficient of determination of  $r^2 \geq 0.75$ . According to this approach, the baseline deforestation rate is assumed to be a continuation of the annual average recorded throughout the historical series for the different types of vegetation present in the reference region, where the regulatory and geomorphological characteristics (such as vegetation, soil and climate) are similar. Using Equation 1 from the previous section (4.1.3), it was possible to make a projection of future annual deforestation for each stratum within the reference region, project area and leakage zone, over the entire project credit period, as shown in Tables 18, 19 and 20. It is important to note that the area deforested annually corresponds to the annual reduction in the remaining forest area and that the difference in forest loss results from the rate of deforestation. This step is also in line with step 5 of the methodology - Definition of Land Use and Land Cover Change Component of the Baseline.

Table 18: Annual areas deforested per forest class icl within Reference Region in the baseline case (baseline activity data per forest class).

Project year <i>t</i>	Area deforested per forest class icl within the reference region		Total baseline deforestation in the reference region	
			ABSLRR <sub>t</sub>	ABSLRR
	Seasonal Forest	Shrub steppe	annual	cumulative
	ha	ha	ha/yr	ha
2023	392,35	7.172,61	7.564,97	7.564,97
2024	389,77	6.905,07	7.294,84	14.859,80
2025	387,19	6.647,51	7.034,71	21.894,51
2026	384,64	6.399,56	6.784,20	28.678,71
2027	382,10	6.160,86	6.542,96	35.221,66
2028	379,58	5.931,06	6.310,63	41.532,30
2029	377,07	5.709,83	6.086,90	47.619,20
2030	374,58	5.496,85	5.871,44	53.490,64
2031	372,11	5.291,82	5.663,93	59.154,57
2032	369,65	5.094,44	5.464,09	64.618,66
2033	367,21	4.904,41	5.271,63	69.890,28
2034	364,79	4.721,48	5.086,27	74.976,55
2035	362,38	4.545,37	4.907,75	79.884,30
2036	359,99	4.375,82	4.735,82	84.620,12
2037	357,62	4.212,61	4.570,22	89.190,34
2038	355,26	4.055,48	4.410,73	93.601,07
2039	352,91	3.904,21	4.257,12	97.858,19
2040	350,58	3.758,58	4.109,16	101.967,35
2041	348,27	3.618,39	3.966,65	105.934,01
2042	345,97	3.483,42	3.829,39	109.763,40
2043	343,69	3.353,49	3.697,17	113.460,57
2044	341,42	3.228,40	3.569,82	117.030,39
2045	339,16	3.107,98	3.447,15	120.477,54
2046	336,93	2.992,06	3.328,98	123.806,52
2047	334,70	2.880,45	3.215,15	127.021,67
2048	332,49	2.773,01	3.105,50	130.127,18
2049	330,30	2.669,58	2.999,88	133.127,05
2050	328,12	2.570,00	2.898,12	136.025,18
2051	325,95	2.474,14	2.800,09	138.825,27
2052	323,80	2.381,86	2.705,66	141.530,93
2053	321,66	2.293,01	2.614,68	144.145,60

2054	319,54	2.207,48	2.527,02	146.672,63
2055	317,43	2.125,14	2.442,58	149.115,21
2056	315,34	2.045,88	2.361,21	151.476,42
2057	313,26	1.969,57	2.282,82	153.759,24
2058	311,19	1.896,10	2.207,29	155.966,53
2059	309,14	1.825,38	2.134,51	158.101,04
2060	307,09	1.757,29	2.064,38	160.165,43
2061	305,07	1.691,74	1.996,81	162.162,24
2062	303,05	1.628,64	1.931,69	164.093,93

Table 19: Annual areas deforested per forest class icl within the Project Area in the baseline case (baseline activity data per forest class).

Project year <i>t</i>	Area deforested per forest class icl within the project area		Total baseline deforestation in the project area	
	Seasonal Forest	Arboreal steppe	ABSLPAT	ABSLPA
			annual	cumulative
	ha	ha	ha/yr	ha
2023	3,00	34,09	37,08	37,08
2024	2,98	32,81	35,79	72,87
2025	2,96	31,59	34,55	107,42
2026	2,94	30,41	33,35	140,76
2027	2,92	29,28	32,19	172,96
2028	2,90	28,19	31,08	204,04
2029	2,88	27,13	30,01	234,05
2030	2,86	26,12	28,98	263,04
2031	2,84	25,15	27,99	291,02
2032	2,82	24,21	27,03	318,06
2033	2,80	23,31	26,11	344,16
2034	2,78	22,44	25,22	369,39
2035	2,77	21,60	24,37	393,75
2036	2,75	20,79	23,54	417,30
2037	2,73	20,02	22,75	440,05
2038	2,71	19,27	21,98	462,03
2039	2,69	18,55	21,25	483,28
2040	2,68	17,86	20,54	503,81
2041	2,66	17,20	19,85	523,67
2042	2,64	16,55	19,19	542,86

2043	2,62	15,94	18,56	561,42
2044	2,61	15,34	17,95	579,37
2045	2,59	14,77	17,36	596,73
2046	2,57	14,22	16,79	613,52
2047	2,56	13,69	16,24	629,76
2048	2,54	13,18	15,72	645,48
2049	2,52	12,69	15,21	660,69
2050	2,50	12,21	14,72	675,41
2051	2,49	11,76	14,25	689,65
2052	2,47	11,32	13,79	703,44
2053	2,46	10,90	13,35	716,80
2054	2,44	10,49	12,93	729,72
2055	2,42	10,10	12,52	742,25
2056	2,41	9,72	12,13	754,38
2057	2,39	9,36	11,75	766,13
2058	2,38	9,01	11,39	777,51
2059	2,36	8,67	11,03	788,55
2060	2,34	8,35	10,70	799,24
2061	2,33	8,04	10,37	809,61
2062	2,31	7,74	10,05	819,66

Table 20: Annual areas deforested per forest class icl within the Leakage Belt in the baseline case (baseline activity data per forest class).

Project year <i>t</i>	Area deforested per forest class icl within the leakage belt		Total baseline deforestation in the leakage belt	
			ABSLK <sub>t</sub>	ABSLK
	Seasonal Forest	Shrub steppe	annual	cumulative
	ha	ha	ha/yr	ha
2023	3,90	40,61	44,51	44,51
2024	3,87	39,10	42,97	87,48
2025	3,85	37,64	41,49	128,97
2026	3,82	36,23	40,06	169,03
2027	3,80	34,88	38,68	207,71
2028	3,77	33,58	37,36	245,07
2029	3,75	32,33	36,08	281,14
2030	3,72	31,12	34,85	315,99
2031	3,70	29,96	33,66	349,65

2032	3,67	28,84	32,52	382,17
2033	3,65	27,77	31,42	413,59
2034	3,63	26,73	30,36	443,95
2035	3,60	25,74	29,34	473,29
2036	3,58	24,78	28,35	501,64
2037	3,56	23,85	27,41	529,05
2038	3,53	22,96	26,49	555,54
2039	3,51	22,11	25,61	581,16
2040	3,49	21,28	24,77	605,92
2041	3,46	20,49	23,95	629,87
2042	3,44	19,72	23,16	653,04
2043	3,42	18,99	22,40	675,44
2044	3,39	18,28	21,67	697,11
2045	3,37	17,60	20,97	718,08
2046	3,35	16,94	20,29	738,37
2047	3,33	16,31	19,64	758,01
2048	3,31	15,70	19,01	777,02
2049	3,28	15,12	18,40	795,41
2050	3,26	14,55	17,81	813,23
2051	3,24	14,01	17,25	830,48
2052	3,22	13,49	16,71	847,18
2053	3,20	12,98	16,18	863,36
2054	3,18	12,50	15,68	879,04
2055	3,16	12,03	15,19	894,23
2056	3,13	11,58	14,72	908,94
2057	3,11	11,15	14,27	923,21
2058	3,09	10,74	13,83	937,04
2059	3,07	10,34	13,41	950,45
2060	3,05	9,95	13,00	963,45
2061	3,03	9,58	12,61	976,06
2062	3,01	9,22	12,23	988,30

When analyzing the projection of future deforestation in the project area over the credit period, it can be seen that, from 2023 to 2062, 23% of the seasonal forest vegetation cover and 78% of the steppe tree vegetation cover would change, but this transformation is being prevented by the implementation of the ongoing project.

#### 4.1.5 Calculation of Baseline Activity Data Per Post-Deforestation Forest Class

Two methods are available for projecting the LU/LC classes that will replace the forests in the baseline case: historical change and modeling. It was decided to use the historical time series of deforestation recorded in the reference region. In this scenario, it is assumed that historical changes are representative of future trends and that, therefore, post-deforestation land uses are allocated to the projected areas of annual deforestation in the same proportions as those observed on land deforested during the historical reference period in the region. Thus, 100% of these areas change from "forest" to "non-forest" and are ultimately destined for agriculture as the final land use. As all the initial classes represented in the previous stage were transformed into non-forest (final post-deforestation class) in the baseline considered, the annual values corresponding to the final classes, which describe the baseline activity by post-deforestation forest class, are the same as the initial class. Tables 21 and 22 present data on the projected area to be deforested in each zone for the project area and the leakage zone, respectively, over the project's credit period.

Table 21: Annual areas deforested in each zone within the Project Area in the baseline case (baseline activity data per zone).

Project year <i>t</i>	Area established after deforestation per zone within the project area		Total baseline deforestation in the project area	
			ABSLPA <sub>t</sub>	ABSLPA
	Seasonal Forest	Arboreal steppe	annual	cumulative
	ha	ha	ha/yr	ha
2023	3,00	34,09	37,08	37,08
2024	2,98	32,81	35,79	72,87
2025	2,96	31,59	34,55	107,42
2026	2,94	30,41	33,35	140,76
2027	2,92	29,28	32,19	172,96
2028	2,90	28,19	31,08	204,04
2029	2,88	27,13	30,01	234,05
2030	2,86	26,12	28,98	263,04
2031	2,84	25,15	27,99	291,02
2032	2,82	24,21	27,03	318,06
2033	2,80	23,31	26,11	344,16
2034	2,78	22,44	25,22	369,39
2035	2,77	21,60	24,37	393,75

2036	2,75	20,79	23,54	417,30
2037	2,73	20,02	22,75	440,05
2038	2,71	19,27	21,98	462,03
2039	2,69	18,55	21,25	483,28
2040	2,68	17,86	20,54	503,81
2041	2,66	17,20	19,85	523,67
2042	2,64	16,55	19,19	542,86
2043	2,62	15,94	18,56	561,42
2044	2,61	15,34	17,95	579,37
2045	2,59	14,77	17,36	596,73
2046	2,57	14,22	16,79	613,52
2047	2,56	13,69	16,24	629,76
2048	2,54	13,18	15,72	645,48
2049	2,52	12,69	15,21	660,69
2050	2,50	12,21	14,72	675,41
2051	2,49	11,76	14,25	689,65
2052	2,47	11,32	13,79	703,44
2053	2,46	10,90	13,35	716,80
2054	2,44	10,49	12,93	729,72
2055	2,42	10,10	12,52	742,25
2056	2,41	9,72	12,13	754,38
2057	2,39	9,36	11,75	766,13
2058	2,38	9,01	11,39	777,51
2059	2,36	8,67	11,03	788,55
2060	2,34	8,35	10,70	799,24
2061	2,33	8,04	10,37	809,61
2062	2,31	7,74	10,05	819,66

Table 22: Annual areas deforested in each zone within the Leakage Belt in the baseline case (baseline activity data per zone).

Project year <i>t</i>	Area established after deforestation per zone within the leakage belt		Total baseline deforestation in the leakage belt	
			ABSLK <sub>t</sub>	ABSLK
	Seasonal Forest	Arboreal steppe	annual	cumulative
	ha	ha	ha/yr	ha
2023	3,90	40,61	44,51	44,51
2024	3,87	39,10	42,97	87,48

2025	3,85	37,64	41,49	128,97
2026	3,82	36,23	40,06	169,03
2027	3,80	34,88	38,68	207,71
2028	3,77	33,58	37,36	245,07
2029	3,75	32,33	36,08	281,14
2030	3,72	31,12	34,85	315,99
2031	3,70	29,96	33,66	349,65
2032	3,67	28,84	32,52	382,17
2033	3,65	27,77	31,42	413,59
2034	3,63	26,73	30,36	443,95
2035	3,60	25,74	29,34	473,29
2036	3,58	24,78	28,35	501,64
2037	3,56	23,85	27,41	529,05
2038	3,53	22,96	26,49	555,54
2039	3,51	22,11	25,61	581,16
2040	3,49	21,28	24,77	605,92
2041	3,46	20,49	23,95	629,87
2042	3,44	19,72	23,16	653,04
2043	3,42	18,99	22,40	675,44
2044	3,39	18,28	21,67	697,11
2045	3,37	17,60	20,97	718,08
2046	3,35	16,94	20,29	738,37
2047	3,33	16,31	19,64	758,01
2048	3,31	15,70	19,01	777,02
2049	3,28	15,12	18,40	795,41
2050	3,26	14,55	17,81	813,23
2051	3,24	14,01	17,25	830,48
2052	3,22	13,49	16,71	847,18
2053	3,20	12,98	16,18	863,36
2054	3,18	12,50	15,68	879,04
2055	3,16	12,03	15,19	894,23
2056	3,13	11,58	14,72	908,94
2057	3,11	11,15	14,27	923,21
2058	3,09	10,74	13,83	937,04
2059	3,07	10,34	13,41	950,45
2060	3,05	9,95	13,00	963,45
2061	3,03	9,58	12,61	976,06
2062	3,01	9,22	12,23	988,30

#### 4.1.6 Estimation of Baseline Carbon Stock Changes and Non-CO<sub>2</sub> Emissions

Before calculating changes in the baseline carbon stock, the average carbon stock (t CO<sub>2e</sub>/ha) of each vegetation type subject to deforestation was estimated. To do this, we collected existing carbon stock data for these classes from published local studies and forest and carbon inventories, adopting a conservative approach. We carried out additional field measurements for classes that had insufficient information, such as the Seasonal Forest and Steppe classes. For these classes, the average carbon stock in soil and above-ground tree biomass per unit area was estimated based on field measurements at sampling points. We used the method of allometric equations to estimate biomass from the measured dimensions of the trees, as well as applying a conversion factor from the above-ground biomass to calculate the carbon stock in the underground biomass (further details can be found in the "Monitoring" section). Carbon stocks and forest class boundaries are assumed to remain constant for all years prior to the year in which baseline deforestation is projected to occur ( $t < t^*$ ). The results of the estimated average carbon stock for each vegetation class in the project area are shown in Tables 23 and 24. For the leakage zone they are shown in Tables 25 and 26.

Table 23: Carbon stocks per hectare of initial forest classes icl existing in the Project Area.

Project year $t$	Initial forest class icl						C <sub>total</sub> icl	
	>	Seasonal forest						
	Average carbon stock per hectare							
	C <sub>ab</sub> icl		C <sub>bb</sub> icl		C <sub>SO</sub> icl			
	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)
2023	855,51	285,63	205,32	68,55	959,76	320,44	2.020,60	674,62
2024	849,86	285,63	203,97	68,55	953,43	320,44	2.007,26	674,62
2025	844,25	285,63	202,62	68,55	947,14	320,44	1.994,01	674,62
2026	838,68	285,63	201,28	68,55	940,89	320,44	1.980,85	674,62
2027	833,15	285,63	199,96	68,55	934,68	320,44	1.967,78	674,62
2028	827,65	285,63	198,64	68,55	928,51	320,44	1.954,79	674,62
2029	822,19	285,63	197,32	68,55	922,38	320,44	1.941,89	674,62
2030	816,76	285,63	196,02	68,55	916,29	320,44	1.929,07	674,62
2031	811,37	285,63	194,73	68,55	910,24	320,44	1.916,34	674,62
2032	806,01	285,63	193,44	68,55	904,24	320,44	1.903,69	674,62
2033	800,69	285,63	192,17	68,55	898,27	320,44	1.891,13	674,62
2034	795,41	285,63	190,90	68,55	892,34	320,44	1.878,65	674,62

2035	790,16	285,63	189,64	68,55	886,45	320,44	1.866,25	674,62
2036	784,94	285,63	188,39	68,55	880,60	320,44	1.853,93	674,62
2037	779,76	285,63	187,14	68,55	874,79	320,44	1.841,69	674,62
2038	774,62	285,63	185,91	68,55	869,01	320,44	1.829,54	674,62
2039	769,50	285,63	184,68	68,55	863,28	320,44	1.817,46	674,62
2040	764,43	285,63	183,46	68,55	857,58	320,44	1.805,47	674,62
2041	759,38	285,63	182,25	68,55	851,92	320,44	1.793,55	674,62
2042	754,37	285,63	181,05	68,55	846,30	320,44	1.781,72	674,62
2043	749,39	285,63	179,85	68,55	840,71	320,44	1.769,96	674,62
2044	744,44	285,63	178,67	68,55	835,16	320,44	1.758,27	674,62
2045	739,53	285,63	177,49	68,55	829,65	320,44	1.746,67	674,62
2046	734,65	285,63	176,32	68,55	824,18	320,44	1.735,14	674,62
2047	729,80	285,63	175,15	68,55	818,74	320,44	1.723,69	674,62
2048	724,98	285,63	174,00	68,55	813,33	320,44	1.712,31	674,62
2049	720,20	285,63	172,85	68,55	807,97	320,44	1.701,01	674,62
2050	715,45	285,63	171,71	68,55	802,63	320,44	1.689,79	674,62
2051	710,72	285,63	170,57	68,55	797,34	320,44	1.678,63	674,62
2052	706,03	285,63	169,45	68,55	792,07	320,44	1.667,55	674,62
2053	701,37	285,63	168,33	68,55	786,85	320,44	1.656,55	674,62
2054	696,74	285,63	167,22	68,55	781,65	320,44	1.645,62	674,62
2055	692,15	285,63	166,11	68,55	776,49	320,44	1.634,75	674,62
2056	687,58	285,63	165,02	68,55	771,37	320,44	1.623,96	674,62
2057	683,04	285,63	163,93	68,55	766,28	320,44	1.613,25	674,62
2058	678,53	285,63	162,85	68,55	761,22	320,44	1.602,60	674,62
2059	674,05	285,63	161,77	68,55	756,20	320,44	1.592,02	674,62
2060	669,60	285,63	160,71	68,55	751,21	320,44	1.581,51	674,62
2061	665,19	285,63	159,64	68,55	746,25	320,44	1.571,08	674,62
2062	660,79	285,63	158,59	68,55	741,32	320,44	1.560,71	674,62

Table 24: Carbon stocks per hectare of initial forest classes icl existing in the Project Area.

Project year <i>t</i>	Initial forest class icl						C <sub>total</sub> icl	
	>	Tree-steppe						
	Average carbon stock per hectare							
	Cabicl		Cbbicl		CSOCicl			
	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)
2023	3.553,18	104,24	994,84	29,19	5.610,13	164,59	10.158,16	298,02
2024	3.420,65	104,24	957,73	29,19	5.400,87	164,59	9.779,26	298,02

2025	3.293,06	104,24	922,01	29,19	5.199,42	164,59	9.414,49	298,02
2026	3.170,23	104,24	887,62	29,19	5.005,48	164,59	9.063,33	298,02
2027	3.051,98	104,24	854,51	29,19	4.818,78	164,59	8.725,27	298,02
2028	2.938,14	104,24	822,64	29,19	4.639,04	164,59	8.399,82	298,02
2029	2.828,55	104,24	791,95	29,19	4.466,00	164,59	8.086,50	298,02
2030	2.723,04	104,24	762,41	29,19	4.299,42	164,59	7.784,88	298,02
2031	2.621,47	104,24	733,98	29,19	4.139,05	164,59	7.494,50	298,02
2032	2.523,69	104,24	706,60	29,19	3.984,66	164,59	7.214,96	298,02
2033	2.429,56	104,24	680,24	29,19	3.836,04	164,59	6.945,84	298,02
2034	2.338,94	104,24	654,87	29,19	3.692,95	164,59	6.686,76	298,02
2035	2.251,69	104,24	630,44	29,19	3.555,20	164,59	6.437,34	298,02
2036	2.167,71	104,24	606,93	29,19	3.422,60	164,59	6.197,23	298,02
2037	2.086,85	104,24	584,29	29,19	3.294,93	164,59	5.966,07	298,02
2038	2.009,01	104,24	562,49	29,19	3.172,03	164,59	5.743,54	298,02
2039	1.934,08	104,24	541,51	29,19	3.053,71	164,59	5.529,30	298,02
2040	1.861,93	104,24	521,32	29,19	2.939,81	164,59	5.323,06	298,02
2041	1.792,48	104,24	501,87	29,19	2.830,16	164,59	5.124,51	298,02
2042	1.725,62	104,24	483,15	29,19	2.724,59	164,59	4.933,37	298,02
2043	1.661,26	104,24	465,13	29,19	2.622,96	164,59	4.749,35	298,02
2044	1.599,29	104,24	447,78	29,19	2.525,13	164,59	4.572,20	298,02
2045	1.539,64	104,24	431,08	29,19	2.430,94	164,59	4.401,66	298,02
2046	1.482,21	104,24	415,00	29,19	2.340,27	164,59	4.237,48	298,02
2047	1.426,92	104,24	399,52	29,19	2.252,97	164,59	4.079,42	298,02
2048	1.373,70	104,24	384,62	29,19	2.168,94	164,59	3.927,26	298,02
2049	1.322,46	104,24	370,27	29,19	2.088,04	164,59	3.780,77	298,02
2050	1.273,13	104,24	356,46	29,19	2.010,15	164,59	3.639,75	298,02
2051	1.225,65	104,24	343,16	29,19	1.935,17	164,59	3.503,98	298,02
2052	1.179,93	104,24	330,36	29,19	1.862,99	164,59	3.373,29	298,02
2053	1.135,92	104,24	318,04	29,19	1.793,50	164,59	3.247,46	298,02
2054	1.093,55	104,24	306,18	29,19	1.726,61	164,59	3.126,33	298,02
2055	1.052,76	104,24	294,76	29,19	1.662,20	164,59	3.009,72	298,02
2056	1.013,49	104,24	283,76	29,19	1.600,20	164,59	2.897,46	298,02
2057	975,69	104,24	273,18	29,19	1.540,52	164,59	2.789,38	298,02
2058	939,29	104,24	262,99	29,19	1.483,05	164,59	2.685,34	298,02
2059	904,26	104,24	253,18	29,19	1.427,74	164,59	2.585,17	298,02
2060	870,53	104,24	243,74	29,19	1.374,48	164,59	2.488,75	298,02
2061	838,06	104,24	234,64	29,19	1.323,21	164,59	2.395,92	298,02
2062	806,80	104,24	225,89	29,19	1.273,86	164,59	2.306,55	298,02

Table 25: Carbon stocks per hectare of initial forest classes icl existing in the Leakage Belt.

Project year <i>t</i>	Initial forest class icl						C <sub>total</sub>	
	>	Seasonal forest						
	Average carbon stock per hectare							
	Cabicl		Cbbicl		CSOCicl		C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)
	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)		
2023	1.114,08	285,63	267,38	68,55	1.249,84	320,44	2.631,30	674,62
2024	1.106,73	285,63	265,61	68,55	1.241,60	320,44	2.613,94	674,62
2025	1.099,42	285,63	263,86	68,55	1.233,40	320,44	2.596,68	674,62
2026	1.092,17	285,63	262,12	68,55	1.225,26	320,44	2.579,55	674,62
2027	1.084,96	285,63	260,39	68,55	1.217,17	320,44	2.562,52	674,62
2028	1.077,80	285,63	258,67	68,55	1.209,14	320,44	2.545,61	674,62
2029	1.070,68	285,63	256,96	68,55	1.201,16	320,44	2.528,81	674,62
2030	1.063,62	285,63	255,27	68,55	1.193,23	320,44	2.512,12	674,62
2031	1.056,60	285,63	253,58	68,55	1.185,36	320,44	2.495,54	674,62
2032	1.049,62	285,63	251,91	68,55	1.177,53	320,44	2.479,07	674,62
2033	1.042,70	285,63	250,25	68,55	1.169,76	320,44	2.462,71	674,62
2034	1.035,81	285,63	248,60	68,55	1.162,04	320,44	2.446,45	674,62
2035	1.028,98	285,63	246,95	68,55	1.154,37	320,44	2.430,30	674,62
2036	1.022,19	285,63	245,32	68,55	1.146,75	320,44	2.414,26	674,62
2037	1.015,44	285,63	243,71	68,55	1.139,19	320,44	2.398,33	674,62
2038	1.008,74	285,63	242,10	68,55	1.131,67	320,44	2.382,50	674,62
2039	1.002,08	285,63	240,50	68,55	1.124,20	320,44	2.366,78	674,62
2040	995,47	285,63	238,91	68,55	1.116,78	320,44	2.351,16	674,62
2041	988,90	285,63	237,34	68,55	1.109,41	320,44	2.335,64	674,62
2042	982,37	285,63	235,77	68,55	1.102,08	320,44	2.320,22	674,62
2043	975,89	285,63	234,21	68,55	1.094,81	320,44	2.304,91	674,62
2044	969,45	285,63	232,67	68,55	1.087,59	320,44	2.289,70	674,62
2045	963,05	285,63	231,13	68,55	1.080,41	320,44	2.274,59	674,62
2046	956,69	285,63	229,61	68,55	1.073,28	320,44	2.259,57	674,62
2047	950,38	285,63	228,09	68,55	1.066,19	320,44	2.244,66	674,62
2048	944,10	285,63	226,58	68,55	1.059,16	320,44	2.229,85	674,62
2049	937,87	285,63	225,09	68,55	1.052,17	320,44	2.215,13	674,62
2050	931,68	285,63	223,60	68,55	1.045,22	320,44	2.200,51	674,62
2051	925,53	285,63	222,13	68,55	1.038,32	320,44	2.185,99	674,62
2052	919,43	285,63	220,66	68,55	1.031,47	320,44	2.171,56	674,62
2053	913,36	285,63	219,21	68,55	1.024,66	320,44	2.157,23	674,62
2054	907,33	285,63	217,76	68,55	1.017,90	320,44	2.142,99	674,62

2055	901,34	285,63	216,32	68,55	1.011,18	320,44	2.128,84	674,62
2056	895,39	285,63	214,89	68,55	1.004,51	320,44	2.114,79	674,62
2057	889,48	285,63	213,48	68,55	997,88	320,44	2.100,84	674,62
2058	883,61	285,63	212,07	68,55	991,29	320,44	2.086,97	674,62
2059	877,78	285,63	210,67	68,55	984,75	320,44	2.073,20	674,62
2060	871,99	285,63	209,28	68,55	978,25	320,44	2.059,51	674,62
2061	866,23	285,63	207,90	68,55	971,79	320,44	2.045,92	674,62
2062	860,51	285,63	206,52	68,55	965,38	320,44	2.032,42	674,62

Table 26: Carbon stocks per hectare of initial forest classes icl existing in the Leakage Belt.

Project year t	Initial forest class icl						Ctoticl	
	>	Tree-steppe						
	Average carbon stock per hectare							
	Cabicl		Cbbicl		CSOCicl			
	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)	C stock (t CO <sub>2e</sub> )	Average (t CO <sub>2e</sub> /ha)
2023	4.233,48	104,24	1.185,31	29,19	6.684,25	164,59	12.103,04	298,02
2024	4.075,57	104,24	1.141,10	29,19	6.434,92	164,59	11.651,59	298,02
2025	3.923,55	104,24	1.098,54	29,19	6.194,90	164,59	11.216,99	298,02
2026	3.777,20	104,24	1.057,56	29,19	5.963,83	164,59	10.798,60	298,02
2027	3.636,31	104,24	1.018,12	29,19	5.741,38	164,59	10.395,81	298,02
2028	3.500,68	104,24	980,14	29,19	5.527,23	164,59	10.008,04	298,02
2029	3.370,10	104,24	943,58	29,19	5.321,06	164,59	9.634,74	298,02
2030	3.244,40	104,24	908,39	29,19	5.122,59	164,59	9.275,37	298,02
2031	3.123,38	104,24	874,50	29,19	4.931,51	164,59	8.929,40	298,02
2032	3.006,88	104,24	841,88	29,19	4.747,57	164,59	8.596,33	298,02
2033	2.894,72	104,24	810,48	29,19	4.570,48	164,59	8.275,69	298,02
2034	2.786,75	104,24	780,25	29,19	4.400,00	164,59	7.967,00	298,02
2035	2.682,80	104,24	751,15	29,19	4.235,88	164,59	7.669,84	298,02
2036	2.582,74	104,24	723,13	29,19	4.077,89	164,59	7.383,75	298,02
2037	2.486,40	104,24	696,16	29,19	3.925,78	164,59	7.108,34	298,02
2038	2.393,66	104,24	670,19	29,19	3.779,35	164,59	6.843,20	298,02
2039	2.304,37	104,24	645,19	29,19	3.638,38	164,59	6.587,94	298,02
2040	2.218,42	104,24	621,13	29,19	3.502,67	164,59	6.342,21	298,02
2041	2.135,67	104,24	597,96	29,19	3.372,02	164,59	6.105,65	298,02
2042	2.056,01	104,24	575,65	29,19	3.246,24	164,59	5.877,91	298,02
2043	1.979,32	104,24	554,18	29,19	3.125,16	164,59	5.658,66	298,02
2044	1.905,49	104,24	533,51	29,19	3.008,59	164,59	5.447,59	298,02

2045	1.834,42	104,24	513,61	29,19	2.896,37	164,59	5.244,40	298,02
2046	1.766,00	104,24	494,45	29,19	2.788,33	164,59	5.048,78	298,02
2047	1.700,12	104,24	476,01	29,19	2.684,33	164,59	4.860,46	298,02
2048	1.636,71	104,24	458,26	29,19	2.584,20	164,59	4.679,17	298,02
2049	1.575,66	104,24	441,16	29,19	2.487,81	164,59	4.504,64	298,02
2050	1.516,89	104,24	424,71	29,19	2.395,02	164,59	4.336,61	298,02
2051	1.460,31	104,24	408,87	29,19	2.305,68	164,59	4.174,86	298,02
2052	1.405,84	104,24	393,62	29,19	2.219,68	164,59	4.019,13	298,02
2053	1.353,40	104,24	378,93	29,19	2.136,89	164,59	3.869,22	298,02
2054	1.302,92	104,24	364,80	29,19	2.057,18	164,59	3.724,90	298,02
2055	1.254,32	104,24	351,19	29,19	1.980,45	164,59	3.585,96	298,02
2056	1.207,53	104,24	338,09	29,19	1.906,58	164,59	3.452,20	298,02
2057	1.162,49	104,24	325,48	29,19	1.835,46	164,59	3.323,44	298,02
2058	1.119,13	104,24	313,34	29,19	1.767,00	164,59	3.199,47	298,02
2059	1.077,39	104,24	301,65	29,19	1.701,09	164,59	3.080,13	298,02
2060	1.037,20	104,24	290,40	29,19	1.637,64	164,59	2.965,24	298,02
2061	998,51	104,24	279,57	29,19	1.576,56	164,59	2.854,64	298,02
2062	961,27	104,24	269,14	29,19	1.517,75	164,59	2.748,16	298,02

Where:

$C_{abicl}$  = Average carbon stock per hectare in above-ground biomass carbon pool of class icl (t CO<sub>2e</sub>/ha)  $C_{bbicl}$  =

Average carbon stock per hectare in below-ground biomass carbon pool of class icl (t CO<sub>2e</sub>/ha)  $C_{social}$  =

Average carbon stock per hectare in soil organic carbon pool of class icl (t CO<sub>2e</sub>/ha)

$C_{total}$  = Average carbon stock per hectare in all accounted carbon pools in class icl (t CO<sub>2e</sub>/ha)

To calculate the post-deforestation carbon stock, the most likely land uses were considered, based on a simple approach that assumes use for agriculture, especially soybean cultivation. We didn't find any local research that quantified carbon stocks in soybean crops, so we used long-term data (14 years) collected by Alves et al. (2020)<sup>75</sup> for the Pampa biome, through an experiment carried out in a crop-livestock integration system at the Agronomic Experimental Station of the Federal University of Rio Grande do Sul, located in the municipality of Eldorado do Sul, in the state of Rio Grande do Sul, Brazil (-30.083333, -51.650000). Crop-livestock integration systems are defined as those in which there is temporary alternation or rotation between pastures and crops in the same area, over time, contributing to the accumulation of carbon in the soil

<sup>75</sup> Alves et al. (2020). Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0167198720304608>

conservative approach. This system usually involves growing soybeans in the summer and ryegrass (*Lolium multiflorum*) in the winter, which acts as a cover crop. The carbon stock in the soil (0-30 cm depth) was 39.0 tons per hectare, which, when multiplied by the ratio between the molecular weights of CO<sub>2</sub> and carbon (44/12), results in 143.00 t CO<sub>2e</sub>/ha. The same experiment also allowed us to access carbon data from the biomass, through the residues or parts of the plant that remain in the field after harvesting. In a conservative way, we also decided to consider the average carbon contribution to the soil in the crop rotation system, adding soybean and corn residues in the summer and ryegrass residues in the winter. Thus, the carbon in this category was 2.449 tons per hectare, which is equivalent to 8.98 t CO<sub>2e</sub>/ha.

In southern Brazil, there are few studies analyzing carbon levels in below-ground biomass in temporary agricultural crops. Bordin et al. (2008)<sup>76</sup>, when investigating the dry matter of soybean roots in an Embrapa experimental area in Paraná, found 0.70882 tons of carbon per hectare (value adjusted to the upper limit of the confidence interval) in a tillage system under direct sowing, which we consider to be a conservative approach. This value corresponds to 2.60 t CO<sub>2e</sub>/ha, representing 28.9% of the total carbon present in the biomass.

The post-deforestation classes generally do not have stable carbon stocks, as land use after deforestation results in changes in carbon stocks over time, as explained in more detail in the following section. For the post-deforestation class, the average carbon stock value is shown in Table 27.

Table 27: Long-Term (20-Year) average carbon stocks per hectare of post-deforestation LU/LC classes present in the Reference Region.

Post-deforestation LU/LC classes fcl			Average carbon stock
>	Non-forest (Farming)		
C stock (t CO <sub>2e</sub> /ha)			
Cabfcl	Cbbfcl	CSOCfcl	Ctotfcl
8,98	2,60	143,00	154,58

<sup>76</sup>Bordin et al. (2008). Available at: <https://doi.org/10.1590/S0100-204X2008001200020>

#### 4.1.6.1 Calculation of Emission Factors

The VM0015 methodology uses linear functions to calculate the reduction in carbon stock in the initial forest classes (icl) and the increase in carbon stock in the post-deforestation classes (fcl). This process is carried out follows:

- For above-ground biomass
  - a) Initial forest classes (icl): immediate release of 100 percent of the carbon stock is assumed to happen during year  $t = t^*$  (year when deforestation occurs).
  - b) Post-deforestation classes (fcl): linear increase from 0 t<sub>CO2e/ha</sub> in year  $t = t^*$  to 100 percent of the long-term (20-year) average carbon stock in year  $t = t^* + 9$  is assumed to happen in the 10-year period following deforestation (i.e., 1/10<sup>th</sup> of the final carbon stock is accumulated each year).
- For below-ground biomass
  - a) Initial forest classes (icl): an annual release of 1/10<sup>th</sup> of the initial carbon stock is assumed to happen each year between  $t = t^*$  and  $t = t^* + 9$ .
  - b) Post-deforestation classes (fcl): linear increase from 0 t<sub>CO2e/ha</sub> in year  $t = t^*$  to 100 percent of the long-term (20-year) average carbon stock in year  $t = t^* + 9$  is assumed to happen in the 10-year period following deforestation (i.e., 1/10<sup>th</sup> of the final carbon stock is accumulated each year).
- For soil organic carbon
  - a) It is assumed that in a 20-year period, the carbon stock changes from that estimated for initial forest classes (icl) to that estimated for postdeforestation classes fcl. The change occurs linearly and may be either a decrease or an increase.

When carbon stocks in the soil organic carbon pool are considered in the baseline, the methodology calls for activity data to be calculated by category (ct), as the linear decay (or increase) function varies according to category. As the context is that 100% of the deforested areas change from "forest" to "", ultimately being destined for agriculture as the final land use, all the initial forest classes are transformed into non-forest (final post-deforestation class) in the baseline considered. Therefore, the annual values corresponding to the land use and land cover change categories, which describe the baseline activity per post-deforestation forest category, are the same as those for the initial class. Table 28 shows these categories, while Tables 29 and 30 show

data on the area deforested in each category within the project area and leakage zone, respectively, over the project credit period.

Table 28: List of Land Use and Land Cover Change Categories (ctz).

LU/LC Change Category		Initial Forest Class		Post-Deforestation Zone	
IDctz	Name	IDicl	Name	IDfcl	Name
1	ZoneCat1	1	Seasonal forest	1	Zone 1: Non-forest (Farming)
2	ZoneCat2	2	Tree steppe	2	Zone 1: Non-forest (Farming)

Table 29: Annual areas deforested in each category ctz within the project area in the baseline case (baseline activity data per category (ctz)).

IDct>	Activity data per LU/LC category ctz within the Project Area		Total baseline deforestation in the project area	
	1	2	ABSLPat	ABSLPA
Name>	Seasonal Forest	Arboreal steppe	annual	cumulative
Project year <i>t</i>	ha	ha	ha	ha
2023	3,00	34,09	37,08	37,08
2024	2,98	32,81	35,79	72,87
2025	2,96	31,59	34,55	107,42
2026	2,94	30,41	33,35	140,76
2027	2,92	29,28	32,19	172,96
2028	2,90	28,19	31,08	204,04
2029	2,88	27,13	30,01	234,05
2030	2,86	26,12	28,98	263,04
2031	2,84	25,15	27,99	291,02
2032	2,82	24,21	27,03	318,06
2033	2,80	23,31	26,11	344,16
2034	2,78	22,44	25,22	369,39
2035	2,77	21,60	24,37	393,75
2036	2,75	20,79	23,54	417,30
2037	2,73	20,02	22,75	440,05
2038	2,71	19,27	21,98	462,03
2039	2,69	18,55	21,25	483,28
2040	2,68	17,86	20,54	503,81
2041	2,66	17,20	19,85	523,67

2042	2,64	16,55	19,19	542,86
2043	2,62	15,94	18,56	561,42
2044	2,61	15,34	17,95	579,37
2045	2,59	14,77	17,36	596,73
2046	2,57	14,22	16,79	613,52
2047	2,56	13,69	16,24	629,76
2048	2,54	13,18	15,72	645,48
2049	2,52	12,69	15,21	660,69
2050	2,50	12,21	14,72	675,41
2051	2,49	11,76	14,25	689,65
2052	2,47	11,32	13,79	703,44
2053	2,46	10,90	13,35	716,80
2054	2,44	10,49	12,93	729,72
2055	2,42	10,10	12,52	742,25
2056	2,41	9,72	12,13	754,38
2057	2,39	9,36	11,75	766,13
2058	2,38	9,01	11,39	777,51
2059	2,36	8,67	11,03	788,55
2060	2,34	8,35	10,70	799,24
2061	2,33	8,04	10,37	809,61
2062	2,31	7,74	10,05	819,66

Table 30: Annual areas deforested in each category ctz within the Leakage Belt in the baseline case (baseline activity data per category (ctz)).

IDct>	Activity data per LU/LC category ctz within the Leakage Belt		Total baseline deforestation in the Leakage Belt	
	1	2	ABSLlKt	ABSLlK
Name>	Seasonal Forest	Shrub steppe	annual	cumulative
Project year t	ha	ha	ha	ha
2023	3,90	40,61	44,51	44,51
2024	3,87	39,10	42,97	87,48
2025	3,85	37,64	41,49	128,97
2026	3,82	36,23	40,06	169,03
2027	3,80	34,88	38,68	207,71
2028	3,77	33,58	37,36	245,07
2029	3,75	32,33	36,08	281,14
2030	3,72	31,12	34,85	315,99

2031	3,70	29,96	33,66	349,65
2032	3,67	28,84	32,52	382,17
2033	3,65	27,77	31,42	413,59
2034	3,63	26,73	30,36	443,95
2035	3,60	25,74	29,34	473,29
2036	3,58	24,78	28,35	501,64
2037	3,56	23,85	27,41	529,05
2038	3,53	22,96	26,49	555,54
2039	3,51	22,11	25,61	581,16
2040	3,49	21,28	24,77	605,92
2041	3,46	20,49	23,95	629,87
2042	3,44	19,72	23,16	653,04
2043	3,42	18,99	22,40	675,44
2044	3,39	18,28	21,67	697,11
2045	3,37	17,60	20,97	718,08
2046	3,35	16,94	20,29	738,37
2047	3,33	16,31	19,64	758,01
2048	3,31	15,70	19,01	777,02
2049	3,28	15,12	18,40	795,41
2050	3,26	14,55	17,81	813,23
2051	3,24	14,01	17,25	830,48
2052	3,22	13,49	16,71	847,18
2053	3,20	12,98	16,18	863,36
2054	3,18	12,50	15,68	879,04
2055	3,16	12,03	15,19	894,23
2056	3,13	11,58	14,72	908,94
2057	3,11	11,15	14,27	923,21
2058	3,09	10,74	13,83	937,04
2059	3,07	10,34	13,41	950,45
2060	3,05	9,95	13,00	963,45
2061	3,03	9,58	12,61	976,06
2062	3,01	9,22	12,23	988,30

Table 31 describes the carbon stock change factors associated with the land use change categories. These factors were then used to calculate the changes in the base carbon stock. The calculations were based on the assumptions established in the VM0015 methodology, using Method 2.

Table 31: Emission factors for land use change categories (ct or ctz) (Method 2).

>		Seasonal forest			Tree steppe		
Year after deforestation		$\Delta C_{abctz,t}$	$\Delta C_{bbctz,t}$	$\Delta C_{SOCctz,t}$	$\Delta C_{abctz,t}$	$\Delta C_{bbctz,t}$	$\Delta C_{SOCctz,t}$
1	t*	-284,73	-6,60	-8,87	-103,35	-2,66	-1,08
2	t*+ 1	0,90	-6,60	-8,87	0,90	-2,66	-1,08
3	t*+ 2	0,90	-6,60	-8,87	0,90	-2,66	-1,08
4	t*+ 3	0,90	-6,60	-8,87	0,90	-2,66	-1,08
5	t*+ 4	0,90	-6,60	-8,87	0,90	-2,66	-1,08
6	t*+ 5	0,90	-6,60	-8,87	0,90	-2,66	-1,08
7	t*+ 6	0,90	-6,60	-8,87	0,90	-2,66	-1,08
8	t*+ 7	0,90	-6,60	-8,87	0,90	-2,66	-1,08
9	t*+ 8	0,90	-6,60	-8,87	0,90	-2,66	-1,08
10	t*+ 9	0,90	-6,60	-8,87	0,90	-2,66	-1,08
11	t*+ 10	0,00	0,00	-8,87	0,00	0,00	-1,08
12	t*+ 11	0,00	0,00	-8,87	0,00	0,00	-1,08
13	t*+ 12	0,00	0,00	-8,87	0,00	0,00	-1,08
14	t*+ 13	0,00	0,00	-8,87	0,00	0,00	-1,08
15	t*+ 14	0,00	0,00	-8,87	0,00	0,00	-1,08
16	t*+ 15	0,00	0,00	-8,87	0,00	0,00	-1,08
17	t*+ 16	0,00	0,00	-8,87	0,00	0,00	-1,08
18	t*+ 17	0,00	0,00	-8,87	0,00	0,00	-1,08
19	t*+ 18	0,00	0,00	-8,87	0,00	0,00	-1,08
20	t*+ 19	0,00	0,00	-8,87	0,00	0,00	-1,08
21	t*+ 20	0,00	0,00	0,00	0,00	0,00	0,00

To determine the reference changes in the carbon stock, the activity data per LU/LC ctz category was multiplied by the respective emission factors. Tables 32, 33 and 34 show the results of the calculations for the project area, while Tables 35, 36 and 37 present the calculations for the leakage zone.

Table 32: Baseline carbon stock change for selected carbon pools in the Project Area (Method 2) - Aboveground

Project year <i>t</i>	Activity data per category × emission factor for aboveground biomass in the Project Area				Total baseline carbon stock change in the Project Area	
	IDct	= 1	IDct	= 2	Annual	Cumulative
	ABSLPAct <sub><i>t</i></sub>	ΔCabct <sub><i>t</i></sub>	ABSLPAct <sub><i>t</i></sub>	ΔCabct <sub><i>t</i></sub>	ΔCabBSLPAt	ΔCabBSLPA
	ha	t CO2e/ha	ha	t CO2e/ha	t CO2e	t CO2e
2023	3,00	-852,82	34,09	-3.522,58	-4.375,40	-4.375,40
2024	2,98	-844,50	32,81	-3.360,58	-4.205,08	-8.580,47
2025	2,96	-836,24	31,59	-3.204,62	-4.040,85	-12.621,33
2026	2,94	-828,03	30,41	-3.054,48	-3.882,50	-16.503,83
2027	2,92	-819,87	29,28	-2.909,94	-3.729,81	-20.233,64
2028	2,90	-811,77	28,19	-2.770,79	-3.582,56	-23.816,20
2029	2,88	-803,73	27,13	-2.636,83	-3.440,55	-27.256,75
2030	2,86	-795,73	26,12	-2.507,86	-3.303,60	-30.560,35
2031	2,84	-787,79	25,15	-2.383,71	-3.171,50	-33.731,85
2032	2,82	-779,90	24,21	-2.264,19	-3.044,09	-36.775,95
2033	2,80	-774,75	23,31	-2.179,74	-2.954,49	-39.730,44
2034	2,78	-769,64	22,44	-2.098,43	-2.868,07	-42.598,51
2035	2,77	-764,56	21,60	-2.020,16	-2.784,72	-45.383,23
2036	2,75	-759,52	20,79	-1.944,81	-2.704,32	-48.087,56
2037	2,73	-754,50	20,02	-1.872,27	-2.626,77	-50.714,33
2038	2,71	-749,52	19,27	-1.802,43	-2.551,95	-53.266,28
2039	2,69	-744,58	18,55	-1.735,20	-2.479,78	-55.746,06
2040	2,68	-739,66	17,86	-1.670,48	-2.410,14	-58.156,20
2041	2,66	-734,78	17,20	-1.608,17	-2.342,95	-60.499,15
2042	2,64	-729,93	16,55	-1.548,18	-2.278,11	-62.777,26
2043	2,62	-725,11	15,94	-1.490,44	-2.215,55	-64.992,81
2044	2,61	-720,33	15,34	-1.434,84	-2.155,17	-67.147,98
2045	2,59	-715,57	14,77	-1.381,32	-2.096,90	-69.244,88
2046	2,57	-710,85	14,22	-1.329,80	-2.040,65	-71.285,53
2047	2,56	-706,16	13,69	-1.280,20	-1.986,36	-73.271,89
2048	2,54	-701,50	13,18	-1.232,45	-1.933,95	-75.205,83
2049	2,52	-696,87	12,69	-1.186,48	-1.883,35	-77.089,18
2050	2,50	-692,27	12,21	-1.142,22	-1.834,49	-78.923,67
2051	2,49	-687,70	11,76	-1.099,62	-1.787,32	-80.710,99
2052	2,47	-683,16	11,32	-1.058,60	-1.741,76	-82.452,75
2053	2,46	-678,65	10,90	-1.019,12	-1.697,77	-84.150,52
2054	2,44	-674,17	10,49	-981,10	-1.655,28	-85.805,79
2055	2,42	-669,72	10,10	-944,51	-1.614,23	-87.420,02

2056	2,41	-665,30	9,72	-909,28	-1.574,58	-88.994,60
2057	2,39	-660,91	9,36	-875,36	-1.536,27	-90.530,88
2058	2,38	-656,55	9,01	-842,71	-1.499,26	-92.030,14
2059	2,36	-652,22	8,67	-811,28	-1.463,49	-93.493,63
2060	2,34	-647,91	8,35	-781,02	-1.428,93	-94.922,56
2061	2,33	-643,64	8,04	-751,88	-1.395,52	-96.318,08
2062	2,31	-639,39	7,74	-723,84	-1.363,23	-97.681,31

Table 33: Baseline carbon stock change for selected carbon pools in the Project Area (Method 2) - Belowground

Project year <i>t</i>	Activity data per category × emission factor for belowground biomass in the Project Area				Total baseline carbon stock change in the Project Area	
	IDct	= 1	IDct	= 2	Annual	Cumulative
	ABSLPAct <sub>t</sub>	ΔCbbct <sub>t</sub>	ABSLPAct <sub>t</sub>	ΔCbbct <sub>t</sub>	ΔCbbBSLPA <sub>t</sub>	ΔCbbBSLPA
	ha	t CO2e/ha	ha	t CO2e/ha	t CO2e	t CO2e
2023	3,00	-19,75	34,09	-90,62	-110,38	-110,38
2024	2,98	-39,38	32,81	-177,86	-217,24	-327,62
2025	2,96	-58,87	31,59	-261,85	-320,72	-648,34
2026	2,94	-78,24	30,41	-342,71	-420,94	-1.069,28
2027	2,92	-97,47	29,28	-420,55	-518,02	-1.587,30
2028	2,90	-116,58	28,19	-495,48	-612,06	-2.199,36
2029	2,88	-135,57	27,13	-567,62	-703,19	-2.902,55
2030	2,86	-154,43	26,12	-637,07	-791,50	-3.694,04
2031	2,84	-173,16	25,15	-703,93	-877,09	-4.571,13
2032	2,82	-191,77	24,21	-768,30	-960,07	-5.531,20
2033	2,80	-190,50	23,31	-739,64	-930,14	-6.461,34
2034	2,78	-189,25	22,44	-712,05	-901,30	-7.362,64
2035	2,77	-188,00	21,60	-685,49	-873,49	-8.236,13
2036	2,75	-186,76	20,79	-659,92	-846,68	-9.082,80
2037	2,73	-185,52	20,02	-635,31	-820,83	-9.903,64
2038	2,71	-184,30	19,27	-611,61	-795,91	-10.699,54
2039	2,69	-183,08	18,55	-588,80	-771,88	-11.471,43
2040	2,68	-181,88	17,86	-566,83	-748,71	-12.220,13
2041	2,66	-180,68	17,20	-545,69	-726,37	-12.946,50
2042	2,64	-179,48	16,55	-525,34	-704,82	-13.651,32
2043	2,62	-178,30	15,94	-505,74	-684,04	-14.335,36
2044	2,61	-177,12	15,34	-486,88	-664,00	-14.999,36
2045	2,59	-175,95	14,77	-468,72	-644,67	-15.644,03

2046	2,57	-174,79	14,22	-451,23	-626,03	-16.270,05
2047	2,56	-173,64	13,69	-434,40	-608,04	-16.878,09
2048	2,54	-172,49	13,18	-418,20	-590,69	-17.468,79
2049	2,52	-171,35	12,69	-402,60	-573,95	-18.042,74
2050	2,50	-170,22	12,21	-387,58	-557,81	-18.600,55
2051	2,49	-169,10	11,76	-373,13	-542,23	-19.142,77
2052	2,47	-167,98	11,32	-359,21	-527,19	-19.669,96
2053	2,46	-166,87	10,90	-345,81	-512,68	-20.182,65
2054	2,44	-165,77	10,49	-332,91	-498,68	-20.681,33
2055	2,42	-164,68	10,10	-320,49	-485,17	-21.166,51
2056	2,41	-163,59	9,72	-308,54	-472,13	-21.638,64
2057	2,39	-162,51	9,36	-297,03	-459,54	-22.098,18
2058	2,38	-161,44	9,01	-285,95	-447,39	-22.545,57
2059	2,36	-160,37	8,67	-275,29	-435,66	-22.981,23
2060	2,34	-159,32	8,35	-265,02	-424,33	-23.405,57
2061	2,33	-158,26	8,04	-255,13	-413,40	-23.818,96
2062	2,31	-157,22	7,74	-245,62	-402,84	-24.221,80

Table 34: Baseline carbon stock change for selected carbon pools in the Project Area (Method 2) - Soil organic carbon

Project year <i>t</i>	Activity data per category × emission factor for soil organic carbon in the Project Area				Total baseline carbon stock change in the Project Area	
	IDct	= 1	IDct	= 2	Annual	Cumulative
	ABSLPAct <sub>t</sub>	ΔCSOCct <sub>t</sub>	ABSLPAct <sub>t</sub>	ΔCSOCct <sub>t</sub>	ΔCSOCBSLPat	ΔCSOCBSLPA
	ha	t CO <sub>2</sub> e/ha	ha	t CO <sub>2</sub> e/ha	t CO <sub>2</sub> e	t CO <sub>2</sub> e
2023	3,00	-26,57	34,09	-36,80	-63,37	-63,37
2024	2,98	-52,97	32,81	-72,22	-125,19	-188,56
2025	2,96	-79,19	31,59	-106,32	-185,51	-374,07
2026	2,94	-105,24	30,41	-139,15	-244,39	-618,46
2027	2,92	-131,12	29,28	-170,75	-301,88	-920,34
2028	2,90	-156,83	28,19	-201,18	-358,01	-1.278,35
2029	2,88	-182,37	27,13	-230,47	-412,84	-1.691,19
2030	2,86	-207,74	26,12	-258,67	-466,41	-2.157,60
2031	2,84	-232,94	25,15	-285,82	-518,76	-2.676,35
2032	2,82	-257,97	24,21	-311,95	-569,93	-3.246,28
2033	2,80	-282,84	23,31	-337,11	-619,96	-3.866,24
2034	2,78	-307,55	22,44	-361,33	-668,88	-4.535,12
2035	2,77	-332,09	21,60	-384,65	-716,74	-5.251,86

2036	2,75	-356,48	20,79	-407,10	-763,57	-6.015,43
2037	2,73	-380,70	20,02	-428,71	-809,40	-6.824,84
2038	2,71	-404,76	19,27	-449,51	-854,27	-7.679,11
2039	2,69	-428,66	18,55	-469,54	-898,20	-8.577,30
2040	2,68	-452,40	17,86	-488,82	-941,22	-9.518,53
2041	2,66	-475,99	17,20	-507,38	-983,37	-10.501,90
2042	2,64	-499,42	16,55	-525,25	-1.024,67	-11.526,57
2043	2,62	-496,12	15,94	-505,66	-1.001,79	-12.528,36
2044	2,61	-492,85	15,34	-486,80	-979,65	-13.508,01
2045	2,59	-489,60	14,77	-468,64	-958,24	-14.466,25
2046	2,57	-486,36	14,22	-451,16	-937,53	-15.403,78
2047	2,56	-483,15	13,69	-434,33	-917,49	-16.321,27
2048	2,54	-479,97	13,18	-418,13	-898,10	-17.219,37
2049	2,52	-476,80	12,69	-402,54	-879,34	-18.098,70
2050	2,50	-473,65	12,21	-387,52	-861,17	-18.959,88
2051	2,49	-470,53	11,76	-373,07	-843,59	-19.803,47
2052	2,47	-467,42	11,32	-359,15	-826,57	-20.630,04
2053	2,46	-464,33	10,90	-345,76	-810,09	-21.440,14
2054	2,44	-461,27	10,49	-332,86	-794,13	-22.234,27
2055	2,42	-458,23	10,10	-320,44	-778,67	-23.012,94
2056	2,41	-455,20	9,72	-308,49	-763,69	-23.776,63
2057	2,39	-452,20	9,36	-296,98	-749,18	-24.525,81
2058	2,38	-449,21	9,01	-285,91	-735,12	-25.260,93
2059	2,36	-446,25	8,67	-275,24	-721,49	-25.982,42
2060	2,34	-443,30	8,35	-264,98	-708,28	-26.690,70
2061	2,33	-440,38	8,04	-255,09	-695,47	-27.386,17
2062	2,31	-437,47	7,74	-245,58	-683,05	-28.069,22

Table 35: Baseline carbon stock change in the Leakage Belt (Method 2) - Aboveground

Project year <i>t</i>	Activity data per category × emission factor for aboveground biomass in the Leakage Belt				Total baseline carbon stock change in the Leakage Belt	
	IDct	= 1	IDct	= 2	Annual	Cumulative
	ABSLLKct <sub>t</sub>	ΔCabct <sub>t</sub>	ABSLLKct <sub>t</sub>	ΔCabct <sub>t</sub>	ΔCabBSLLKt	ΔCabBSLLK
	ha	t CO2e/ha	ha	t CO2e/ha	t CO2e	t CO2e
2023	3,90	-1.110,58	40,61	-4.197,01	-5.307,58	-5.307,58
2024	3,87	-1.099,74	39,10	-4.003,99	-5.103,74	-10.411,32
2025	3,85	-1.088,98	37,64	-3.818,17	-4.907,16	-15.318,48
2026	3,82	-1.078,29	36,23	-3.639,29	-4.717,58	-20.036,06

2027	3,80	-1.067,67	34,88	-3.467,07	-4.534,75	-24.570,80
2028	3,77	-1.057,12	33,58	-3.301,28	-4.358,41	-28.929,21
2029	3,75	-1.046,65	32,33	-3.141,67	-4.188,32	-33.117,53
2030	3,72	-1.036,23	31,12	-2.988,02	-4.024,26	-37.141,78
2031	3,70	-1.025,89	29,96	-2.840,10	-3.865,99	-41.007,77
2032	3,67	-1.015,62	28,84	-2.697,69	-3.713,31	-44.721,08
2033	3,65	-1.008,92	27,77	-2.597,07	-3.605,99	-48.327,07
2034	3,63	-1.002,26	26,73	-2.500,20	-3.502,46	-51.829,53
2035	3,60	-995,64	25,74	-2.406,94	-3.402,58	-55.232,11
2036	3,58	-989,07	24,78	-2.317,16	-3.306,23	-58.538,34
2037	3,56	-982,54	23,85	-2.230,73	-3.213,28	-61.751,62
2038	3,53	-976,06	22,96	-2.147,53	-3.123,58	-64.875,20
2039	3,51	-969,62	22,11	-2.067,42	-3.037,04	-67.912,24
2040	3,49	-963,22	21,28	-1.990,31	-2.953,53	-70.865,77
2041	3,46	-956,86	20,49	-1.916,07	-2.872,93	-73.738,70
2042	3,44	-950,55	19,72	-1.844,60	-2.795,15	-76.533,85
2043	3,42	-944,27	18,99	-1.775,80	-2.720,07	-79.253,91
2044	3,39	-938,04	18,28	-1.709,56	-2.647,60	-81.901,51
2045	3,37	-931,85	17,60	-1.645,79	-2.577,64	-84.479,15
2046	3,35	-925,70	16,94	-1.584,40	-2.510,10	-86.989,26
2047	3,33	-919,59	16,31	-1.525,31	-2.444,89	-89.434,15
2048	3,31	-913,52	15,70	-1.468,41	-2.381,93	-91.816,08
2049	3,28	-907,49	15,12	-1.413,64	-2.321,13	-94.137,21
2050	3,26	-901,50	14,55	-1.360,91	-2.262,41	-96.399,63
2051	3,24	-895,55	14,01	-1.310,15	-2.205,70	-98.605,33
2052	3,22	-889,64	13,49	-1.261,28	-2.150,92	-100.756,25
2053	3,20	-883,77	12,98	-1.214,24	-2.098,00	-102.854,25
2054	3,18	-877,94	12,50	-1.168,94	-2.046,88	-104.901,13
2055	3,16	-872,14	12,03	-1.125,34	-1.997,48	-106.898,62
2056	3,13	-866,38	11,58	-1.083,37	-1.949,75	-108.848,37
2057	3,11	-860,67	11,15	-1.042,96	-1.903,62	-110.751,99
2058	3,09	-854,99	10,74	-1.004,06	-1.859,04	-112.611,03
2059	3,07	-849,34	10,34	-966,60	-1.815,95	-114.426,98
2060	3,05	-843,74	9,95	-930,55	-1.774,29	-116.201,27
2061	3,03	-838,17	9,58	-895,84	-1.734,01	-117.935,28
2062	3,01	-832,64	9,22	-862,43	-1.695,06	-119.630,34

Table 36: Baseline carbon stock change in the Leakage Belt (Method 2) - Belowground

Project year <i>t</i>	Activity data per category × emission factor for belowground biomass in the Leakage Belt				Total baseline carbon stock change in the Leakage Belt	
	IDct	= 1	IDct	= 2	Annual	Cumulative
	ABSLLKct <sub>t</sub>	ΔCbbct <sub>t</sub>	ABSLLKct <sub>t</sub>	ΔCbbct <sub>t</sub>	ΔCbbBSLLK <sub>t</sub>	ΔCbbBSLLK
	ha	t CO <sub>2</sub> e/ha	ha	t CO <sub>2</sub> e/ha	t CO <sub>2</sub> e	t CO <sub>2</sub> e
2023	3,90	-25,72	40,61	-107,97	-133,70	-133,70
2024	3,87	-51,28	39,10	-211,92	-263,20	-396,89
2025	3,85	-76,66	37,64	-311,99	-388,65	-785,54
2026	3,82	-101,88	36,23	-408,32	-510,20	-1.295,74
2027	3,80	-126,93	34,88	-501,06	-628,00	-1.923,74
2028	3,77	-151,82	33,58	-590,35	-742,16	-2.665,90
2029	3,75	-176,54	32,33	-676,30	-852,84	-3.518,74
2030	3,72	-201,10	31,12	-759,04	-960,14	-4.478,88
2031	3,70	-225,50	29,96	-838,70	-1.064,20	-5.543,08
2032	3,67	-249,73	28,84	-915,39	-1.165,12	-6.708,21
2033	3,65	-248,08	27,77	-881,25	-1.129,33	-7.837,54
2034	3,63	-246,45	26,73	-848,38	-1.094,82	-8.932,36
2035	3,60	-244,82	25,74	-816,73	-1.061,55	-9.993,92
2036	3,58	-243,20	24,78	-786,27	-1.029,47	-11.023,39
2037	3,56	-241,60	23,85	-756,94	-998,54	-12.021,93
2038	3,53	-240,00	22,96	-728,71	-968,71	-12.990,64
2039	3,51	-238,42	22,11	-701,53	-939,95	-13.930,59
2040	3,49	-236,85	21,28	-675,36	-912,21	-14.842,79
2041	3,46	-235,28	20,49	-650,17	-885,45	-15.728,24
2042	3,44	-233,73	19,72	-625,92	-859,65	-16.587,89
2043	3,42	-232,19	18,99	-602,57	-834,76	-17.422,65
2044	3,39	-230,65	18,28	-580,10	-810,75	-18.233,40
2045	3,37	-229,13	17,60	-558,46	-787,59	-19.020,99
2046	3,35	-227,62	16,94	-537,63	-765,25	-19.786,24
2047	3,33	-226,12	16,31	-517,57	-743,69	-20.529,93
2048	3,31	-224,63	15,70	-498,27	-722,89	-21.252,82
2049	3,28	-223,14	15,12	-479,68	-702,83	-21.955,65
2050	3,26	-221,67	14,55	-461,79	-683,46	-22.639,11
2051	3,24	-220,21	14,01	-444,57	-664,77	-23.303,88
2052	3,22	-218,75	13,49	-427,98	-646,74	-23.950,62
2053	3,20	-217,31	12,98	-412,02	-629,33	-24.579,95
2054	3,18	-215,88	12,50	-396,65	-612,53	-25.192,48
2055	3,16	-214,45	12,03	-381,86	-596,31	-25.788,78
2056	3,13	-213,04	11,58	-367,61	-580,65	-26.369,43

2057	3,11	-211,63	11,15	-353,90	-565,53	-26.934,96
2058	3,09	-210,23	10,74	-340,70	-550,93	-27.485,90
2059	3,07	-208,85	10,34	-327,99	-536,84	-28.022,73
2060	3,05	-207,47	9,95	-315,76	-523,23	-28.545,96
2061	3,03	-206,10	9,58	-303,98	-510,08	-29.056,04
2062	3,01	-204,74	9,22	-292,64	-497,38	-29.553,42

Table 37: Baseline carbon stock change in the Leakage Belt (Method 2) - Soil organic carbon

Project year <i>t</i>	Activity data per category × emission factor for soil organic carbon in the Leakage Belt				Total baseline carbon stock change in the Leakage Belt	
	IDct	= 1	IDct	= 2	Annual	Cumulative
	ABSLLKct,t	ΔCSOCct,t	ABSLLKct,t	ΔCSOCct,t	ΔCSOCBSLLKt	ΔCSOCBSLLK
	ha	t CO2e/ha	ha	t CO2e/ha	t CO2e	t CO2e
2023	3,90	-34,60	40,61	-43,84	-78,44	-78,44
2024	3,87	-68,98	39,10	-86,04	-155,03	-233,47
2025	3,85	-103,13	37,64	-126,68	-229,81	-463,27
2026	3,82	-137,05	36,23	-165,79	-302,84	-766,12
2027	3,80	-170,75	34,88	-203,45	-374,20	-1.140,32
2028	3,77	-204,23	33,58	-239,70	-443,93	-1.584,25
2029	3,75	-237,49	32,33	-274,60	-512,08	-2.096,33
2030	3,72	-270,52	31,12	-308,20	-578,72	-2.675,05
2031	3,70	-303,34	29,96	-340,54	-643,88	-3.318,93
2032	3,67	-335,94	28,84	-371,68	-707,62	-4.026,56
2033	3,65	-368,33	27,77	-401,65	-769,99	-4.796,54
2034	3,63	-400,51	26,73	-430,51	-831,02	-5.627,56
2035	3,60	-432,47	25,74	-458,29	-890,76	-6.518,32
2036	3,58	-464,22	24,78	-485,04	-949,26	-7.467,58
2037	3,56	-495,76	23,85	-510,79	-1.006,55	-8.474,12
2038	3,53	-527,09	22,96	-535,58	-1.062,67	-9.536,79
2039	3,51	-558,22	22,11	-559,44	-1.117,65	-10.654,44
2040	3,49	-589,14	21,28	-582,41	-1.171,55	-11.825,99
2041	3,46	-619,85	20,49	-604,53	-1.224,38	-13.050,37
2042	3,44	-650,36	19,72	-625,82	-1.276,18	-14.326,56
2043	3,42	-646,07	18,99	-602,48	-1.248,55	-15.575,10
2044	3,39	-641,81	18,28	-580,00	-1.221,81	-16.796,92
2045	3,37	-637,57	17,60	-558,37	-1.195,94	-17.992,86
2046	3,35	-633,36	16,94	-537,54	-1.170,91	-19.163,77
2047	3,33	-629,18	16,31	-517,49	-1.146,68	-20.310,44

2048	3,31	-625,03	15,70	-498,19	-1.123,22	-21.433,66
2049	3,28	-620,91	15,12	-479,61	-1.100,51	-22.534,18
2050	3,26	-616,81	14,55	-461,72	-1.078,53	-23.612,70
2051	3,24	-612,74	14,01	-444,50	-1.057,23	-24.669,94
2052	3,22	-608,69	13,49	-427,92	-1.036,61	-25.706,55
2053	3,20	-604,68	12,98	-411,96	-1.016,63	-26.723,18
2054	3,18	-600,69	12,50	-396,59	-997,27	-27.720,45
2055	3,16	-596,72	12,03	-381,80	-978,52	-28.698,97
2056	3,13	-592,78	11,58	-367,56	-960,34	-29.659,31
2057	3,11	-588,87	11,15	-353,85	-942,72	-30.602,02
2058	3,09	-584,98	10,74	-340,65	-925,63	-31.527,65
2059	3,07	-581,12	10,34	-327,94	-909,06	-32.436,72
2060	3,05	-577,29	9,95	-315,71	-893,00	-33.329,71
2061	3,03	-573,48	9,58	-303,93	-877,41	-34.207,12
2062	3,01	-569,69	9,22	-292,60	-862,29	-35.069,41

#### 4.1.6.2 Estimation of other GHG emissions

The other GHG emissions in the baseline within the project boundaries can be estimated as follows:

$$GHG_{BSL,E} = \sum_{t=1}^t \sum_{i=1}^M (EFC_{i,t} + E_{BiomassBurn,i,t} + N_2O_{direct-N,i,t}) \quad (3)$$

Where:

$GHG_{BSL,E}$  = Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline up to year t\*; t CO2e

$EFC_{i,t}$  = Net CO2e emission from fossil fuel combustion in stratum i in year t; t CO2e

$E_{BiomassBurn,i,t}$  = Non-CO2 emissions due to biomass burning as part of deforestation activities in stratum i in year t; t CO2e

$N_2O_{direct-N,i,t}$  = Direct N2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t; t CO2e

i = 1, 2, 3, ... M strata

t = 1, 2, 3, ...t\* years elapsed since the projected start of the project activity

Conservatively, we chose not to consider net CO<sub>2</sub>e emissions from burning fossil fuels (EFC<sub>i,t</sub>), nor non-CO<sub>2</sub> GHG emissions from burning biomass (EBiomassBurn<sub>i,t</sub>), as part of deforestation activities, although we recognize that the gases released by deforestation can be significant, both in terms of immediate impact and contribution. We also chose not to consider direct N<sub>2</sub>O emissions (N<sub>2</sub>Odirect-N<sub>i,t</sub>) resulting from the application nitrogen in alternative land use within the project boundary, as we understand that although nitrogen is the nutrient most required by grain, soybeans in particular have the capacity for biological nitrogen fixation by their roots, eliminating the need for complementary fertilization with this nutrient<sup>77</sup>. This approach is considered conservative, as it does not take into account the nitrogen demand of the second crop.

## 4.2 Project Emissions

The net GHG emissions in the VCS AFOLU project scenario correspond to the sum of the changes in carbon stocks caused by deforestation, degradation or natural disturbances, in addition to the gas emissions generated by these actions. In this context, if there is an increase in the carbon stock of the reservoirs considered, this represents a positive change in this dynamic, and vice versa. In the case of the project, the positive change in carbon stocks is conservatively ignored, although it is recognized that by implementing conservation activities, the project tends to generate an increase in carbon stocks due to forest growth and carbon sequestration.

To support the quantification of *ex-ante* emissions and also for future *ex-post* monitoring, you can use the complementary module VMD0015 - Methods for monitoring of GHG emissions and removals in REDD and ciw projects (M-REDD), which summarizes emissions in the following equation:

$$\Delta C_{WPS-REDD} = \sum_{t=1}^{t^*} \sum_{i=1}^M \Delta C_{( \Delta C_{P,DefPA,i,t} + P_{,Deg,i,t} + \Delta C_{P,DistPA,i,t} + GHG_{P-E,i,t} )} \quad (4)$$

Where:

$\Delta C_{WPS-REDD}$  = Net GHG emissions in the REDD project scenario up to year t\*; t CO<sub>2</sub>e

$\Delta C_{P, , DefPAit}$  = Net carbon stock change as a result of deforestation in the project area in the project case in stratum i in year t; t CO<sub>2</sub>e

<sup>77</sup> Sfredo, 2008. Available at: <https://www.infoteca.cnptia.embrapa.br/handle/doc/470934>

$\Delta C_{P, Degit}$  = Net carbon stock change as a result of degradation in the project area in the project case in stratum  $i$  in year  $t$ ;  $t_{CO2e}$

$\Delta C_{P, DistPAit}$  = Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum  $i$  in year  $t$ ;  $t_{CO2e}$

$GHG_{P-E, it}$  = Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum  $i$  in year  $t$ ;  $t_{CO2e}$

$i$  = 1, 2, 3, ...  $M$  strata

$t$  = 1, 2, 3, ...  $t^*$  years elapsed since the start of the project activity.

The project's activities take place on private property that has surveillance and territorial patrols, which guarantees the immediate identification and reporting of deforestation or vegetation degradation (for example, logging, firewood collection, charcoal production or other aggravating activities not previously considered). Thus, changes in the carbon stock due to degradation and the GHG emissions associated with this activity in the project area will be accounted for as zero, in the same way as emissions resulting from the burning of fossil fuels, also not included in the baseline scenario due to their minimal impact. Therefore,  $\Delta C_{PDegit} = 0$ ;  $GHG_{P-Eit} = 0$ .

There is no evidence, even in the literature, of significant changes in carbon stocks due to natural disturbances in the project area in previous years (using the historical period as a base), so  $\Delta C_{PDistPAit} = 0$ . If these disturbances occur during the project, they will be recorded. It is important to note that no planned activities, such as the use of equipment or the clearing of native vegetation to build roads or other infrastructure, will generate emissions under the project. All the landowners involved have signed a contract undertaking not to convert the project's accounting areas.

Considering what has been said so far, the net GHG emissions in the VCS AFOLU project scenario are basically a function of the change in the net carbon stock associated with deforestation in the different strata of the project area ( $\Delta C_{PDefPAit}$ ). This same equation can be adapted for the leakage area (LB), where the net GHG emissions generated by the project activities represent the sum of the changes in the carbon stock resulting from deforestation in this area, as shown in the equation below:

$$\Delta C_{WPS-REDD, LB} = \sum_{t=1}^{t^*} \sum_{i=1}^M \Delta C_{P, DefLB, i, t} \quad (5)$$

Where:

$\Delta C_{WPS-REDD, LB}$  = Net GHG emissions in the leakage belt in the REDD project case up to year  $t^*$ ;  $t_{CO2e}$

$\Delta C_{P,DefLB, it}$  = Net carbon stock change as a result of deforestation in the leakage belt the project case in stratum  $i$  in year  $t$ ;  $t$  CO<sub>2e</sub>

$i$  = 1, 2, 3, ... $M$  strata in the project scenario

$t$  = 1, 2, 3, ...  $t^*$  years elapsed since the start of the project activity.

- **Ex Ante Estimation of Carbon Stock Changes due to Unavoidable Unplanned Deforestation Within the Project Area**

Although the project aims to avoid deforestation, some unplanned deforestation may occur in the project area. The actual reduction in deforestation under the project depends on the effectiveness of the activities implemented, an aspect that cannot be measured beforehand. Post-implementation measurements are crucial to determining actual emission reductions.

To allow for *ex ante* projections, a conservative and realistic assumption was made about the effectiveness of the activities proposed in the project, with the estimation of an Effectiveness Index (*EI*) ranging from 0 (no effectiveness) to 1 (maximum effectiveness). The estimated *EI* value was used to adjust the baseline projections, multiplying them by the factor  $(1 - EI)$ , resulting in the estimated *ex ante* unplanned deforestation emissions for the project. For the calculations, an *EI* of 0.98 (98%) was considered. The following equation illustrates this process.

$$\Delta C_{UDdPA_t} = \Delta C_{BSL_t} * (1 - EI) \tag{6}$$

Where:

$\Delta C_{UDdPA_t}$  = Total ex ante actual carbon stock change due to unavoids unplanned deforestation at year  $t$  in the project area (t CO<sub>2e</sub>)

$\Delta C_{BSL_t}$  = Total baseline carbon stock change at year  $t$  in the project area (t CO<sub>2e</sub>)

*EI* = Ex ante estimated Effectiveness Index (%)

$t$  = 1, 2, 3, ...,  $T$ , a year of the proposed project crediting period (dimensionless)

- **Ex Ante Estimation of CH<sub>4</sub> and N<sub>2</sub>O Emissions from Grazing Animals**

Conceptually, according to the VCS standard itself and as established in the IPCC 2003 Good Practice Guidance, the term degradation consists of the continuous reduction of canopy cover and/or carbon stocks in a forest due to human activities, including animal grazing, but without resulting in the conversion of the forest into

non-forest land (which would be classified as deforestation). Emissions from grazing in the project area are presented separately, as we do not consider this to be degradation per se, especially when referring to the Brazilian Pampa biome, which involves a very complex field-forest dynamic. The importance of this historical and synergistic interaction between gaucho culture and animal husbandry, and its relevance to maintaining the expansion of forests over native grasslands, has already been discussed previously and will not be explored further here. What can be emphasized is that low grazing on native vegetation has not caused a reduction in canopy cover, which can be verified by historical images of the area. On the other hand, in the absence of grazing, studies indicate that forest fragments tend to expand over the countryside, especially in riparian zones in areas of lower relief, close to sources of forest propagules<sup>78</sup>. This advance of the forest occurs not only from the edges, but also by "jumps", with the formation of forest clumps in the middle of the field<sup>79</sup>. This growth in forest area is a reality in many municipalities in Rio Grande do Sul today<sup>80</sup>. This phenomenon can be linked both to the restrictions imposed by legislation and to the proximity of forest fragments, which facilitates forest colonization, as well as the increase in the time it takes to exclude grazing. In this context, Oliveira and Pillar (2003)<sup>81</sup> state that the process of forest expansion occurs in a directional manner, with the gradual replacement grassland vegetation by tree and shrub elements. However, it is important to add that, in general, the long-term maintenance of grasslands requires periodic disturbances to plant communities, to the point that disturbance can be considered an intrinsic characteristic of most grassland ecosystems<sup>82</sup>. The ecosystems of the Pampa were probably formed in contact with primitive grazing animals, and so "grazing is not that far back in the evolutionary history of the region's grassland ecosystems, and the introduction of cattle and horses into the Campos Sulinos [...] did not represent a major impact on the biota of the South Brazilian grasslands"<sup>83</sup>. And even if this impact has occurred at the level of the structure and floristic composition of the forests, the use of cattle does not compromise the carbon stocks in the soil<sup>84</sup>.

The GHG emissions estimated at this stage include methane ( $\text{CH}_4$ ) from enteric fermentation ( $4ECH_{ferm_t}$ ) and animal excrement ( $4ECH_{man_t}$ ), as well as the

<sup>78</sup> Redin, 2023. Available at: <https://repositorio.ufsm.br/handle/1/13333>

<sup>79</sup> Machado, 2004. Available at: <https://lume.ufrgs.br/handle/10183/4074>

<sup>80</sup> Benedetti, 2010. Available at: <https://repositorio.ufsm.br/handle/1/3728>

<sup>81</sup> Oliveira and Pillar, 2004. Available at: <https://doi.org/10.1556/comec.5.2004.2.8>

<sup>82</sup> Bugalho and Abreu, 2008. Available at: <https://om.ciheam.org/om/pdf/a79/00800611.pdf>

<sup>83</sup> Bencke, 2009. Available at:

[https://www.researchgate.net/publication/293107527\\_Diversidade\\_e\\_conservacao\\_da\\_fauna\\_dos\\_Campos\\_do\\_Sul\\_do\\_Brazil](https://www.researchgate.net/publication/293107527_Diversidade_e_conservacao_da_fauna_dos_Campos_do_Sul_do_Brazil)

<sup>84</sup> Miracle, 2023. Available at: <https://repositorio.ufsm.br/handle/1/28733>

direct and indirect emissions of nitrous oxide ( $N_2O$ ) resulting from the disposal of grazing animal excrement ( $2EN_{Oman_t}$ ).  $CO_2$  emissions are not estimated because annual net  $CO_2$  emissions are assumed to be zero, with the  $CO_2$  absorbed by plants in photosynthesis being returned to the atmosphere as respired  $CO_2$ . The following equation, based on IPCC guidelines, helps to interpret the calculation.

$$GHG-Eg_t = ECH_{4ferm_t} + ECH_{4man_t} + EN_{2Oman_t} \quad (7)$$

Where:

$GHG-Eg_t$  = Emissions from grazing animals in project area in year t ( $t_{CO_2e/yr}$ )  $ECH_{4ferm_t}$  =  $CH_4$

emissions from enteric fermentation in project area at year t ( $t_{CO_2e/yr}$ )  $ECH_{4man_t}$  =  $CH_4$

emissions from manure management in project area in year t ( $t_{CO_2e/yr}$ )  $EN_{2Oman_t}$  =  $N_2O$

emissions from manure management in Project area at year t ( $t_{CO_2e/yr}$ )

t = 1, 2, 3, ..., T years of the project crediting period (dimensionless)

Based on the information on livestock activity at Fazenda Camaquã, which covers the project area, the emission values were obtained according to the group of animals, and then the total emissions and the average per hectare were calculated, considering the boundaries of the farm. We used data on emissions from grazing animals from a GHG survey carried out in 2021 for Fazenda Camaquã (the data can be shared with the verifier at a later date). The study estimated a total emission of 12,434.64  $t_{CO_2e}$ , which results in an average of 7.70  $t_{CO_2e/ha}$ . Table 38 shows a summary of the farm's emissions.

Table 38: Information on livestock farming on the Camaquã farm.

Livestock group	Population	Average weight (kg)	Total weight (kg)	Livestock emissions ( $t_{CO_2e}$ )
Beef cattle	594	415	246,510	12,154.93
Horse	16	450	7,200	14.35
Sheep	250	35	8,750	265.36
<b>Total</b>	<b>860</b>	<b>900</b>	<b>262,460</b>	<b>12,434.64</b>

- Ex Ante Estimated Net Actual Carbon Stock Changes in the Project Area

The results of the previous evaluations are summarized in Table 39.

Table 39: Ex ante estimated net carbon stock change in the Project Area under the project scenario.

Project year	Total Carbon Stock Decrease due to Unavoided Unplanned Deforestation		Total Ex Ante GHG Emissions due to Grazing Activities		Total Carbon Stock Change in the Project Case	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta\text{CUDdPA}_t$	$\Delta\text{CUDdPA}_t$	$\text{GHG-Eg}_t$	$\text{GHG-Eg}_t$	$\Delta\text{CPSPa}_t$	$\Delta\text{CPSPa}_t$
	t CO <sub>2</sub> e	t CO <sub>2</sub> e	t CO <sub>2</sub> e	t CO <sub>2</sub> e	t CO <sub>2</sub> e	t CO <sub>2</sub> e
2023	90,98	90,98	285,52	285,52	376,50	376,50
2024	90,95	181,93	275,58	561,10	366,53	743,03
2025	90,94	272,87	266,00	827,10	356,95	1.099,98
2026	90,96	363,83	256,78	1.083,88	347,74	1.447,71
2027	90,99	454,83	247,90	1.331,78	338,89	1.786,60
2028	91,05	545,88	239,34	1.571,12	330,39	2.117,00
2029	91,13	637,01	231,10	1.802,22	322,23	2.439,23
2030	91,23	728,24	223,16	2.025,37	314,39	2.753,61
2031	91,35	819,59	215,51	2.240,88	306,86	3.060,47
2032	91,48	911,07	208,14	2.449,02	299,62	3.360,09
2033	90,09	1.001,16	201,05	2.650,07	291,14	3.651,23
2034	88,77	1.089,93	194,21	2.844,28	282,97	3.934,21
2035	87,50	1.177,42	187,62	3.031,90	275,12	4.209,33
2036	86,29	1.263,72	181,28	3.213,18	267,57	4.476,90
2037	85,14	1.348,86	175,17	3.388,35	260,31	4.737,21
2038	84,04	1.432,90	169,28	3.557,63	253,32	4.990,53
2039	83,00	1.515,90	163,61	3.721,23	246,60	5.237,13
2040	82,00	1.597,90	158,14	3.879,38	240,14	5.477,27
2041	81,05	1.678,95	152,87	4.032,25	233,93	5.711,20
2042	80,15	1.759,10	147,80	4.180,05	227,95	5.939,15
2043	78,03	1.837,13	142,91	4.322,96	220,94	6.160,09
2044	75,98	1.913,11	138,20	4.461,16	214,18	6.374,27
2045	74,00	1.987,10	133,66	4.594,83	207,66	6.581,93
2046	72,08	2.059,19	129,29	4.724,11	201,37	6.783,30
2047	70,24	2.129,43	125,07	4.849,19	195,31	6.978,61
2048	68,45	2.197,88	121,01	4.970,20	189,47	7.168,08
2049	66,73	2.264,61	117,10	5.087,30	183,83	7.351,91
2050	65,07	2.329,68	113,33	5.200,63	178,40	7.530,31

2051	63,46	2.393,14	109,69	5.310,32	173,16	7.703,47
2052	61,91	2.455,06	106,19	5.416,51	168,10	7.871,57
2053	60,41	2.515,47	102,81	5.519,32	163,22	8.034,79
2054	58,96	2.574,43	99,56	5.618,88	158,52	8.193,31
2055	57,56	2.631,99	96,42	5.715,30	153,98	8.347,29
2056	56,21	2.688,20	93,40	5.808,70	149,61	8.496,90
2057	54,90	2.743,10	90,48	5.899,18	145,38	8.642,28
2058	53,64	2.796,73	87,67	5.986,86	141,31	8.783,59
2059	52,41	2.849,15	84,96	6.071,82	137,38	8.920,97
2060	51,23	2.900,38	82,35	6.154,18	133,58	9.054,55
2061	50,09	2.950,46	79,84	6.234,01	129,92	9.184,48
2062	48,98	2.999,45	77,41	6.311,42	126,39	9.310,87

### 4.3 Leakage Emissions

Activities that could lead to deforestation within the project area in the baseline scenario may be displaced outside the property boundaries due to the implementation of VCS AFOLU project actions. To conservatively calculate this leakage, the estimated change in the carbon stock of the project area was multiplied by a Displacement Leakage Factor (DLF = 0.02), which represents the percentage of deforestation (2%) that is expected to be displaced outside the project boundaries. As the main agent of deforestation, the legal owner of the land, has the opportunity to participate directly in activities within the project area, and considering that the main characteristic of the project is to continue to generate an income linked conservation, the risk of displacement of deforestation is minimized, which leads to the conclusion that the DLF value used is a conservative estimate. Table 40 shows the estimated total leakage due to the displacement of unplanned deforestation from the project area to the leakage zone.

Table 40: Ex ante estimated total leakage due to displaced deforestation.

Project year	Total Ex Ante Decrease in Carbon Stocks due to Displaced Deforestation		Total Net Carbon Stock Change due to Leakage	
	Annual	Cumulative	Annual	Cumulative
	$\Delta\text{CADLKt}$	$\Delta\text{CADLK}$	$\Delta\text{CLKt}$	$\Delta\text{CLK}$
	t CO <sub>2</sub> e	t CO <sub>2</sub> e	t CO <sub>2</sub> e	t CO <sub>2</sub> e
2023	90,98	90,98	90,98	90,98
2024	90,95	181,93	90,95	181,93
2025	90,94	272,87	90,94	272,87

2026	90,96	363,83	90,96	363,83
2027	90,99	454,83	90,99	454,83
2028	91,05	545,88	91,05	545,88
2029	91,13	637,01	91,13	637,01
2030	91,23	728,24	91,23	728,24
2031	91,35	819,59	91,35	819,59
2032	91,48	911,07	91,48	911,07
2033	90,09	1.001,16	90,09	1.001,16
2034	88,77	1.089,93	88,77	1.089,93
2035	87,50	1.177,42	87,50	1.177,42
2036	86,29	1.263,72	86,29	1.263,72
2037	85,14	1.348,86	85,14	1.348,86
2038	84,04	1.432,90	84,04	1.432,90
2039	83,00	1.515,90	83,00	1.515,90
2040	82,00	1.597,90	82,00	1.597,90
2041	81,05	1.678,95	81,05	1.678,95
2042	80,15	1.759,10	80,15	1.759,10
2043	78,03	1.837,13	78,03	1.837,13
2044	75,98	1.913,11	75,98	1.913,11
2045	74,00	1.987,10	74,00	1.987,10
2046	72,08	2.059,19	72,08	2.059,19
2047	70,24	2.129,43	70,24	2.129,43
2048	68,45	2.197,88	68,45	2.197,88
2049	66,73	2.264,61	66,73	2.264,61
2050	65,07	2.329,68	65,07	2.329,68
2051	63,46	2.393,14	63,46	2.393,14
2052	61,91	2.455,06	61,91	2.455,06
2053	60,41	2.515,47	60,41	2.515,47
2054	58,96	2.574,43	58,96	2.574,43
2055	57,56	2.631,99	57,56	2.631,99
2056	56,21	2.688,20	56,21	2.688,20
2057	54,90	2.743,10	54,90	2.743,10
2058	53,64	2.796,73	53,64	2.796,73
2059	52,41	2.849,15	52,41	2.849,15
2060	51,23	2.900,38	51,23	2.900,38
2061	50,09	2.950,46	50,09	2.950,46
2062	48,98	2.999,45	48,98	2.999,45

#### 4.4 Estimated GHG Emission Reductions and Carbon Dioxide Removals

The total net reductions in greenhouse gas emissions from the AUD project activity can be calculated as follows:

$$\Delta REDD_t = \Delta CBSLPA_t - \Delta CPSPA_t - \Delta CLK_t \quad (8)$$

Where:

$\Delta REDD_t$  = Ex ante estimated net anthropogenic GHG emission reduction attributable to the AUD project activity at year t (t CO<sub>2e</sub>)

$\Delta CBSLPA_t$  = Sum of baseline carbon stock changes in the project area at year t (t CO<sub>2e</sub>)

$\Delta CPSPA_t$  = Sum of ex ante estimated actual carbon stock changes in the project area at year t (t CO<sub>2e</sub>)

$\Delta CLK_t$  = Sum of ex ante estimated leakage net carbon stock changes at year t (t CO<sub>2e</sub>) t = 1, 2, 3, ..., T, a year of the proposed project crediting period (dimensionless)

- **Calculation of Verified Carbon Units (VCUs)**

The following equation was used to estimate the number of VCUs for the project's credit period:

$$VCU_t = \Delta REDD_t - VBC_t \quad (9)$$

$$VBC_t = (\Delta CBSLPA_t - \Delta CPSPA_t) * RF_t \quad (10)$$

Where:

$VCU_t$  = Number of potential Verified Carbon Units at year t (t CO<sub>2e</sub>)

$\Delta REDD_t$  = Ex ante estimated net anthropogenic GHG emission reductions attributable to the AUD project activity at year t (t CO<sub>2e/ha</sub>)

$VBC_t$  = Number of buffer credits deposited in the VCS AFOLU non-permanence buffer at year t (t CO<sub>2e</sub>)

$\Delta CBSLPA_t$  = Sum of baseline carbon stock changes in the project area at year t (t CO<sub>2e</sub>)

$\Delta CPSPA_t$  = Sum of ex ante estimated actual carbon stock changes in the project area at year t (t CO<sub>2e/ha</sub>)

$RF_t$  = Risk factor used to calculate buffer credits (%)

t = 1, 2, 3, ..., T, a year of the proposed project crediting period (dimensionless)

The buffer retention percentage ( $RF_t$ ) is defined by the project's overall risk rating, which results from a prior assessment and the sum of the associated risk factors (internal, external and natural), obtained using the T-BAR tool. As a conservative measure, a value of 12% was adopted. Table 41 shows the results of the calculations for each variable related to the process of estimating reductions in GHG emissions and the potential for generating verified carbon units.

Table 41: *Ex ante* estimated net GHG emission reductions and Verified Carbon Units (VCUs).

Project year t	Baseline Carbon Stock Changes		Ex Ante Project Carbon Stock Changes		Ex Ante Leakage Carbon Stock Changes		Ex Ante Net Anthropogenic GHG Emission Reductions		Ex Ante Buffer Credits		Ex Ante Tradable VCUs	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
	$\Delta CBSLPA_t$	$\Delta CBSLPA$	$\Delta CPSPA_t$	$\Delta CPSPA$	$\Delta CLK_t$	$\Delta CLK$	$\Delta REDD_t$	$\Delta REDD$	VBC <sub>t</sub>	VBC	VCU <sub>t</sub>	VCU
	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>	t CO <sub>2e</sub>
2023	4.549,14	4.549,14	376,50	376,50	90,98	90,98	4.081,65	4.081,65	500,72	500,72	3.580,94	3.580,94
2024	4.547,51	9.096,64	366,53	743,03	90,95	181,93	4.090,03	8.171,68	501,72	1.002,43	3.588,31	7.169,25
2025	4.547,09	13.643,73	356,95	1.099,98	90,94	272,87	4.099,20	12.270,88	502,82	1.505,25	3.596,39	10.765,63
2026	4.547,84	18.191,57	347,74	1.447,71	90,96	363,83	4.109,15	16.380,03	504,01	2.009,26	3.605,13	14.370,76
2027	4.549,70	22.741,28	338,89	1.786,60	90,99	454,83	4.119,82	20.499,85	505,30	2.514,56	3.614,52	17.985,29
2028	4.552,63	27.293,91	330,39	2.117,00	91,05	545,88	4.131,19	24.631,04	506,67	3.021,23	3.624,52	21.609,81
2029	4.556,58	31.850,49	322,23	2.439,23	91,13	637,01	4.143,22	28.774,26	508,12	3.529,35	3.635,10	25.244,90
2030	4.561,50	36.411,99	314,39	2.753,61	91,23	728,24	4.155,88	32.930,14	509,65	4.039,01	3.646,23	28.891,13
2031	4.567,35	40.979,34	306,86	3.060,47	91,35	819,59	4.169,15	37.099,28	511,26	4.550,26	3.657,89	32.549,02
2032	4.574,08	45.553,42	299,62	3.360,09	91,48	911,07	4.182,98	41.282,26	512,94	5.063,20	3.670,04	36.219,06
2033	4.504,59	50.058,01	291,14	3.651,23	90,09	1.001,16	4.123,36	45.405,62	505,61	5.568,81	3.617,75	39.836,81
2034	4.438,25	54.496,27	282,97	3.934,21	88,77	1.089,93	4.066,51	49.472,13	498,63	6.067,45	3.567,88	43.404,69
2035	4.374,95	58.871,22	275,12	4.209,33	87,50	1.177,42	4.012,33	53.484,47	491,98	6.559,43	3.520,35	46.925,04
2036	4.314,58	63.185,79	267,57	4.476,90	86,29	1.263,72	3.960,71	57.445,18	485,64	7.045,07	3.475,07	50.400,11
2037	4.257,00	67.442,80	260,31	4.737,21	85,14	1.348,86	3.911,56	61.356,74	479,60	7.524,67	3.431,95	53.832,07
2038	4.202,13	71.644,93	253,32	4.990,53	84,04	1.432,90	3.864,77	65.221,50	473,86	7.998,53	3.390,91	57.222,98
2039	4.149,86	75.794,79	246,60	5.237,13	83,00	1.515,90	3.820,26	69.041,76	468,39	8.466,92	3.351,87	60.574,84
2040	4.100,07	79.894,86	240,14	5.477,27	82,00	1.597,90	3.777,93	72.819,69	463,19	8.930,11	3.314,74	63.889,58
2041	4.052,69	83.947,55	233,93	5.711,20	81,05	1.678,95	3.737,71	76.557,40	458,25	9.388,36	3.279,46	67.169,03
2042	4.007,61	87.955,16	227,95	5.939,15	80,15	1.759,10	3.699,50	80.256,90	453,56	9.841,92	3.245,95	70.414,98

2043	3.901,38	91.856,53	220,94	6.160,09	78,03	1.837,13	3.602,41	83.859,31	441,65	10.283,57	3.160,76	73.575,74
2044	3.798,82	95.655,35	214,18	6.374,27	75,98	1.913,11	3.508,67	87.367,98	430,16	10.713,73	3.078,51	76.654,25
2045	3.699,81	99.355,16	207,66	6.581,93	74,00	1.987,10	3.418,15	90.786,13	419,06	11.132,79	2.999,09	79.653,34
2046	3.604,20	102.959,36	201,37	6.783,30	72,08	2.059,19	3.330,75	94.116,87	408,34	11.541,13	2.922,41	82.575,75
2047	3.511,89	106.471,25	195,31	6.978,61	70,24	2.129,43	3.246,34	97.363,21	397,99	11.939,12	2.848,35	85.424,10
2048	3.422,74	109.893,99	189,47	7.168,08	68,45	2.197,88	3.164,81	100.528,03	387,99	12.327,11	2.776,82	88.200,92
2049	3.336,64	113.230,62	183,83	7.351,91	66,73	2.264,61	3.086,07	103.614,10	378,34	12.705,45	2.707,73	90.908,65
2050	3.253,47	116.484,09	178,40	7.530,31	65,07	2.329,68	3.010,00	106.624,10	369,01	13.074,45	2.641,00	93.549,65
2051	3.173,14	119.657,23	173,16	7.703,47	63,46	2.393,14	2.936,52	109.560,62	360,00	13.434,45	2.576,52	96.126,17
2052	3.095,53	122.752,76	168,10	7.871,57	61,91	2.455,06	2.865,52	112.426,14	351,29	13.785,74	2.514,23	98.640,39
2053	3.020,54	125.773,30	163,22	8.034,79	60,41	2.515,47	2.796,91	115.223,04	342,88	14.128,62	2.454,03	101.094,42
2054	2.948,09	128.721,39	158,52	8.193,31	58,96	2.574,43	2.730,61	117.953,65	334,75	14.463,37	2.395,86	103.490,28
2055	2.878,07	131.599,46	153,98	8.347,29	57,56	2.631,99	2.666,53	120.620,18	326,89	14.790,26	2.339,64	105.829,92
2056	2.810,41	134.409,87	149,61	8.496,90	56,21	2.688,20	2.604,59	123.224,77	319,30	15.109,56	2.285,30	108.115,22
2057	2.745,00	137.154,87	145,38	8.642,28	54,90	2.743,10	2.544,72	125.769,49	311,95	15.421,51	2.232,76	110.347,98
2058	2.681,77	139.836,64	141,31	8.783,59	53,64	2.796,73	2.486,83	128.256,32	304,86	15.726,37	2.181,97	112.529,95
2059	2.620,64	142.457,28	137,38	8.920,97	52,41	2.849,15	2.430,85	130.687,17	297,99	16.024,36	2.132,86	114.662,81
2060	2.561,54	145.018,83	133,58	9.054,55	51,23	2.900,38	2.376,73	133.063,90	291,35	16.315,71	2.085,37	116.748,18
2061	2.504,39	147.523,21	129,92	9.184,48	50,09	2.950,46	2.324,38	135.388,27	284,94	16.600,65	2.039,44	118.787,62
2062	2.449,11	149.972,32	126,39	9.310,87	48,98	2.999,45	2.273,74	137.662,01	278,73	16.879,37	1.995,01	120.782,64

## 5 MONITORING

### 5.1 Data and Parameters Available at Validation

The information presented in the following tables corresponds to all the data and parameters that have been defined or are accessible for consultation during validation. The values provided are used to quantify the reductions and removals estimated for the project crediting period in Section 4 above.

<b>Data / Parameter</b>	CF
<b>Data unit</b>	t C/ t d.m.
<b>Description</b>	Carbon fraction in biomass
<b>Source of data</b>	Default value - IPCC, 2006
<b>Value applied</b>	0.47
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	We are not aware of a high-impact regional scientific source that offers more precise estimates. What does exist are studies focused on the Amazon and Atlantic Rainforest biomes, and due to the great differences between these types of vegetation, it was decided to maintain the IPCC's international conversion standard.
<b>Purpose of data</b>	It relates to all calculations in the baseline scenario that include plant biomass.
<b>Comments</b>	If new and more accurate data on the carbon fraction in biomass becomes available in the future, especially relation to local studies, this data can be used for calculations.

<b>Data / Parameter</b>	Ctotal
<b>Data unit</b>	t CO <sub>2</sub> e/ha
<b>Description</b>	Average carbon stock per hectare in all accounted carbon pools in class icl
<b>Source of data</b>	Local data collected in sample plots
<b>Value applied</b>	See Tables in Section 4.1
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	In order to determine the carbon stock in the main reservoirs included in the managed area, six temporary forest inventory plots were established, distributed systematically ( $\pm 1$ km distance between points) in order to facilitate navigation in the field

and to include the two locally defined vegetation types: seasonal forest (three plots) and shrub-steppe (3 plots).

#### Seasonal forest

The aerial part biomass inventory followed the REDD+ methodology according to the FAO (Hewson et al., 2014)<sup>85</sup>, with adjustments made by the authors. Two nested circular plots were set up, each with a total area of 125 m<sup>2</sup>. In the inner circle, with a radius of 2.82 m, species with DBH (circumference at breast height) between 5 and 15 cm measured; in the outer circle, with a radius of 5.64 m, all individuals with  $\geq 15$  cm were measured. In each plot, the species are identified and their DBH and height are recorded. The trees' DBH was measured with a tape measure and their height was recorded using a Hagl f hypsometer. Once this information was available, biomass (in t C/ha) was obtained using the allometric equation model from Chave et al., 2014<sup>86</sup> ( $AGB = 0.0673 * (\rho d^2 h)^{0.976}$ ), where AGB is above-ground biomass (kg),  $\rho$  is wood density (g.cm<sup>3</sup>), d is diameter (cm) and h is height (m).

For biomass, composed mainly of living roots, the estimate was made based on the biomass of the aerial part, using a ratio of 0.24 for the Seasonal Deciduous Forest physiognomy in the Pampa biome, as established in Table 27 of the reference report of the "Fourth National Inventory of Anthropogenic Greenhouse Gas Emissions and Removals"<sup>87</sup>.

Soil organic carbon was quantified by taking samples up to 40 cm deep in open trenches in the center of each forest inventory plot. Undeformed samples with a known volume (obtained by volumetric ring) were used to determine the mass of the sample and the volume of the cylinder, which made it possible to calculate the density of the soil at the different depths; while soil analysis made it possible to determine the total content of available organic carbon. Collections followed good practice procedures and all analyses were carried out in a specialized laboratory at the Federal University of Santa Maria (UFSM). Soil organic carbon estimates followed the parameters established in VMD0004.

#### Arabian steppe

For the aerial biomass inventory, the same arrangement of nested circular plots used for the Seasonal Forest class was maintained, with the only adaptation being the diameter, which became the base diameter (DB30) measured at 30 cm from the ground, according to the methodology proposed by Guimar es (2020)<sup>88</sup> for Cerrado vegetation of the wooded Savannah type. Although we understand the particularities that differentiate Cerrado vegetation from Pampa vegetation, it is believed that this type of vegetation is closer to what we are defining as Steppe-arborea in this project. Shoot biomass was estimated using the allometric equation  $y = [(409.0469739 * v^{0.97545}) * 1.17] / 10^6$ , where y represents

<sup>85</sup> Hewson et al, 2014. Available at: <https://cambioclimatico.ineter.gov.br/bibliografia/Mitigacion%20del%20cambio%20climatico/manual-MRV-REDD-version-1%20miti.pdf>

<sup>86</sup> Chaves et al., 2014. Available at: <https://doi.org/10.1111/gcb.12629>

<sup>87</sup> 4CN, 2020. Available at: <https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/publicacoes/relatorios-de-referencia-sectorial/pdf/inventario4/lulucf-jan21.zip>

<sup>88</sup> Guimar es, 2020. Available at: <https://repositorio.bc.ufg.br/tede/items/81eb95e0-5fb7-4880-99cd-1812edb0f4f5/full>

	<p>the above-ground tree biomass (t) and v is the cylindrical volume (dm<sup>3</sup>) calculated from the base diameter (measured at 0.30 m height).</p> <p>Obtaining data on below-ground biomass followed the same approach described for the seasonal forest, but with a ratio of 0.28 for the steppe-arboreal phytophysiognomy of the Pampa biome, as established in Table 27 of the reference report of the "Fourth National Inventory of Anthropogenic Greenhouse Gas Emissions and Removals".</p> <p>Soil organic carbon was quantified by taking samples up to 40 cm deep in open trenches in the center of each forest inventory plot. Undeformed samples with a known volume (obtained by volumetric ring) were used to determine the mass of the sample and the volume of the cylinder, which made it possible to calculate the density of the soil at the different depths; while soil analysis made it possible to determine the total content of available organic carbon. Collections followed good practice procedures and all analyses were carried out in a specialized laboratory at the Federal University of Santa Maria (UFSM). Soil organic carbon estimates followed the parameters established in VMD0004.</p>
<b>Purpose of data</b>	Used to calculate baseline emissions from deforestation in the baseline scenario.
<b>Comments</b>	N/A

<b>Data / Parameter</b>	$\Delta\text{CBSLPAt}$
<b>Data unit</b>	t CO <sub>2</sub> e
<b>Description</b>	Total baseline carbon stock change within the project area at year t
<b>Source of data</b>	Calculated
<b>Value applied</b>	Tables in Section 4
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	<p>The total change in carbon stock from the baseline in the project area in year t is calculated as follows:</p> $\Delta\text{CBSLPAt} = \Delta\text{CabBSLPAt} + \Delta\text{CbbBSLPAt} + \Delta\text{CSOCBSLPAt}$ <p>Where:</p> <p><math>\Delta\text{CBSLPAt}</math> = Total baseline carbon stock changes in the project area at year t; tCO<sub>2</sub>e</p> <p><math>\Delta\text{CabBSLPAt}</math> = Total baseline carbon stock change for the aboveground biomass pool in the project area for initial forest class at year t; tCO<sub>2</sub>e</p> <p><math>\Delta\text{CbbBSLPAt}</math> = Total baseline carbon stock change for the belowground biomass pool in the project area for initial forest class at year t; tCO<sub>2</sub>e</p> <p><math>\Delta\text{CSOCBSLPAt}</math> = Total baseline carbon stock change for Soil organic carbon pool in the project area for initial forest class at year t; tCO<sub>2</sub>e</p>
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Comments</b>	N/A

<b>Data / Parameter</b>	EI
<b>Data unit</b>	%
<b>Description</b>	Ex ante estimated Effectiveness Index
<b>Source of data</b>	Conservative value for the VCS methodology
<b>Value applied</b>	98
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	<p>Although the project aims to avoid deforestation, some unplanned deforestation may occur in the project area. To allow for ex ante projections, a conservative and realistic assumption was made about the effectiveness of the activities proposed in the project, with an estimated Effectiveness Index (EI) ranging from 0% (no effectiveness) to 100% (maximum effectiveness).</p> <p>As the main agent of deforestation, the legal owner of the land, has the opportunity to participate directly in activities within the project area, and considering that the main feature of the project is to continue to generate an income linked to conservation, the risk of displacement of deforestation is minimized, which leads to the conclusion that the EI value used is a conservative estimate and is in line with best practice guidelines.</p>
<b>Purpose of data</b>	The estimated EI value was used to adjust the baseline projections by multiplying them by the factor (1 - EI), resulting in the estimated ex ante unplanned deforestation emissions for the project.
<b>Comments</b>	Ex-post monitoring of the project area should be carried out to assess the rate of deforestation and the project's emissions. This parameter will be reviewed each time the baseline is renewed (10 years).

<b>Data / Parameter</b>	DLF
<b>Data unit</b>	%
<b>Description</b>	Displacement Leakage Factor
<b>Source of data</b>	Conservative value for the VCS methodology
<b>Value applied</b>	2
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	<p>Activities that could lead to deforestation within the project area in the baseline scenario may be shifted outside the property boundaries due to the implementation of VCS AFOLU project actions. As the main agent of deforestation, the legal owner of the land, has the opportunity to participate directly in activities within the project area, and considering that the main feature of the project is to continue to generate an income linked to conservation, the risk of displacement of deforestation is minimized, which leads to the conclusion that the DLF value used is a conservative estimate and is in line with good practice guidelines.</p>
<b>Purpose of data</b>	The ex-ante estimate of total leakage due to displaced deforestation was estimated by multiplying the change in the baseline carbon stock in the project area by the DLF, which represents the percentage of

	deforestation that is expected to be moved outside the project boundaries.
<b>Comments</b>	This parameter will be reviewed every time the baseline is renewed (10 years).

<b>Data / Parameter</b>	Rf1
<b>Data unit</b>	%
<b>Description</b>	Risk factor used to calculate buffer credits
<b>Source of data</b>	A conservative value was adopted, established by the project's overall risk rating
<b>Value applied</b>	12
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	This parameter reflects the project's non-permanence risk rating, which was used to define the amount of buffer credits to be deposited in the AFOLU joint reserve account.
<b>Purpose of data</b>	Requirement as established by VM0015 v1.2
<b>Comments</b>	N/A

## 5.2 Data and Parameters Monitored

The information presented in the tables below corresponds all the data and parameters that will be monitored during the project crediting period. The values provided are used to quantify the reductions and removals estimated for project crediting period in Section 4 above.

<b>Data / Parameter</b>	Cabicl
<b>Data unit</b>	t CO2e/ha
<b>Description</b>	Average carbon stock per hectare in above-ground biomass carbon pool of class icl
<b>Source of data</b>	Obtained from data measured in the field
<b>Description of measurement methods and procedures to be applied</b>	To estimate the carbon stock in the above-ground biomass, primary data obtained in the field forest inventories is used. The project uses temporary sampling plots, combined with appropriate allometric equations for each type of vegetation defined (Seasonal Forest and Steppe). More information on the methodology is available in the previous section.

<b>Frequency of monitoring/recording</b>	New assessments are made at each renewal of the baseline validity period, when there is a monitoring report, or whenever information needs to be updated.
<b>Value applied</b>	See Tables in Section 4
<b>Monitoring equipment</b>	No monitoring equipment is used to determine this parameter.
<b>QA/QC procedures to be applied</b>	Complies with the requirements of VM0015 v1.2
<b>Purpose of data</b>	This parameter is used to calculate the carbon stocks per hectare of the initial forest classes existing in the reference region, the project area and the leakage zone. It is also used to calculate the emission factors for the land use change categories and, subsequently, to estimate the change in the baseline carbon stock in the selected carbon pools in the project area and the leakage zone.
<b>Calculation method</b>	Sampling plots, combined with appropriate allometric equations for each vegetation type.
<b>Comments</b>	N/A

<b>Data / Parameter</b>	Cbbicl
<b>Data unit</b>	t CO <sub>2</sub> e/ha
<b>Description</b>	Average carbon stock per hectare in below-ground biomass carbon pool of class icl
<b>Source of data</b>	Obtained indirectly, based on data collected in the field
<b>Description of measurement methods and procedures to be applied</b>	Obtaining data on below-ground biomass is costly, from collection in the field to analysis of the material in the laboratory, requiring more sampling time and a large financial investment. For this reason, below-ground biomass will be estimated based on the results obtained for above-ground tree biomass (described above), using a specific root-to-shoot ratio for each vegetation type defined. More information on the methodology is available in the previous section.
<b>Frequency of monitoring/recording</b>	New assessments are made at each renewal of the baseline validity period, when there is a monitoring report, or whenever information needs to be updated.
<b>Value applied</b>	See Tables in Section 4
<b>Monitoring equipment</b>	No monitoring equipment is used to determine this parameter.
<b>QA/QC procedures to be applied</b>	Complies with the requirements of VM0015 v1.2

<b>Purpose of data</b>	This parameter is used to calculate the carbon stocks per hectare of the initial forest classes existing in the reference region, the project area and the leakage zone. It is also used to calculate the emission factors for the land use change categories and, subsequently, to estimate the change in the baseline carbon stock in the selected carbon pools in the project area and the leakage zone.
<b>Calculation method</b>	Indirect estimate, using a specific root-to-shoot ratio for each type of vegetation in the Pampa (0.24 for Seasonal Forest and 0.28 for Steppe).
<b>Comments</b>	N/A

<b>Data / Parameter</b>	CSOCicl
<b>Data unit</b>	t CO <sub>2</sub> e/ha
<b>Description</b>	Average carbon stock per hectare in soil organic carbon pool of class icl
<b>Source of data</b>	Obtained from data collected in the field
<b>Description of measurement methods and procedures to be applied</b>	In order to quantify soil organic carbon, one of the main reservoirs of the Pampa biome, soil samples up to 40 cm deep were collected from open trenches in the center each forest inventory plot, taking into account the different types of vegetation present in the project area. Collections followed good practice procedures and all the necessary analyses were carried out in a specialized laboratory at the Federal University of Santa Maria (UFSM). Soil organic carbon estimates followed the parameters established in VMD0004. More information on the methodology is available in the previous section.
<b>Frequency of monitoring/recording</b>	New assessments are made at each renewal of the baseline validity period, when there is a monitoring report, or whenever information needs to be updated.
<b>Value applied</b>	See Tables in Section 4
<b>Monitoring equipment</b>	No monitoring equipment is used to determine this parameter.
<b>QA/QC procedures to be applied</b>	Soil organic carbon stock estimates followed the parameters established in VMD0004.
<b>Purpose of data</b>	This parameter is used to calculate the carbon stocks per hectare of the initial forest classes existing in the reference region, the project area and the leakage zone. It is also used to calculate the emission factors for the land use change categories and, subsequently, to estimate the change in the baseline carbon stock in the selected carbon pools in the project area and the leakage zone.
<b>Calculation method</b>	According to VMD0004.
<b>Comments</b>	N/A

<b>Data / Parameter</b>	ABSLRRt
<b>Data unit</b>	ha
<b>Description</b>	Annual area of baseline deforestation in stratum i within the reference region at year t
<b>Source of data</b>	Calculated based on the MapBiomass "Deforestation and Secondary Vegetation (Collection 9)" map, generated for the reference region, according to the year chosen.
<b>Description of measurement methods and procedures to be applied</b>	With access to the deforestation maps from the most recent MapBiomass collections, a raster file is exported in GeoTIFF format, which represents images and geographical information using a grid of pixels. Deforestation events are defined based on an analysis of the trajectory of each pixel, using persistence rules related to each of the classes involving vegetation suppression. All MapBiomass thematic maps are produced from the pixel-by-pixel classification of Landsat images with a spatial resolution of 30m. MapBiomass data is public, open and free under the CC-BY-SA license, and has an overall accuracy of 87.07% for the Pampa area, exceeding the minimum accuracy of 80% required by VM0015. More information on the MapBiomass methodology can be found at: <a href="https://brasil.mapbiomas.org/visao-geral-da-metodologia/">https://brasil.mapbiomas.org/visao-geral-da-metodologia/</a> .
<b>Frequency of monitoring/recording</b>	New assessments are made at each renewal of the baseline validity period, when there is a monitoring report, or whenever information needs to be updated.
<b>Value applied</b>	See Tables in Section 4
<b>Monitoring equipment</b>	No equipment is used
<b>QA/QC procedures to be applied</b>	Best practices in remote sensing
<b>Purpose of data</b>	This parameter is used to calculate baseline emissions, providing ex ante and ex post values of the area deforested by forest class within the reference region.
<b>Calculation method</b>	Analysis of satellite images and maps
<b>Comments</b>	N/A

<b>Data / Parameter</b>	ABSLPAT
<b>Data unit</b>	ha
<b>Description</b>	Annual area of baseline deforestation in stratum i within the Project Area at year t
<b>Source of data</b>	Calculated based on the MapBiomass map of areas of "Deforestation and Secondary Vegetation (Collection 9)", generated for the project area, according to the year chosen.

<b>Description of measurement methods and procedures to be applied</b>	Deforestation events will be identified by analyzing the trajectory of each pixel, as detailed above for the reference region. In addition, changes in vegetation cover caused by deforestation events or conversion of native vegetation will be monitored by analyzing satellite images from the 'MapBiomass use and cover' platform and by consulting the 'MapBiomass Alert' platform, a system for validating and refining deforestation alerts using high-resolution satellite images (Planet 3.7m).
<b>Frequency of monitoring/recording</b>	New assessments are made at each renewal of the baseline validity period, when there is a monitoring report, or whenever information needs to be updated.
<b>Value applied</b>	See Tables in Section 4
<b>Monitoring equipment</b>	No equipment is used
<b>QA/QC procedures to be applied</b>	Best practices in remote sensing
<b>Purpose of data</b>	This parameter is used to calculate baseline emissions, providing ex ante and ex post values of the area deforested by forest class within the project area.
<b>Calculation method</b>	Analysis of satellite images and maps
<b>Comments</b>	N/A

<b>Data / Parameter</b>	ABSLKt
<b>Data unit</b>	ha
<b>Description</b>	Annual area of baseline deforestation in stratum i within the Leakage Belt at year t
<b>Source of data</b>	Calculated based on the MapBiomass map of "Deforestation and Secondary Vegetation (Collection 9)" areas generated for the leakage zone, according to year chosen.
<b>Description of measurement methods and procedures to be applied</b>	Deforestation events will be identified by analyzing the trajectory of each pixel, as detailed above for the reference region. In addition, changes in vegetation cover caused by deforestation events or conversion of native vegetation will be monitored by analyzing satellite images from the 'MapBiomass use and cover' platform and by consulting the 'MapBiomass Alert' platform, a system for validating and refining deforestation alerts using high-resolution satellite images (Planet 3.7m).
<b>Frequency of monitoring/recording</b>	New assessments are made at each renewal of baseline validity period, when there is a monitoring report, or whenever information needs to be updated.
<b>Value applied</b>	See Tables in Section 4

<b>Monitoring equipment</b>	No equipment is used
<b>QA/QC procedures to be applied</b>	Best practices in remote sensing
<b>Purpose of data</b>	This parameter is used to calculate baseline emissions, providing ex ante and ex post values of the area cleared by forest class within the leakage zone.
<b>Calculation method</b>	Analysis of satellite images and maps
<b>Comments</b>	N/A

### 5.3 Monitoring Plan

The purpose of this monitoring plan is to explain how the tasks will be carried out over the course of the carbon project. To this end, subsections have been created to make it easier to understand the process as a whole.

- **Organizational structure**

The project proponent, Coomysa - Cooperativa Mista Santa Bárbara do Sul Ltda., is responsible for the administration, management and marketing of the Verified Carbon Credits (VCUs), in accordance with the agreement between the parties. In addition, Coomysa is responsible for keeping all the necessary documentation for the project in compliance. It is also responsible for implementing and/or maintaining the project's forestry management, as well as raising awareness among landowners about the importance of conserving the Pampa's native vegetation and its associated benefits. To this end, the project has a partnership with the Federal University of Santa Maria (UFSM), which plays a key role in achieving the expected results. Coomysa, together with the main conversion agents, the legal owners of the land, are responsible for carrying out (or will have to hire third parties to do so) the actions monitoring via satellite images, surveillance and territorial patrolling, maintenance of firebreaks to prevent fires, expansion of forest inventories and installation of educational signs. They are also responsible for strategic decisions related to the effectiveness of environmental benefits, such as monitoring and recording local species of fauna and flora, as well as environmental education activities to strengthen engagement with resident employees, including training on fire prevention and identification of species of relevant ecological interest, such as the Pampean pampas cat (*Leopardus munoai*) and the stone lizard (*Homonota uruguayensis*), the only lizard native to Rio Grande do Sul, restricted to the Pampa region.

- **Baseline review**

The baseline will be updated every 10 years or whenever new regulatory requirements are published. During the review, information will be collected on the agents, factors and underlying causes of deforestation in the reference region, with the aim of improving future projections. Areas that have already received credits for avoided deforestation in previous periods will be excluded from future projections, ensuring that they are not credited again. Baseline monitoring will follow the VM0015 v1.2 methodology, or the latest applicable version, ensuring accuracy and compliance with the required standards.

- **Data collection and management system**

#### # Monitoring deforestation and project emissions

Changes in vegetation cover due to unplanned deforestation are monitored through periodic assessments of satellite images obtained from the MapBiomas platform. Emissions from deforestation are estimated considering the area of forest loss identified and the average stock of forest carbon per unit area. The project boundary, as established in the PD, will act as the "initial reference map of forest cover", against which changes in forest cover will be analyzed during each monitoring cycle. The resulting classified image is compared with the previous one to identify changes in forest cover during the monitoring cycle, and is then adopted as the new reference map for the next monitoring interval. In this way, the forest reference map is updated with each monitoring event.

#### # Monitoring natural disturbances and catastrophic events

Carbon stock losses in the project area caused by natural disturbances, such as forest fires or other catastrophic events, will be estimated immediately after the event. If the affected area has already generated VCUs in previous verifications, the total net change in carbon stocks and GHG emissions will be assessed, and a corresponding amount of VCUs will be canceled from the VCS buffer. In the specific case of forest fires, non-CO2 emissions will only be accounted for when they are significant, and the project proponent must inform Verra immediately after identifying any potential loss event, ensuring the appropriate updates in the project reports.

### # Leak monitoring

Deforestation within the leakage zone can be considered leakage from activity displacement due to the implementation of the VCS AFOLU project. This zone will be monitored in the same way as the project area. The latest VCS guidelines on the subject will be applied. However, if there is clear evidence that the conversion in the leakage zone is the result of deforestation agents unrelated to the project, the deforestation detected will not be attributed to the project activity and will therefore not be considered leakage.

### # Updating carbon stock estimates

Carbon stocks in the different pools considered (biomass, below-ground biomass and soil organic carbon) will be estimated whenever the baseline validity period is renewed (initially scheduled to occur every 10 years), when a monitoring report needs to be submitted, or whenever information provided needs to be updated. The first field survey took place in December 2024, covering data on biomass and soil organic carbon in temporary forest inventory plots (methodological details are described in section 5.1). Studies of this kind ensure the credibility of the data used and will continue to be carried out in the future to update carbon stock estimates. Figures 26, 27, 28, 29, 30 and 31 illustrate the practice being carried out.

### # Methods for obtaining, recording, analyzing and reporting data on the monitored parameters

All data sources, documents, maps and records generated during the  
The records of the project implementation will be stored securely, kept in the cloud under the management of Coomysa, and will be available for inspection by VCS verifiers during the verification/validation process. Coomysa will hold the authority to carry out the recording, monitoring, measuring and reporting (or may contract a third party to carry out these activities).

Figure 26: Moving the team to the field.



Figure 27: Representation of the understory of the two types of vegetation described in this project.  
a) Seasonal forest; b) Steppe.



Figure 28: Forest survey in circular temporary plots, collecting data on species, DBH and tree height.



Figure 29: Trenches opened in the center of each forest survey plot.



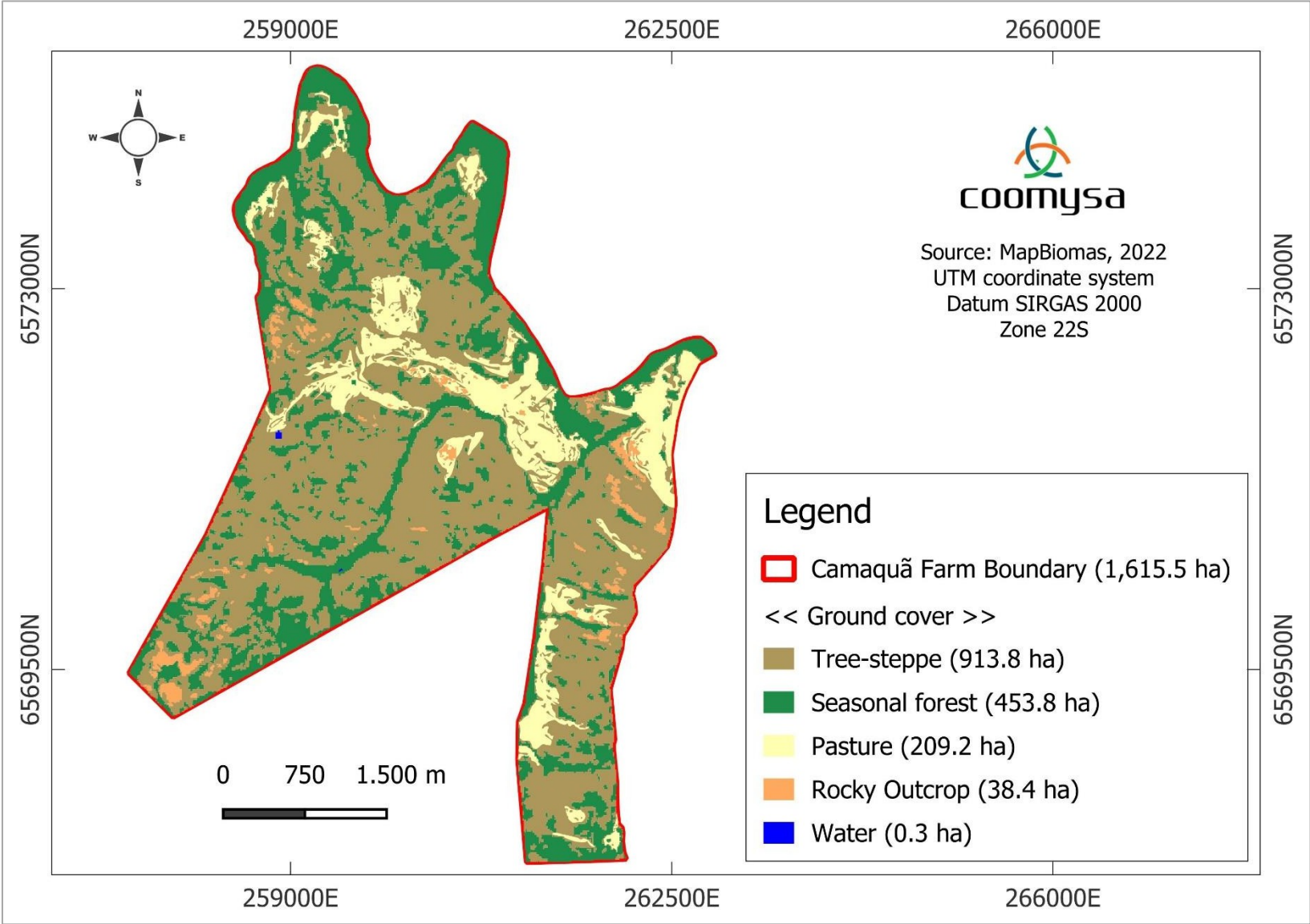
Figure 30: Soil sampled at various depths for analysis of total carbon content in the laboratory.



Figure 31: Collection of undeformed soil samples using the volumetric ring method.



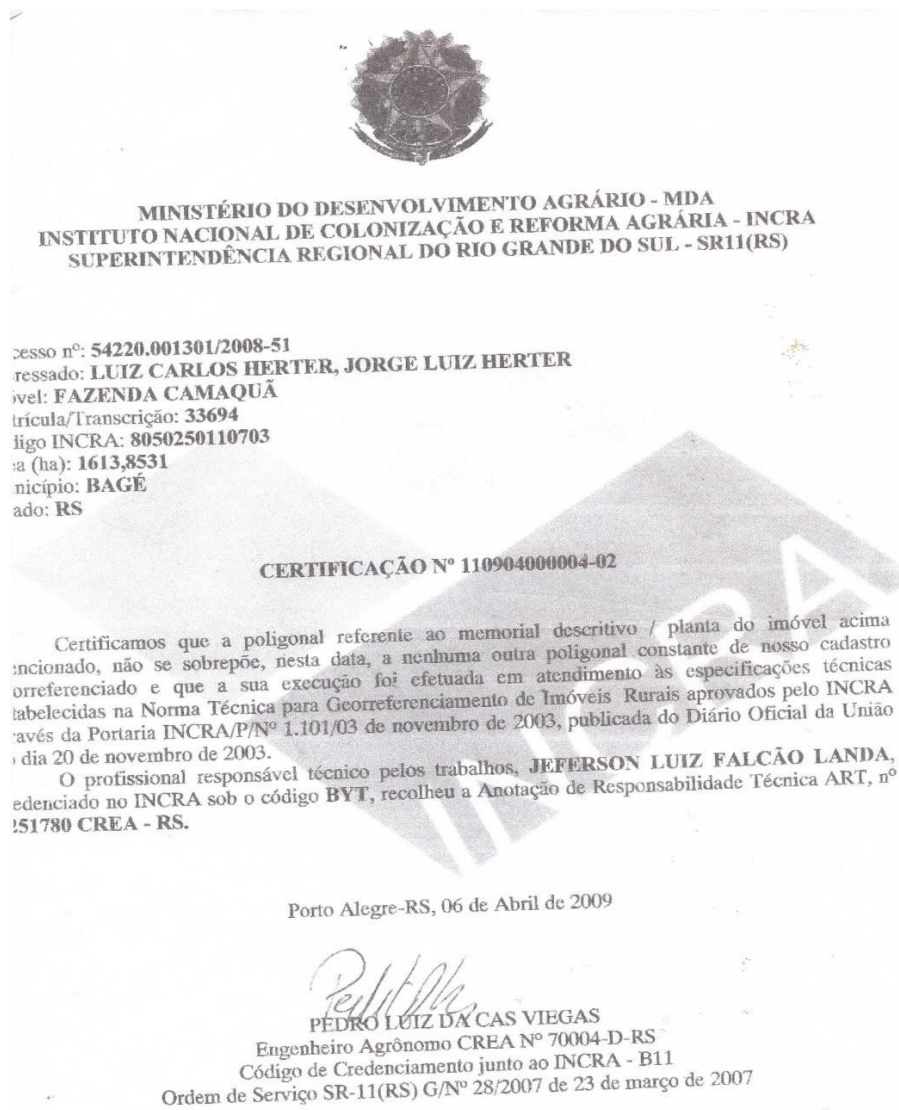
# APPENDIX 1: LAND USE AND LAND COVER MAP




# APPENDIX 2: OWNERSHIP AND ENVIRONMENTAL COMPLIANCE DOCUMENTS

As supplementary information, below are some of the official registration documents mentioned in Section 1.7.

**Document 1: Registration of private ownership and technical report on the rural property.**



  
**MINISTÉRIO DO DESENVOLVIMENTO AGRÁRIO - MDA**  
**INSTITUTO NACIONAL DE COLONIZAÇÃO E REFORMA AGRÁRIA - INCRA**  
**SUPERINTENDÊNCIA REGIONAL DO RIO GRANDE DO SUL - SR11(RS)**


Processo nº: 54220.001301/2008-51  
Assessorado: LUIZ CARLOS HERTER, JORGE LUIZ HERTER  
Nível: FAZENDA CAMAQUÃ  
Matrícula/Transcrição: 33694  
Registro INCRA: 8050250110703  
Área (ha): 1613,8531  
Município: BAGÉ  
Estado: RS

**CERTIFICAÇÃO Nº 110904000004-02**

Certificamos que a poligonal referente ao memorial descritivo / planta do imóvel acima mencionado, não se sobrepõe, nesta data, a nenhuma outra poligonal constante de nosso cadastro georreferenciado e que a sua execução foi efetuada em atendimento às especificações técnicas estabelecidas na Norma Técnica para Georreferenciamento de Imóveis Rurais aprovados pelo INCRA através da Portaria INCRA/P/Nº 1.101/03 de novembro de 2003, publicada no Diário Oficial da União em 20 de novembro de 2003.

O profissional responsável técnico pelos trabalhos, **JEFERSON LUIZ FALCÃO LANDA**, credenciado no INCRA sob o código **BYT**, recolheu a Anotação de Responsabilidade Técnica ART, nº **151780 CREA - RS**.

Porto Alegre-RS, 06 de Abril de 2009

  
**PEDRO LUIZ DA CAS VIEGAS**  
Engenheiro Agrônomo CREA Nº 70004-D-RS  
Código de Credenciamento junto ao INCRA - B11  
Ordem de Serviço SR-11(RS) G/Nº 28/2007 de 23 de março de 2007

## LAUDO TÉCNICO

### **I - INTRODUÇÃO:**

Este Laudo Técnico é relativo ao levantamento planimétrico realizado em uma propriedade rural, denominada "Fazenda Camaquã", situada no Passo do Cação (Rio Camaquã), município de Bagé/RS, possuindo área superficial total de 1.615 ha 52 a 80 ca. É de propriedade de Luiz Carlos Herter e Jorge Luiz Herter.

### **II - CONFRONTAÇÕES:**

N - Rio Camaquã  
S - Luiz Eduardo Luiz de Oliveira  
O - Elisabete Simões Pires, Gelci Coelho e Rio Camaquã  
E - Estrada Municipal para o Passo do Cação  
SO - Sucs. Daroso  
SE - Luiz Eduardo Luiz de Oliveira  
NE - Rio Camaquã  
NO - Rio Camaquã

### **III - COORDENADAS GEOGRÁFICAS (memorial descritivo):**

O levantamento teve início na Estação E0, com a coordenada geográfica de posição LAT S 30,99931° e LONG W 053,49124°, seguindo o Rumo NO 26°19'06", com uma distância de 89,41 metros até a Estação E1; daí, segue o Rumo NE 26°41'54", com uma distância de 87,52 metros até a Estação E2; daí, segue o Rumo NO 13°03'13", com uma distância de 87,00 metros até a Estação E3; daí, segue o Rumo NO 30°30'00", com uma distância de 80,00 metros até a Estação E4; daí, segue o Rumo NE 04°55'23", com uma distância de 361,06 metros até a Estação E5; daí, segue o Rumo NO 03°55'37", com uma distância de 372,49 metros até a Estação E6; daí, segue o Rumo NE 12°00'00", com uma distância de 78,44 metros até a Estação E7; daí, segue o Rumo NO 11°11'26", com uma distância de 139,67 metros até a Estação E8; daí, segue o Rumo NO 08°02'39", com uma distância de 332,21 metros até a Estação E9; daí, segue o Rumo NE 16°26'09", com uma distância de 350,15 metros até a Estação E10; daí, segue o Rumo N 00°00'00", com uma distância de 80,00 metros até a Estação E11; daí, segue o Rumo NE 18°51'31", com uma distância de 364,91 metros até a Estação E12; daí, segue o Rumo NO 18°31'00", com uma distância de 106,40 metros até a Estação E13; daí, segue o Rumo NE 18°44'28", com uma distância de 82,20 metros até a Estação E14; daí, segue o Rumo NE 44°15'20", com uma distância de 140,00 metros até a Estação E15; daí, segue o Rumo NE 43°10'58", com uma distância de 301,08 metros até a Estação E16; daí, segue o Rumo NE 16°09'31", com uma distância de 164,12 metros até a Estação E17; daí, segue o Rumo NE 09°26'14", com uma distância

de 250,00 metros até a Estação E18; daí, segue o Rumo NO 10°40'43", com uma distância de 365,17 metros até a Estação E19; daí, segue o Rumo NE 03°21'01", com uma distância de 340,62 metros até a Estação E20; daí, segue o Rumo SE 85°30'22", com uma distância de 150,00 metros até a Estação E21. Faz divisa, nestas linhas, com a Estrada Municipal para o Passo do Cação.

Da Estação E21, segue o Rumo NO 15°40'04", com uma distância de 100,00 metros até a Estação E22; daí, segue o Rumo NE 47°32'28", com uma distância de 62,20 metros até a Estação E23; e, daí, segue o Rumo NE 07°02'37", com uma distância de 231,80 metros até a Estação E24. Ao longo de todas estas linhas, existe uma faixa de terra extrapolygonal até a margem do Rio Camaquã onde, com as águas deste, faz divisa.

Da Estação E24, segue o Rumo NO 85°00'00", com uma distância de 105,32 metros até a Estação E25; daí, segue o Rumo NE 22°26'11", com uma distância de 268,24 metros até a Estação E26; e, daí, segue o Rumo NE 46°12'41", com uma distância de 190,15 metros até a Estação E27. Faz divisa, nestas linhas, com a Estrada Municipal para o Passo do Cação.

Da Estação E27, segue o Rumo NO 81°40'51", com uma distância de 196,27 metros até a Estação E28; daí, segue o Rumo SO 71°12'34", com uma distância de 576,81 metros até a Estação E29; daí, segue o Rumo SO 27°15'05", com uma distância de 102,09 metros até a Estação E30; daí, segue o Rumo SO 64°21'17", com uma distância de 479,42 metros até a Estação E31; daí, segue o Rumo O 90°00'00", com uma distância de 246,34 metros até a Estação E32; daí, segue o Rumo NO 36°00'00", com uma distância de 828,60 metros até a Estação E33; daí, segue o Rumo NO 45°02'49", com uma distância de 190,00 metros até a Estação E34; daí, segue o Rumo NO 21°10'22", com uma distância de 242,00 metros até a Estação E35; daí, segue o Rumo NO 08°29'14", com uma distância de 261,27 metros até a Estação E36; daí, segue o Rumo NE 17°40'23", com uma distância de 351,88 metros até a Estação E37; daí, segue o Rumo NE 11°30'33", com uma distância de 644,25 metros até a Estação E38; daí, segue o Rumo NO 70°00'03", com uma distância de 400,00 metros até a Estação E39; daí, segue o Rumo SO 43°30'26", com uma distância de 760,10 metros até a Estação E40; daí, segue o Rumo NO 88°08'49", com uma distância de 313,09 metros até a Estação E41; daí, segue o Rumo NO 37°00'0", com uma distância de 450,00 metros até a Estação E42; daí, segue o Rumo NO 05°45'30", com uma distância de 418,41 metros até a Estação E43; daí, segue o Rumo NO 48°00'10", com uma distância de 350,00 metros até a Estação E44; daí, segue o Rumo SO 89°30'00", com uma distância de 155,64 metros até a Estação E45; daí, segue o Rumo SO 46°12'34", com uma distância de 150,02 metros até a Estação E46; daí, segue o Rumo SO 10°15'05", com uma distância de 661,12 metros até a Estação E47; daí, segue o Rumo SO 65°21'17"; com uma distância de 200,00 metros até a Estação E48;

daí, segue o Rumo SO 52°00'00", com uma distância de 261,18 metros até a Estação E49; daí, segue o Rumo SO 20°00'00", com uma distância de 180,00 metros até a Estação E50; daí, segue o Rumo SE 08°02'49", com uma distância de 137,37 metros até a Estação E51; daí, segue o Rumo SE 31°10'22", com uma distância de 538,45 metros até a Estação E52; daí, segue o Rumo SO 08°29'14", com uma distância de 168,10 metros até a Estação E53; e, daí, segue o Rumo SO 45°40'23", com uma distância de 76,40 metros até a Estação E54. Ao longo de todas estas linhas, existe uma faixa de terra extra-polygonal até a margem do Rio Camaquã onde, com as águas deste, faz divisa.

Da Estação E54, segue o Rumo SE 13°30'33", com uma distância de 881,27 metros até a Estação E55; e, daí, segue o Rumo SO 24°00'03", com uma distância de 2.981,27 metros até a Estação E56. Faz divisa, nestas linhas, com Elisabete Simões Pires.

Da Estação E56, segue o Rumo SE 40°30'26", com uma distância de 461,49 metros até a Estação E57. Faz divisa com a Sucs. Daroso.

Da Estação E57, segue o Rumo NE 57°08'49", com uma distância de 3.899,14 metros até a Estação E58. Faz divisa nos primeiros 1.328,94 metros com Luiz Eduardo Luiz de Oliveira e, nos restantes 2.570,20 metros com Gelci Coelho.

Da Estação E58, segue o Rumo SO 09°00'0", com uma distância de 1.528,66 metros até a Estação E59; daí, segue o Rumo SO 45°45'30", com uma distância de 130,00 metros até a Estação E60; e, daí, segue o Rumo SE 06°00'10", com uma distância de 1.281,08 metros até a Estação E61. Ao longo de todas estas linhas, existe uma faixa de terra extra-polygonal até uma sanga, onde, com as águas desta, faz divisa com Gelci Coelho.

Da Estação E61, segue o Rumo NE 88°30'00", com uma distância de 902,45 metros até a Estação E0 (início do levantamento). Faz divisa com Luiz Eduardo Luiz de Oliveira.

**IV - DO APROVEITAMENTO DO IMÓVEL:**

**a) Áreas inaproveitáveis:**

**- Áreas inaproveitáveis tributáveis:**

Estradas internas.....	01,2480 hectares
Açudes.....	03,3880 hectares
Sede.....	01,1900 hectares
Potreiro XII.....	<u>03,7280 hectares</u>
<b>Total.....</b>	<b>09,5540 hectares</b>

**- Áreas inaproveitáveis não tributáveis:**

Sangas.....	04,9500 hectares
Afloramento rochoso.....	101,4526 hectares
Mata nativa (preservação permanente).....	<u>587,2118 hectares</u>
<b>Total.....</b>	<b>693,6144 hectares</b>

**Total inaproveitável.....703 ha 16 a 84 ca**

**Total de área aproveitável.....912 ha 35 a 96 ca**

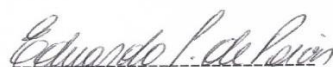
**V - COORDENADAS DE GEOREFERENCIAMENTO:**


ESTAÇÃO	COORDENADA E	COORDENADA N
00	262123,41	6567798,27
PORTEIRA DE ACESSO	262576,44	6571070,55
27	262951,87	6572500,76
38	261074,21	6574438,73
54	258885,62	6572998,11
57	257921,03	6569090,33
58	261450,52	6570682,81

Pelotas, 10 de dezembro de 2005

Topografia e Pesquisa:

Resp. Técnica:

  
**Eduardo G. de Paiva**  
 Eng. Agrôn. CREA 72126

  
**Luiz Fernando da Silveira**  
 Eng. Agrícola CREA 135837

**Document 2: Receipt of registration of the property in the Rural Environmental Registry (CAR).**

**RECIBO DE INSCRIÇÃO DO IMÓVEL RURAL NO CAR**

Registro no CAR: RS-4301602-546E.04E1.610A.4D1B.9BDE.E385.D5F4.8817	Data de Cadastro: 05/05/2016 16:33:51
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**RECIBO DE INSCRIÇÃO DO IMÓVEL RURAL NO CAR**

Nome do Imóvel Rural: FAZENDA CAMAQUA		
Município: Bagé	UF: Rio Grande do Sul	
Coordenadas Geográficas do Centroide do Imóvel Rural:	Latitude: 30°57'57,58" S	Longitude: 53°30'37,56" O
Área Total (ha) do Imóvel Rural: 1.600,0910	Módulos Fiscais: 57,1461	
Código do Protocolo: RS-4301602-8FE3.B581.B391.C113.DF2D.CA03.88F3.5959		

**INFORMAÇÕES GERAIS**

1. Este documento garante o cumprimento do disposto nos § 2º do art. 14 e § 3º do art. 29 da Lei nº 12.651, de 2012, e se constitui em instrumento suficiente para atender ao disposto no art. 78-A da referida lei;
2. O presente documento representa a confirmação de que foi realizada a declaração do imóvel rural no Cadastro Ambiental Rural-CAR e que está sujeito à validação pelo órgão competente;
3. As informações prestadas no CAR são de caráter declaratório;
4. Os documentos, especialmente os de caráter pessoal ou dominial, são de responsabilidade do proprietário ou possuidor rural declarante, que ficarão sujeitos às penas previstas no art. 299, do Código Penal (Decreto-Lei nº 2.848, de 7 de setembro de 1940) e no art. 69-A da Lei nº 9.605, de 12 de fevereiro de 1998;
5. O demonstrativo da situação das informações declaradas no CAR, relativas às áreas de Preservação Permanente, de uso restrito e de Reserva Legal poderá ser acompanhado no sítio eletrônico [www.car.gov.br](http://www.car.gov.br);
6. Esta inscrição do Imóvel Rural no CAR poderá ser suspensa ou cancelada, a qualquer tempo, em função do não atendimento de notificações de pendência ou inconsistências detectadas pelo órgão competente nos prazos concedidos ou por motivo de irregularidades constatadas;
7. Este documento não substitui qualquer licença ou autorização ambiental para exploração florestal ou supressão de vegetação, como também não dispensa as autorizações necessárias ao exercício da atividade econômica no imóvel rural;
8. A inscrição do Imóvel Rural no CAR não será considerada título para fins de reconhecimento de direito de propriedade ou posse; e
9. O declarante assume plena responsabilidade ambiental sobre o Imóvel Rural declarado em seu nome, sem prejuízo de responsabilização por danos ambientais em área contígua, posteriormente comprovada como de sua propriedade ou posse.





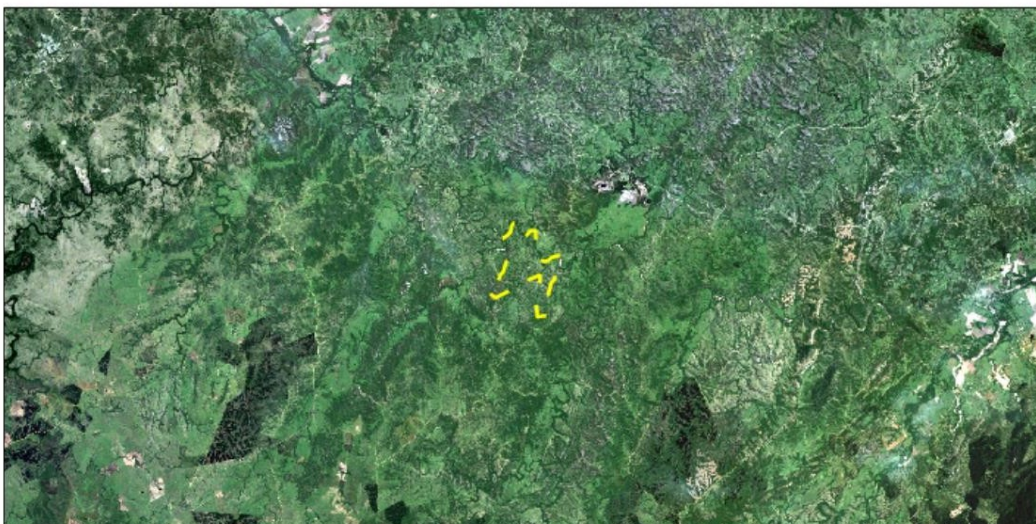
## RECIBO DE INSCRIÇÃO DO IMÓVEL RURAL NO CAR

Registro no CAR: RS-4301602-546E.04E1.610A.4D1B.9BDE.E385.D5F4.8817	Data de Cadastro: 05/05/2016 16:33:51
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### INFORMAÇÕES ADICIONAIS

Foi detectada uma diferença entre a área do imóvel rural declarada conforme documentação comprobatória de propriedade/posse/concessão [1600.0 hectares] e a área do imóvel rural identificada em representação gráfica [1.600,0910 hectares].

### REPRESENTAÇÃO GRÁFICA



### IDENTIFICAÇÃO DO PROPRIETÁRIO/POSSUIDOR

CPF: 427.012.440-72	Nome: JORGE LUIZ HERTER
CPF: 245.960.510-20	Nome: LUIZ CARLOS HERTER

### ÁREAS DECLARADAS (em hectares)





## RECIBO DE INSCRIÇÃO DO IMÓVEL RURAL NO CAR

Registro no CAR: RS-4301602-546E.04E1.610A.4D1B.9BDE.E385.D5F4.8817	Data de Cadastro: 05/05/2016 16:33:51
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Imóvel		Imóvel	
Área Total do Imóvel	1.600,0910	Área Consolidada	1.579,7462
Área de Servidão Administrativa	0,0000	Remanescente de Vegetação Nativa	18,6409
Área Líquida do Imóvel	1.600,0910	<b>Reserva Legal</b>	
<b>APP / Uso Restrito</b>		Área de Reserva Legal	0,0000
Área de Preservação Permanente	34,2236		
Área de Uso Restrito	0,0000		

### MATRÍCULAS DAS PROPRIEDADES DO IMÓVEL

Número da Matrícula	Data do Documento	Livro	Folha	Município do Cartório
10.648/015	14/12/2005	52/B	20	Pelotas/RS

