MONITORING & IMPLEMENTATION OF THE CARBON PROJECT IN THE EMAS-TAQUARI BIODIVERSITY CORRIDOR, GOIÁS AND MATO GROSSO DO SUL, BRAZIL

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<th>Carbon Project in the Emas-Taquari Biodiversity Corridor, Goiás and Mato Grosso do Sul, Brazil</th>
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ii. Project location: Goiás and Mato Grosso do Sul, Brazil

iii. Project Proponent: Oréades Núcleo de Geoprocessamento (Oréades Geoprocessing Center)

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v. Project start date, GHG accounting period and lifetime: The project activities have officially started on 06/12/2010. The project crediting period goes from 06/12/2010 until 05/12/2040. Project lifetime 30 years.

vi. Project implementation period covered by the PIR: From 06/12/2010 until 10/07/2015 (forest inventory conclusion).


http://www.climate-standards.org/?s=emas


ix. Brief summary of the climate, community and biodiversity benefits generated by the project since the project start date and during the current implementation period covered by the PIR: In the first 5 years the project removed from the atmosphere 13,611.39 tCO2e through the plantation of 520 hectares (more than six hundred thousand seedlings of native tree species). In terms of biodiversity benefits, the project was implemented in strategic sites along the landscape, aiming to increase the connection between remaining fragments, creating a mosaic of native forest amid monocultures and crop fields, reducing inbreeding, and promoting gene flow among native species through the creation of biodiversity corridors. The monitoring of fauna have shown the return to the project areas of some endangered mammals such as tapirs and jaguars (*Panthera onca*). In addition, the project has benefited 51 (directly) and 19 (indirectly) rural.
settled families, 9 quilombola families, and a group of 34 temporary employees hired up to work with planting activities. The net positive impacts on the communities assisted by the project is due to the work opportunities, social inclusion, environmental education and income alternatives offered by the project activities.

| x. Optional Gold Level criteria used and a brief summary of the exceptional benefits generated by the project to meet the requirements of each relevant Gold Level | Exceptional biodiversity benefits are sustained by the spread use of native tree species of Cerrado (one of the 35 global biodiversity hotspots) and the forest fragments connectivity, supporting the fauna and flora genetic flux in an area surrounded by the agribusiness and monoculture activity. |
| xi. Date of completion of this version of the PIR, and version number as appropriate. | 30/05/2016, PIR v.2.1. |
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Abbreviations

AFOLU: Agriculture, Forestry and Other Land Use
APP: Areas of Permanent Preservation (Áreas de Preservação Permanente)
CAR: Rural Environmental Registry (Cadastro Ambiental Rural)
DBH: Diameter at Breast Height
GHG: Greenhouse Gases
GIS: Geographic Information System
HCV: High Conservation Value
IBAMA: Brazilian Institute of Environment and Renewable Natural Resources (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis)
INPE: National Institute for Space Research (Instituto Nacional de Pesquisas Espaciais)
IPCC: Intergovernmental Panel on Climate Change
LR: Legal Reserve (Reserva Legal)
MCT: Ministry of Science and Technology (Ministério da Ciência e Tecnologia)
MMA: Ministry of Environment (Ministério do Meio Ambiente)
MP: Monitoring Plan
PD: Project Document
PROARCO: Program for the Prevention and Control of Forest Fires in the Arc of Deforestation
RPPN: Private Reserve of Natural Heritage (Reserva Particular do Patrimônio Natural)
SOP: Standard Operating Procedure
UC: Conservation Units (Unidades de Conservação)
UNFCCC: United Nations Framework Convention on Climate Change
VCS: Verified Carbon Standard
VCU: Verified Carbon Unit
1 GENERAL

1.1 Summary Description of the Project (G3)

The project for the reforestation of the Emas-Taquari ecological corridor is part of a broader strategy of conservation and restoration of the Cerrado-Pantanal biodiversity corridor. This project consists of a voluntary partnership involving landowners, non-profit sector institutions, and local conservation units for the recovery of degraded areas and promotion of gene flow among fauna and flora species, through the creation of biodiversity corridors connecting remaining Cerrado fragments in the area surrounding the Emas National Park, GO, and the Nascentes do Rio Taquari State Park, MS. The project includes the reforestation of 589 hectares¹ using native Cerrado species, especially those strongly interrelated with the fauna and/or those with non-destructive economic uses (non-timber), such as fruits, seeds, fibers, oils, and honey.

The non-timber economic use of the planted forest species is a key strategy for the creation of biodiversity corridors, as it will stimulate greater participation and commitment from landowners, who allowed their property to be reforested. We believe that once they realize there are opportunities for economic gain with native species, the landowners involved with the project will more proactively engage in the maintenance and preservation of reforested areas.

The project aims at an average removal of 12.13 tons of CO₂e per hectare per year, which, after 30 years is expected to have accumulated 198.26 tons of dry biomass (above and below ground), or 363.81 tons of CO₂e, per hectare. Project activities have started in 2010. At the end of the 30 year crediting period, the project anticipates a total stock of 214,245 tons of carbon dioxide in its 588.9 hectares¹.

Regarding to the community objectives, the main goals are the following:

- To stimulate the local economy through strengthening sustainable and exemplary businesses in terms of social and environmental responsibility associated with ecological restoration and native seedling production.
- Encourage the involvement of the communities in the reforestation process, increasing their income and quality of life.
- Strengthen businesses that encourage or promote the conservation or restoration of the Cerrado, as opposed to conventional practices that degrade it Involve local institutions in actions aiming to increase appreciation of the Cerrado.
- Train and create opportunities for social inclusion of people who are disadvantaged or at risk.
- Promote communication as a means of ensuring transparency and equal opportunity of access to information.

1.2 Project Location (G1 & G3)

The project areas and the communities involved in the project activities are located between southwestern Goiás and northeastern Mato Grosso do Sul, spread in three municipalities: Mineiros, Chapadão do Sul, and Alcinópolis. The physical description of the project areas by the moment of validation can be viewed in Annex I. The reforestation project of the Biodiversity Corridor Emas-Taquari encompasses four private and one public properties (Figure 1, 2 and 3).

¹ Over the course of project implementation there was a reduction to 520 hectares. This will be explained in detail on the sections below as well as the changes on the project potential removals.
Figure 1: Geographical location of the areas and communities covered by Emas-Taquari reforestation project. (refer to Annex XXIV and XXVI)
Figure 2: Polygons representing reforestation areas and the five substrata identified during validation (2010) in the Flores do Ipe (1), Mirassol da Furna (2), Lugar Jacubiinha (3) and Babilonia (4) farms.

Figure 3: Images from the area by the time of the validation (2010) representing the Flores do Ipe (1), Mirassol da Furna (2), Lugar Jacubiinha (3) and Babilonia (4) farms.
The project region encompasses nine different Cerrado phytophysiognomys, as the following: Riparian Forest, Vereda, Seasonal Forest, Cerradão (woodland savannah), Cerrado, Campo Cerrado, Campo rupestre, Campo Sujo and Campo Limpo (grasslands) (Figure 4).

Figure 4: Cerrado's Phytophysiognomies. Source: Embrapa Cerrados.

The landscape and the geomorphology of the project area are part of the Northern Plateau Paraná Sedimentary Basin, comprising residual tabular forms in high portions, partially eroded and dissected along the greater valleys, with altitudes ranging from 890 and 390 meters above sea level. The elevated portions constitute extensive plains, covered by latosols and quartz sands, originally occupied by a mosaic of vegetation types characteristic of the Cerrado biome.

According to Koppen classification, the region falls within the type AW, characteristic of the tropical humid climates with two distinct seasons: dry in winter and humid in summer. The annual precipitation varies between 1,200 and 3,000 mm and the length of the dry period between 5 and 6 months.

1.3 Project Proponent (G4)

Oréades Núcleo de Geoprocessamento is the Project proponent, responsible for managing, coordinating, and implementing the project with help from other parties involved. Oréades is in charge of management of reforestation activities, GIS, carbon credits commercialization as well as focal point for the other parties involved.

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1.4 Other Entities Involved in the Project (G4)

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<thead>
<tr>
<th>Entities</th>
<th>Stakeholders</th>
<th>Roles and Responsibilities</th>
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</tr>
</thead>
<tbody>
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| Alcinópolis Mato Grosso do Sul | Representing the city hall in the project | Elisberto Martins Resende  
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| Settlements and Communities | Formiguinha | Gathering seeds and producing seedlings of native species for the project. | Anilton Teodoro de Deus - President of the Association of Residents  
Mobile: (64) 9288-9342 |
| Serra das Araras | Gathering seeds and producing seedlings of native species for the project. | Valteci Alves Ferreira - President of the Association of Residents  
Mobile: (64) 9647-0290 |
| Pouso Alegre | Gathering seeds and producing seedlings of native species for the project. | Francisco Antonio de Oliveira - President of the Association of Residents  
Mobile: (64) 9998-0538 |
| Buracão | Gathering seeds and producing seedlings of native species for the project. | Orlei Oliveira Araújo  
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During the last five years the above-mentioned entities have been working together to implement the Carbon Project in the Emas-Taquari Biodiversity Corridor. The team management has been carried out by Oréades Núcleo de Geoprocessamento (see Annex II).

Despite of the challengers faced by the atypical dry season that hit the project area for two consecutive years (2011 and 2012), these entities were able to conduce the project activities quite successfully. With the leadership of Oréades technical team and the consent of the farmers, it was possible to access the carbon market in order to guarantee financial resources to implement the project activities.

1.5 Project Start Date (G3)

The activities involving the articulation and definition of services involving the landowners, communities, and the project proponent began in February 2009. The starting of physical implementation of the project was scheduled for 2010 (planting activities were subject to the prior selling of carbon credits - or a portion of them - to be generated by the project during its crediting period). Based on this the project activities have officially started on 06/12/2010.

1.6 Project Crediting Period (G3)

The crediting period of the reforestation project is 30 years after which the forest is expected to reach both maturity and consequently, a balanced flow of carbon dioxide between the atmosphere and the biomass. Considering the project activities have officially started on 06/12/2010 as per the registered VCS PD, the project crediting period goes from 06/12/2010 until 05/12/2040.

2 IMPLEMENTATION OF DESIGN

The project is operational and its implementation is concluded, according to that stated in the registered VCS and CCB PD. From the original area planned to be reforested under the project activity (588.9ha), 88% (or 520.57ha) was carried out (refer to Annex XXIV and XXVI). In the first monitoring period, it was considered a total reforested area of 462.19ha, which was sampled for the proceedings of the first forest biomass inventory. The biomass values obtained with the use of an alometric equation were extrapolated to estimate the biomass of other non-inventoried project sites, according to their planting age.

Around 635,500 seedlings were planted under project activities according to the following timeline:

- 100 hectares in 2010/2011;
- 138 hectares in 2011/2012
- 222 hectares in 2012/2013;
- 60 hectares in 2013/2014.

The level of coordination between the project partners is deemed very well. The landowners are very motivated and actively participating in the project activities. Once included in the project design with its
eligible 24.1ha, the Nascentes do Rio Taquari State Park (PENT) was withdrawn from the project, but it is worth mentioning that the good relationship between Oréades and IMASUL\(^2\) remains unchanged. This decision was based mainly on two aspects:

- There is no legal framework to support carbon credits trade and ownership in the PENT boundaries, and this became reforestation activities of high cost and with no financial return for the project.
- The PENT is public owned by the State of Mato Grosso do Sul, so that they are unable to grant consent for Oréades to trade the carbon credits generated through the restoration activities.

The community involvement within the project is also deemed very good, once new partners have been added in the project activities, like seed collection and seedling production, as well as activities related to the sustainable development in the region. Finally, the community and biodiversity activities and their monitoring are operational and no significant changes, compared to that stated in the registered CCB PD, have been notified during the first 5 years of the project activities. One exception relies on the intervals and specific components of social and biodiversity aspects monitored in the first 5 years, which are explained in detail on section 4.2.

2.1 Sectoral Scope and Project Type

The project is a small-scale Reforestation/Afforestation Grouped Project (AFOLU - Afforestation, Reforestation and Revegetation - ARR). The Grouped Project approach was stated after the PD register. Notwithstanding, it’s worth mentioning that no new area became part of the project scope during this first monitoring period. New areas are supposed to be included in the Grouped Project only from the second monitoring period ahead.

2.2 Description of the Project Activity (G3)

The project main activities are based on reforesting areas that are deforested, degraded, and occupied by agriculture and livestock. Based on this, the project plans has involved and empowered the association of poor communities in the region in many different ways, as seed collection, seedling production, planting techniques, monitoring and driving the reforested area. The techniques used for the recovery and maintenance of planted areas is described in detail in Annex V, which in general terms consist of:

1. Diagnosis and planning:
2. Pre-planting and soil preparation activities
3. Activities related to planting and recovering of degraded areas,
4. Maintenance and planting monitoring activities,

In addition to the physical restoration activities of described above, as well as in the Annex V, the project also counted with concurrent activities as:

1. Education and cooperation with communities and landowners about biodiversity conservation.
2. Environmental education, training, prevention and fighting forest fires.

\(^2\)Mato Grosso do Sul Environment Institute that is responsible for PENT management.
3. Direct involvement of communities in reforestation activities, with emphasis on seed collection, seedling production, planting, maintenance, and management of non-timber forest products.

The removal of GHG (CO2) for this first monitoring period, took place during the five years growth of the seedlings introduced as part of project’s activities, through photosynthesis. In the absence of the project, the areas would not be reforested, remaining forestless, with a low biomass stock in the vegetation and reduced concentrations of carbon per hectare. The carbon dioxide removed biologically from the atmosphere by individual trees is being stored in the woody parts of plants and will remain fixed in dynamic equilibrium in the project's forest areas.

The main changes in the project activities stated in the registered PD was the cancellation of the reforestation in the PENT area (please refer to section 2 above), as well as the suspension of works with the Nova Esperança Therapeutic Community and changes regarding the involvement of the Cedro quilombola community in 2013. On the other hand, some families of the settlement Dois Saltos were included in the project activities (the activities with Formiguinha, Serra das Araras and Pouso Alegre settlements and the Buracão community remain unchanged). In order to recover the insertion of the quilombolas communities a new strategic plan was delineated for the next five years. The reviewed arrangement of project participants is presented in the section 1.4.

In addition to the abovementioned, some small changes have occurred in the project activity if compared to the registered PD, as follow:

- CPM (seedlings protector collar) was not used because this equipment could not be found in the market. The idea still exists but depends on the availability.

- The using of Hydrogel was suspended, once the results were not satisfactory. It was observed "air pocket" between the roots and soil causing seedling death, especially in sandy soils.

- The partnership between Oréades and CI has ended in terms of performing activities altogether, but CI is still on board.

- The activities presented in section 3.10 of the registered CCB PD were carried out, however it was not formalized the Advisory Board for the project. Those involved, such as farmers and communities have always been actively participating in the project activities design and implementation.

The project activities presented in table 13 of section 3.2 of the registered CCB PD were updated to include the abovementioned changes, as well as the implementation status of each one of them (please refer to Annex IX).

Finally, some delay in the biodiversity monitoring was registered, but it was concluded up to 2016 and its results are presented in section 8. Part of the area was hit by fire two months after the biomass forest inventory and few months before the verification, as described in the section below.

2.3 Management of Risks to Project Benefits (G3)

The risks listed in the section 1.11 of the registered PD were precisely identified, once some of them has occurred indeed, as the seedling mortality superior to 20% due to climatic factors, poor sandy soils and fires and the withdrawal of PENT areas due to the lack of legal framework regarding carbon credits ownership in public areas.

---

3 Remaining descendants of former slaves.
Accidental or criminal threats, such as fire, were mitigated through conservation strategies developed specifically for the project, like the building of firebreaks and periodic monitoring of fire outbreaks with help from the property owners during the most critical times. To achieve this, the project trained and supported the local forest fire brigade as well as developed environmental education activities and information campaigns focused on local communities, landowners involved in the project and residents of neighboring project areas. However, few weeks after the first biomass forest inventory (July 2015) part of the project areas was hit by an accidental fire (disruption of a high voltage wire) that burnt a sugar cane plantation next to the project area, and them part of the reforested areas as well. According to the section 3.7.7 of the AFOLU Requirements VCS v.3, the Loss Event Report applies in the following situations:

- Where an event occurs that is likely to qualify as a loss event⁴.
- VCU have been previously issued.

The fire event has affected around 140.28 hectares of the project area, and despite of low seedling mortality rate (less than 10% as confirmed by the VVB in the field) and the root system that was not affected (50% of the individual biomass), the PP has assumed this event as a loss event. However, once the event has occurred after the forest inventory, the GHG emission due to fire will be automatically accounted in the next verification period. Anyhow, the loss event report will be prepared in order to register the event for future assessments.

Permanence of the carbon stock removed from the atmosphere by the plants is being ensured by legal instruments, which determine areas where the vegetation must be protected (and restored in case of degradation or forest loss). This appears in the registration documents of the rural properties⁵. In this case, the protection of forest fragments is ensured by the Law nº 12.651/2012 as Permanent Preservation Areas and Legal Reserves. In some small areas of the project where the forest physiognomy protection is not required by the Forest Code (multiple use areas), the owner’s intention was to increase the area of native Cerrado vegetation on his property and the non-timber usufruct, pledging to ensure the preservation of the plantations, and not open new areas for relocation of agricultural activities.

Additional information regarding implementation status of measures to mitigate likely risks to climate, community and biodiversity, please refer to the Annex XVII.

2.4 Measures to Maintain High Conservation Values (G3)

Table 1: High Conservation Values identified in the project zone

<table>
<thead>
<tr>
<th>High Conservation Values attributes identified in the project zone.</th>
<th>Specific measures implemented during the first monitoring period (2010-2015).</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCV 1 – Areas containing significant concentration values on the biodiversity level</td>
<td>Only native species were used in the 462 hectares of reforestation activities.</td>
</tr>
</tbody>
</table>

---

⁴ According to the VCS definitions, loss event refers to “any event that results in a loss of more than five percent of carbon stocks in pools included in the project boundary but is not planned for in the project description”.

⁵ Rural Environmental Registry (CAR).
2.5 Project Financing (G3 & G4)

This carbon project was initiated with the financial support of Conservation International - CI through the project CPFY 09/037 “Support for the preparation of the Project Design Document of the Biodiversity Corridor Emas-Taquari”, with a budget of BRL 79,754.00. CI also supported the project adjustments and validation through the CPFY 10/019 “Support for carbon project in Corridor Emas-Taquari”, with a budget of BRL 121,270.00.

After the validation, Natura Cosmetics company acquired up-front around 80% of the ex-ante credits amount for BRL 2,913,949.00, in which the amount of BRL 920,198.40 was withholding to be paid gradually in a period of 25 years. This up-front selling was critical for the project start up and were...
used for the planting of 520 hectares, as well as to the implementation of other project activities and covering of PP’s expenses during the first five years of the project.

In 2015, the institution started three new projects, one with Guaraciaba Power Transmission, one with Matrinchã Transmission and another with Agro Brazil, totaling BRL 5,016,254.00, with completion period of four years. Finally, Oréades owns a nursery with a capacity of 300,000 seedlings/year, and provides services of seedlings plantation, management and monitoring, as well as GIS consultancies.

2.6 Employment Opportunities and Worker Safety (G4)

Capacity building actions brought knowledge to the communities and strengthened a new perception concerning the sustainable use of natural resources in the Cerrado. The project leveraged employment opportunities and delivered alternatives of income generation and economic increase to families who were previously in need. Both from the side of the communities (quilombolas and rural settled) and from the side of Oreade’s staff have participated to the project design and execution, being continuously benefited with the necessary trainings to run the project activities. It included a lot of field and demonstrative practices from the seeds collection to the seedlings production and planting activities with the teams. Work safety rules were always respected, complying with current legislation. To reinforce this, the project team is promoting the adoption of formal protocols towards the reduction of labor risks and accidents avoidance, always prioritizing workers’ health and safety. A contract is being signed with a specialized company that will promote capacity building and trainings on safety at work measures, giving recycling trainings every two years (Annex XX).

The commercialization of seeds and native seedlings to Oreade’s by the assisted communities to supply the demands of reforesting the project sites is outstanding. However, since the project sites are finite, it is natural that these activities would gradually finish. In order to continue the cycle, the project intends to retake the communities when new project sites adhere, increasing the demand for seedlings, and in the medium-term, to encourage them to take economic advantage of the non-timber products origined from the forests they have planted. Providing social and economic opportunities and benefits is part of the carbon project, so that the communities engagement is to be maintained also by the support to any other activities that may empower them to generate their own income.

Several vacancies were made available to hire new workers in the nursery and during the planting periods. These vacancies were divulged over the communities and surroundings through announcements at the National Employment System (SINE).

2.7 Stakeholders (G3)

The quilombolas (remnants of former slaves) and the rural settled communities, as well as people from the Nova Esperança Therapeutic Community, have been assisted by the project developed by Oréades since 2005. With these communities, Oréades has developed several initiatives relating to reforestation and the construction of nurseries. In partnership with IBRAÇE,

Oréades has developed a socio-economic diagnosis in order to assist and guide several activities, such as the carbon reforestation project of the Emas-Taquari Biodiversity Corridor.

These communities are all located around the Emas National Park (PNE) and the Nascentes do Rio Taquari State Park (PENT), and are within the Emas-Taquari Biodiversity Corridor. Therefore, they are fundamental to the development of landscape planning, by joining conservation and economic activities to ensure the sustainable use of natural Cerrado resources.

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6 Instituto Brasil Central (www.ibracego.org.br).
Much like the communities, the owners of the areas that make up the project have also participated in the activities developed by Oréades in the region. For the development of the Emas-Taquari Biodiversity Corridor Carbon Project, several meetings were held, in which the owners actively participated by asking questions, providing inputs and making suggestions.

In this sense, landowners, communities, and other project stakeholders such as universities, schools, and local public authorities were all involved during the project development and after project validation. They have being notified about all processes and results through communication channels established by Oréades, namely: mailing, phone calls and meetings in person. Oréades has been carefully with landowners, for example, to inform them about any project activity on their properties. So do the communities, when any project update or new activity seemed relevant and needed to be shared.

All the rural settled communities involved in the project are incentivized to exercise social control, with the support of the monitoring methodology of the Participatory Rural Appraisal - PRA (Diagnóstico Rural Participativo - DRP, in Portuguese)7 (Annex X.a). The details and outcomes related to this methodology and its tools is described in section 7 and 8.

The Advisory Board, initially thought in the PD 2010, whose members (owners, communities representatives and project partners) would facilitate conflict management and set solutions, it was not consolidated. This did not happen because landowners and communities representatives and even the PP (Oréades) did not see the necessity to spend time holding a Board. In addition, members from Conservation International directly connected to the project in the past left that organization, and there was no replacement until involvement weaken.

On the other hand, Oréades is responsible for a kind of system of complaint office, which is being very important to avoid and solve conflicts among project participants. Oréades realized that the most efficient way to manage this part of the project was giving assistance to each family, landowner or any other stakeholder individually rather than working collectively, since each one had its own specific problem. Until 2013, personal services were conducted to every family, when Oréades staff could collect data, elaborate reports and make the respective payments as part of the project activities.

The historical good relationship between Oréades and both farmers and communities is a positive factor to help with the fast resolution of disputes that might arise throughout the project lifetime. In addition, Oréades has always maintained a good relationship with those groups, so that everyone has an open channel to postulate questions, comments and suggestions not only during the project design, but also along the entire project lifetime.

The leaders and representatives of the existing associations in the communities are always informed about the planned project activities. They receive phone calls to be informed about any forthcoming activity, check availability for scheduled meetings, and participate to evaluation meetings (i.e. PRA), audits, among others. For more information regarding communities and stakeholders consultation, comments received, involvement in the currently project, partnership with PP in other projects and mediation of conflicts, please refer to sections G.3.8, G.3.9 and G.3.10 of registered CCB PD and sections 6.1, 6.2 and 6.3 of the registered VCS PD, as well as Annex X.a.

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7 Available in November 2016.
3 LEgal Status

3.1 Compliance with Laws, Statutes, Property Rights and Other Regulatory Frameworks (G4 & G5)

There is no federal, state, or municipal laws restricting reforestation with native species on private lands. Reforestation with native tree species complies with all federal or state laws, except in specific cases, such as planting trees on roads under power lines, or in areas near airports. None of these conditions applies to any of sites selected by the project. Additionally, Brazilian environmental legislation\(^8\), as it relates to land use, tends to agree with the purpose of this project, as it aims to promote the recovery of degraded areas using native species.

No products prohibited by law were used during planting or maintenance of plots. In addition, the project activities did not use fire to clear areas before planting. Thus, the project did not violate anyone of the country's current environmental law. To the contrary, the project has promoted improvements in the natural environment without losing sight of the economic aspect that will ensure sustainability, permanence and social benefits in the long term. With the exception of areas located in Permanent Preservation Areas (APP) in private properties, such as the farm Lugar Jacubinha, all remaining areas could be available to non-timber forest management.

The areas reforested by the project were pending only on the approval of the landowners, who have already formally agreed to participate to the project by the time of validation. They have allocated part of their properties for permanent forest recovery; please refer to Annexes XV.a, XV.b, XV.c and XV.e (Statements of Commitment of owners' approval to cede land and carbon credits). A Letter of consent issued by official bodies containing the documents formalizing the partnership and involvement of all public entities in the project was signed between these official bodies and the PP (Annex XV.d).

3.2 Evidence of Right of Use (G5)

Please refer to Annexes XV.a to XV.e.

3.3 Emissions Trading Programs and Other Binding Limits (CL1)

The net GHG emission removals generated by the project will not be used for compliance with any emissions trading program, neither to meet any kind of binding limits on GHG emissions project. The project verified carbon units will be traded and accounted via VCS registry system (Markit environmental registry)\(^9\), so that information about buyer, sales or verification status may be traced anytime by anyone, thus ensuring the guarantee of transparency and protecting buyer from double counting.

3.4 Participation under Other GHG Programs (CL1)

The project was registered only under the Verified Carbon Standard (VCS) as ID 738\(^10\) and Climate, Community and Biodiversity Standards (CCB Standards)\(^11\).

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\(^9\) https://mer.markit.com/br-reg/public/project.jsp?project_id=10000000000716

\(^10\) http://www.vcsprojectdatabase.org/#/project_details/738

\(^11\) http://www.climate-standards.org/?s=emas
3.5 Other Forms of Environmental Credit (CL1)

The project does not intend to generate any other form of GHG-related environmental credits, beyond the VCU to be registered in the Markit Environmental Registry, please refer to section 3.3 above.

3.6 Projects Rejected by Other GHG Programs (CL1)

The project was not submitted to any other GHG programs. Please refer to section 3.4, above.

3.7 Respect for Rights and No Involuntary Relocation (G5)

All areas part of the mosaic of the Project Emas-Taquari Biodiversity Corridor are voluntary adhesions. The project activity did not apply any direct physical action on any other area not referred in the Annex I or that is not part of the community covered by the project.

In addition, the project activity did not displace or will displace people or induce changes in traditional ways of life; on the contrary, the project seeks to retrieve traditional knowledge on sustainable use of biodiversity products.

3.8 Illegal Activities and Project Benefits (G5)

The table 2 below identifies the most significant illegal activities that can occur in the region and the project strategies used to avoid them.

Table 2: Illegal activities and risks to project benefits

<table>
<thead>
<tr>
<th>Illegal activities</th>
<th>Neutralization measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate</td>
<td>Use of fire as pasture management toll in cattle rising without the previous consent of competent supervisory agencies</td>
</tr>
<tr>
<td>Community</td>
<td>Environmental education as awareness tool and public awareness of the adjacent communities.</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Firebreaks maintenance for protection and prevention of flora and fauna from fires.</td>
</tr>
</tbody>
</table>

The project activities and thus the project benefits are not derived from illegal activities, as stated in section 3.1 above.
4 APPLICATION OF METHODOLOGY

4.1 Title and Reference of Methodology

The methodology used was AR-AMS0001: “Simplified baseline and monitoring methodologies for small-scale afforestation and reforestation project activities under the clean development mechanism implemented on grassland and croplands” – Version 5\(^{12}\).

4.2 Deviations from the Monitoring Plan

Although the stratification procedure carefully carried out in order to obtain strata as homogeneous as possible for parcels allocation and data collection, it was observed the impossibility of reaching a standard sample error below 10% accuracy and 95% confidence interval. Even if increasing the number of plots in each property and sample universe, the error threshold would be exceeded, not allowing to extrapolate the average confidence interval of CO2e stocks for the reforestation of 385.77ha (Fazenda Babilônia lots 8, 9 and 10), 68.21ha (Flores do Ipe) and 17.05ha (Lugar Jacobinha). According to the Annex XXI (Memorial calculation of sampling effort), the total number of parcels achieved from the sampling effort calculation is prohibitive (1,124 parcels, or 25% of the entirely reforested area). This is due to the immense heterogeneity intra and interspecific existing among the native species used in planting. The limits set out in PD registered, should only be achieved from the third monitoring event ahead, when the plantations is supposed to acquire a more homogeneous forest structure, able to fit in the statistic models and the sampling effort equations.

Thus, in the present inventory of ex-post removals, the forest biomass and CO2e stocks could not be estimated based on the average calculated from the stratified or non-stratified (e.g. Lugar Jacobinha) samplings, which was carefully, outlined in the project areas. This is due to several reasons justified below:

A) Five years of project activity were not enough for the seedlings to reach the minimal homogeneity that could enable the team to random sampling or delimit strata. Consequently, the statistical principle of local control could not be applied, in other words, in cases where the environment under study is very heterogeneous, it is not possible to obtain reliable estimates of biomass (or CO2e) from the stratification method (Scolforo and Mello 2006).

B) An average value of forest biomass (or CO2e), below the maximum permissible error of 10% with 95% confidence interval, as set out in the registered PD, was wrongly assumed from the case of commercial silviculture. These rigorous level of accuracy and confidence interval is applicable (and more feasible) in the cases of homogeneous clonal eucalyptus or pine forests (Pellico Netto & Brena 1997). For reforestation with native species the heterogeneity is supposed to persist until the reforestation reach a structure more likely to a mature native forest or savanna, which may occur after the third monitoring event (15th years ahead).

C) In the case of reforestation with native species of Cerrado, which were recently planted (no more five years), the growth rate of seedlings varies a lot between species and even within the same species. Therefore, in the first decade of plantation, a uniform growth rate as well as the biomass per hectare, is very unlikely, regardless the management. In addition, field studies have shown that in the early years the cerrado species concentrate much more energy in roots than in shoots (Hoffmann et al. 2005).

D) An alternative to overcome the problem of sampling would be running a census,
covering 100% of the population. However, this is not feasible for an area of 462 hectares with almost half million plants, not only for the huge scale, but also because of prohibitive costs.

Based on the conditions herein discussed, the results of the ex post removals inventory for the first monitoring period will be presented as the dry biomass and carbon stock directly measured, and as the stock of CO₂e in the strata and in the total project area (please refer to Annex III). As it was not feasible to generate statistical inferences from the sampling, neither to extrapolate the confidence interval of CO₂e average stock for the project areas, it was decided, for conservativeness, to exclude from the calculus the six largest individuals (outliers) as per its Db, H and dry biomass. In this regard, a comparison between original calculus (with top outliers) and the final calculus adopted in this monitoring event (without top outliers) was done in order to show the difference between both, and the high level of conservativeness assumed for this first monitoring period. In the total, 60% less biomass/CO₂e compared to the calculus including all measured data (please refer to Annex VI).

Finally a standard operation procedure (SOP) specific for forest inventory was prepared in order to overcame any eventual issue in the subsequent biomass monitorings, please refer to Annexes XXIII.

For more information regarding the forest inventory and ex-post calculation approaches, please refer to Annexes III and III.a. v3.1

4.3 Project Boundary (G1)

Table 3: Relevant GHG sources, sinks and reservoirs for the project and baseline scenarios

<table>
<thead>
<tr>
<th>Source</th>
<th>Gas</th>
<th>Included?</th>
<th>Justification/Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above and below ground biomass of trees and woody plants and perennial ground biomass of grasses.</td>
<td>CO₂</td>
<td>Yes</td>
<td>Biomass within the vegetation, prior to project activities, which should be deducted from the final volume.</td>
</tr>
<tr>
<td></td>
<td>CH₄</td>
<td>No</td>
<td>Does not apply</td>
</tr>
<tr>
<td></td>
<td>N₂O</td>
<td>No</td>
<td>Does not apply</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>No</td>
<td>Does not apply</td>
</tr>
<tr>
<td>Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above and below ground biomass of trees and woody plants and perennial ground biomass of grasses.</td>
<td>CO₂</td>
<td>Yes</td>
<td>Removal due to the growth of trees introduced by the project</td>
</tr>
<tr>
<td></td>
<td>CH₄</td>
<td>No</td>
<td>Does not apply</td>
</tr>
<tr>
<td></td>
<td>N₂O</td>
<td>No</td>
<td>Does not apply</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>No</td>
<td>Does not apply</td>
</tr>
<tr>
<td>Organic fertilizers (manure)</td>
<td>CO₂</td>
<td>No</td>
<td>Does not apply</td>
</tr>
<tr>
<td></td>
<td>CH₄</td>
<td>No</td>
<td>Does not apply</td>
</tr>
<tr>
<td></td>
<td>N₂O</td>
<td>No</td>
<td>Does not apply</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>No</td>
<td>Does not apply</td>
</tr>
</tbody>
</table>
4.4 Baseline Scenario (G2)

The most likely baseline scenario identified in the project areas is the continuation of common land use and occupation practices associated with agricultural and livestock practices, which use fire, all of which lead to reduction in carbon stocks. After five years of project activity, there was no evidence of changes in current practices in the project areas or region (see Figures 4, 5, 6, 7 and Table 4 below). Therefore, it is not expected significant changes in the medium term regarding current land use and occupation practices, nor significant changes in carbon stocks of productive systems in the project areas. However, in the absence of project activities, it is supposed the maintenance of previous productive activities of low concentration of carbon, as livestock, monoculture soybean, corn, cotton and sugar cane, since these cultivations have been the predominant activities in the region. The trend of growth of this crop areas in the last decade also support this analysis (Annex I, Figure 4, 5, 6 and 7).

The observed regeneration of trees is significantly lower in the Cerrado, due to its natural soil and climate characteristics as well as fire events, when compared to other Brazilian forest biomes, such as the Amazon and the Atlantic Forest. This can be substantiated through the analysis of satellite images taken in previous years of different project areas (Annex I, which show that the areas that had their forest cover removed, have not shown significant biomass gain after 20 years as per NDVI analysis. Thus, it is not expected that the ecosystem be able to naturally convert its currently deforested areas into forest physiognomies without human interference\textsuperscript{13}. That suggests the need for direct intervention through soil preparation, planting seedlings, and fire-preventing activities.

Due to the lower potential for regeneration of Cerrado trees and because the areas are very susceptible to fire, it is expected that in a scenario without the project, the previous stocks of carbon contained in the biomass might in some cases even undergo a slight decrease\textsuperscript{14}. In this sense, the scenario to the baseline in the project areas follows the logic of item b of paragraph 6 of section II of the AR-AMS0001.

\textsuperscript{13} Regeneration, in the project areas, tends to be well below 10% of the amount the project intends to remove over its lifetime through induced reforestation (section 4), so that the change in carbon stocks in the baseline scenario can be disregarded, as instructed by the AR-AMS0001 methodology.

\textsuperscript{14} It is important to remark that among the project activities, preventing, controlling and fighting fires is a major conservation strategy, along with the reforestation activities.
Figure 5: Dynamics of corn cultivation (in hectares) in the municipalities covered by the project. (Source: http://www.sidra.ibge.gov.br/)

Figure 6: Dynamics of the cultivation of sorghum, sunflower, sugar cane, cotton, beans, and rice (sum of all crops in hectares) in the municipalities covered by the project. (Source: http://www.sidra.ibge.gov.br/)
Figure 7: Dynamics of cattle rising (in herds) in the municipalities covered by the project. (Source: http://www.sidra.ibge.gov.br/)

Finally, the constant fires that affect the region (Table 4 and Figure 7), whether accidental, criminal, or used for pasture management, make up, together with the agricultural activities, the most plausible baseline for the project area. Therefore, in the absence of project activities, rudimentary practices using fire, as well as the regional vocation for agrobusiness based on monoculture, reinforce the most likely scenario of systematic reduction of carbon stocks previously retained in the biomass of project areas, just as it is in the surrounding areas (Annex I).

Table 4: Fire outbreaks registered in the last 5 years in the municipalities covered by the project.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Number of fires reported each year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcinópolis - MS</td>
<td>117</td>
</tr>
<tr>
<td>Chapadão do Sul - MS</td>
<td>161</td>
</tr>
<tr>
<td>Mineiros - GO</td>
<td>437</td>
</tr>
<tr>
<td>Total occurrences in</td>
<td>715</td>
</tr>
</tbody>
</table>

15 Registers from 01/01/2015 until 09/10/2015.
Figure 7: Fire outbreak registers in the project region.  

Source: region INPE/CPTEC- Fire Database (BDQueimadas)\textsuperscript{16}

**Biodiversity**

In terms of biodiversity impacts, the most likely land use scenario and the baseline scenario identified for the project (the continuation of common land use), would affect negatively the biodiversity not only in the areas covered by the project but also in the project region as a whole, for the reasons presented below.

According to Moreira *et al* (2005)\textsuperscript{1}, the process of agricultural and livestock exploitation is the strongest cause of landscape change in the country, especially in the Cerrado biome. Studies conducted in the project area have identified a large exposure to deforestation strain that the different land uses have on conservation units. Given their proximity to agricultural areas, both the PNE and the PENT have suffered serious impacts, especially from pesticide contamination and soil erosion, which include even the formation of gullies.

Besides soybean, other monocultures are present in the area, such as cotton and corn, not to mention extensive livestock farming. Moreira *et al.* (2005)\textsuperscript{1} demonstrate in their analyses of three towns surrounding the PNE (Mineiros, Chapadão do Céu and Costa Rica) the existence of a major landscape change in the area. They argue that farming bears the largest share of the responsibility for the opening of new areas. Calculations show that, together, the three towns lose about 9% of their natural vegetation per year (including legally protected areas such as APPs and RLs). This means that, following the current pattern of land use, the region shall lose all of its natural vegetation in the next nine years, except for protected areas in Conservation Units.

Regarding pastures, De Zen *et al.* (2008)\textsuperscript{2} refers to negative externalities of livestock farming resulting in an ecosystem destruction vector. This is caused by the expansion of pastures into adjacent areas, land degradation due to low investment in pasture maintenance, pollution of water resources through nutrient loading (nitrogen, phosphorus, and potassium from manure), hormones, heavy metals, and other pollutants.

\textsuperscript{16} \url{http://www.dpi.inpe.br/proarco/bdqueimadas/}
pathogens carried into riverbeds by soil leaching, and the most recently addressed negative externality generated by the livestock industry: GHG emissions.

Forest fires are frequent in the project area. They originate from the practice of cleaning the pastures. This technique is widely used because of its low cost to producers. It is mainly used during August and September, when the weather is drier and windier. Every year, it becomes one of the most serious environmental problems in the region. According to the Fire Management Plan Revision of the PNE, forest fires in the project area come from poorly managed or unauthorized burnings. They spread fast and frequently become forest fires.

Even though the Cerrado is naturally able to support fire well, given the morphological structures of plants and climatic events that lead to natural fires (lightning) – usually during the rainy season, the permanence, extent and intensity of natural fires compared to man-made fires is smaller. Fires in pastures or in natural areas cause not only a gradual destruction of the ecosystem, but also an enormous amount of greenhouse gases to be released into the atmosphere.

In addition, the absence of the project activities would not bring the positive impacts foreseen for the biodiversity, as follow:

Aside from absence of gene flow of wild fauna and flora, through pollen and seed circulation between forest fragments in a scenario without project, the communities of the region, especially the ones assisted by the project, would not have the opportunity to learn alternative mechanisms for income generation, and thus harmoniously integrate productive activities with the Cerrado environment.

Taking into account the scenario of perpetuation of agriculture and livestock practices in the project region, it is expected that the scenario shall evolve, according to studies conducted by WWF17, as shown in the following diagram:

![Agriculture Degeneration Cycle Diagram](image)

Figure 9 - Agriculture Degeneration Cycle
Source: Agenda 21 for Agriculture in Brazil.

Based on the diagram, the report states that known processes in current agriculture, as they are developed in the project area, promote the removal of the original vegetation cover, and are therefore responsible for the loss of much of the biodiversity in situ, leaving the ecosystem more vulnerable by reducing its resilience. Inadequate management is the cause of serious environmental problems: erosion, especially surface and, subsequently, rill erosion, which may develop into gullies. With the

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17 Analysis of the Environmental Impacts of Agricultural Activity in the Cerrado and its interrelation with Water Resources in the Pantanal Region.
loss of soil caused by erosion, there shall not be enough nutrients to meet the nutritional needs of plants, so that fertilizers shall be necessary.

Inorganic fertilizers may, when used excessively, impair the biological quality of a food crop, contaminate water resources, and leave the soil poor in microfauna that inhibit natural crop predators. Without natural enemies, plagues emerge, and pesticides, such as insecticides, fungicides, and others, are necessary in order to fight them. Depending upon their active ingredient, these substances can have long residual effects coming into contact with groundwater and other water bodies and contaminating them. These chemicals may also seep into the food chain of ecosystems and ultimately contaminate humans.

This chain of negative events, which may be provoked by agricultural activities in the project area, can be understood in two main aspects: the compromising of biotic factors, mainly flora and fauna; and of abiotic factors, the water and soil.

The PNE Management Plan notes an example in which a drastic reduction in insect diversity was found in the buffer zone, where there are soybean, cotton and corn crops in all cultivation stages. Over 96% of insects found in cultivated areas are pest insects. The pollinating insect diversity detected was very low in buffer zone crop areas, even in areas very close to the edge of the park.

It is estimated that the insect behavior in the region is influenced by insecticide use and other pesticides used in agriculture. For the same reason, it has been suggested that fish communities have suffered similar impacts on their diversity and population size. The impacts are exacerbated by agricultural effluents released into rivers such as drainwater used in cleaning agricultural facilities (milking areas, stables, etc.), flood water, silage effluent, fertilizers and pesticides which, much like urban sewage, overload oxygen consumption in recipient systems, thus raising eutrophication levels. It is also important to consider the danger of introducing pesticides into water bodies, which, in this case, lies in the toxicity of these compounds to aquatic fauna, as well as in the high mortality rates of aquatic plants it can cause, which in turn could jeopardize the balance of dissolved oxygen from reservoirs (BIANCHINI, 1994).

The Management Plan also reports that in the PNE areas the surrounding farmers identified five animal species as problematic: the mountain lion and the jaguar, which prey on cattle, horses and sheep; and several canine species (maned wolves, foxes, and wild dogs), which prey on chickens (SILVEIRA & JÁCOMO, 2002). The same authors report other species that cause more minor problems in crops, such as the peccary, the tapir, the six-banded armadillo, and the peccary.

Due to the loss of their habitat and consequent unavailability of prey/food, these species tend to attack crops and livestock. Santos et al. (2008) conducted research in the areas surrounding the PNE, reporting the human perception about the presence and activity of jaguar. The study shows that many of the people interviewed respond aggressively to the species and suggest retaliating against the attacks.

Another major aggravating factor known in the project area is the annual fires. The irregular fires are the result of poor farm management. Fires may eventually spread out over large areas, causing the destruction of hundreds of hectares. The effects of fire on biodiversity may represent, according to Coutinho (2000), a change in the landscape, confirming a reduction in the succession potential for the Cerrado. Since the woody vegetation is sensitive to fire exposure and despite its inherent tolerance of it, frequent and intense fires substantially reduce the maintenance and replacement of trees and shrubs, progressively decreasing their density. As a result, the Cerradão eventually presents a more open physiognomy, gradually becoming cerrado stricto sensu, campos cerrados and finnaly, campos sujos.
In terms of communities living in the project zone the most likely land use scenario associated with the baseline scenario (the continuation of common land use), would have, in general, negative impacts, as discussed below:

The Emas-Taquari Biodiversity Corridor Carbon Project intends to deliver social benefits involving low-income, excluded, and disadvantaged communities. We expect to help 20 settled families, 20 quilombola families, 1 community for recovering addicts.

Considering that the average monthly income of these families is a minimum wage (data from survey conducted by Oréades), and that it is difficult for them to become productively established, the project activities provide an incentive and a source of increased property income, which indirectly prevents rural exodus. Without the project activities, the settled and quilombola families shall possibly not have access to these new opportunities for increasing their income through gathering and selling seeds, production and sale of seedlings for the reforested areas, as well as seedling production supported by the Oréades nursery.

Despite the excellent economic growth rates in the project area due to the success of agribusiness, the indexes of employment and income generation do not meet the needs of the population. Moreover, the type of agribusiness developed in the area demands highly technical operation (which does not require labor force), and when it does require a labor force, the employees must have expertise in the field, which is not the case of the community encompassed by the project activities.

Finally, without the project, these families would likely not be encouraged to take part in training processes that allow for increased self-esteem, knowledge exchange and improved social, economic, and environmental development of the community.

4.5 Additionality (G2)

In the absence of project activities, the 520 hectares in the Emas-Taquari Biodiversity Corridor would not be reforested. Therefore, the removal of carbon dioxide through photosynthesis and plant growth would not occur. Additionally, the protection of reforested areas against forest fires, as project activities, would not be implemented, further compromising the remaining biomass stocks in the project areas; or, at best, the stocks would remain at stables levels.

The assessment of additionality of this small scale reforestation project was based on Appendix B – "Assessment of Additionality" – of the AR-AMS0001 methodology.

The main aspect supporting additionality of the project is the non-commercial aspect of reforestation, aimed at the restoration of forest areas within the macro strategy to recover the Cerrado-Pantanal Biodiversity Corridor. Even considering the possibility of a sustainable management of non-timber resources in the project areas in the long term, such management should be understood only as an economic alternative for the sole purpose of enabling the maintenance of the areas when the proceeds from the sale of carbon credits come to an end.

Thus, the revenue generated from sales of carbon credits is critical to the physical implementation of the project, representing the only significant source of revenue capable of supporting the activities of planting and maintenance of reforested areas. In other words, the carbon credit mechanism was the tool found by the project proponents in order to obtain funding for the activities related to the conservation and recovery of the area corresponding to the Emas-Taquari Biodiversity Corridor.

The following is a short description of the main obstacles to the implementation of the Project by the time of its validation, in accordance with the applicable additionality tool (appendix B of AR-AMS0001 – “Assessment of Additionality”).
Investment Obstacles

- High reforestation costs, estimated at roughly BRL 6,482.00 per hectare by the time of project validation, considering only planting and maintenance activities. Not including work on environmental education, support fire brigade, working with the community, among others.

- Difficult access to credit: most landowners fear or show no interest in getting bank loans for the reforestation of their areas. The ignorance of the commercial potentials for non-timber use of native species, as well as fear of debt, makes long-term investment in native forests not an option for income generation in the region, unlike agriculture and livestock.

- Lack of funds for the activities of non-timber forest management.

Technological Obstacles

- Difficulty of access to the techniques of seedling production and reforestation in the Cerrado biome: reforestation under Cerrado characteristics demands several techincs not fully developed by the time of project validation. In addition, there are technical constraints in obtaining seeds and seedlings (i.e. dormancy that is difficult to break for many of the Cerrado seed).

- Technical constraints and qualified staff: only through the partnerships in the beggining proposed by the project between non-governmental institutions\(^\text{18}\), regional conservation boards and land owners enables the reforestation project to become technical and executiively feasible, since none of the actors involved have their own, technical or operational structure for carrying out such initiative.

Obstacles related to common practice

- This small scale reforestation project was the first activity related to recovery of degraded areas and improvement of environmental conditions in the region, since common practice there includes deforestation to make the land suitable for grazing and agriculture and the use of fire as a management tool.

- Reforestation is not a part of the local communities’s culture, also the benefits of such an undertaking were not well understood by locals and landowners, especially due to the scarcity of cases that could serve as examples by the time project starting. This initiative was part of a new paradigm for the region.

- The additionality of reforestation activity in Legal Reserve areas was guaranteed by the extensive and systematic negligence by local landowners regarding to the applicable environmental legislation\(^\text{19}\) by the time of Project validation, particularly regarding Articles 2 and 16 of the Brazilian Forest Code - Law 4771/65. Regarding to this is worth mentioning that after the project registration in 2010 the Brazilian Forest Code was modified\(^\text{20}\), reducing the area to be reforested within private properties\(^\text{21}\). In this sense the project activities under the new forest legislation has become more additional if compared to that, valid at the time of

\(^{18}\) Oréades and Conservation International.

\(^{19}\) The additionality tool for projects of AR determines that: once proven that over 30% of properties in the region where it operates the project do not meet the legal requirements, failure to comply with the law is regarded as “business as usual”.

\(^{20}\) Law nº 12.651, in force since 25th May 2012


project validation. In other words, some areas already reforested by the project would not be necessary to do so according to the current legislation.

Obstacles related to environmental conditions

- The continued employment of current soil management practices have created unfavourable conditions to natural regeneration in most areas covered by the project. These areas also lost its original forest cover to make way for agricultural activities are currently exposed to erosive processes, such as fire, floods, transit of animals (livestock), agricultural activities and occupation predominantly aggressive invasive grass species (kikuia, Andropogon and Brachiaria).

- Fires during the dry season is a management tool still used to restore pasture in the project surroundings, and even though the project participants have abandoned it, it continues to threaten the project areas.

- The climate in the area covered by the project includes a 5-month drought period, so the project activities are essential in monitoring and preventing fires, as well as in watching the water stress levels of seedlings.

- The presence of exotic grasses in the pastures affects the process of regeneration in the areas, as they compete with native species for nutrients, light, and water. Therefore, mechanically or chemical controlling the grasses is extremely important for the establishment of the reforestation process. Without such direct human intervention, it is unlikely that natural regeneration would take place or even that the introduced seedlings would be able to restore forest physiognomy in the project areas.

Social Obstacles

- Lack of qualified or trained: there was a strong lack of knowledge and environmental awareness in the local population. This neglect of the importance of environmental services provided by the Cerrado ecosystems could hampers the establishment of projects aimed at conservation and restoration of the natural and genetic resources of species. Such lack of commitment to environmental issues, associated with ignorance of the economic potential of native species of the Cerrado, hindered social adherence to this initiative of conservation and sustainable use of local forests.

In the absence of the project, the reforested areas would not be able to reach the forest/cerrado physiognomy and consequently the biodiversity benefits would not have occurred, namely: recuperation of natural habitats, forest fragments connectivity, introduction of at least half million seedlings of native tree species, environmental education, support to fire brigades etc.

Regarding to community aspects, the project has engaged 25 families from the settlement and 20 families from quilombos. In the absence of the project, none of the activities and social approaches listed in section 2.2, 2.4 (HCV 5), and 2.7 would have occurred. In addition, these families, that have an average income of a minimum wage per month, possibly would not have access to the opportunities to increase their incomes, through seeds collection and sale, as well as production and sale of seedlings for the project activities.

Finally, in spite of the project region presents excellent rates of economic growth by success of agribusiness, this has not influenced significantly the index of employment and income to that population. This is because the type of agribusiness developed in the region demand highly technified operations, which dispense labor contingent.
5 MONITORING DATA AND PARAMETERS

5.1 Description of the Monitoring Plan (CL3, CM3 & B3)

The monitoring of planting in a broader sense was a continuous and periodic process for ensuring the integrity of the reforested areas. It has included regular watches to identify: i) pest attack; ii) susceptibility to forest fires; iii) seedlings mortality rates; iv) high water deficit, especially in the early years after planting; and v) signs of anthropogenic disturbance.

The monitoring of biomass and carbon stocks, in turn, has started five years after the project starting (2nd quarter of 2015) and will take place every five years until the end of the project’s 30-year crediting period.

The calculation for CO₂e removal was done using the biomass quantification calculated by the forest inventory (Annex III). The project proponent has conducted the inventory with support of a specialized company\(^\text{22}\). According to the guidelines stated in the PD, a third party company shall conduct the carbon equivalent calculations\(^\text{23}\).

The purpose of monitoring is to verify the GHG removal by the reforestation activities during its crediting period of 30 years. The forest inventory allows the quantification, every five years, of the forest biomass accumulated by the project activity, which in turn shall be used to quantify the amount of equivalent CO₂ removed by the project. The change in carbon stocks is being monitored through permanent parcels as recommended by the AR-AMS0001 methodology and Section 4.3.3.4 of the IPCC GPG for LULUCF. For more information about the forest inventory, biomass quantification, biomass sampling efforts and parcels location please refer to Annexes III, III.a (v3.1), III.b, XXI and XXV

The project anticipates six monitoring sessions to be conducted every five years during the crediting period of 30 years; information regarding the monitoring shall be available for consultation for 32 years.

The section 5.3 below shows the data to be collected or used for the verifiable monitoring of carbon stock changes in carbon pools within the project boundaries. All monitoring data on the variables described in the section 5.3 will be archived in a database under the responsibility of Oréades.

Baseline monitoring

According to the applicable methodology and decision 6/CMP.1, Appendix B, paragraph 6, baseline monitoring is not necessary and should be equal to the amount estimated in ex-ante calculations (please refer to sections 6.1, below).

Leakage monitoring

Following the methodology AR-AMS0001 v.5, the average annual leakage is equal to 15% of removals ex-ante planned for the first crediting period of the project, and no monitoring is not necessary. Please refer to section 6.3 below.

Project net removal monitoring

For ex-post estimates of net GHG removals by sinks, the methodology stipulates that the project area be split in order to improve the accuracy and precision of the calculations. Please refer to Annex III.

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\(^{22}\) As indicated in the validated PD, Oréades could outsource this service by hiring a specialized company (C3 – Floresta in this case). However, Oréades’ employee has accompanied the inventory teams during the data collection activities to ensure quality and adherence of the service to the monitoring plan registered in the PD.

\(^{23}\) The PP has hired C3 – Floresta, Meio Ambiente & Energia for the service.
According to the AR-AMS0001 v.5 and the registered PD, the calculation of above-ground biomass was done by using an allometric equations developed specifically for the Cerrado biome24 (TIER 2), while for the below-ground biomass estimation, the same reference study of allometric equation (Abdala, et.al 1998) was used to determinate the root/shoot ratio.

Overview of carbon stock monitoring procedures in the project areas

The procedures for i) stratified sampling, ii) data collection and iii) calculation of carbon stocks are explained in Annex III and can be summarized in the following logical sequence:

1. A few months before the monitoring for the preparation of the project's carbon stock monitoring report, the total area was divided into visually homogeneous strata.

2. Three pilot sampling units were randomly allocated for each stratum.

3. The averages and standard deviations were calculated for each stratum.

4. The required sampling intensity for biomass inventories in each stratum, as well as sampling errors and confidence intervals, were calculated.

5. From the procedure described above the final number of parcels per stratum is calculated.

6. Final permanent parcels are randomly allocated for all strata, which shall serve as the basis for the biomass (and carbon) calculation throughout the project's crediting period. (refer to annex XV)

7. The D30 and oblique height of all trees within the boundaries of the parcels are measured.

8. The above ground dry biomass for each individual and for the parcel as a whole is calculated.

9. The value of above-ground dry biomass is extrapolated over the stratum area.

10. The below ground dry biomass is quantified using the above-ground dry biomass data.

11. The total dry biomass value is converted into tons of equivalent CO₂.

12. The volumes of all strata are added to reach the project's total stock of CO₂e at the time of checking.

Overview of social monitoring procedures in the project areas

According to the CCB PD validated in 2010 and the respective Social Impacts Monitoring Plan submitted, the majority of the planned activities followed the dashboard. Other monitoring activities, which were not anticipated in the project PD, took place, because of Oreade’s efforts and expertise in the project zone to carry on customary work and with local communities. The only significant change refers to the frequency of the PRA application, not fitting the year 3 in 2014, but postponing it to 2015. Furthermore, the quilombola communities attended only the baseline year (2011) of the PRA. Please, refer to section 7 to see parameters and monitored data in detail.

Analyzed data, reports on the social status of the project and many other parallel activities resulting from the carbon project implementation were publicized in the project website, including other types of registrations (i.e. photos, videos and media pieces). A feedback was given to the communities and other stakeholders as well.

Overview of biodiversity monitoring procedures in the project areas

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According to the CCB PD validated in 2010 and the respective Biodiversity Monitoring Program submitted, the project implementers did not perform the baseline year. Originally, the target fauna groups were mammals, birds and invertebrates. Along the process, however, the invertebrate groups were excluded from the biodiversity monitoring activities because the PP decided to systematically focus on the other two groups. Even so, in 2013 and 2014 the region of the Araguai River’s headwaters, which meets the project zone, was monitored by the Jaguar Institute (hired by Oréades) in respect to mammals, showing interesting results.

In 2015, preliminary results were obtained concerning fauna inventories for mammals and, to some extent, for birds. These efforts covered the project zone and one specific site project. In order to accomplish what was planned in the Biodiversity Monitoring Plan (Annexes XVI and XVI.a), specific and systematic information about fauna monitoring in terms of abundance and diversity to every project site, are presented in detail. Please, refer to section 8 to see parameters and monitored data in detail.

5.2 Data and Parameters Available at Validation (CL3)

<table>
<thead>
<tr>
<th>Data Unit / Parameter</th>
<th>Root/shoot ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Description:</td>
<td>Root/shoot ratio</td>
</tr>
<tr>
<td>Value applied:</td>
<td>1.0</td>
</tr>
<tr>
<td>Purpose of the data:</td>
<td>This parameter is used to estimate the below ground biomass based in the measured above ground biomass and is applicable for the project GHG removal calculation.</td>
</tr>
<tr>
<td>Any comment:</td>
<td>This value is applicable to cerrado physiognomy, which is known as the “upside down forest” by concentrating energy and resources in root system development as survival strategy under Cerrado conditions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Unit / Parameter</th>
<th>$B_{(t)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>tCO$_2$e/ha</td>
</tr>
<tr>
<td>Description:</td>
<td>Carbon stocks in the living biomass within the project boundary at time t in the absence of the project activity.</td>
</tr>
</tbody>
</table>
### Purpose of the data:
This parameter is used to quantify the baseline stock to be subtracted from the total GHG removal.

### Any comment:
This value refers to the baseline carbon stock in the living biomass within the project boundary at time of the project starting that remains unchanged (stable) during the entire project lifetime.

#### Data and Parameters Monitored (CL3, CM3 & B3)

<table>
<thead>
<tr>
<th>Data Unit / Parameter</th>
<th>D30j</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>Centimeters</td>
</tr>
<tr>
<td>Description:</td>
<td>Diameter at 30 cm high for each tree in the permanent parcel.</td>
</tr>
<tr>
<td>Source of data:</td>
<td>Forest field inventory.</td>
</tr>
<tr>
<td>Description of measurement methods and procedures to be applied:</td>
<td>Measuring dimensions on site using calipers and/or measuring tape.</td>
</tr>
<tr>
<td>Frequency of monitoring/recording:</td>
<td>Each five years.</td>
</tr>
<tr>
<td>Value monitored:</td>
<td>Please refer to Annex III.a v3.1.</td>
</tr>
<tr>
<td>Monitoring equipment:</td>
<td>Calipers and/or measuring tape.</td>
</tr>
<tr>
<td>QA/QC procedures to be applied:</td>
<td>Previously trained staff for data collection coordinated by an agronomist or forester, who is responsible for writing down the values on the field form, so that errors can be avoided. Outliers values were excluded.</td>
</tr>
<tr>
<td>Calculation method:</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Any comment:</td>
<td>D30 shall be measured for each tree in the parcel (20m x 50m).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Unit / Parameter</th>
<th>Hj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>Meters or decimeters.</td>
</tr>
<tr>
<td>Description:</td>
<td>Oblique height of each tree in the monitoring parcel.</td>
</tr>
<tr>
<td>Source of data:</td>
<td>Forest field inventory.</td>
</tr>
<tr>
<td>Description of measurement methods and procedures to be applied:</td>
<td>Measuring of height values using a telescopic rod.</td>
</tr>
<tr>
<td>Frequency of monitoring/recording:</td>
<td>Each five years.</td>
</tr>
<tr>
<td>Value monitored:</td>
<td>Please refer to Annex III.a v3.1</td>
</tr>
<tr>
<td>Monitoring equipment:</td>
<td>Telescopic rod.</td>
</tr>
<tr>
<td>QA/QC procedures to be applied:</td>
<td>Previously trained staff for data collection coordinated by an agronomist or forester, who is responsible for writing down the values on the field form, so that errors can be avoided. Outliers values were excluded.</td>
</tr>
<tr>
<td>Calculation method:</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Any comment:</td>
<td>Hj shall be measured for each tree in the parcel (20m x 50m).</td>
</tr>
</tbody>
</table>

| Data Unit / Parameter: | Housing; production; income; education; physical infrastructure; leisure/culture; and biodiversity |
| Data unit: | Number of families dwelling in a certain type of house; number of different products and animals creation; BRL/family; number of families in a certain type of scholarity level; percentage of families assisted by any type of infrastructure; number of families enjoying forms of leisure per number of available forms of leisure. |
| Description: | Housing; production; income; education; physical infrastructure; leisure/culture; and biodiversity. |
| Source of data: | Participatory Rural Appraisal – PRA. |
| Description of measurement methods and procedures to be applied: | Periodic application of the tools existing in the PRA methodology. |
| Frequency of monitoring/recording: | Annually until the third year of the project and biannually until the fifth year. |
| Value monitored: | Please refer to Annex X.a. |
| Monitoring equipment: | Not applicable. |
| QA/QC procedures to be applied: | Previously trained staff for data collection, coordinated by a sociologist, pedagogue or similar, who is responsible for facilitating meetings and writing and updating reports. |
| Calculation method: | Not applicable. |
| Any comment: | Data obtained through the periodic application of the PRA shall be useful to evaluate project social changes and gains, based on the evolution and status of the chosen parameters. |

| Data Unit / Parameter: | N |
| Data unit: | Number of species and number of registers/100 |
| Description: | Species richness, abundance and distribution. |
| Source of data: | Fauna inventory. |
| Description of measurement methods and procedures to be applied: | Sampling points to capture video/photos on site. |
| Frequency of monitoring/recording: | Each five years. |
| Value monitored: | Please refer to Annex X.a |
| Monitoring equipment: | Camera traps. |
| QA/QC procedures to be applied: | Biologists and vets with the expertise to place the camera traps adequately, identify species and monitor individuals’ movement. |
| Calculation method: | Not applicable. |
| Any comment: | Species richness, abundance and distribution shall be measured in terms of the amount of registers obtained through sampling efforts. |

| Data Unit / Parameter: | **N; DA; AA; DO; and FA** |
| Data unit: | Number of species; number of trees per hectare; number of trees per parcel they may occur; square meters per hectare; and number of trees per parcel sampled. |
| Description: | Floristic (species richness) and phytosociological (density, abundance, dominance and frequency) parameters. |
| Source of data: | Forest field inventory. |
| Description of measurement methods and procedures to be applied: | Counting and measurement of trees within the boundaries of the permanent parcels randomly sampled on site. |
| Frequency of monitoring/recording: | Each five years. |
| Value monitored: | Please refer to Annex III.b |
| Monitoring equipment: | Calipers and/or measuring tape and telescopic rod. |
| QA/QC procedures to be applied: | Previously trained staff for data collection coordinated by an agronomist or forester, who is responsible for writing down the values on the field form, so that errors can be avoided. Outliers values were excluded. |
| Calculation method: | Not applicable |
| Any comment: | Floristic and phytosociological parameters shall be used, over time, to evaluate species diversity and the role of each species in relation to the forests under growth and reestablishment. |
6 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS (CLIMATE)

6.1 Baseline Emissions (G2)

The project followed the AR-AMS0001 methodology guidelines regarding the criteria for area stratification. According to the methodology criteria, the project was stratified into two groups: “A” and “B” (see section 2.1):

A. Agricultural areas where changes in carbon stocks in the living biomass do not exceed 10% of the amount anticipated for removal by the project.

B. Grazing areas where changes in carbon stocks within the living woody biomass do not exceed 10% of the amount of removal proposed by the project.

Since there is no biomass increase in the project areas in the baseline scenario (please refer to section 4.4, above), the project baseline is equal to the existing biomass stock in the areas before the start of the reforestation project \(t_0 = t_5\).

The current existing stock within each stratum was calculated ex-ante following the equations provided by the AR-AMS0001 methodology, as follows:

\[
B(t) = \sum_{i=1}^{I} (B_A(t)i + B_B(t)i) * A_i
\]

\(B_{(t)} = \text{Carbon stocks in the living biomass within the project boundary at time } t \text{ in the absence of the project activity (t C)}\)

\(B_A(t)i = \text{Carbon stocks in the above-ground biomass at time } t \text{ of stratum } i \text{ in the absence of the project activity (t C/ha)}\)

\(B_B(t)i = \text{Carbon stocks in the below-ground biomass at time } t \text{ of stratum } i \text{ in the absence of the project activity (t C/ha)}\)

\(A_i = \text{Project area of stratum } i \text{ (ha)}\)

\(i = \text{Stratum } i \text{ (I = total number of stratum)}\)

\[B_A(t) = M(t) * 0.5\]

\(B_A(t) = \text{Carbon stocks in living biomass that would existed at time } t \text{ in the absence of project activity (t C/ha)}\)

\(M(t) = \text{Above-ground biomass at time } t \text{ that would have occurred in the absence of the project activity (t d.m./ha)}\).

0.5 = Carbon fraction of dry matter (t C/t d.m.).

\[B_B(t=0) = B_B(t) = 0.5 * (M_{grass} * R_{grass} + M_{woody}(t=0) * R_{woody})\]

\(B_B(t) = \text{Carbon stocks in living biomass that would have occurred at time } t \text{ in the absence of project activity (t C/ha)}\).
\( M_{\text{grass}} \) = Above-ground biomass in grass pastures at time \( t \) that would have occurred in the absence of the project activity (t d.m./ha).

\( M_{\text{woody}}(t=0) \) = Above-ground biomass of woody perennials at \( t=0 \) that would have occurred in the absence of the project activity (t d.m./ha).

\( R_{\text{woody}} \) = Root to shoot ratio of woody perennials (t d.m./t d.m.).

\( R_{\text{grass}} \) = Root to shoot ratio for grassland (t d.m./t d.m.).

During the field surveys, within the two main strata (A and B), different biomass concentrations per hectare were identified, so that the strata A and B were further divided into sub-strata (a, b, b', c, and agriculture), allowing for more accurate calculation as shown in Table 5.
Table 5: Description and distribution of the strata and sub-strata's areas within the project (2010).

<table>
<thead>
<tr>
<th>Reference Area</th>
<th>Owner/farm</th>
<th>Area (ha)</th>
<th>Stratum</th>
<th>Sub-stratum</th>
<th>Sub-stratum area</th>
<th>Reference Image25</th>
<th>Image area26</th>
<th>Points</th>
<th>UTM Coordinates for picture-taking (S/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>Cezar Sandri/Flores do Ipê</td>
<td>80.5</td>
<td>B  c</td>
<td>10.3</td>
<td>CR08 and CR09</td>
<td>1797; 1801; 1804</td>
<td></td>
<td>6</td>
<td>8052516; 306847</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b’</td>
<td>70.2</td>
<td>CS04 and CS07</td>
<td>1817; 1820</td>
<td></td>
<td>7</td>
<td>8052839; 306712</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1838</td>
<td></td>
<td>8</td>
<td>8051585; 306529</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1856; 1859</td>
<td></td>
<td>9</td>
<td>8051805; 306438</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1863; 1873</td>
<td></td>
<td>10</td>
<td>8052062; 306209</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1877; 1882</td>
<td></td>
<td>11</td>
<td>8052068; 306704</td>
</tr>
<tr>
<td>(B)</td>
<td>Lúcio Flávio/Mirassol da Fuma</td>
<td>42.8</td>
<td>B  a</td>
<td>42.8</td>
<td>CL01 to CL07</td>
<td>2068; 2069</td>
<td></td>
<td>28</td>
<td>7983966; 248547</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2076; 2077</td>
<td></td>
<td>29</td>
<td>7984241; 248744</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2087; 2091</td>
<td></td>
<td>30</td>
<td>7984332; 248920</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2102; 2106</td>
<td></td>
<td>31</td>
<td>7984759; 248874</td>
</tr>
<tr>
<td>(C)</td>
<td>PENT</td>
<td>27.2</td>
<td>B  b</td>
<td>24.1</td>
<td>CS01-CS05</td>
<td>2006; 2019; 2035</td>
<td>2015; 2029</td>
<td>12</td>
<td>7991509; 243884</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2026; 2027</td>
<td></td>
<td>27</td>
<td>7992025; 243268</td>
</tr>
<tr>
<td>(D)</td>
<td>Rogério Viana/Lugar Jacobinha</td>
<td>60.1</td>
<td>A  agriculture</td>
<td>60.1</td>
<td>-</td>
<td>4254</td>
<td></td>
<td>4</td>
<td>8011650; 285141</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4261; 4272</td>
<td></td>
<td>5</td>
<td>8011017; 284387</td>
</tr>
<tr>
<td>(E)</td>
<td>Vanir Potrich/Lots 8, 9, 10</td>
<td>381.3</td>
<td>B  a</td>
<td>289.6</td>
<td>CL01 to CL07</td>
<td>4158; 4165; 4161;</td>
<td>4179</td>
<td>1</td>
<td>8018897; 276436</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b</td>
<td>91.8</td>
<td>CS01-CS05</td>
<td>4162; 4171</td>
<td>4164; 4204;</td>
<td>2</td>
<td>8018867; 276027</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4186; 4206</td>
<td></td>
<td>3</td>
<td>8017897; 277035</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>592</td>
<td></td>
<td>588.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference between the sums of the areas is due to the vegetation areas within the PENT, which have been excluded from the area of the strata.

25 Series of stereo-photographs for quantifying the vegetation biomass in the central Brazil Cerrado area – Volume I: Reference used for quantification of biomass stocks in different strata.
26 Annex VIII.
The references used to quantify the biomass per hectare (woody biomass) for each of the different strata was extracted, by the time of validation, from the study conducted by Ottmar et al (2001), entitled: Series of stereo-photographs for quantifying the vegetation biomass in the Central Brazil Cerrado area – Volume I, according to Table 5 and 6. Total baseline and carbon stock accounted by the time of the first verification are presented in Table 7.

Table 6: *Ex-ante* baseline quantification of the mean biomass and average carbon stocks per hectare for each of the different strata (refer to Annex VIII).

<table>
<thead>
<tr>
<th>Sub-stratum</th>
<th>References from Ottmar et. al (2001)</th>
<th>Average woody biomass stock (tones of dry biomass/ha)</th>
<th>Grass biomass stock (tones of dry biomass/ha)</th>
<th>Total stock in biomass above and below ground (tons of dry biomass/ha)</th>
<th>CO2e stock in the woody biomass (t/ha)</th>
<th>CO2e stock in the grass (t/ha)</th>
<th>Total stock of CO2e per hectare B(t)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>CL01 to CL07</td>
<td>0.59</td>
<td>0.59</td>
<td>4.12</td>
<td>5.30</td>
<td>1.08</td>
<td>1.08</td>
</tr>
<tr>
<td>b</td>
<td>CS01 to CS05</td>
<td>3.46</td>
<td>3.46</td>
<td>2.17</td>
<td>9.09</td>
<td>6.35</td>
<td>6.35</td>
</tr>
<tr>
<td>b'</td>
<td>CS04 and CS07</td>
<td>6.06</td>
<td>6.06</td>
<td>2.44</td>
<td>14.56</td>
<td>11.12</td>
<td>11.12</td>
</tr>
<tr>
<td>c</td>
<td>CR08 and CR09</td>
<td>28.19</td>
<td>28.19</td>
<td>1.17</td>
<td>57.55</td>
<td>51.73</td>
<td>51.73</td>
</tr>
<tr>
<td>agriculture</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7: Total carbon stock after and before the project start (baseline 2010) in the strata, project sites/areas, and in the entire project\(^{27}\) (refer to Annex III.a v3.1).

<table>
<thead>
<tr>
<th>Farm Owner</th>
<th>Farm</th>
<th>Strata</th>
<th>Area (ha)</th>
<th>Strata stocks per hectare after 5 years from the project start (t CO2e/ha)</th>
<th>Total project and strata stocks after 5 years from the project start (t CO2e)</th>
<th>Total project and strata stocks before the project start (Baseline) (t CO2e)</th>
<th>Annual average net removal after 5 years from the project start (t CO2e/ha/year)</th>
<th>Total net removal after 5 years from the project start (t CO2e/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanir Potrich</td>
<td>Babilônia lotes 8, 9 e 10</td>
<td>A1</td>
<td>57,58</td>
<td>38,99</td>
<td>2.244,97</td>
<td>4,348,17</td>
<td>6,15</td>
<td>45,61</td>
</tr>
<tr>
<td>Vanir Potrich</td>
<td>Babilônia lotes 8, 9 e 10</td>
<td>A2</td>
<td>78,85</td>
<td>17,84</td>
<td>1.406,98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanir Potrich</td>
<td>Babilônia lotes 8, 9 e 10</td>
<td>A3</td>
<td>109,48</td>
<td>48,15</td>
<td>5.271,67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{27}\) Only areas that were planted and monitored were included, thus the baseline stock from PENT and Mirassol da Furna farm were not accounted in this first verification.
For more information regarding baseline stock *ex-ante* calculation, please refer to Annex VIII. For more information regarding the baseline accounted for this first verification, please refer to Annex III.a v3.1.

### 6.2 Project Emission

According to the AR-AMS0001 v.5, project emissions are considered insignificant and therefore neglected. The project does not anticipate the use of fire for preparing the areas, and emissions caused by project activities is restricted to those from nitrogen-based fertilizers, however they are not significant when compared to the total amount of emissions removed by the project and thus can be neglected, as per the AR-AMS0001 guidelines.

### 6.3 Leakage

There was not displacement of population during the first 5 years of project activities. Similarly, the displacement of some animals was not associated with opening new areas for grazing, but the incorporation of the quota already established for cattle grazing within their own farms, since the total capacity of the number of animals per hectare is low and could be maintained in the broad expanse of grasslands that exist outside the project boundaries. However, as observed in the field these old pastures already established are not properly handled and the number of animals to be displaced would require more than 10% of the average capacity of these pastures on the supply of food for cattle. The turnover number of animals displaced would also require more than 10% of average production capacity per hectare of these pastures. Furthermore, currently the area of agriculture represents 10.2% of the total project area to be reforested.
During the first three years, the project team worked with the owners to ensure that no activities occur outside the project boundaries with potential for emission and that directly relate to the project activities, such as opening new grazing areas and agriculture to offset the area occupied by the reforestation project.

Following the methodology AR-AMS0001, the average annual leakage is equal to 15% of removals ex ante planned for the first crediting period of the project.

Therefore, the leakage for the first crediting period of the project is determined at the time of verification according to the equations below, as per methodology AR-AMS0001.

For the first verification period:

\[
L_{tv} = 0.15 \times (P_{(t)} - B_{(t=0)}) - \sum_{t=0}^{t} GHG_{PROJ,(t)}
\]

For subsequent periods:

\[
L_{tv} = 0.15 \times (P_{(t)} - P_{(t-k)}) - \sum_{t-k}^{t} GHG_{PROJ,(t)}
\]

\(L_{tv}\) = GHG emission due to leakage at the time of verification (t CO2-e).

\(P_{(t)}\) = Carbon stocks within the project boundary achieved by the project activity at time t (t CO2-e).

\(GHG_{PROJ,(t)}\) = Project emissions (CO2-e/year t).

\(B_{(t=0)}\) = Carbon stocks in biomass at time 0 that would have occurred in the absence of the project activity (t CO2-e).

\(tv\) = Year of verification (years).

\(\kappa\) = Time span between two verifications (year).

Table 8: Total Leakage for the first crediting period (ex-post calculation).

<table>
<thead>
<tr>
<th>(P_{(t=5)}) = Carbon stocks within the project boundary achieved by the project activity at time t (t CO2-e)</th>
<th>(B_{(t=0=5)}) = Carbon stocks in biomass at time 0 that would have occurred in the absence of the project activity (t CO2-e)</th>
<th>(GHG_{PROJ,(t=5)}) = Project emissions (CO2-e/year 5)</th>
<th>(L_{t=5} = ) GHG emission due to leakage at the time of verification (t CO2-e).</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.741,63</td>
<td>7.728,22</td>
<td>-</td>
<td>2.402,01</td>
</tr>
</tbody>
</table>

For more information regarding leakage calculation, please refer to Annex III.a v3.1.
6.4 Summary of GHG Emission Reductions and Removals (CL1 & CL2)

The formulas used for ex-post calculation of net removals by the project activities is the following:

\[
Credits_{(t)} = P_{(t)} - \sum_{t=0}^{N} (GHG_{PROJ, (t)} - \Delta C_{BSL, t}) - L_{tv}
\]

For the subsequent periods:

\[
Credits_{(tv)} = P_{(tv)} - \sum_{t=0}^{N} (GHG_{PROJ, (tv)} - \Delta C_{BSL, tv}) - L_{CP1}
\]

Where:

\[P_{(t)} = \text{Carbon stocks within the project boundary achieved by the project activity at time } t \ (t \text{ CO}_2\text{-e}).\]

\[GHG_{PROJ, (t)} = \text{project emissions (CO}_2\text{-e/year } t).\]

\[\Delta C_{BSL, t} = \text{Net baseline GHG removals by sinks (CO}_2\text{-e/year } t).\]

\[L_{tv} = \text{Total amount of GHG emission due to leakage at the time of verification (t CO}_2\text{-e).}\]

\[L_{CP1} = \text{Total amount of GHG emission due to leakage at the end of the first crediting period (t CO}_2\text{-e).}\]

\[Credits_{(tv-k)} = \text{Units of carbon credits issued following the previous verification.}\]

\[tv = \text{Year of verification (years).}\]

\[k = \text{Time span between two verifications (year).}\]

The carbon stock within the project boundary achieved by the project activity at time 5 (years) - \[P_{(5)}\] was calculated based in the biomass forest inventory, as presented below in Table 9.

Table 9: Ex-post calculation of net removals by the project activities.

<table>
<thead>
<tr>
<th>[P_{(t=5)}]</th>
<th>[\Delta C_{BSL, t=5}]</th>
<th>[GHG_{PROJ, (t=5)}]</th>
<th>[L_{t=5}]</th>
<th>[Credits_{(t=5)}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.741,63</td>
<td>7.728,22</td>
<td>-</td>
<td>2.402,01</td>
<td>13.611,39</td>
</tr>
</tbody>
</table>

For more information regarding the memory of calculus of the biomass forest inventory and net GHG removal, please refer to Annex III and III.a.

Table 10 presents the final balance of VCU\(^s\) (Verified Carbon Units) generated by the project, based on the ex-post calculations for the first verification period, taking into account the discount and the leakage of the buffer that must be retained according to risk analysis of non-permanence (please refer to section 4.4.1 of the registered VCS PD).
Table 10: Final balance of VCU’s calculated ex-post for the first monitoring period (2010-2015).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Ex-post calculated volume (tCO2e)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in carbon stock (t=5)</td>
<td>23.741,63</td>
<td>Carbon stocks within the project boundary achieved by the project activity at time t=5 (t CO2-e)</td>
</tr>
<tr>
<td>Baseline (stable)</td>
<td>7.728,22</td>
<td>Considered only for the areas that were planted and monitored (462 ha)</td>
</tr>
<tr>
<td>Net removal</td>
<td>16.013,41</td>
<td>= 23.741,63 - 7.728,22</td>
</tr>
<tr>
<td>Leakage (t=5)</td>
<td>2.402,01</td>
<td>= 16.013,41 * 15%</td>
</tr>
<tr>
<td>Credits (t=5)</td>
<td>13.611.39</td>
<td>= 16.013.41 – 2.402.01</td>
</tr>
<tr>
<td>Buffer (10%)28</td>
<td>1.361</td>
<td>= 13.611.39 * 10%</td>
</tr>
<tr>
<td>Total VCU’s</td>
<td>12.250,39</td>
<td>= 13.611.39 - 1.361</td>
</tr>
</tbody>
</table>

6.5 Climate Change Adaptation Benefits (GL1)

Several studies, particularly those that guide the fourth IPCC report, reveal information on the possible impacts on Brazil (and its ecosystems) in the face of current climate change. These studies are mainly based on the increase in temperature, changes in precipitation patterns, and changes in the distribution of extreme weather events such as droughts, floods, penetration of cold fronts, frost, severe storms, windstorms, hail, and others. In general, an increase of 4 to 6°C is expected in parts of Brazil (mainly in the Amazon) at the end of the century, as reported by Nobre (2001)iv.

The following A2 developed scenarios (according to different climate models) show the potential changes in temperature and precipitation for Latin America. The choice of the A2 scenarios to illustrate the changes in temperature (Figure 9) and precipitation (Figure 10) is justified by the fact that they correspond to an increase ranging from 2°C to 6°C in Latin America, which are the values closest to the ones in the Brazilian studies reported by Nobre (2001).

28 According to the updated Non-permanence risk assessment and buffer determination, please refer to Annex XXII, XXII.a and XXVII
Figure 9 - Temperature anomalies projections (°C) for South America (A2 Scenario).
In addition, more recent studies conducted by the IPCC (fifth IPCC report)\(^{29}\) reinforce this new climate trends of disruption of historical climatic patterns, where severe climatic events are expected to become stronger in intensity and more frequently, as can be seen below (Figures 11, 12 and 13).

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Figure 12: Temperature and precipitation changes assessment for South America. Source: IPCC fifth assessment WG II: “Climate Change 2014: Impacts, Adaptation, and Vulnerability”

Figure 13: regional impacts expected due to global climate changes. Source: IPCC fifth assessment WG II: “Climate Change 2014: Impacts, Adaptation, and Vulnerability”
Generally, the foreseen changes in temperature for the country would cause increased surface evaporation, inducing changes in the water balance of natural vegetation. According to Nobre (2001), for the Cerrado, a temperature increase of over 3°C would result in less water in the soil. Marengo (2007) states that the increase of temperature induces a higher evapotranspiration rate (the sum of surface water evaporation and plant transpiration), reducing the amount of water in the soil, even if rainfall does not decrease significantly.

For the Cerrado biome, global warming may bring changes that include the clearing of vegetation and loss of fauna and flora species. Fewer trees, a consequence of the foreseen clearing processes, and their replacement with grasses and herbs (which contribute little to carbon dioxide retention), means more carbon and greater heat retention in the atmosphere (CARVALHO and BUSTAMANTE, 2009).

Siqueira and Peterson (2003) studied ecological niche modeling techniques to determine the effects of climate change in the distribution of tree species in the Cerrado. By crosschecking information among 15,657 occurrence points of 162 tree species, they revealed a reduction of about 25% of the Cerrado area in the optimistic scenario and a reduction of nearly 90% in the worst-case scenario. For both scenarios, reductions of over 50% were anticipated for all species. They observed that, for the optimistic scenario, 18 species would be driven to extinction, while the pessimistic scenario points toward 56 species meeting such a fate.

For the areas covered by the project, in its absence it is expected that they become more sensitive to increasing drought periods and lose their ability to retain moisture in the soil. This is due to water resources and soil water supplies responding better to drought events within forest habitats. On the other hand, areas devoid of forest cover, as were the project areas by the time of validation, tend to suffer more from prolonged drought and high temperatures, since the reduced rainfall and rising temperatures lead to reductions in water flow or even to the extinction of springs in previously cleared areas.

Based in the above mentioned, the project expects to face climate risks with several actions listed along this document, as well the registered PDs.

Regarding to the biodiversity impacts mitigation strategies we can point out the increase in protected areas (conservation units, as well as establishing APP and RL), through the reforestation itself in areas located within the Emas – Taquari Biodiversity Corridor. In this regarding, the exclusive use of native Cerrado species should strengthen this conservation strategy, once native species enjoy greater adaptability. Therefore, they are more resistant to local pests and participate in the food chain, development, and interaction with various fauna species, among other important environmental functions.

Researchers from Embrapa Cerrados\textsuperscript{30} analyzed typical species from that biome that are more responsive to the common changes in temperature and rainfall across the region. Researchers have identified five plants (\textit{Q. grandiflora}, \textit{Q. paviflora}, \textit{L. pacari}, \textit{S. multijulga}, and \textit{B. virgilioides}) occurring in more than 80\% of the biome, suggesting a high adaptive capacity. These five species are included in the list of species used by the project.

The planting of native species should hinder the loss of plant biomass, as should the parallel actions to protect the forest and reforested areas, such as the building of firebreaks as well as preventing and fighting forest fires. The planting locations favor riverbanks, recharge areas, and springs, so that they may also function as mitigating effects for climate risks, guaranteeing hydric maintenance in the project areas, and thus promoting water availability for the soil, for biodiversity, and for human use.

From a social point of view, it is expected that the project activity, through knowledge exchange, shall contribute to the formation of environmentally responsible citizens, who can use management techniques that avoid fire, or that employ fire in accordance with recognized safety parameters. The

\textsuperscript{30} Empresa Brasileira de Pesquisa Agropecuária.
PP also expects that the communities benefiting from the project not only obtain greater environmental awareness, but also affirm themselves socially and financially by reducing their vulnerability to social and environmental consequences of climate change.

The project activity also aims to promote research and understanding of the potential for vulnerability and adaptation of the Cerrado regarding climate change, through partnerships with educational and research institutions. Field research, supported by these institutions, shall look deeper into issues of biome adaptation and conservation, which are important to guide decision-making on land use and resource management in the Cerrado.

Finally, the set of actions proposed by the Emas-Taquari Biodiversity Corridor Carbon Project also provide important action, management, and participation tools to meet the goals proposed by the Biodiversity Corridors, such as mitigating landscape fragmentation, connecting protected areas, promoting gene flow, and sustainable regional development. By establishing these lines of action, the project aims to contribute directly and indirectly to the strengthening of local biodiversity in the face of challenges likely to arise from climate change.

Table 11 summarizes how project activities must support communities and biodiversity to face the expected impacts from climate changes.

<table>
<thead>
<tr>
<th>Probable impacts from climate changes</th>
<th>Project Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate</td>
<td></td>
</tr>
<tr>
<td>Increased likelihood of forest fires and the consequent increase in GHG emissions.</td>
<td>Supporting the Fire Brigade.</td>
</tr>
<tr>
<td></td>
<td>Building of firebreaks.</td>
</tr>
<tr>
<td></td>
<td>Environmental Education.</td>
</tr>
<tr>
<td>Community</td>
<td></td>
</tr>
<tr>
<td>Restriction of access to water.</td>
<td>Training for reforestation and land use.</td>
</tr>
<tr>
<td>Decrease in agricultural productivity and, consequently, restricted access to food.</td>
<td>Reforestation of critical areas for the conservation of soil and water services.</td>
</tr>
<tr>
<td>Rural exodus.</td>
<td>Support for sustainable management practices aiming income generation and food security</td>
</tr>
<tr>
<td></td>
<td>Environmental Education.</td>
</tr>
<tr>
<td>Biodiversity</td>
<td></td>
</tr>
<tr>
<td>Desertification.</td>
<td>Reduction of environmental fragmentation.</td>
</tr>
<tr>
<td>Loss of plant biomass.</td>
<td>Connection between Conservation Units and remaining forest fragments.</td>
</tr>
<tr>
<td>Direct biodiversity loss.</td>
<td>Strengthening gene flow and reducing endogamy by connecting forest fragments (populations).</td>
</tr>
<tr>
<td></td>
<td>Reforestation with native species.</td>
</tr>
</tbody>
</table>

### 7 COMMUNITY

**CM1.1. Impacts on the communities**

Throughout its implementation, the Emas-Taquari Biodiversity Corridor Carbon Project aimed not only to reforest degraded areas, but also to provide social benefits and economic alternatives to low-income people from unassisted communities. The engaged communities were involved in all stages of the project activities and until now, the project has benefited 51 (directly) and 19 (indirectly) rural settled
families, 9 quilombola families, and a group of 34 temporary employees hired up to work with planting activities. The net positive impacts on the communities assisted by the project relies upon the opportunities, social inclusion and better conditions they have acquired to work and generate their own income. To illustrate, this was mostly due to the access to treated water, which allowed the maintenance of many small-scale economic activities such as farming, small animals creation and livestock, besides the supply of native seeds and seedlings for reforestation specifically in the beginning of the project implementation.

Positive impacts on the Buracão community

In the Buracão quilombola community, ten families were included in the beginning of the project, but only five made available to participate into the project and then were assessed in relation to their socioeconomic situation in 2011 (see more details in section GL2).

The project intended to promote integration among the local families, encouraging them to work together for the community development, which would reduce the departure of younger members and try to preserve local traditions as well. At the same time, families would increase their income through the productive and commercial activities implemented by the project. The capacity building and trainings on natural resources management focused on how they could take as much as possible advantage on seedlings production and other project activities. Hence, it was expected that they could produce goods from local resources and them strength the supply chains.

In this context, five families were benefit by capacity-building sessions focused on environmental education, seeds collection and tree seedlings production, and awareness of the sustainable use of Cerrado’s natural resources (i.e. fruits and seeds). The understanding about the rational economic use of fruits and seeds became clear to the community perception to not compromise the future generations.

Environmental education provided knowledge and understanding about Cerrado’s economic value and the importance of its rational and sustainable use. It brought collective awareness towards conservation. The importance to take care about the springs and rivers from where they withdraw water for both human and animal’s needs was incorporated.

Seedlings production in the Buracão quilombola community was very effective, reaching the rate of 9,720 seedlings used by the project, receiving an extra monthly income of BRL 372 per family along 2013. This was really worth because, initially, the financial resources of the families came only from a few retirement accounts and financial supports from the youngest who could obtain new opportunities in the city. In this sense, the local traditional community is deeply changing and do not hold anymore its original cultural identity. Many members have changed to the city (mainly the youngest) and the oldest ones do not have much interest with the project anymore.

Nevertheless, the project left a legacy to the community based on a more broad view of the Cerrado, and its respective value and conservation needs, considering that the biome is a source of richness that whether explored in sustainable ways it can generate additional economic alternatives and income. A positive impact relies on the fact that a few members of the community are still collecting and trading native seeds for reforestation activities. One of the young leaders and the Buracão’s representative - Diana Gonçalves the Jesus - is deeply involved into the project. She has graduated in Forestry and nowadays coordinates Oreade's tree nursery, being an example of a well succeed remnant who believed in the project’s opportunities and returned this properly to her native community.
Positive impacts on the Cedro community

In the Cedro quilombola community, ten families were included in the beginning of the project and only four made available to participate into the project and then were assessed in relation to their socioeconomic situation in 2011 (see more details in section GL2).

The project intended to stimulate the production of medicinal plants, in which families used to work with, by supporting the scale-up of collective medicinal garden. Originally, the community already owned a small-scale tree nursery (20,000 seedlings capacity), but they were in need of technical assistance, capacity building and instructions on collective organization. For these reasons, the project aimed to improve their local nursery activity, so that it could be possible to diversify and enhance the use of local species. Increasing income generation activities and shaking the local economy, it would benefit the community with a better access to public policies and credit.

In this context, four families were benefit by capacity-building sessions focused on environmental education, seeds collection and tree seedlings production, and awareness of the sustainable use of Cerrado’s natural resources (i.e. fruits and seeds). The understanding about the rational economic use of fruits and seeds became clear to the community perception to not compromise the future generations.

Environmental education provided knowledge and understanding about Cerrado’s economic value and the importance of its rational and sustainable use. It brought collective awareness towards conservation and nature economic value.

Seedlings production in the Cedro quilombola community was not as effective as in the Buracão. The reasons for such problems was due to the difficulties in which some members had in working with project activities since their physical limitations associated to the advanced age is incisive. Furthermore, it was not possible to engage younger members because most of them have migrated to the city seeking for new opportunities and jobs. Even though, families who attended the project produced 7,776 seedlings, receiving an extra monthly income of BRL 372 per family along 2013.

Because of many young members have left the community on their own to go to the city, this might contribute to the local quilombola’s culture losses. However, the project always intended to keep the youngest families inside the community, encouraging them to work with seedlings production and at the same time enhancing the chances to preserve local traditions and livelihoods alive. The main legacy can be assured by the knowledge with seedlings production and the level of awareness disseminated concerning the rational use of the Cerrado and its economic value, beyond the need to preserve native and restore degraded lands.

Positive impacts on the Serra das Araras, Pouso Alegre and Formiguinhas settlements

In the Serra das Araras, Pouso Alegre and Formiguinhas rural settlements, 25 families were included in the beginning of the project and all they made available to participate and were assessed in relation to their socioeconomic situation in 2011 (see more details in section GL2).

It was expected that the project could help increase families’ income based on the production and trade of native seedlings during and after the reforestation, being supported by the Centro de Produção de Mudas Nativas do Cerrado (the name given to Oreade’s tree nursery). The project financed minimal infrastructure and materials enabling the settlers to produce their own seedlings. Beyond the commercialization of the seedlings, with the project support, the families became able to restore and enrich their properties planting native species with socioeconomic value, once they have
received adequate training and technical competencies. Another source of income resulted from the project activities was the revenues obtained with the collection and trade of native seeds, attending the demand of nurseries and other markets in the region.

Considering that in the average, the families’ monthly income was around one minimal wage (based on Oréades data) and that they found difficulties to establish a permanent productive activity, the project activities were a big incentive. The project became a real alternative of increasing income and at the same time, it avoided rural exodus and the loss of collective identity. To exemplify, by engaging a group of women, the project stimulated the increase in the production and processing of baru nuts (*Dipteryx alata*), since this procedure was formerly usual in the routine of the families to manufacture foodstuffs, aligned to the good market price of the baru nuts.

In this context, as long as the project activities were taking place, more families decided to attend it, reaching the milestone of 51 families involved. They were benefit by capacity-building sessions focused on environmental education, seeds collection and tree seedlings production, and awareness of the sustainable use of Cerrado’s natural resources (i.e. fruits and seeds). The understanding about the rational economic use of fruits and seeds became clear to the community perception to not compromise the future generations.

Environmental education provided knowledge and understanding about Cerrado’s economic value and the importance of its rational and sustainable use. It brought collective awareness towards conservation. In the last years, for instance, it was detected water scarcity as a big issue, so that the settlers realized the need to preserve springs and rivers where from they withdraw water for their needs.

Seedlings production in the Serra das Araras, Pouso Alegre and Formiguinhas settlements were very effective. However, they have suffered a lot with the lack of water as a limiting factor to seedlings production and agriculture activities. Despite of these hard constraints, they were capable to produce 97,200 seedlings, receiving a monthly income of BRL 373 per family along 2012 and 2013. In the beginning of the project, the seedlings they produced and sold were the unique source of income available to themselves, beyond a few retirement accounts. Another positive impact was that some members started to reforest their own properties using native species.

In relation to the lack of water, the settlers mobilized themselves and asked for help to Oréades to fundraise resources to implement a water supply system for 51 families living in the three settlements. As a result, they were granted with the installation of a drinking water distribution system in each house, which is compounded by an artesian well and branches for the residences. The HSBC Institute has sponsored this initiative.31

Today, the community has assimilated a more broad view of the Cerrado, recognizing the needed value for conservation, once the biome is a source of richness that whether explored in sustainable ways it can generate economic alternatives, additional revenues and social inclusion. Reforestation activities has ended and the communities are not producing seedlings as before, but some are still collecting seeds and conducting several economic activities previously impracticable (see section GL2).

**Positive impacts on the Nova Esperança Therapeutic Community**

The Nova Esperança Therapeutic Community used to promote nursery laboring as an effective activity for young and adult men under treatment against drug addiction. They had a tree nursery and received support by Oréades in the past. Their role in the beginning of the project was to supply the seedlings demand to reforest the most far project site (250km apart from Mineiros), owned by Maria Otilia and located in Chapadão do Sul municipality, Mato Grosso do Sul state. Because of the distance where the community is situated and the withdrawal of Maria Otilia’s farm from the project due to problems with land documentation, still at the time of the project validation in 2010, the Nova Esperança community was removed from the project.

CM 1.2. Maintenance of High Conservation Values

See section G3.

7.1 Negative Offsite Stakeholder impacts (CM2)

CM 2.1. Negative social impacts

As stated in the Design Document CCB Standard in 2010 (section CM2.1), the project did not anticipate any negative social impacts outside the project boundaries. Therefore, the project did not result in any net negative impact on the well-being of other stakeholder groups.

CM 2.2. Mitigating negative social impacts

As it was anticipated the inexistence of negative social impacts, no mitigation plans related to social and economic impacts on the main stakeholders were taken into consideration.

CM 2.3. Clarifying the project’s lack of negative impacts

The project activities did not negatively affect those locally involved with the project, since it did not cause the need for moving (relocation), neither other conflicts related to the use of important natural resources that are essential to the subsistence of surrounding communities.

On the contrary, according to the benefits described on section G3.2 of the Design Document CCB Standard in 2010, the project has not only positively affected the local communities, but also indirectly benefited other communities and local stakeholders in the project region. This was made possible because of the knowledge dissemination, effective communication and valuing of the Cerrado and its traditional ways of life spread out by the project implementers.

At the first moment, not all invited families immediately joined the project. However, along the implementation of the project activities and the financial return it caused, other families showed interest with the project and demonstrated they would like to benefit by its activities. As a result, today 51 families are able to act with seeds collection and trade, which became a permanent activity that additionally increase the families’ incomes.

Another settlement called Dois Saltos, located in the municipality of Santa Rita do Araguaia, about 60 km far from the project zone, has arisen interest to participate to the project. In this sense, more 19
families were trained in seeds collection techniques, making this a kind of adding activity to increase household income. As in the other three settlements, in Dois Saltos there was mobilization of the community to claim to Oréades to carry out a drinking water supply project for 19 families.

7.2 Exceptional Community Benefits (GL2)

Since the project was validated in 2010, there is no updated data available from official governmental entities that can be used to the required scale, as specific indexes to evaluate social and economic aspects. Thus, as proposed in the monitoring methodology in 2010, it was applied the mechanism of the Participatory Rural Appraisal - PRA (Diagnóstico Rural Participativo - DRP, in Portuguese). It refers to a comprehensive tool that fits well to the purposes of measuring the impacts of exceptional benefits. Very inclusive and easy to be applied, the PRA holds a variety of techniques and practices. In the case of the project, it allowed communities to make their own diagnosis, so that they could start to self-manage their planning and development. Furthermore, the participants had the opportunity to share different experiences and knowledge, improving their skills in planning and action.

The results obtained from the PRA are presented in detail in Annex X.a32. A Social Networks Analysis - SNA (Análise de Redes Sociais - ARS, in Portuguese) was also carried out once. The PRA reports were published at the proponent’s institutional website33. Initially, the tools available in this methodology were systematically applied to define the situation in 2011 (considered as the baseline year) and, subsequently, to monitor the years 1 (2012), 2 (2013) and 3 (2014) along the project execution. From the year 4 (2016) and on, the PRA will be applied each two years, until the year 5 (2018). The project proponents were unable to apply the PRA in 2014 because of financial issues among others constraints, so that they needed to postpone it to 2016 and on, causing changes on the chronogram for further evaluations. According to the PRA, there are specific indicators and tools that can provide valuable information to prove positive gains to the communities, in terms of both quantity and quality. They are seven: housing, production, income, education, physical infrastructure, leisure/culture, and biodiversity.

Considering the physical infrastructure in 2011, 70% of the families from Serra das Araras, Pouso Alegre and Formiguinha rural settlements confirmed they had serious problems of water access in terms of quantity and quality. This was very adverse not only to their own needs, but it also hindered their business to move on due to the water quality conditions that did not comply with minimal legal requirements. The water issues were seriously affecting small farming activities and compromising smallholders to stay in the land. Regarding to the income indicator, it was found that in the average, families used to earn a little bit more than the minimal wage34, which was not enough to sustain their families adequately.

In the last application of the PRA made in 2013, several improvements were registered; being the most positive results measured by the infrastructure and income indicators. To date, 100% of the families gained access to treated water and families could guarantee their subsistence and develop their economic activities35, which led to an income increase to almost one and a half minimal wage.

32 Available in November 2016.
33 http://www.oreades.org.br/carbono/?menu=relatorios&cat=4
34 http://minimosalario.com.br/
35 http://www.incra.gov.br/noticias/sistema-de-distribuicao-de-agua-incrementa-renda-de-assentados-e-une-comunidade-em-goias
It is important to mention that the carbon project allowed performing better engagement, capabilities and the collectivism of the communities, facilitating Oréades to apply to the grant obtained with the HSBC Institute. Challenges and opportunities were made clear, wherein the families that started to produce seedlings were the same who formerly could access water. Many others families were interested in producing seedlings too, but they could not do that before with a poor access to water.

The National Institute for Land Reform (INCRA) appreciated the model adopted in the Serra das Araras, Pouso Alegre and Formiguinha settlements. The representative of Goias state intends to divulgate the work led by Oréades as an example to be replicated in other areas under land reform, especially where water scarcity is intense and people suffer a lot in the dry season.

More than helping improving the families’ revenues in the rural settlements, the wide access to water avoided conflicts, allowed smallholders to focus in other activities instead of spending the whole day looking for water, contributed to people permanence on the land, and provided the possibility to increase and diversify foodstuffs, small animals creation and seedlings production (Annex X). Some people had the opportunity to supply public schools with the school lunch, through partnerships signed up with the local town halls. Others could purchase private cars and trucks since they have earned more money and financial conditions after the project activities.

The indicators monitored with the PRA in 2011, 2012 and 2013 have been demonstrating increasing improvements on the welfare of the communities every year of its application, according to the peculiarity of each indicator analyzed. In the last PRA made in 2013, as regards to housing, all the families already lived in brick worked houses, having toilets and piped water. In respect to production, there was an increase of 142% in the variety of products, changing from 7 to 17, between 2011 and 2013. Concerning infrastructure, the most notable outcome is attributed to the new given access to treated water. Yet transportation and roads did not present significant changes, although increasing income has favored many families to buy their own vehicles and enabled the commercialization of products and goods, making them definitely entering the market.

Education remained the same when analyzing scholarity levels. Leisure presented a small change compared to the baseline year since the major part of the families still have few options to enjoy. Finally, in the year 2 (2013) the perception towards biodiversity was better reported by the families when they talked about the natural resources (i.e. counting of the number of baru trees inside garden), identifying and valuing medicinal and fruit species, as well as reporting the visualization of native fauna on their properties.

In respect to the Buracão and Cedro quilombolas communities, as already described in the sections above, attendance to the project activities was unsatisfactory. Therefore, it was not possible to apply the PRA beyond the baseline year, which was reinforced by the dropout of the youngest members who moved to the city in the first years of the project.

Based on the main goals the project has assumed, it has been demonstrating to be capable in delivering tangible benefits to people who were previously disadvantaged or at risk. By full engagement, technical trainings, and creation of opportunities to be part of the restoration supply chain, in parallel, other remarkable benefits came true. This can be supported by social inclusion, human well-being, local economic alternatives, and work and income generation, contributing to the project’s social goals and to the sustainable use of the Cerrado.
8 BIODIVERSITY

8.1 Net Positive Biodiversity Impacts (B1)

B1.1. Impacts on the biodiversity

The Emas-Taquari Biodiversity Corridor Carbon Project was implemented in strategic sites along the landscape, aiming to increase the maintenance of local biodiversity, connect remaining fragments, create a mosaic of native forest amid monocultures and crop fields, reduce inbreeding, and promote gene flow among native species through the creation of biodiversity corridors.

The Emas-Taquari corridor encompasses landscapes in the Cerrado and Pantanal biomes (Figure 14). It goes through the southwestern of Goias to the middle-north Mato Grosso do Sul and southeastern Mato Grosso. In the total, it covers an area around 6 million hectares, comprising the municipalities of Alcinópolis, Alto Araguaia, Chapadão do Céu, Costa Rica, Coxim, Mineiros, Portelândia e Serranópolis. The reforestation of the project chosen areas directly contributes to the provision of environmental services.

As stated in the Design Document CCB Standard in 2010, the project matched with the primarily goals of Conservation International to foster the establishment of biodiversity corridors, especially in the main natural regions of Brazil. In the same way, a Biodiversity Monitoring Plan was developed and submitted around one year after validation, as committed in the 2010 PD. This plan was elaborated in partnership with academic researchers and specialists from the University of Brasilia. It was supposed to be applied for the first time in 2012 (baseline year), but it failed. However, by the end of 2015 both fauna monitoring assessments of mammals (Annex XVIII) and birds (Annex XIX) were concluded, respectively, by the Jaguar Institute and the University of Brasilia. The information obtained by these assessments, based on scientific methodologies applied to the reforested areas and vicinities, have a comprehensive, qualitative and quantitative scope. They complement some data obtained through the PRA, which holds a differentiated approach linked to the communities’ perception in relation to the biodiversity indicators (Annex X.a).
Figure 14 The Emas-Taquari Biodiversity Corridor Carbon Project.

Overall, the net positive impacts on biodiversity firstly relies on the prioritized use of native Cerrado species in the reforestation activities. Based on the forest inventory conducted in July 2015, it was registered and increasing number of tree species and amount of individuals existing in prior degraded lands and old pasturelands. In addition, landscape changes are notable in terms of vegetation cover, reinforcing the land use change from non-forest to forest. Some pictures taken at the same place before and after the project implementation (see below) illustrate this, proving the gradual forest increment throughout the project lifetime. Biodiversity co-benefits will reflect on fragments connectivity, springs and riparian areas protection, such as in habitats conservation.

As stated in the CCB PD of 2010, the target fauna groups were mammals, birds and invertebrates. Along the process, however, the invertebrate groups were excluded from the biodiversity monitoring activities because the PP decided to systematically focus on the other two groups (section 5.1). In 2013 and 2014, the Jaguar Institute initiated a long-term fauna inventory in the region of the Araguaia River’s headwaters, which focused mainly on mammals and met the project zone.

The presence of typical local fauna has been frequently observed in the project area, which indicates the occurrence of typical mammals at the project zone after the project activities start. This has been observed by sighting or particular signals, such as, trails, footprints and feces. Registers using camera
traps strategically allocated in the project area and vicinities (Emas National Park and cane farms), have provided systematic data, which are described in detail below. Main results, in this regard, seem to indicate that all species detected in native fragments may occur over the cane matrix. Thus, cane might be permeable for the majority of the Cerrado mammals in the region, not damming connectivity between vegetated remnants, which meets one of the project goals to create a mosaic amid monocultures and crop fields.

With respect to the biodiversity corridor, significant results were found in terms of the existence of native mammal species typical of the Cerrado biome. Specifically, the sampling and monitoring efforts applied in the field have demonstrated to be effective. In the total, 30 different species of medium and big mammals were registered along the reforested areas in the farms and vicinities, being nine species classified as vulnerable according to the degree of threat they are exposed (Annex XVIII).

Typical avifauna, considered as an essential group for seeds dispersal, especially in areas under reforestation, can be fully observed in the project areas and vicinities. This greatly increments the variety of species coming from nursery to the reforested areas, and favors natural successional processes. The first monitoring campaign have shown a wide richness of birds in the project area, between 99 and 130 species identified. Some endemic species were observed such as the *Alipiopsitta xanthops*, *Cyanocorax cirstatellus*, *Myiothlypis leucophrys*, *Cypsnagra hirundinacea*, *Saltatricula atricollis* (Annex XIX), reinforcing the importance of the project in the long term for the protection and restoration of the natural habitats indispensable for these species maintenance. In addition, the execution of periodic bird assessments will provide inputs to evaluate the role of the avifauna in the process of rebuilding the native vegetation.

**Positive impacts on the Babilonia Farm Lots 8, 9 and 10**

The positive impacts on biodiversity can be supported by the estimate of 682 trees/ha, as opposed to the inexistence or lack of trees and growing seedlings and saplings, prior to the project implementation. Here, abandoned pastureland with few shrubs and trees compounded the baseline. Although it sounds low compared to the rate of 1111 seedlings planted per hectare, typical cerrado holds from 600 to 1200 woody plants with minimum 5 cm of diameter at 30 cm height (Felfili et al 2005). This suggests that the early plantation may properly reach higher densities as observed in the kind of vegetation the project aims to restore. Additionally, an expressive number of 98 species (planted and naturally regenerated) were identified in the field (Annex III.b).

In relation to changes in the landscape, the Figure 15 shows noticeable differences in the landscape, before and after the project implementation.
In the Araguaia River's headwaters and throughout the reforested plots in the Vanir farm camera traps captured between July 2013 and October 2014, the occurrence of 56 different species: 36 mammals (Figures 16 and 17), 18 birds and two reptiles. Some of them are listed in the IUCN as nearly threatened or vulnerable.

Figure 15 Comparison between Vanir Potrick's farm in 2010 (left) and 2015 (right). The fence is a reference.

Figure 16 Registers of jaguars captured by camera traps in the Vanir Potrick's farm.

Figure 17 Registers of tapir and anteater captured by camera traps in the Vanir Potrick's farm.
According to the specific fauna’s assessments made for the first monitoring period in the project areas at this farm, 27 medium and big mammals species were registered (Annex XVIII). The species with the highest abundance were the peccary (*Pecari tajacu*), tapir (*Tapirus terrestris*) and crab-eating fox (*Cerdocyon thous*). In addition, 130 bird species could be observed during the monitoring activities of the local avifauna (Annex XIX).

No negative impacts on biodiversity associated to the project activities took place in the Babilonia Farm.

**Positive impacts on the Lugar Jacubinha Farm**

The positive impacts on biodiversity can be supported by the estimate of 733 trees/ha, as opposed to the inexistence or lack of trees and growing seedlings and saplings, prior to the project implementation. In the total, 30 species (mostly planted) were identified in the field (Annex III.b).

In relation to changes in the landscape, the Figure 18 shows noticeable differences in the landscape, before and after the project implementation. What draws attention is that this project site held as baseline an agricultural stratum prior to the project start, and now a new forest is coming out.

![Figure 18 - Comparison between Rogerio Vian’s farm in 2010 (left) and 2015 (right). The reforested polygons are located only at the right margin of the road and they refer to Permanent Protected Areas, according to the Brazilian Forest Code.](image)

Oréades decided to not duplicate fauna inventories efforts into the reforested areas at this farm for two reasons: i) it is too close to the Babilonia farm, which was intensively sampled and; ii) it had just been monitored in 2013 and 2014, by the long term fauna inventory in the region of the Araguaia River’s headwaters, meeting the project zone as well. The significant results attributed to this long term biodiversity monitoring are mentioned in the description results of the Babilonia farm.

No negative impacts on biodiversity associated to the project activities took place in the Lugar Jacubinha Farm.

**Positive impacts on the Mirassol da Furna Farm**

The positive impacts on biodiversity can be supported by the current growth of native seedlings and saplings planted within the project activities, as opposed to the prior existence of abandoned pasturelands with few shrubs and remnants tree species. For this first monitoring period, this farm is a non-forest inventoried project site, mainly because of its early planting age. However, it is not deterrent suggesting that this area may properly reach higher densities as observed in the kind of vegetation the
project aims to restore, since the same efforts and appropriated planting techniques were standardized to all project sites.

According to the specific fauna’s assessments made for the first monitoring period in the project areas at this farm, 21 medium and big mammals species were registered (Annex XVIII). The species with the highest abundance were the peccary (*Pecari tajacu*), tapir (*Tapirus terrestris*) and crab-eating fox (*Cerdocyon thous*). In addition, 99 bird species could be observed during the monitoring activities of the local avifauna (Annex XIX). Figure 19 shows a native bird species in some of the areas under reforestation.

![Figure 19 - Area under reforestation (left) and the register of an individual of Crotophaga ani (right) in the Lucio Flavo’s farm.](image)

No negative impacts on biodiversity associated to the project activities took place in the Mirassol da Furna Farm.

**Positive impacts on the Flores do Ipe Farm**

The positive impacts on biodiversity can be supported by the estimate of 962 trees/ha, as opposed to the inexistence or lack of trees and growing seedlings and saplings, prior to the project implementation. Here, abandoned pastureland with few shrubs and trees compounded the baseline. The current tree density verified in field is closer to the higher interval of woody plants in typical cerrado with minimum 5 cm of diameter at 30 cm height, which varies from 600 to 1200 woody plants, according to Felfili et al (2005). This also suggests that the early plantation may properly reach higher densities as observed in the kind of vegetation the project aims to restore. Additionally, an impressive number of 96 species (planted and naturally regenerated) were identified in the field (Annex III.b).

In relation to changes in the landscape, the Figure 20 shows noticeable differences in the landscape, before and after the project implementation.
According to the specific fauna’s assessments made for the first monitoring period in the project areas at this farm, 18 medium and big mammals species were registered (Annex XVIII). The species with the highest abundance were the collared anteater (*Tamandua tetradactyla*), anteater (*Myrmecophaga tridactyla*) and nine-banded armadillo (*Dasypus novemcinctus*). In addition, 102 bird species could be observed during the monitoring activities of the local avifauna (Annex XIX).

No negative impacts on biodiversity associated to the project activities took place in Flores do Ipe Farm.

### 8.2 Negative Offsite Biodiversity Impacts (B2)

#### B2.1. Negative biodiversity impacts

As stated in the Design Document CCB Standard in 2010 (section B2.1), the project did not anticipate any negative biodiversity impacts outside the project boundaries.

On the contrary, the project promoted local biodiversity conservation by engaging local communities and prioritizing the use of native species. The positive benefits surpassed many threats that would arise, providing food and shelter to the fauna during fire events, refuge against hunters, and water resources protection. Since the project hardly focused on the restoration of degraded lands to secure environmental services and biodiversity, stakeholders’ awareness succeed towards the alternative to generate income and conserve ecosystems and natural resources.

#### B2.2. Mitigating biodiversity negative impacts

As it was anticipated the inexistence of negative impacts on biodiversity, no mitigation plans were taken into consideration. However, environmental education, communication and inclusiveness efforts made with the local communities and landowners helped to secure and increase biodiversity gains into the project areas and adjacent places.

The partnership made with Jaguar Institute, among others, has supported studies and biological assessments in the project zone. This strengthened the biodiversity monitoring strategies and will continuously contribute to better quantify and understand the biodiversity issues.
8.3 Exceptional Biodiversity Benefits (GL3)

As already mentioned, the exceptional biodiversity benefits are sustained by the spread use of native tree species in the reforestation process, contributing to protect and propagate the flora in the Cerrado biome. Many people have been realizing this intrinsic potential, which became more popular in the region and surroundings. They have aggregated value to this natural resource, so that seeds and seedlings of Cerrado species are today products and goods sustainably obtained from the biodiversity.

Moreover, the provision of environmental services by the land use change is outstanding. The increase in species diversity, tree density, vegetation cover, soil protection, and biomass was due to the half million of native seedlings planted to colonize abandoned/degraded areas.

Finally, the local fauna takes part of the exceptional benefits delivered as well. These animals can be fairly living together and reproduce as the project advances. Species strongly associated to environmental quality and balance, and belonging to the chain top, which were found during monitoring activities, represent big wins to the project.

9 ADDITIONAL INFORMATION

As explained to the VVB during this first verification, the project proponente has adjusted the project scope from the currently “project activity” to “grouped project”, taken to account the VCS AFOLU item 3.8, as well as the CCB standard sections G1.13-15. In this regarding, the criteria for the inclusion of new areas were specified in the updated PD, registered in the VCS project database.

For additional information regarding the first monitoring period, please refer to the Annexes I to XXVI.

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36 One of the 35 global biodiversity hotspots


