



SOCIALCARBON®

Fazenda Cristal: Conservation and Bamboo Afforestation



Document prepared by Vert Ecotech S/A

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1. Project Details

1.1 Summary Description of the Project

Project name	Fazenda Cristal: Conservation and Bamboo Afforestation
Project Type	AFOLU/ARR
Applied Methodology	SCM0003 - Methodology for Carbon Removals in Private Conservation Areas CDM A/R-AMS0007 – Small-scale Methodology - Afforestation and reforestation project activities implemented on lands other than wetlands
Host Country	Brazil
Latitude	8.025.817 m S
Longitude	636.327 m E

Brazil is a relatively large territory country, with a significant occupying space within its continent. As a result of its location, which is mostly inside of Tropical Zone of the Earth, its vegetation presents, generally, relatively fast growth, as well as good rates of biomass development. Consequently, the country represents an important agent for the removal of greenhouse gases, such as Carbon Dioxide (CO₂).

Due to its geographic heterogeneity, Brazil comprises several biomes that represent household to thousands of species of fungi, plants and animals, meaning fundamental ecological importance for the planet.

The Cerrado biome, one of the six Brazilian biomes, represents high territorial significance as it is found on approximately 25% of the country's area, mainly on its central zone, constituting the second largest biome in South America. Cerrado is composed of plateau zones/highlands and harbours the 3 largest watersheds in South America. It is undoubtedly an important area for water recharge on the continent (MMA, 2005).

Sequentially, the Pantanal biome borders the Cerrado in almost all its extension and it is under significant influence from it. Pantanal is composed of flooded sedimentary plains under the action of rivers that drain the

Alto Paraguai watershed. It is considered the largest continental wetland on planet (BAZZO *et al.*, 2012) and after the year 2000 it was named a UNESCO Biosphere Reserve.

There is, however, a known history of deforestation in sensitive zones, such as forests and aquifer recharge areas in these regions, involving the Cerrado and Pantanal biomes. They are usually under pressures of conversions of their land into pasture areas and agricultural monoculture crops. This fact accords with the identification of these biomes as two of the most threatened on the planet (MYERS *et al.*, 2020).

These pressures contribute in a relevant way to the reduction of the potential removal of greenhouse gases from the atmosphere, such as CO₂, by the country. Therefore, this fact directly supports one of the main problems of society nowadays: global warming.

That being announced, it is also possible to claim that Brazil still counts on important remaining preserved native vegetation areas, which may usually be located on private properties. The preservation of these areas may directly contribute to mitigation of climate change effects by maintaining the sequestration and storage of CO₂ in their vegetation mass, whether in the soil or above it.

The Fazenda Cristal: Conservation and Bamboo Afforestation project aims to promote conservation of managed primary and secondary formations of preserved native areas, and to promote a native bamboo punctual afforestation in a former pasture area, both located in different sites within the same property. The focus is to guarantee a fully restoration of the vegetation with the purpose of increasing the potential storage carbon on its area, targeting the reduction of the global warming effects along with social development.

The property in evidence is named FAZENDA CRISTAL and it is located in the city of Corumbá, State of Mato Grosso do Sul, Brazil. Its total area is 19.397,90 hectares and it is fully covered by Pantanal biome (IBGE, 2019).

This project uses SocialCarbon Methodology SCM0003, which consists of successive analyses of land use maps that are developed using secure databases with relevant recognition in geographic information systems community. These analyses take place from the 20th year prior to the beginning of the project, contraposing the different land use classifications, in order to classify the areas of native vegetation between primary or secondary formations, in addition to identify the eligible and ineligible areas for the project – those in which occurs conversions to alternative land use, like agricultural activities.

The method relies on a specific self-analysis procedure to validate the credibility of the classification of land use pixels, over the years, by the database used. With the regarding mapping, the areas are finally set to be officially defined as carbon sinks, proceeding to a following stage where they are submitted to a specific formula to calculate the annual carbon removal. Social activities also become part of the farm's scope, related to the gains raised by conservation activities.

Regarding the A/R-AMS0007 Small-scale Methodology, the project consists in an afforestation activity focused in converting a former pasture area from zero into a native bamboo formation. A small, specific, and propitious area was chosen to harbour around 200.000 seedlings of “Taquara” bamboo (*Guadua chacoensis* (Rojas) Londoño & Peterson), based on academic evidence of plant development and positive impact about its strong potential to remove CO₂ from atmosphere.

All things considered, this project aims for an estimated annual average of 12.810 ton of GHG removal, with a total of 123.960 ton in 10 years. It seeks for a 99-year establishment for conservation area, as the methodology suggests; and for a 25-year establishment for bamboo afforestation, plus renewal considering a replanting plan.

A direct partnership is advanced with a non-governmental organization called Instituto Homem Pantaneiro, which works focused on the Pantanal biome preservation, research and scientific studies, and partnerships with local community. Part of the resources from this project plan will be allocated to the non-governmental organization, which in turn will allocate them into regional existing socio-environmental projects.

This project is a direct action in transmitting the established United Nations (UN) goals, through the Paris Agreement, of retaining global warming by 1.5°C by the end of the century (2100 A.D.). Considering the UN Sustainable Development Goals (SDG), this project covers directly the following global goals: 13 – Climate Action; and 15 – Life on Land; and indirectly, which may be explained furtherly in this assessment: 3 – Good Health and Well-Being; 4 – Quality Education; 8 – Decent Work and Economic Growth; 10 – Reduced Inequalities; and 16 – Peace, Justice and Strong Institutions.

Furthermore, the Fazenda Cristal: Conservation and Bamboo Afforestation project directly helps Brazil in complying with its Nationally Determined Contribution (NDC) to the Paris Agreement, as announced to the UN in 2020. Brazil's commitment is to reduce in 37% its total net emissions of greenhouse gases by the year of 2025 and 43% by 2030¹. These goals are based on data extracted from the role of 2005, which represents a more accurate and robust greenhouse gas emissions information.

1.2 Sectoral Scope and Project Type

This project is seeking registration under the SOCIALCARBON Standard as an Agriculture, Forestry and Other Land Use – AFOLU project, Scope 14, category Afforestation, Reforestation and Revegetation (ARR). It has

¹ BRAZIL. Nationally Determined Contribution (NDC). Paris Agreement, March 21, 2022. Available at: <https://www.gov.br/casacivil/pt-br/assuntos/comite-interministerial-sobre-mudanca-do-clima/arquivos-cimv/item-de-pauta-3-paris-agreement-brazil-ndc-final-1.pdf>.

been developed in compliance with the SOCIALCARBON® Methodology SCM0003 “Methodology for Carbon Removal in Private Conservation Areas”; also, with the Clean Development Mechanism (CDM) “Methodology AR-AMS0007: Afforestation and reforestation project activities implemented on lands other than wetlands” (version 3.1). This project is, therefore, non-grouped small-scale project with multiple project activities.

1.3 Project Eligibility

The biophysical-chemical processes that remove carbon from the atmosphere are well understood, stable and quantifiable. Carbon removals will lead to carbon credits incomes in order to benefit the owner of the area, local workers and their families, also to foster the local development of local socioeconomic environment.

The eligibility of this project was confirmed by the verification of compliance with all present conditions in the table “Table 2 – List of conditions for the applicability of the Methodology for Carbon Removal in Private Conservation Areas”, from SCM0003 Methodology.

The eligibility runs through the existence of formally registered private conservation area, with floristic characteristics of Cerrado and Pantanal biome, despite being inserted in an officially demarcated area belonging exclusively to Pantanal biome. It is important to highlight that it is understood that the vegetation cover target is represented by “*areas where human activities have not caused any significant changes in its original characteristics of structure and composition during a minimum period of 20 (twenty) years prior to the project start date*”, or even “*areas where human activities have caused significant changes in its original characteristics of structure and composition, but there has been no conversion to alternative land use within the area or any degradation that would bring about a regression in its status within the process of ecological succession*”² – in other words: managed primary and secondary vegetation formations.

Using the database of a collaborative network called MapBiomias³, which is composed of Non-Governmental Organizations (NGOs), universities, and technology start-ups, it was possible to verify the existence of 3 types of vegetation formations: Grassland Formation; Savanna Formation; and Forest Formation. Within these main formations, there are several subtypes of vegetation that naturally occur in this project’s area, described in the table below in their Portuguese original names.

Grassland Formation

Campo Limpo, Campo Sujo e Campo Rupestre

² Text extracted from SOCIALCARBON® Methodology SCM0003 “Methodology for Carbon Removal in Private Conservation Areas”.

³ MAPBIOMAS, 2023. Projeto MapBiomias – Coleção v.7.0 da Série Anual de Mapas de Uso e Cobertura da Terra do Brasil. Available at: <https://mapbiomas.org/>.

Savanna Formation	Vereda, Palmeiral, Parque de Cerrado e Cerrado “stricto sensu”
Forest Formation	Cerradão, Mata Seca, Mata de Galeria, Mata Ciliar

As for the A/R-AMS0007 Methodology, the eligibility of this project was confirmed by the verification of compliance with all present conditions in its section 2.3 - Applicability, as the target area of afforestation is not a wetland, does not contain organic soil, neither receive any kinds of inputs.

Furthermore, the native bamboo afforestation activity is considered legally applicable within the project area, as it attends to the State Decree No. 14.273/2015, which provides for the “Restricted Use Area” of the floodplain of Pantanal in the State of Mato Grosso do Sul, to be well described in Section 1.14.

Project market leakage assessments will be submitted to periodic review if necessary.

Non-permanence risk analyses in this AFOLU project will be addressed for each activity of this project through the SOCIALCARBON AFOLU Non-Permanence Risk Tool, which determines the number of credits allocated to the AFOLU buffer account. These documents are found in Appendix 1.

This project is not registered in any other GHG program.

Applicable SOCIALCARBON indicators are detailed in Section 6 of this document.

1.4 Project Design

This project is considered a non-grouped small-scale project, with multiple project activities, conceived as a pilot project, since there is great potential for larger-scale expansion in the country where it occurs, for private properties with similar characteristics.

1.5 Project Proponent

Organisation name	Vert Ecotech S/A
Contact person	Bruno Nunes Bolzam André Luiz Jardini Munhoz Alexandre Chiachiri Rodrigues Silva



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1.6 Other Entities Involved in the Project

Organisation name	STW Ambiental Consultoria Sustentável LTDA
Role	Consulting and PDD Development
Contact person	Kaio Gayego Bello João Gabriel Chaib Eduardo José Omizolo
Title	Kaio Gayego Bello – Technical Responsible João Gabriel Chaib – Technical Developer Eduardo José Omizolo – Comercial Responsible
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Organisation name	Insuela Pereira e Conti Investimentos e Participações S/A
Role	Owner of FAZENDA CRISTAL
Contact person	Milton Insuela Pereira Junior
Title	Milton Insuela Pereira Junior - President
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1.7 Ownership

In mutual agreement, through an official contract, it has been set that FAZENDA CRISTAL project area remains under the responsibility of its legal owner, Insuela, Pereira e Conti Investimentos e Participações S/A, while the property of the carbon rights will belong to Vert Ecotech S/A, which is responsible for the payments necessary for the development of activities related to the compliance with SOCIALCARBON Standard.

Net earnings will be shared with the farm owner in accordance with the terms of the contractual agreement, and the latter is previously consulted and informed about those sharing mechanisms before signing the agreement. Further information may be found in Appendix 2.

Prior and periodic follow-up meetings are held between those responsible for the farm and Vert Ecotech S/A to ensure that there are no legal occurrences in relation to land tenure and that the site meets the requirements of SCM0003 and A/R-AMS0007 methodologies.

FAZENDA CRISTAL's legal responsible remain under contract to ensure the SOCIALCARBON® Standard is followed throughout the lifetime of the project. Since Vert Ecotech S/A will develop project activities that enhance the reduction of GHG emissions, their subordinates will also remain under contract to guarantee the correct execution of possible necessary services, as recommended in the SCM0003 Methodology.

The documents proving the land title and ownership of the property is available in Appendix 3.

1.8 Project Start Date

SCM0003: Estimated start date for carbon components of this project is January 1st, 2020, after validations and baseline measurements. Important related actions are already underway in the property since 2014 though. These actions are well described in Section 3.5 and have been developed by the property owner to promote the environmental protection. Such measures are lined up with the purposes of the current project. Evidence of previous conservation activities are found in Appendix 4.

A/R-AMS0007: Estimated start date for this project is August 1st, 2023, as it is conceived as an ex-ante projection, considering this is scheduled to be the date on which land preparation for afforestation will begin.

1.9 Project Crediting Period

SCM0003: The project crediting period is 10 years, from January 1st of 2020 to December 31st of 2029, which may be renewable at a maximum of ten times, with a total crediting period of no more than 100 years. This project may be renewed and extended beyond this initial crediting period, if verified and validated to do so, in accordance with SOCIALCARBON® Standards.

A/R-AMS0007: The project crediting period is 25 years, from August 1st, 2023, to June 30st, 2048, which may be renewable at a maximum of 4 times, with a total crediting period of 100 years, considering an opportune replanting project. Native bamboo's lifespan is well described below in this very section. This project may be renewed and extended beyond this initial crediting period, if verified and validated to do so, in accordance with SOCIALCARBON® Standards.

According to Greco & Cromberg (2011), in general, after the third year, the shoots phase of clumping bamboos, such as *Guadua chacoensis* (with pachymorphous rhizome) begins. It coincides with the rainy season, starting in mid-spring and remains throughout the summer. The bud development of pachymorphous bamboos takes approximately four months (FARRELLY, 1984 *apud* GRECO & CROMBERG, 2011) as it is still soft and vary between 30-40 cm height. This phase ends when it reaches its final height, unveiling side buds that may be represented as thorns.

Herrera & Ospina (2007) *apud* Greco & Cromberg (2011) state that this second phase occurs, on average, between 6 months to 3 years, representing part of the maturation of young colms. The mature colms, on the other hand, are classified between 3 and 10 years, with a maturation closure going on between 3 and 6 years, but generally occurring at the 7th year, as demonstrated by Rojas-Pinzón (2005), for *Guadua angustifolia*. It

reaches, then, the maximum biomass productivity. Likewise, Greco & Cromberg (2011) have also brought together studies that suggest a productivity decline beginning at the 7th year for other bamboo species.

These authors also mention the importance of adequate management, so that this productivity reaches its potential, such as removal of vegetal dry material, pruning, harvesting – which may occur from the 5th to the 8th year, in general, when the colm has reached maximum diameter, considering other healthy relative factors, such as watering and nutritional availability.

It is understood that with the appropriate management of the bamboo crop, following what it is to be detailed in an opportune external document entitled "Fazenda Cristal's Bamboo Forest: Management Plan", this project may reach its maximum effectiveness in biomass production, as well as durability. This plan is under responsibility of outsourced specialized technical professionals.

However, as part of bamboo's natural cycle, it is known that even with proper management, bamboo plants may present an approximate life cycle and succumb after a certain period.

A study conducted in Colombia by Zapata *et al.* (2015) evaluated the performance of different *Guadua* bamboo species in a commercial plantation and observed that *Guadua angustifolia* and *Guadua chacoensis* showed an average lifespan of about 25 years.

Sequentially, the temporal, spatial and spectral behaviour of the life cycle of populations of bamboo (*Guadua spp.*) in southwestern Amazonia was studied, through the interpretation of images from optical orbital sensors. The spectral behaviour of the forest dossal in each phase of the cycle was described and the cycle duration was then determined. It was concluded that the lifespan of *Guadua spp.* in southwestern Amazonia is 28 years (CARVALHO, 2010).

Successively, a study on the species *Guadua weberbaueri*, which occurs in Peru, penetrating Brazilian territory through the lowland hill interfluves in the state of Acre, occupying large clearings and dominating the forest dossals, indicated that it may have an estimated lifespan of 29 to 32 years (SILVEIRA, 1999).

Other factors that may affect *Guadua* bamboo's genus plants longevity include soil quality, water availability, sun exposure, management practices and the incidence of diseases and pests. In addition, there is the aspect related to flowering cycles, which may also lead to decay of individuals.

According to Alves (2010), the lifespan of the species *Guadua chacoensis* probably follows a monocarpic pattern (or "semelpora"), with periodic massive flowering at approximately regular intervals, with partial survival of the rhizome possibility. However, the author states that there is no established or studied pattern for greater accuracy of flowering cycles for this genus, also that it may vary according to factors such as growing environment and its genetics.

It is correct to affirm that there is no general rule applicable to all species because the flowering cycle varies within the species. Nevertheless, the available data suggest that the flowering cycle of Brazilian native bamboos ranges from 15 to 35 years, but with blooms occurring outside this pattern. Sporadic flowering, possibly by stress, has also been recorded for Guadua genus species. Populations of the same species separated by reasonable distance may flower according to their own calendar, suggesting that they are genetically distinct populations (EMBRAPA, 2017).

Considering all the above mentioned, it is assumed as lifespan, for the species in this study, the representative value of 25 years, as the possible aspects related to the vigour of the crops will be evaluated annually, with the objective to provide accurate data to be inserted in a predicted replanting project plan. Therefore, crops natural degradation, as well as flowering, are foreseen in a detailed replanting plan – an external document entitled "Fazenda Cristal's Bamboo Forest: Replanting Plan" to be developed by outsourced specialized technical professionals.

Finally, there is the possibility of renewing this project's crediting period, regardless of replanting activities, for further 25 years, up to the final value allowed by the official standard in use.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	Yes
Large project	No
Year	Estimated GHG emission reductions or removals (tCO ₂ e) – SCM0003
2020	7.460
2021	7.460

2022	7.460
2023	7.460
2024	7.460
2025	7.460
2026	7.460
2027	7.460
2028	7.460
2029	7.460
Total estimated ERs	70.460
Total number of crediting years	10
Average annual ERs	7.460
Year	Estimated GHG emission reductions or removals (tCO₂e) – AR-AMS0007
2023 (from 01 August to 31 December)	2.229

2024	5.350
2025	5.350
2026	5.350
2027-2047	107.000
2048 (from 01 January to 31 July)	3.120
Total estimated ERs	128.399
Total number of crediting years	25
Average annual ERs	5.350
Total Average annual ERs (both methodologies)	12.810

1.11 Description of the Project Activity

The project on screen consists of generating carbon credits from conservation areas located in a private property along with punctual afforestation of native bamboo (*Guadua chacoensis* (Rojas) Londoño & Peterson) in a separated area within the same property.

Successive analyses of land use maps are developed, using secure databases with relevant recognition in geographic information systems community. These analyses take place from the 20th year prior to the beginning of the project, contraposing the differences of classifications of land use to reclassify the areas of native vegetation between primary or secondary formations, in addition to identify the eligible and ineligible areas for the project – those in which occurs conversions to alternative land use, like agricultural activities.

The method relies on a specific self-analysis procedure to validate the credibility of the classification of land use pixels, over the years, by the database used. With the regarding mapping, the areas are finally set to be officially delimited as carbon sinks, proceeding to a following stage where they are submitted to a specific formula to calculate the annual carbon removal.

These areas are supposed to be under periodic monitoring to guarantee their maximum preservation, such as monitoring physical factors *in loco*, as well as monitoring the status of the vegetation areas to ensure their permanence in the proper classes of vegetation over the years.

Local community may develop conservation activities, such as specialization in field and/or aerial monitoring, forest stage evaluation, fences and firebreaks, including the participation in trainings and teaching other communities about the aspects related to the conservation of native vegetation. These activities may represent an important bias for decentralization of labour activities related to livestock in the municipality of Corumbá/MS.

By guaranteeing geoprocessing of data, with smart monitoring activities – to be described in Section 5, and on-site monitoring, in addition to potential financial return to the stakeholders, it is certain that preservation activities will increase significantly, as well as accurately verification of the carbon removals that are occurring in the area.

Along with the conservation areas, the ARR methodology also applied in this project, relies in monitoring the development of native bamboo seedlings to be planted in a former pasture area, composed by exotic grassland. The area is already fenced and protected to avoid any impact that would compromise the seedling's development. Planting and management are carried out according to specifications based on updated studies, that may ecologically favour both development of bamboo and local area itself regarding environmental aspects.

The *Guadua chacoensis* bamboo (Rojas) Londoño & Peterson is a native species from⁴ South America, occurring in areas of Tropical Forest, Savanna, Cerrado and Atlantic Forest in countries such as Brazil, Argentina, Bolivia and Paraguay. The “Taquara bamboo” – as it is popularly known, is found in tropical and subtropical climate regions, with annual rainfall above 1.000 mm and annual average temperatures between 18 and 27°C (MEJÍA *et al.*, 2018). It is normally associated with occurrences in riverbanks, specially from watershed of Paraná, Paraguay and Alto Amazonas (OSTAPIV *apud* EMBRAPA, 2017)

According to Araujo *et al.* (2018), *Guadua chacoensis* (Rojas) Londoño & Peterson is one of the most resistant bamboo species in the world, with high density, durability and flexibility. It has a fast-growing behaviour and

⁴ It is classified as “native” in Brazilian territory according to Re flora – an updated and academic significant database of flora and fungi from Brazil. Available at: http://servicos.jbrj.gov.br/flora/search/Guadua_chacoensis.

can be harvested without the need for replanting, which makes it a sustainable and economical option to produce several products. However, despite the potential advantages, this variety of bamboo presents a low rate of use in Brazil, specially related to rural construction (VILPOUX *et al.*, 2015 *apud* EMBRAPA, 2017).



Image 1.11-1: *Guadua chacoensis* native bamboo species (BAMBÚ CULTIVOS, 2023⁵)

There are several important scientific research that evidence the positive impacts of production and application of bamboo species over the world. Also, studies relating bamboo to the restoration and recovery of degraded land. Complementarily, it is possible to observe studies that reveals its efficiency as an eco-material with several applications for industry. Finally, a consistent academic base reveals its affinity with carbon sequestration projects, and fortunately indicates its planting and growing characteristics, as well as biomass production and total carbon contents, that are well described in Section 4.

⁵ Image available at: <https://bambucultivos.mitiendanube.com/>.



Image 1.11-2: Bamboo’s drawing referring to CO₂ storage potential (GRECO, 2010 - Professor Beraldo)

It is important to mention that EMBRAPA (in Portuguese, Empresa Brasileira de Pesquisa Agropecuária) – the Brazilian Agricultural Research Institution, have published in 2017 the book “Bambus no Brasil: da biologia à tecnologia” (in English, “Bamboos in Brazil: from biology to technology”), that synthesizes a series of updated academic productions referring to bamboo’s biology and conservation, development, production, and industrial uses.

It is also prudent to mention the Federal Law No. 12.484/2011, known as the law of incentive to bamboo sustainable management. It was enacted in 2011 objecting the sustainable production and use of bamboo in Brazil. This law establishes tax and financial incentives for rural properties, entrepreneurs and cooperatives that carry out activities related to the management and use of bamboo, in addition to creating guidelines for the sustainable management of bamboo forests in the country.

Considering the implementation phase of the bamboo afforestation in an exotic pasture area, conventional soil preparation will be adopted, with soil nutritional corrections when needed, using tractors and machines available in the property for subsequent planting of seedlings. It is certain that there shall occur an interesting increase in employments related to this phase of the project, throughout the entire chain involved in these activities.

Any native vegetation species – pioneer or secondary, within the project’s boundary will be maintained, such as “capões” and/or small trees from grassland formations (“Campo Sujo/Rupestre” or even “Cerrado stricto sensu”). Areas with major native grassland occurrence – grasses species from Cerrado or Pantanal biome – will not be removed during soil preparation activities.

The seedlings spacing considered for this project is 7 x 7 m (CRUZ RIOS, 2009 *apud* GRECO & CROMBERG, 2011). This distance includes the size of the species and the practical space required for harvest. In addition, the fact that the *Guadua* genus is considered a clumping bamboo, large-sized and has long rhizomes, unlike the creeping varieties, that may require smaller distances.

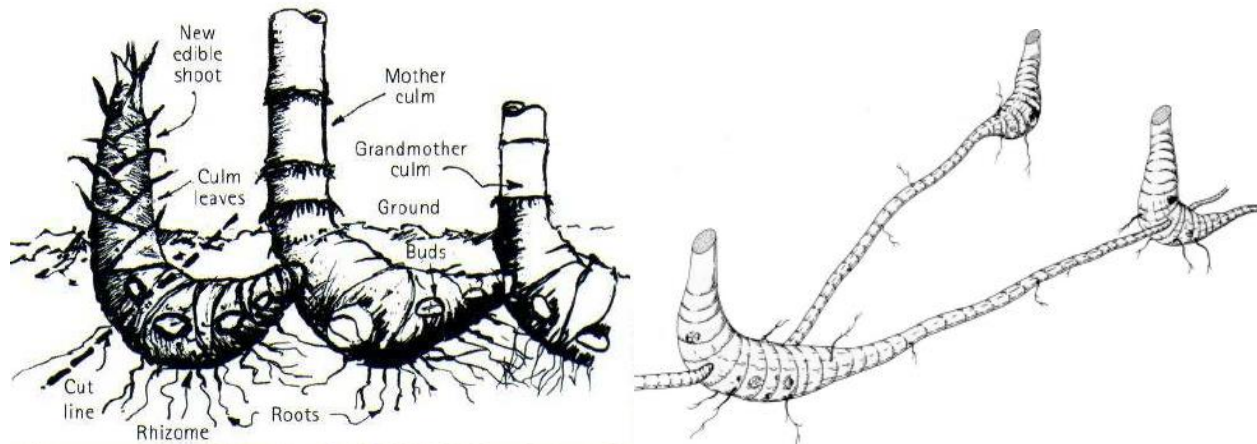


Image 1.11-3: Illustrations of common bamboo rhizome structure (left) and elongated rhizome (right) example of development (GRECO, 2010)

The planting pits and planting preparations will be carried out in accordance with the technical guidelines set out in the external document entitled "Fazenda Cristal's Bamboo Forest: Management Plan". It is recommendable that the project includes guidelines from the book *Bambu – Management and Cultivation* (in Portuguese, *Bambu – Cultivo e Manejo*) by the authors Tiago Machado Greco and Marina Cromberg, published in 2011 in Brazil, by Insular publisher. This reference considers updated information on Brazilians commercial bamboo species, revealing each aspect related to bamboo's cultivation, from environmental conditions to plantation's productivity and development. In general, pits of 0,50 meters in depth and diameter may be adopted, with soil correction and fertilization when needed (GRECO & CROMBERG, 2011).

Other considerations regarding this bamboo forest maintenance, pest control, fertilization, harvest, and other special cares will be adopted throughout this project, in a long-term update, based on field analysis and updated bibliographic references of this species, to be included in the foreseen management plan updates and monitoring reports when needed.

Considering socioeconomic aspects, the production and use of *Guadua chacoensis* (Rojas) Londoño & Peterson bamboo may contribute to the development of local communities as it appears as an alternative pole of opportunities for technical qualification and jobs, enabling the development of secondary local activities with the selling or transformation of its harvested raw material, such as working cooperatives, generating jobs and incomes for all involved parties.

Apart from livestock activity, the region of Mato Grosso do Sul in Brazil may potentially benefit from this interesting and sustainable opportunity, as the afforestation and related activities do not necessarily require traditional male rural workers.

Both areas related to this project would begin to compose rural property's activities scope with a guaranteed income. They would not be a target of competition with other land uses, inherent to rural properties, such as pasture and extensive agricultural production. Social development may also become part of the farm's scope, related to income raised by project's activities.

The project is not located within a jurisdiction covered by a jurisdictional REDD+ program.

1.12 Project Location

The farm named FAZENDA CRISTAL is in the city of Corumbá, State of Mato Grosso do Sul, Brazil. Its total area is 19.397,90 ha and it is fully covered by Pantanal biome (IBGE, 2019). The KML file with the area boundary is submitted separately from this document. Central geographic coordinates are: Longitude 636.327,00 m E and Latitude 8.025.817.00 m S (Datum SIRGAS 2000 UTM Zone 21 S). An illustration of the exact location of the farm and its context within Brazil is found below. Later in Section 3.3 and 3.5, different illustrations reveal the specific areas of the property that are objects of this project.

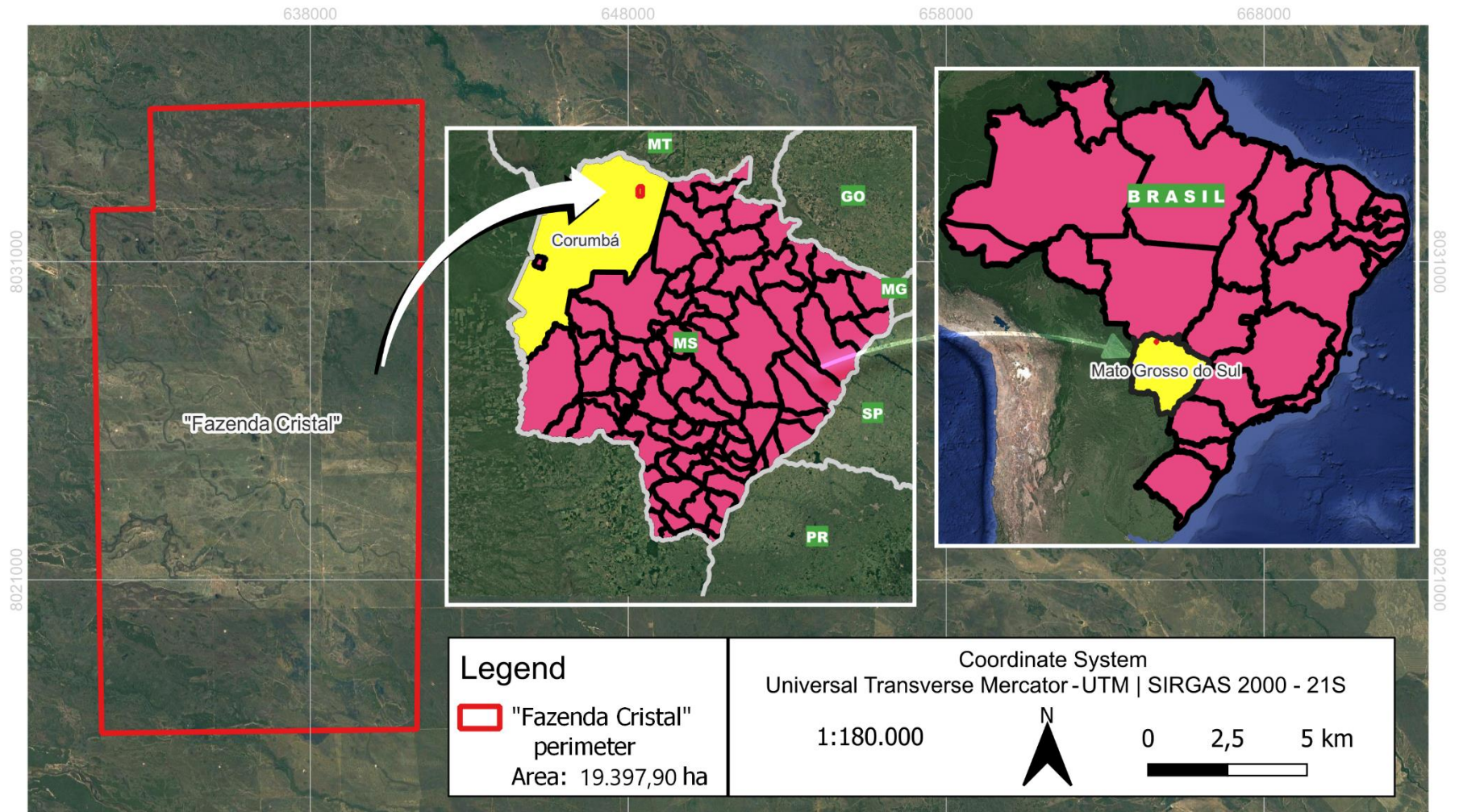


Image 1.12-1: Fazenda Cristal's location and its context within Brazil's territory

1.13 Conditions Prior to Project Initiation

Fazenda Cristal: Conservation and Bamboo Afforestation project is being developed in a farm which main activity is livestock. The farm is in Midwest region of Brazil (Centro-Oeste, in Portuguese), where this activity is found in the majority rural properties in this region. This fact is related to the agricultural aptitude in the region, such as soil characteristic, land relief, climate, vegetation, among other parameters that may support such activity.

The point that currently makes FAZENDA CRISTAL stand out from most of other properties in its region is a special concern about environmental aspects. There is an impetus for protecting its natural resources that has been occurring for a couple of years.

Due to its geographic heterogeneity, Brazil comprises several biomes that represent household to thousands of species of fungi, plants and animals, meaning fundamental ecological importance for the planet.

The Cerrado biome, one of the six general Brazilian biomes, represents high territorial significance as it is found on approximately 25% of the country's area, mainly on its central zone, constituting the second largest biome in South America. Cerrado is composed of plateau zones/highlands and harbours the 3 largest watersheds in South America. It is undoubtedly an important area for water recharge on the continent (MMA, 2005).

Sequentially, the Pantanal biome borders the Cerrado in almost all its extension and is under significant influence from it. Pantanal is composed of flooded sedimentary plains under the action of rivers that drain the Alto Paraguai watershed. It is considered the largest continental wetland on the planet (BAZZO *et al.*, 2012) and after the year 2000 it was named a UNESCO Biosphere Reserve.



Image 1.13-1: Pantanal's wetlands with Grassland, Savanna and Forest formations (Author records, 2023)

There is, however, a known history of deforestation in sensitive zones, such as forests and aquifer recharge areas in these regions, involving Cerrado and Pantanal biomes. They are usually under pressures of conversions of their land into pasture areas and agricultural monoculture crops. This fact accords with the identification of these biomes as two of the most threatened on the planet. (MYERS *et al.*, 2020).

It is important to state that Cerrado and Pantanal biomes are considered global biodiversity hotspots⁶.

The property named FAZENDA CRISTAL is located in the city of Corumbá, State of Mato Grosso do Sul, Brazil. Its total area is 19.397,90 ha and it is fully covered by Pantanal biome as mentioned before, although there are, naturally, portions of areas occupied by typical Cerrado phytophysionomies.

⁶ Hotspot may be understood as an area that presents an extreme abundance of endemic species and suffers an exceptional loss of habitat. Ministério do Meio Ambiente. Available at: <https://www.gov.br/mma/pt-br/assuntos/ecossistemas-1/biomas/cerrado>.

As previously mentioned, Pantanal is part of Paraguay River Watershed, with a well-defined tropical climate, composed by a rainy summer season – October to March, and a dry winter.

There is an average variation of precipitation from 800 to 1200 millimetres (mm) and altitude from 80 to 170 meters (m) (GODÓI FILHO, 2016), although it is surrounded by Cerrado's plateaus that may reach around 700 meters high. The hydrological behaviour is quite peculiar and significantly influenced by local climatic events, such as accumulation of rainwater or even water contribution from the adjacent plateaus (BAZZO *et al.*, 2012).

The biome is formed by sandy soils and the natural fertility rates of these soils are between medium and low categories (SANTOS, 2001). Naturally, a significant part of it is formed by hydromorphic soils (above 90%) and it means a reflection of the low rate of water drainage, meeting potential tendencies to remain flooded for longer periods.

The flora diversity of this biome is represented by an exchange of elements from the Atlantic Forest (Mata Atlântica, in Portuguese), Cerrado, Amazon Forest (Floresta Amazônica, in Portuguese) and Chaco, where the Savanna Formation is the most representative type of vegetation – a typical tropical formation, composed of grasses, shrubs and scattered trees.

Among the vegetation formations of Pantanal, it is feasible to stand out: 1-“Campos alagáveis” – predominantly formed by low vegetation; 2-“Capões” – islands of bushy-arboreal vegetation; and 3-Monodominant formations – as the name implies, like the “Lixeiral formation”, dominated by the Lixeira tree (*Curatella americana L*), with potential for colonizing its site of occurrence.



Image 1.13-2: Monodominant Formation, with the occurrence of Lixeira trees – *Curatella americana* L (Author records, 2023)

The main economic activity in Pantanal is the extensive cattle production and the biome currently faces enormous political, economic and social pressures for productivity and livestock competitiveness enhances. This fact culminates into the introduction of technologies that may bring negative impacts for the environment, especially deforestation – including forest fires that aims for the establishment of new pastures (BAZZO *et al.*, 2012).



Image 1.13-3: Pantanal's forest fires – represents a severe damage for the biome over the decades (CORREIO BRAZILIENSE, 2020⁷)

Other relevant factor is the silting up of rivers, as well as the increase in erosion processes as a result of the expansion of agricultural frontiers. These problems may lead to significant changes in superficial dynamics of the biome (VARGAS, 2006).

The city of Corumbá-MS has an estimated population of 112.669 inhabitants (IBGE, 2021) and it owns a port that serves the last easily navigable stretch of the Paraguay River for large vessels, being considered one of the most important river ports in Brazil.

In addition to the economic importance of livestock for this city, it is also important to highlight the significant industrial activity of mineral extraction, such as Iron and Manganese.

The proportion of workers in a formal employment status was only 15% over the total population, according to IBGE⁸ (Instituto Brasileiro de Geografia e Estatística, in Portuguese), with the average salary representing

⁷ Image and article available at: <https://www.correiobraziliense.com.br/brasil/2020/09/4877414-pantanal-pode-levar-ate-50-anos-para-se-recuperar-de-queimadas.html>.

⁸ City's statistic data available at: <https://www.ibge.gov.br/cidades-e-estados/ms/corumba.html>.

only 2.8 times the basic salary (about 695 US dollars). Furthermore, 37,6% of the inhabitants live monthly with half of the basic salary per person.

Despite Corumbá's economic diversification, there is an undeniably important issue to be managed related to poverty and social exclusion, as highlighted by Brito (2011), who analysed aspects of household income, neighbourhood infrastructure, level of education, disease rates, use of public health services and health plans in Corumbá-MS.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The main document related to Brazil's legal provisions is the Property Registration Record (Registro da Matrícula do Imóvel, in Portuguese), which is attached to this project. The number of this document is 30.137 and it certifies the regularity of the rural property called FAZENDA CRISTAL with the Law No. 10.267/2001 and its amendments – Brazil's Law concerning mandatory georeferencing of rural properties. It also describes that it is in compliance with INCRA (Instituto Nacional de Colonização e Reforma Agrária, in Portuguese) – National Institute of Colonization and Land Reform, referring the process No.16130100023-88 of January 14, 2013.

On its turn, the CAR (Cadastro Ambiental Rural in Portuguese) – Rural Environmental Registry, represents a national electronic public record, mandatory for all rural properties, integrating environmental information and composing a database for monitoring environmental issues. Fazenda Cristal's CAR, as well as its Statement of Declared Situation (Demonstrativo da Situação das Informações Declaradas in Portuguese), are attached to this project in Appendix 5. It is extremely important to state in this section that the referred document is usually set as “under analyses” and it occurs due to several reasons that do not concern the property owners and may take a several months/years to be updated – even though the official situation is set as “active”.

Another important Federal Law is the No. 12.484/2011, that provides for the National Incentive Policy for the Sustainable Management and Cultivation of Bamboo in Brazil. This Law was published in 2011 with prospective basis of encouraging sustainable management and use of products and services derived from bamboo in the country.

Among other attributions, it establishes financial incentives for rural producers, cooperatives and related entrepreneurs who develop activities related to the management and use of bamboo. Also, promotes accessible financial credit to bamboo related projects; implementation of research in order to develop specific technologies focused on management and sustainable use of bamboo.

In compliance with article no. 48 of Mato Grosso do Sul State Resolution SEMADE 09/2015, which establishes norms for environmental licensing, the cultivation of native bamboo in Pantanal is exempt from environmental licensing, according to its Annex IX, item 9.2.0-c⁹.

Subsequently, Municipal Law No. 98/2006, which establishes the Master Plan of the municipality of Corumbá, Mato Grosso do Sul, indicates, in its article no. 26-II, that the area where the farm is located covers the Rural Macrozone. This corresponds to the entire rural area of the Municipality and will be organized according to zones with different purposes to be specified through the Ecological-Economic Zoning – ZEE (in Portuguese, Zoneamento Ecológico-Econômico).

In this context, the document prepared by the State of Mato Grosso do Sul, called "Ecological-Economic Zoning", from 2015, established guidelines for territorial management in Mato Grosso do Sul, by classifying areas in this state into different zones, considering the ecological, economic, social and cultural characteristics of each region.

According to the referred document, there is a reclassification of the ecological-economic zoning to a Recovery Zone – after a detailed study on region's geoenvironmental and hydrogeological vulnerabilities. This classification is linked with the provisions of Federal Law No. 12.651 of 2012, which establishes, in Chapter 3 - Restricted Use Areas, the following: "*Article 10: in plains and wetlands of Pantanal, ecologically sustainable exploration is allowed, considering technical recommendations of the official research bodies, with suppression of native vegetation for alternative land use subject to authorization from the state environmental agency, based on the recommendations mentioned in this article*".

The same ZEE-MS document gives general guidelines for the occupation and sustainable exploitation of this area, where FAZENDA CRISTAL property is located.

Finally, there is, then, the State Decree No. 14.273, that provides for the "Restricted Use Area" of the floodplain of Pantanal in the State of Mato Grosso do Sul and other arrangements. It establishes rules for the sustainable management of the Pantanal biome, aiming on preserving the region's biodiversity and natural resources.

This decree is important as it discusses and determines issues related to exempts of environmental authorization for certain vegetation cleaning activities on properties, as well as specifications for Legal Reserve areas – 20%. Additionally, it regards permission for grazing in specific Legal Reserve areas, as long as it would potentially preserve its native vegetation cover, by contributing to the reduction of native grassland biomass and consequently to the incidence of forest fires.

⁹ Mato Grosso do Sul State – Instituto de Meio Ambiente do Mato Grosso do Sul (IMASUL). Resolution SEMADE no.9, May 13, 2015. Available at: <https://www.imasul.ms.gov.br/wp-content/uploads/2019/11/Res-Semade-09-2015-compilada.pdf>.

In addition to the mandatory property documents, we have an important synchronization with the laws regarding the protection of vegetation areas in the country, which are described below:

- Federal Law No. 12.651 (2012): Provides for the Protection of Native Vegetation (also known as the “Forest Code”);
- Federal Law No. 6.938 (1981): Provides for the National Environmental Policy;
- Federal Law No. 9.985 (2000): Establishes the National System of Nature Conservation Units;
- Federal Law No. 14.119 (2021): Establishes the “Payment for Environmental Services (PSA)”;
- Federal Law No. 11.077 (2022): Establishes the procedures for the preparation of Sectoral Plans for Mitigation of Climate Change, institutes the National System for the Reduction of Greenhouse Gas Emissions.

1.15 Participation under Other GHG Programs

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

Fazenda Cristal: Conservation and Bamboo Afforestation project has never been registered under any other GHG programs. Also, there is no other intention to register for other GHG programs.

1.1.1 Projects Rejected by Other GHG Programs

Fazenda Cristal: Conservation and Bamboo Afforestation project has never been rejected by any other GHG programs.

1.16 Other Forms of Credit

Emissions Trading Programs and Other Binding Limits

Fazenda Cristal: Conservation and Bamboo Afforestation project aims to be listed exclusively on SOCIALCARBON® registry and no other institutions. Verified GHG removals that result in issued SCUs to this project’s account will not be traded or used on any other similar programs or mechanisms.

Other Forms of Environmental Credit

Fazenda Cristal: Conservation and Bamboo Afforestation has never received any other form of GHG-related environmental credit, including renewable energy certificates.

1.17 Additional Information Relevant to the Project

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

2. Safeguards

2.1 Local Stakeholder Consultation

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

2.2 Summary of Safeguarding Assessment

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

3. Application of Methodology

3.1 Title and Reference of Methodology

This project uses an official methodology approved by SOCIALCARBON and currently in force, which is named SCM0003 – Methodology for Carbon Removal in Private Conservation Areas (Version 1.0), with a release date of February 8, 2023.

This project uses the guidelines tool for the inclusion of additionality items, also approved by SOCIALCARBON, which is named SCT0001 - Tool for the demonstration and assessment of additionality in SOCIALCARBON Agriculture, Forestry and Other Land Use (AFOLU) project activities (Version 1.0), with a release date of September 26, 2022. SOCIALCARBON AFOLU Non-Permanence Risk Tool - Version 1.0 is also part of this project development.

Another official methodology in use is the Clean Development Mechanism – United Nations Climate Change approved, name AR-AMS0007: Afforestation and reforestation project activities implemented on lands other than wetlands (Version 3.1), with a release date of October 4, 2013, small scale.

This project uses the guidelines tool for the estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, also approved by United Nations Climate Change which is named AR-TOOL14 (Version 4.2), with an entry to force date of July 24, 2015. Other tools as part of the development of this project were: EB 65 – Report, Annex 31 – “Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” (Version 4.0); and AR-TOOL15 “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity”.

3.2 Applicability of Methodology

The SCM0003 Methodology was chosen because it is the closest to the project scope, which includes the intention to preserve a sensitive biome as Pantanal, using areas of private properties, that are mainly susceptible to deforestation activities linked to livestock development in the region.

The applicability conditions established by the SCM0003 Methodology are listed in the table below, along with the necessary information to compliance these conditions.

Conditions for applicability of the SCM0003 Methodology	Description	Compliance with the applicability conditions
Type of project	Generating carbon (CO ₂) removal in private conservation areas.	Yes.
Project area	<p>Areas of native vegetation on formally registered private property within Brazil.</p> <p>Eligible Areas:</p> <ul style="list-style-type: none"> • Managed primary formations • Managed secondary formations <p>Observation: Native wetlands vegetation (under managed primary and secondary formations) are also considered eligible (such as bottomland forests, floodplain forests, mangrove forests, flooded fields) as long as they do not grow on peat.</p> <p>Ineligible Areas:</p> <ul style="list-style-type: none"> • Areas where there have been changes in the land use and cover (“conversion” to alternative land use) within the 10 (ten) years prior to the project starting date) • Areas making alternative use of the land • Non-native forest species • Non-vegetation cover • Wetlands growing on peat (e.g., peat swamp forests) • Areas that are subject to a Conduct Adjustment Agreement or 	<p>Yes.</p> <p>There is, legally and technically, native vegetation area located in this private property, which possess its property registration legal record since 2014.</p> <p>Each of the polygons in private conservation area on property that have had any conversion within 10 years prior to the project starting date; also, with alternative use of the land; with non-native forest species; and non-vegetation cover were <u>excluded</u> from the project, as the methodology implies.</p>

Conditions for applicability of the SCM0003 Methodology	Description	Compliance with the applicability conditions
	similar instrument, as part of a judicial or administrative proceeding • Areas that have been subject of an Environmental Offence Notification within the last ten years	
Project scale	This methodology is applicable to small-scale or large-scale project activities. Small-scale and large-scale designations are as per CDM definitions, according to the SOCIALCARBON Standard.	Yes. It consists of a small-scale project.
Eligibility of the property	Areas where all applicability conditions set out in this methodology, including land ownership, can be supported by legal and/or administrative documentation.	Yes. All necessary documents to support legal and administrative involvement about the property are revealed in this report.
Eligibility of the property owner	Private Individual or Legal Entity legally established in Brazil.	Yes.
Type of vegetation	Native vegetation cover (managed primary and secondary formations).	Yes.
Condition of the vegetation	• <u>Managed primary formations</u> : vegetation cover where it is understood that human activities have not caused any significant changes in its original characteristics of structure and composition during a minimum period of 20 (twenty) years prior to the project start date. This cover is	Yes. To be described below, according to the methodology applied.

Conditions for applicability of the SCM0003 Methodology	Description	Compliance with the applicability conditions
	<p>found in private conservation areas where legal instruments for mandatory or voluntary environmental conservation may or may not apply, subject to exceptions. It is also understood that carbon removal results from anthropogenic GHG removals activities (IPCC, 2006).</p> <ul style="list-style-type: none"> • <u>Managed secondary formations</u>: vegetation cover where it is understood that human activities have caused significant changes in its original characteristics of structure and composition, but there has been no conversion to alternative land use within the area or any degradation that would bring about a regression in its status within the process of ecological succession, during the last 10 (ten) years prior to the project start date. It is also understood that carbon removal results from anthropogenic GHG removals (IPCC, 2006). 	

It is important to mention that a previous step related to the accuracy analysis of the reference base for the land use and cover was performed through GIS platform, comparing MapBiomass's 2021 Land Use and Cover Map with a satellite image from CBERS4A¹⁰, code WPM21, date 2021-08-02, resolution 8 x 8 meters, according to SCM 0003 Methodology – Section 5 (Project Boundary) with the following results:

¹⁰ Specific parameters were added to find a proper image for the objective site. Satellite image is available at: <http://www2.dgi.inpe.br/catalogo/explore>.

Number of pixels sampled	Land Use and Cover	Number of common pixels	Matching percentage
300	Forest formation	13	
	Savanna formation	24	
	Grassland formation	174	
	Water area	17	
	Pasture	52	
TOTAL		280	93%

Relatively to A/R-AMS0007 Methodology, it was chosen in order to foment the forest development in Pantanal, using proper plots of areas of private properties, that are mainly susceptible to degrading activities linked to livestock development in the region. This forest development, in turn, is aligned with social local development and carbon storage.

The applicability conditions established by this methodology are listed in the table below, along with the necessary information to attend it.

Conditions for applicability of the A/R-AMS0007 Methodology	Description	Compliance with the applicability conditions
2.3 – a)	The land subject to the project activity does not fall in wetland category	Yes. According to official (geodata from governmental sources and <i>in loco</i> analyses, the area subject to planting does not have specific characteristics of a permanently humid ecosystem, such as swamps, bogs, marshes, fens or

Conditions for applicability of the A/R-AMS0007 Methodology	Description	Compliance with the applicability conditions
		<p>related¹¹, being composed of grassland developed by anthropic action (non-native) for grazing activity.</p> <p>Complementarily, there is the confirmation of land use types cover change, in Section 2.2 of the applied methodology, which includes “Grassland to forested land”. This land use represents the actual use found in the afforestation activities, which, for instance, excludes any possible area classified as wetlands within its boundary.</p>
2.3 – b) (i)	Soil disturbance attributable to the project activity does not cover more than ten per cent of area in each of the following types of land, when these lands are land containing organic soils.	<p>Not applicable.</p> <p>The soil of the area subject to planting does not refer to significant amount of organic matter, such as peat, histosols or even managed soils for this purpose. As previously detailed, the soils in this region are naturally poor in organic content and nutrients.</p>
2.3 – b) (ii)	Soil disturbance attributable to the project activity does not cover more than ten per cent of area in each of the following types of land, when these lands are lands which, in the baseline, is subjected to land-use and management	<p>Not applicable.</p> <p>Land submitted to this project is represented in majority by former pasture area, composed of grassland developed by anthropic action (non-native) for grazing</p>

¹¹ EPA – Environmental Protection Agency, United States - Office of Wetlands, Oceans and Watersheds. Types of Wetlands - EPA 843-F-01-002b September 2001. Available at: https://www.epa.gov/sites/default/files/2021-01/documents/types_of_wetlands.pdf.

Conditions for applicability of the A/R-AMS0007 Methodology	Description	Compliance with the applicability conditions
	practices and receives high inputs such as manure in tropical wet tillage.	activity. This development generally uses no inputs of manure nor related.

3.3 Project Boundary

The carbon pools used within the project boundary for SCM0003 Methodology were linked to the Ministry of Science, Technology and Innovation (in Portuguese, Ministério da Ciência, Tecnologia e Inovação, MCTI) for removals estimations, using the most recent data available from Brazil's National Communication to the United Nations Framework Convention on Climate Change.

As the methodology states, carbon pools may be deemed insignificant and do not need to be accounted for if any carbon pool result in an increment of less than 5% of the total CO₂ removals or if the total omitted increase in GHG emissions amounts to less than 5% of the total GHG benefit generated by the project.

Source	Gas	Included?	Justification/Explanation	
Baseline	Aboveground woody biomass	CO ₂	Yes	The project aims for CO ₂ removal from native vegetation areas that has been absorbing the gas throughout its development and regeneration, but also during its establishment and constancy, along with its successional stages. This source may represent the largest carbon pool covered by it. The project start date is 2020, therefore there is CO ₂ removal from this source from the baseline scenario.
		CH ₄	No	Negligible under applicability conditions.
		N ₂ O	No	Negligible under applicability conditions.
		Other	No	Negligible under applicability conditions.

Source	Gas	Included?	Justification/Explanation
	Belowground biomass	CO ₂	Yes There is significant absorption of CO ₂ for the development of belowground biomass in native vegetation areas, along with its successional stages. The project start date is 2020, therefore there is CO ₂ removal from this source from the baseline scenario.
		CH ₄	No Negligible under applicability conditions.
		N ₂ O	No Negligible under applicability conditions.
		Other	No Negligible under applicability conditions.
	Biomass burning	CO ₂	No Conservatively omitted.
		CH ₄	No Conservatively omitted.
		N ₂ O	No Conservatively omitted.
Project	Aboveground woody biomass	CO ₂	Yes The project aims for CO ₂ removal from native vegetation areas that has been absorbing the gas throughout its development and regeneration, but also during its establishment and constancy, along with its successional stages. This source may represent the largest carbon pool covered by it.
		CH ₄	No Negligible under applicability conditions.
		N ₂ O	No Negligible under applicability conditions.
		Other	No Negligible under applicability conditions.
	Belowground biomass	CO ₂	Yes There is significant absorption of CO ₂ for the development of belowground biomass in native vegetation areas, along with its successional stages. The carbon stock in this pool is expected

Source	Gas	Included?	Justification/Explanation	
			to increase as a result of the implementation of this project.	
	CH ₄	No	Negligible under applicability conditions.	
	N ₂ O	No	Negligible under applicability conditions.	
	Other	No	Negligible under applicability conditions.	
	Biomass burning	CO ₂	Yes	Major emission source considered.
		CH ₄	Yes	Major emission source considered.
		N ₂ O	Yes	Major emission source considered.

Emissions from fossil fuel consumption within the project area of this methodology have been excluded from the project boundary. This is because the main activities regarding the conservation area, such as fences and temporary roads were developed before the project start date. Also, it is understood that the ongoing management of fences and firebreaks is comparatively low compared to other rural activities, particularly because of the durability considered for both. As a result, any change in fossil fuel consumption resulting from the project is expected to be negligible.

A map illustrating the project boundary location and the referenced areas in compliance with the methodology used is found below.

It is found that the Property Registration Record (Registo da Matrícula do Imóvel, in Portuguese), No. 30.137, which is attached to this document (appendix section) certifies the regularity of the Legal Reserve of the property, as clearly identified in the map above (green) with a total area of approximately 3.976 hectare, which means approximately 20% of FAZENDA CRISTAL's official area, that summarizes 19.397,90 ha.

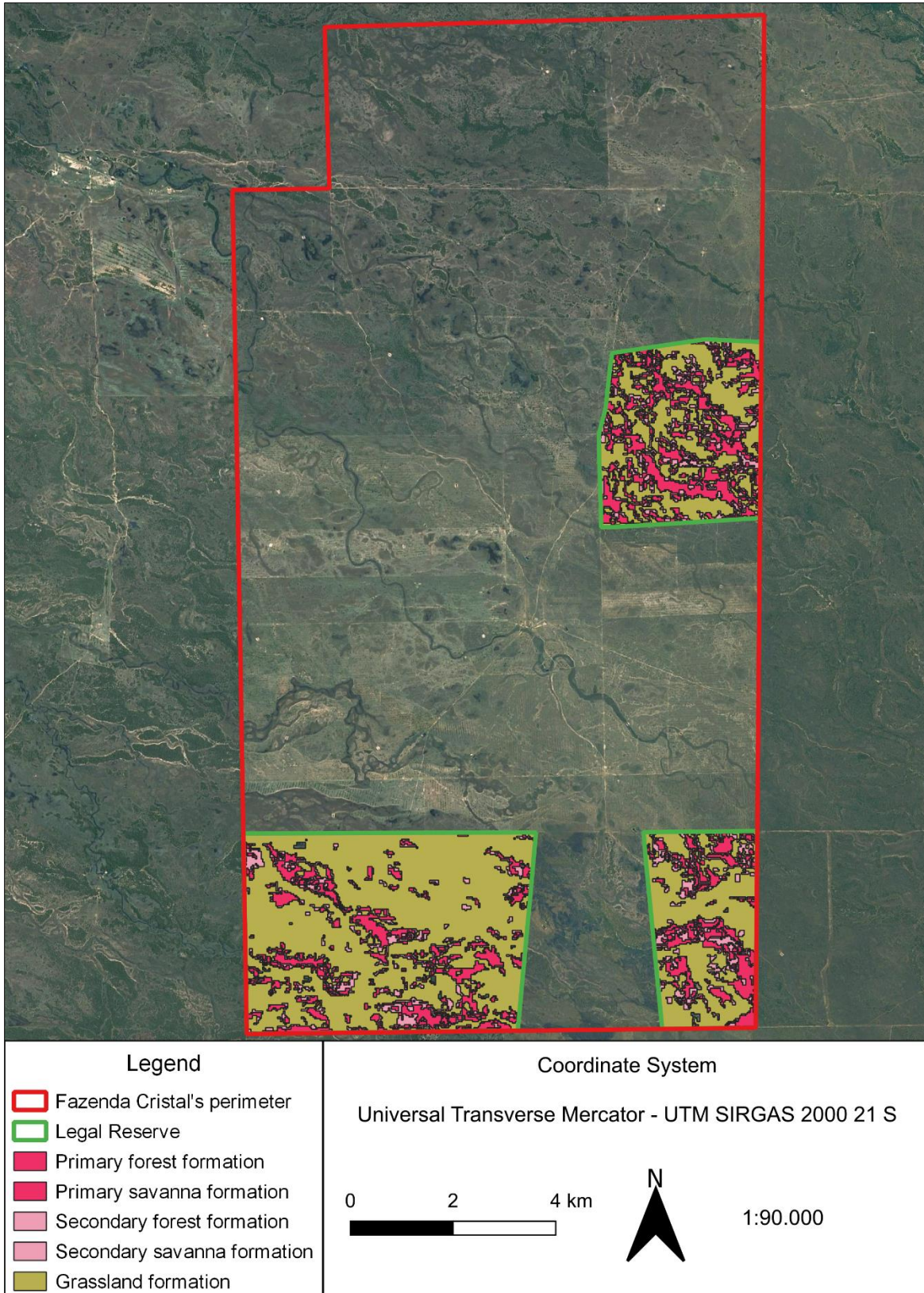


Image 3.3-1: FAZENDA CRISTAL's project boundary and representative areas within the methodology applied

With reference to A/R-AMS0007 Methodology, the carbon pools selected for accounting of carbon stock changes are shown in table below. An illustration of project's planting boundary is found posteriorly.

Carbon pool	Included?	Justification/Explanation
Aboveground biomass	Yes	This is the major carbon pool subjected to project activity.
Belowground biomass	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity.
Dead wood Litter and Soil organic carbon	No	Carbon stock in these pools may increase due to implementation of the project activity.

As for the emission sources and associated GHGs selected for accounting, these are found in table below.

Source	Gas	Included?	Justification/Explanation
Burning of woody biomass	CO ₂	No	CO ₂ emissions due to burning of biomass are accounted as a change in carbon stock.
	CH ₄	Yes	Burning of woody biomass for the purpose of site preparation, or as part of forest management, is allowed under this methodology.
	N ₂ O	Yes	Burning of woody biomass for the purpose of site preparation, or as part of forest management, is allowed under this methodology.

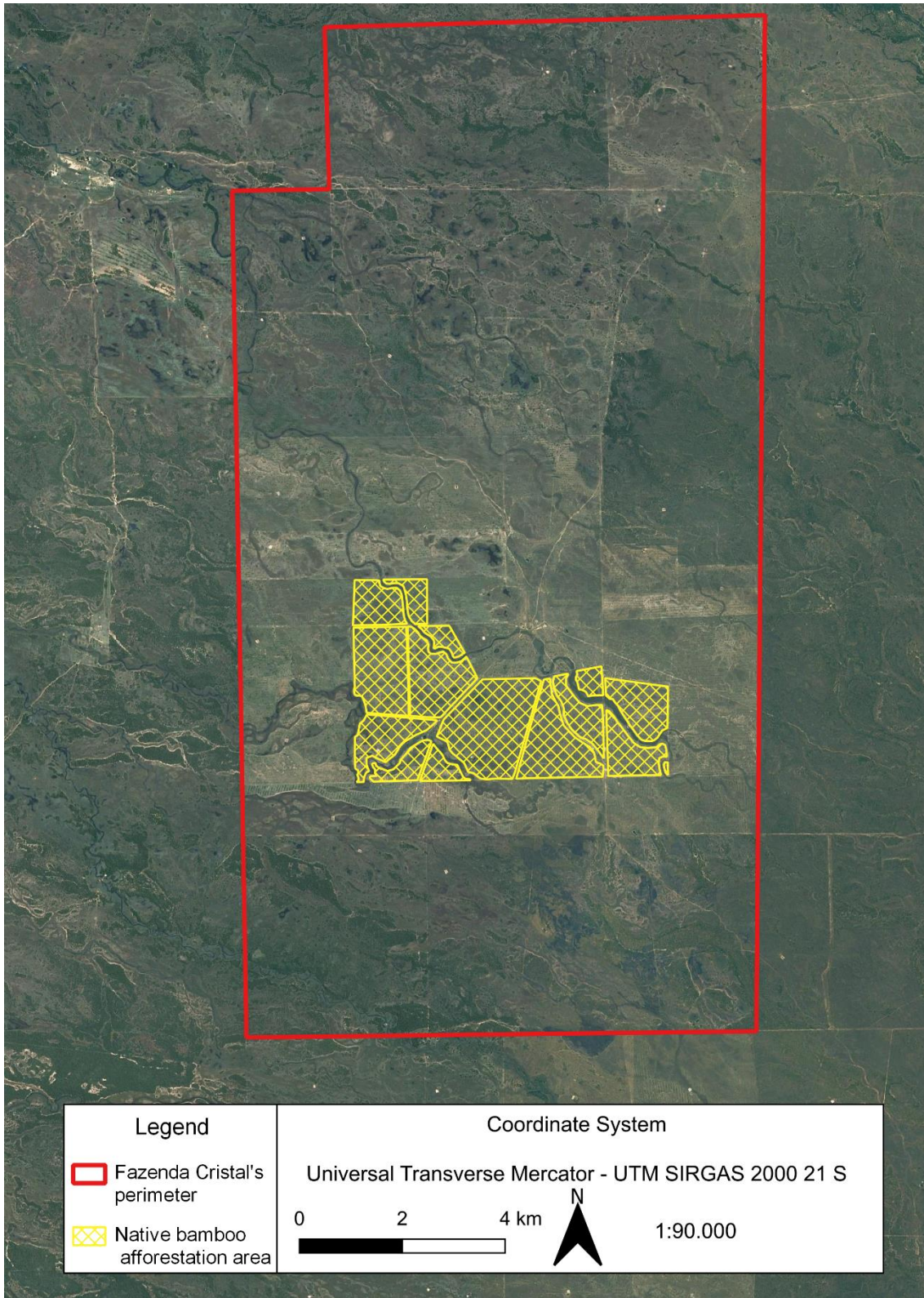


Image 3.3-2: FAZENDA CRISTAL's project boundary and representative areas within the methodology applied

3.4 Social, Economic and Environmental Impacts

Activity	Aspect	Impact	Effect	Comments/ Observation
Hiring workers for activities related to conservation areas maintenance and afforestation activities	Socioeconomic	Increasing employment offer for formal rural workers in the region; Increasing economic stability and capacity for workers.	Favourable	Monitored by the indicator “Local Employment Opportunities”
Hiring workers for activities related to conservation and afforestation areas monitoring	Socioeconomic	Increasing formal job offer for specialist workers in the region; Increasing economic stability and capacity for workers.	Favourable	Monitored by the indicator “Local Employment Opportunities”
Maintenance of workers in project activities	Social	Increasing qualification, training, awareness and environmental education for employers and community.	Favourable	Monitored by the indicator “Community Qualification”
Conservation of native vegetation areas (project as a whole)	Environmental	A relatively long list could be unravelled about the environmental positive impacts related to the conservation of native vegetation areas. Among other aspects, it is important to mention: increasing biodiversity and ecological	Favourable	Monitored by the indicator “Vegetation Restoration”

Activity	Aspect	Impact	Effect	Comments/ Observation
		connectivity lines; increasing air quality; increasing supply of groundwater reservoir; increasing soil protection; increasing the quality of the regional microclimate.		
Bamboo afforestation (project as a whole)	Environmental	Bamboo afforestation may represent a few environmental gains as it improves soil quality – its root system is highly branched and can penetrate deep into the soil, improving its structure and fertility. In addition, the leaves and branches that fall from the plants during the bamboo's life cycle are rich in nutrients and may be used as a natural fertilizer. Along with soil improvements, it may represent positive impact for conservation of local biodiversity, once it is considered a native species, many animal species may benefit from its cycle.	Favourable	Monitored by the indicator “Bamboo Native Forest” and “Biodiversity and Ecosystem Functionality”
Maintenance of firebreaks on the perimeters of the conservation	Environmental	Under certain circumstances, firebreaks can promote an increase in erosion processes and soil loss where they are inserted.	Neutral	Monitored by the indicator “Firebreaks”

Activity	Aspect	Impact	Effect	Comments/ Observation
and afforestation areas		However, it is important to mention that the Pantanal plains do not reveal slopes higher than 3% of declivity and this fact turns this impact to “relatively neutral”.		
Conservation of native vegetation areas (project as a whole)	Environmental	Decreasing deforestation and decrease of GHG emissions	Favourable	Monitored by the indicator “Removals (Conservation)”
Prevention of grazing activities in Legal Reserve conservation area	Environmental	As the State Decree 14.273 establishes, it is commonly permitted to practice controlled pasture activity regarding state’s private Legal Reserve areas. This occurs due to grazing contribution to the reduction of native grassland biomass and consequently to the incidence of forest fires. However, regarding the project of conservation through SCM0003, as the area is not allowed to be in any kind of anthropic use, there will consequently be an effective monitoring of areas, as well as periodic activities of maintenance of firebreaks within the regarding perimeter	Neutral	Monitored by the indicator “Firebreaks”

Activity	Aspect	Impact	Effect	Comments/ Observation
Bamboo afforestation (project as a whole)	Environmental	Decreasing deforestation and decrease of GHG emissions	Favourable	Monitored by the indicator “Removals (Afforestation)”
Conservation of native vegetation and afforestation (projects as a whole)	Economic	Decreasing farm owner’s economic dependence on his main activity (increasing diversification of income-generating)	Favourable	Monitored by the indicator “Reduction of Dependency on Monoactivities”
Use and disposal of bamboo as raw material	Economic	Income generating for parties involved in harvesting, using and selling of bamboo material for wholesale or retail	Favourable	Monitored by the indicator “Profits From Bamboo”
Use and disposal of bamboo as raw material	Environmental	Bamboo is a renewable raw material, that has a fast growth cycle and can be harvested periodically without the need for replanting. It can be used for several purposes, such as civil construction, furniture manufacturing, handicrafts and paper. With these possibilities of disposal of FAZENDA CRISTAL’s bamboo, there is a potential to reduction of pressure of wood or other degrading material consumption	Favourable	Monitored by the indicator “Profits From Bamboo”

Activity	Aspect	Impact	Effect	Comments/ Observation
Monoculture of bamboo crops	Environmental	<p>In any circumstances the production/planting of a unique vegetal species in a significant area represents a disadvantage for environmental aspect. The monoculture crops of bamboo may potentially represent an area with vulnerability to diseases and pests as there is limited variability of natural control. Therefore, it may become dependent on specific pesticides with negative impacts over the environment. However, considering the planting area is a former pasture area, with exotic grassland, it is possible to estimate that an afforestation with native bamboo may present positive impacts as well in a long term, confronting negative impacts quoted above.</p>	Neutral	Monitored by the indicator “Bamboo Native Forest”
Activities related to soil preparation for afforestation	Environmental	<p>Considering the initial phase of the project, soil preparation activities may promote negative impacts since there is a predictable loss of its structural layer, with potential superficial dynamic processes. However,</p>	Neutral	Monitored by the indicator “Bamboo Native Forest”

Activity	Aspect	Impact	Effect	Comments/ Observation
		considering that it is a temporary situation, to be remedied by the very development of the planted species, this impact was considered neutral.		

3.5 Baseline Scenario

Although FAZENDA CRISTAL's project represents a small-scale project, it is clear to affirm that there has been investments or conservation activities undertaken by the property owner. Brazilian's Federal Law No 12.651/2012, named as the "Forest Code" (Código Florestal, in Portuguese) establishes the Legal Reserve (Reserva Legal, in Portuguese), which states that rural properties must allocate a minimum percentage of their total area for this purpose. The Legal Reserve (LR) area may vary according to the region where the property is located and the type of vegetation that occurs on site. For Pantanal biome it is required that the reserve area totalize at least 20% of the property.

All things considered, it is found that the Property Registration Record (Registro da Matrícula do Imóvel, in Portuguese), No. 30.137, certifies the regularity of the Legal Reserve of the property, making it clear that it was established since 2014, what enforces the argument that conservation activities have been occurring and monitored by the responsible entities since then.

FAZENDA CRISTAL's official area is 19.397,90 hectare (ha) which then implies in a Legal Reserve of 3.879 hectare (20%). Practically, it is found out that the LR of the farm summarizes 3.976 ha, lightly above the value required by law. The Image 3.3-1 in Section 3.3 reveals the perimeter considered for this very project, through SCM0003 Methodology. The project area, however, is reduced to 3.931,90 ha, once there are ineligible areas within LR while applying the SCM0003 Methodology – such as rocky outcrops, water bodies, roads, etc.

This could lead the scenario to a situation where native vegetation formations are anthropically managed and protected, representing CO₂ removals as result of anthropogenic activities, being the area classified under the concept of carbon removal on managed lands according to the IPCC (2003, 2006).

Specifically, from 2019 to 2022, according to the property owner, it was made a significant action of maintenance of fences along the conservation area perimeter, in order to guarantee full protection from cattle invasion and related, also to ensure greater durability of fences avoiding imprecise attempt of monitoring it.

The approximate amount spent with materials related to these conservation activities was BRL 135.000,00, between wood post replacement when needed and barbed/plain wire lines replacement. A couple of evidence of invoice related are found in Appendix 4.

Considering the previous expositions along with Section 1.8 – Project Start Date, this baseline scenario may account 2020, 2021, 2022 and 2023 conservation activities in FAZENDA CRISTAL, to be calculated in Section 4.1.

Further details about the baseline scenario are described below in Section 3.6 – Additionality, using the most recent version of the “Tool for the Demonstration and Assessment of Additionality in SOCIALCARBON Agriculture, Forestry and Other Land Use (AFOLU) Project Activities” (SCT0001).

As for the A/R-AMS0007 Methodology related to bamboo afforestation, the baseline scenario of a small-scale A/R CDM project activity implemented under this methodology is continuation of the pre-project land use. Image 3.3-2 in Section 3.3 illustrates this project boundary and representative designed areas within this methodology. Therefore, considering the pre-project trees that already exists within the boundaries of this methodology are not supposed to be removed, neither will suffer with competition from bamboo plantation and will not be inventoried along with projects plants, baseline is to be considered as zero. Yet, it is important to reinforce that vegetation to be substituted by native bamboo afforestation is essentially represented by exotic grasses, with high invasion and spreading potential.

While analyzing more accurately the limits of the bamboo seedlings planting, it is certain to affirm that the property under study provided specific piquet areas previously used for grazing activities. These areas are mostly composed of exotic grassland, although the native grassland naturally remains in patches within these areas.

Understanding the importance of preserving this native grassland formation, in addition to the requirements preconized in State Decree No. 14.273, which provides for the Restricted Use Area of the Pantanal floodplain in the State of Mato Grosso do Sul, this project chose not to make any changes in these remaining native patches, also to apply a safe distance during the soil preparation and seedling planting activities, in order to naturally preserve this phytophysiology within the limits of the afforestation project. Management activities will ensure that the Taquara bamboo’s possible invasive potential does not come to the fore.

It is worth considering that all areas of permanent protection (Áreas de Preservação Permanente, in Portuguese) related to local watercourses have also been conservatively buffered from planting project, as

well as any significant wetlands and other types of water resources. No changes to local water regime are considered for this project.

Finally, the eventual clearing of former pasture area for planting purposes will follow the same pre-existing procedure used in the property for livestock activities, safeguarding representative samples of diversity of present phytophysiognomy, as determined by the aforementioned state decree.

The illustration below reveals the details of the planned planting estimate as explained above, which totals approximately 1,000 hectares of area, within the designed area. A further illustration shows each methodology applied related to its boundary baseline scenario.

Additional details related to the methodologies are well described in the following Section 4. *In loco* register that identifies exotic and native grassland in the afforestation area are found in Appendix 6: Photographic Register.

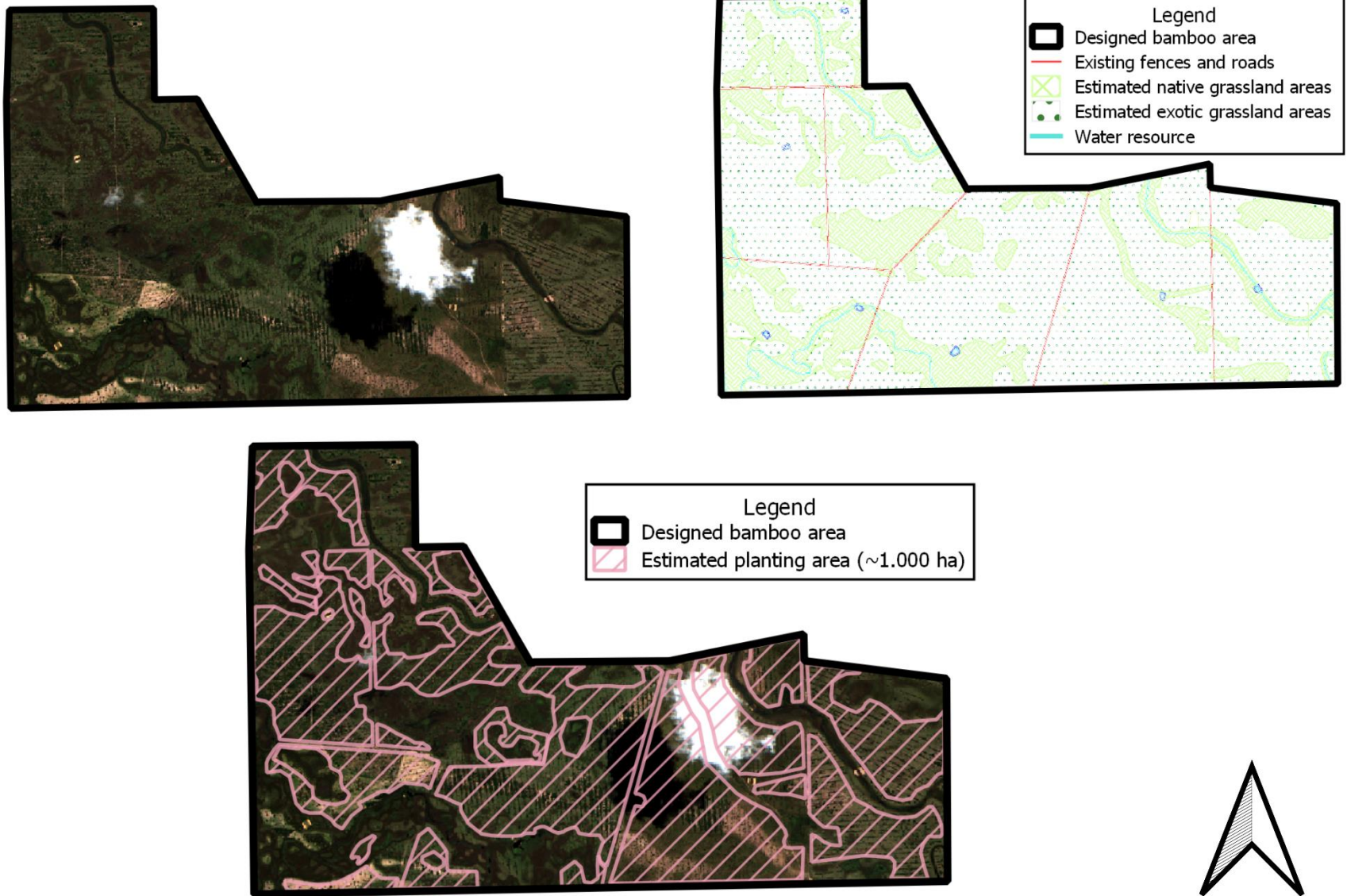


Image 3.5-1: Bamboo's accurate baseline and boundary delimitation for afforestation activities

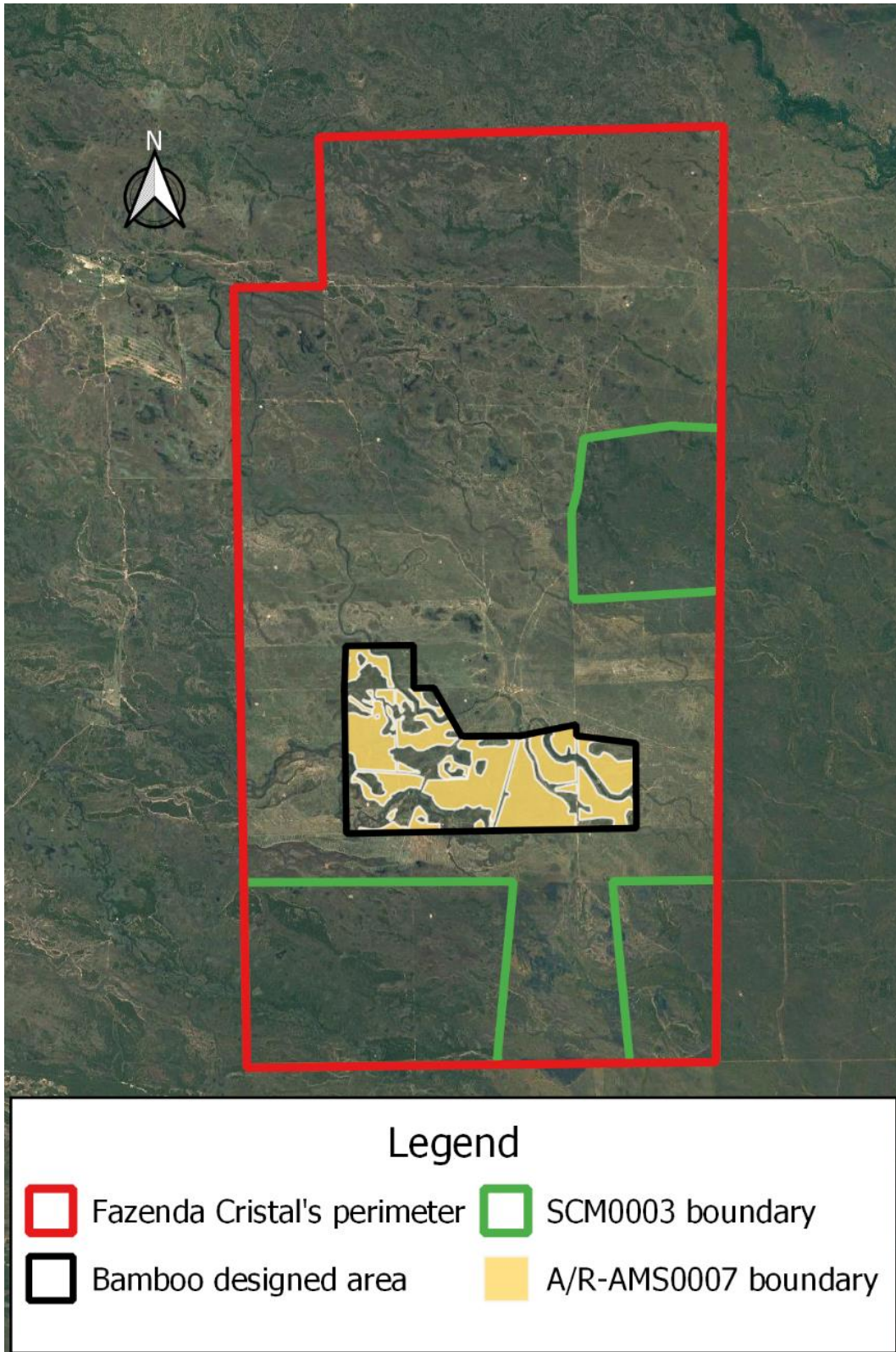


Image 3.5-2: Baseline representative boundary areas within respective methodology applied

3.6 Additionality

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

3.7 Methodology Deviations

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

4. Quantification of GHG Emission Reductions and Removals

4.1 Baseline Emissions

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

4.2 Project Emissions

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

4.3 Leakage

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

4.4 Net GHG Emission Reductions and Removals

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

5. Monitoring

5.1 Data and Parameters Available at Validation

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

5.2 Data and Parameters Monitored for Verification

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

5.3 Data Monitored for Broader Sustainability Components

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

5.4 Monitoring Plan

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

6. SOCIALCARBON Indicators

6.1 Indicators at Point Zero

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

6.2 Performance at Point Zero

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

6.3 Performance Hexagon

Section not required for DRAFT version. Further information will be inserted into PDD complete version.

1. Appendix 1: Non-Permanence Risk Analysis

2. Appendix 2: Formal Contract Between Parties

3. Appendix 3: Property Registration Record

4. Appendix 4: Evidence of Previous Conservation Activities

5. Appendix 5: Rural Environmental Registry and Statement of Declared Situation

6. Appendix 6: Photographic Register



Photo 1: Aerial view of part of the Legal Reserve – Fazenda Cristal



Photo 2: Aerial view of part of the Legal Reserve – Fazenda Cristal



Photo 3: Aerial view of property headquarters and support sheds – Fazenda Cristal



Photo 4: Aerial view of characteristic wetlands from Pantanal biome – Fazenda Cristal



Photo 5: Ground view of mammal “Cervo-do-Pantanal” (*Blastocerus dichotomus*) – Fazenda Cristal



Photo 6: Ground view of grassland formation with native grass and savanna formation at the background –
Fazenda Cristal



Photo 7: Ground view of cattle activity beyond the fence – Fazenda Cristal



Photo 8: Ground view of Legal Reserve beyond the regular fence – Fazenda Cristal



Photo 9: Ground view of “Cerradão” physiognomy with characteristic sandy soil – Fazenda Cristal



Photo 10: Ground view of forest formation in one of the conservation sites – Fazenda Cristal



Photo 11: Ground view of “Tuiuiú” bird (*Jabiru mycteria*) – Fazenda Cristal



Photo 12: Aerial view of firebreaks evidence surrounding Legal Reserve area – Fazenda Cristal



Photo 13: Aerial view of Legal Reserve area – Fazenda Cristal

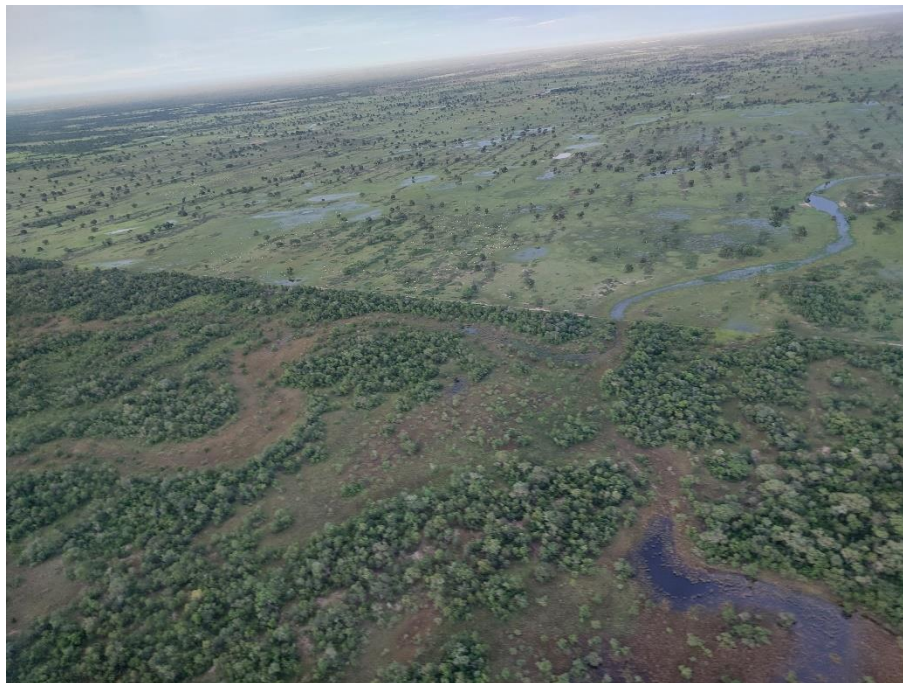


Photo 14: Aerial view of Legal Reserve area with both savanna and forest formation – Fazenda Cristal



Photo 15: Representative ground view of future afforestation area with majorly exotic grassland occupation – “Braquiarão, Braquiária, Humidícola, Mombaça, etc” – Fazenda Cristal



Photo 16: Representative aerial view of future afforestation area with majorly exotic grassland occupation – Fazenda Cristal

7. Appendix 7: Safeguarding Assessment

8. Appendix 8: Environmental Characterization Map – Fazenda Cristal

9. Appendix 9: Feasibility Assessment and Related

10. Appendix 10: Flareless and Mapper Preventing Monitoring

11. Appendix 11: Bibliographic References