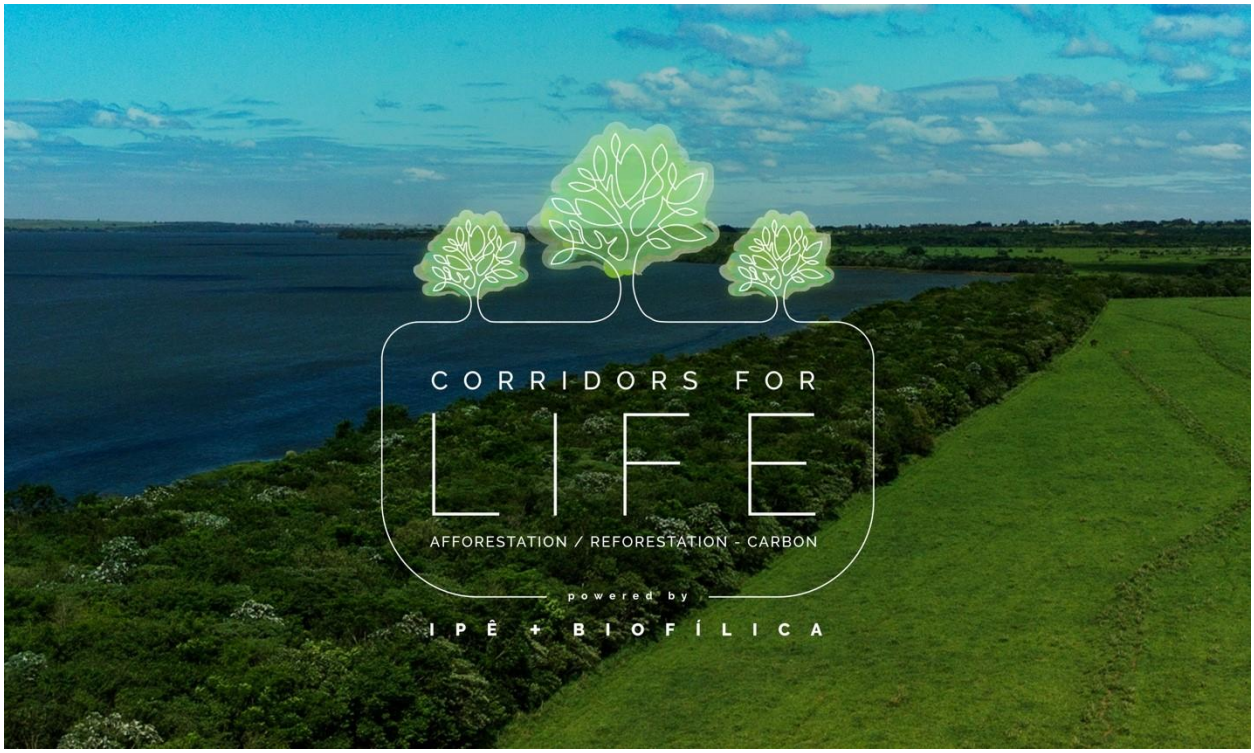
CORRIDORS FOR LIFE ARR GROUPED PROJECT



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Project Title	Corridors for Life ARR Grouped Project
Version	6.0
Date of Issue	29-September-2023
Project Location	Brazil, State of São Paulo
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Project Lifetime	18 November 2021 –17 November 2071; 50-year lifetime
GHG Accounting Period	18 November 2021 –17 November 2071; 50-year lifetime
History of CCB Status	First validation attempt in December 2022
Gold Level Criteria	GL3 Gold Level – Exceptional Benefits for Biodiversity **Benefits for Biodiversity** The project generates exceptional benefits for biodiversity by connecting forest fragments of the Atlantic Forest and increasing habitat for species of fauna and flora that depend on large conserved areas for their long-term survival and that are threatened with extinction, in particular the tapir (*Tapirus terrestris*), the cedro-rosa (*Cedrela fissilis*), the jequitibá-rosa (*Cariniana legalis*), the black lion tamarin (*Leontopithecus chrysopygus*), the pau-marfim (*Balfourodendron riedelianum*), the peroba-rosa (*Aspidosperma polyneuron*), the ipê-felpudo (*Zeyheria tuberculosa*) and the giant anteater (*Myrmecophaga tridactyla*).

Expected Verification Schedule	The first verification is expected to occur 3 years after validation.

SUMMARY

1. SUMMARY OF PROJECT BENEFITS

Corridors for Life ARR Grouped Project aims to mitigate climate change through the planting of native trees that will remove carbon from the atmosphere, large-scale landscape restoration and biodiversity conservation through ecological corridors that promote connectivity between remaining forest fragments and protect soil, water resources, and promote employment and income generation through capacity building and procurement of products and services from local businesses in the restoration chain. With this, the project has the potential, over its 50 years, to restore 75,000 hectares and sequester 29,213,780 tons of CO_2, in addition to generating 600 jobs, potentially benefiting 180 women and contributing to the conservation of 8 endangered species, with 3 being critically endangered or in danger according to the red list of the International Union for Conservation of Nature - IUCN.

1.1. Unique Project Benefits

The summarized results or impacts of the expected benefits in the Corridors for Life ARR Grouped Project are shown in Table 1, which follows below:

Table 1 - Summary of expected benefits in the Corridors for Life ARR Grouped Project.

Outcome or Impact Estimated by the End of Project Lifetime	Section Reference
1) Expected Climate Benefits: The Corridors for Life ARR Grouped Project is estimated to remove 29,213,780 tCO2eq, from the atmosphere at the end of its life cycle over its 50-year project lifetime, which is equivalent to an average of 584,276 tCO_2e/yr. This figure is associated with the goal of restoring 75,000 hectares in the Project Zone.	3
2) Benefits to the community located in the Corridors for Life ARR Grouped Project Zone and other stakeholders will focus on socioeconomic development aspects, income generation and diversification, promotion of gender equity, opportunities for youth and women, technical training, environmental regularization, promotion of sustainable practices and articulation of ways to educate people, environmentally speaking, on issues related to forest valuation and preservation, so that they can experience the benefits associated with human well-being, social and environmental harmony that the Project can provide.	4
3) Expected Benefits to Biodiversity: the Corridors for Life ARR Grouped Project will increase the native vegetation cover and connectivity between forest fragments of relevance to the Project Zone, through the implementation of restorations via planting of native species and facilitation of areas of natural regeneration; providing improved population viability and, consequently, the conservation of species of fauna and flora, including endemic, vulnerable and endangered species, according to the IUCN Red List. Associated with forest restoration are also important environmental services such as conservation of water and soil resources, pollination, and control of pests and diseases in local agriculture.	5

1.2. Standardized Benefit Metrics

Various metrics for estimating the net benefit that the Corridors for Life ARR Grouped Project aims to achieve over the lifetime of the Project are shown below (Table 2).

Table 2 – Estimated net benefit for different metrics over the lifetime of the Corridors for Life ARR Grouped Project.

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
GHG emission reductions or removals	Net estimated emission removals in the project area, measured against the without-project scenario	29,213,780 tons CO_2eq	3
	Net estimated emission reductions in the project area, measured against the without-project scenario	Not applicable	-
Forest[1] cover	For REDD[2] projects: Estimated number of hectares of reduced forest loss in the project area measured against the without-project scenario	Not applicable	-
	For ARR[3] projects: Estimated number of hectares of forest cover increased in the project area measured against the without-project scenario	75,000 hectares	3
Improved land management	Number of hectares of existing production forest land in which IFM[4] practices are expected to occurred as a result of project activities, measured against the without-project scenario	Not applicable	-
	Number of hectares of non-forest land in which improved land management practices are expected to occurred as a result of project activities, measured against the without-project scenario	Not applicable	-
Training	Total number of community members who are expected to have improved skills and/or knowledge resulting from training provided as part of project activities	At least 600 people	4
	Number of female community members who are expected to have improved skills and/or knowledge resulting from training as part of project activities	Potentially 180 women	4

[1] Land with woody vegetation that meets an internationally accepted definition (e.g., UNFCCC, FAO or IPCC) of what constitutes a forest, which includes threshold parameters, such as minimum forest area, tree height and level of crown cover, and may include mature, secondary, degraded and wetland forests (*VCS Program Definitions*)
[2] Reduced emissions from deforestation and forest degradation (REDD) - Activities that reduce GHG emissions by slowing or stopping conversion of forests to non-forest land and/or reduce the degradation of forest land where forest biomass is lost (*VCS Program Definitions*)
[3] Afforestation, reforestation and revegetation (ARR) - Activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and/or restoring vegetative cover through the planting, sowing and/or human-assisted natural regeneration of woody vegetation (*VCS Program Definitions*)
[4] Improved forest management (IFM) - Activities that change forest management practices and increase carbon stock on forest lands managed for wood products such as saw timber, pulpwood and fuelwood (*VCS Program Definitions*)

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
Employment	Total number of people expected to be employed in project activities,[5] expressed as number of full-time employees[6]	At least 600 people	4
	Number of women expected to be employed as a result of project activities, expressed as number of full-time employees	Potentially 180 women	4
Livelihoods	Total number of people expected to have improved livelihoods[7] or income generated as a result of project activities	At least 600 people	4
	Number of women expected to have improved livelihoods or income generated as a result of project activities	Potentially 180 women	4
Health	Total number of people for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	Not applicable	-
	Number of women for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	Not applicable	-
Education	Total number of people for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	At least 600 people	-
	Number of women and girls for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	Potentially 180 women	-
Water	Total number of people who are expected to experience increased water quality and/or improved access to drinking water as a result of project activities, measured against the without-project scenario	Not applicable	-
	Number of women who are expected to experience increased water quality and/or improved access to	Not applicable	-

[5] Employed in project activities means people directly working on project activities in return for compensation (financial or otherwise), including employees, contracted workers, sub-contracted workers and community members that are paid to carry out project-related work.
[6] Full time equivalency is calculated as the total number of hours worked (by full-time, part-time, temporary and/or seasonal staff) divided by the average number of hours worked in full-time jobs within the country, region or economic territory (adapted from the UN System of National Accounts (1993) paragraphs 17.14[15.102];[17.28])
[7] Livelihoods are the capabilities, assets (including material and social resources) and activities required for a means of living (Krantz, Lasse, 2001. *The Sustainable Livelihood Approach to Poverty Reduction*. SIDA). Livelihood benefits may include benefits reported in the Employment metrics of this table.

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
	drinking water as a result of project activities, measured against the without-project scenario		
Well-being	Total number of community members whose well-being[8] is expected to improve as a result of project activities	At least 600 people	-
	Number of women whose well-being is expected to improve as a result of project activities	Potentially 180 women	-
Biodiversity conservation	Expected change in the number of hectares managed significantly better by the project for biodiversity conservation,[9] measured against the without-project scenario	Approximately 215,000 hectares	5
	Expected number of globally Critically Endangered or Endangered species[10] benefiting from reduced threats as a result of project activities,[11] measured against the without-project scenario	3 species	5

[8] Well-being is people's experience of the quality of their lives. Well-being benefits may include benefits reported in other metrics of this table (e.g. Training, Employment, Livelihoods, Health, Education and Water), and may also include other benefits such as strengthened legal rights to resources, increased food security, conservation of access to areas of cultural significance, etc.
[9] Managed for biodiversity conservation in this context means areas where specific management measures are being implemented as a part of project activities with an objective of enhancing biodiversity conservation, e.g. enhancing the status of endangered species
[10] Per IUCN's Red List of Threatened Species
[11] In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

2. GENERAL

2.1. Project Goals, Design and Long-Term Viability

2.1.1. Summary Description of the Project (G1.2)

The Corridors for Life ARR Grouped Project aims, through the remuneration of carbon credits, to enable large-scale forest restoration in priority areas for environmental conservation by planting native forest species and facilitating natural regeneration on private rural properties – historically characterized by the predominance of unmanaged grasslands and some annual croplands - in the Pontal do Paranapanema region, located in the far west of the state of São Paulo, Brazil. In short, land use in the Project Zone is mostly occupied by agriculture and pastures destined for extensive livestock, in poorly managed pastures with invasive grasses, which are gradually being replaced by annual agricultural crops (especially sugar cane and soy). This dynamic of predominance of the agricultural matrix in the Project Zone was reflected in the stagnation of a low native forest cover in the region in the last three decades.

The project strategy is based on the concept of Forest Landscape Restoration (FLR). FLR is defined as a process that aims to regain ecological functionality and enhance human well-being in deforested or degraded landscapes. In this sense, this project aims to implement ecological corridors for the connection of remaining forest fragments that are part of the nucleus of the Trinational Biodiversity Corridor and the Atlantic Forest Biosphere Reserve, such as Morro do Diabo State Park (PEMD), which is home to endemic and endangered species, such as the Black lion tamarin (*Leontopithecus chrysopygus*).

In order to make the restoration actions feasible, which are operationally complex and highly costly, this carbon project has joined efforts and structured activities that value the local players and its historical values. Through the union of efforts between the Instituto de Pesquisas Ecológicas (IPÊ) - a Non-Governmental Organization based on science, social empowerment and institutional articulation that aims to conserve biodiversity and promote local socioeconomic development - and the Biofílica Ambipar Environmental Investments - a company with a solid track record in developing projects with Nature-Based Solutions and in the environmental services market in Brazil - the following activities were developed, contemplated in the project's theory of change:

- Restoration through planting seedlings and facilitating regeneration
- Capacity building of local communities in the restoration chain and environmental awareness
- Acquisition of native forest seedlings and contracting forest restoration and maintenance services from local communities
- Research, development, and innovation of project activities
- Research and management of endangered fauna species

With this new structure, the Corridors for Life ARR Grouped Project will scale up the actions already carried out by IPÊ in the project region, both environmentally and socially, planting 75 thousand hectares in 20 years, removing 29,213,780 tCO_2 in 50 years (584,276 tCO_2/year), benefiting at least 600 people per year and contributing to the conservation of 8 endangered species, with 3 being critically endangered or in danger according to the IUCN Red List. To achieve this goal, the planning considers a gradual increase in the scale of the operation over the first years.

Finally, confirming the potential, quality, and notoriety of this carbon project, the Corridors for Life ARR Grouped Project won the Best Individual Offsetting Project award from Environmental Finance[12].

[12] https://www.environmental-finance.com/content/awards/voluntary-carbon-market-rankings-2022/

2.1.2. Project Scale

Project Scale	
Project	
Large project	X

2.1.3. Project Proponent (G1.1)

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2.1.5. Physical Parameters (G1.3)

The Corridors for Life ARR Grouped Project is located in western State of São Paulo (Brazil), in the region known as Pontal do Paranapanema, between parallels 22°38'35.59 "S and 22°15'43.18 "S, meridians 53° 5 '12.51 "O and 52° 0'26.30"W.

The Project Zone covers 1,750,447 ha and comprises 30 municipalities in the Presidente Prudente micro-region, including: Alfredo Marcondes, Alvares Machado, Anhumas, Caiabu, Caiuá, Emilianópolis, Estrela do Norte, Euclides da Cunha Paulista, Indiana , João Ramalho, Maraba Paulista, Martinópolis, Mirante do Paranapanema, Narandiba, Piquerobi, Pirapozinho, Presidente Bernades, Presidente Epitácio, Presidente Prudente, Presidente Venceslau, Rancharia, Regente Feijó, Ribeirão dos Índios, Rosana, Sandovalina, Santo Anastácio, Santo Expedito, Taciba, Tarabai and Teodoro Sampaio.

The Project Zone (Figure 1) landscape is characterized by diverse contexts of land use and land use governance. The region is part of the Trinational Biodiversity Corridor (Figure 2), Atlantic Forest Biosphere Reserve – RBMA (Figure 3) and contains five Conservation Units (habitat reserves with different protection levels under law 9.9835 of 2000): Environmental Protection Area (APA) Ilhas e Vázeas do Rio Paraná, Ecological Station (ESEC) Mico-leão-preto, Private Natural Heritage Reserve (RPPN) Mosquito, Private Natural Heritage Reserve (RPPN) Vista Bonita, Rio do Peixe State Park and Morro do Diabo State Park. The Trinational Biodiversity Corridor is a joint action by Argentina, Brazil and Paraguay that aims connect forest fragments and conservation units from the Atlantic Forest Ecoregion by gradually restoring native vegetation in corridors (Di Bitetti, Placci, Dietz, 2003). As for the Atlantic Forest Biosphere Reserve, it was delineated by UNESCO's Man and the Biosphere (Mab) Program and presents the main remaining areas of the Atlantic Forest Biome, which includes the Project Zone. The design of the Reserve helps in the proposition of socio-environmental conservation activities and policies, within the scope of Environmental Planning (UNESCO, 2021). For this, the Biosphere Reserve in Brazil presents the following zoning:

- Core areas, composed of the priority areas for the conservation of the reserve, which in Pontal do Paranapanema context is represented by the PE Morro do Diabo and the ESEC Mico-leão-preto;
- Buffering areas, composed of strips to diminish the negative anthropic pressure from the environments outside the core, and mainly, connecting the core areas through ecological corridors, mosaics and green belts;
- Transition areas, composed of strips of territory that cover the core areas and buffer areas, and where environmental awareness activities are developed in the Reserve. These areas usually have a matrix of agricultural or urban use.

In this context, three farms of the project overlap with the RBMA: Nossa Senhora Aparecida farm, which presents overlapping with the buffer area and the transition area of the RBMA; Matuto farm and São Paulo farm, which are located in the transition area of the RBMA. This overlap is in accordance with the environmental conservation objectives of the Corridors for Life ARR Grouped Project, since the restoration of locations on the farms will help in the formation of ecological corridors, contributing to the conservationist guidelines in the region.

In addition to these conservation strategy zones and state conservation areas, the Project Zone features private rural properties and Land Reform Settlements of the Land Institute Foundation of the State of São Paulo (Itesp) and the National Institute for Colonization and Land Reform (INCRA), with the latter being areas where its inhabitants possess the land, which belongs to the federal government. The predominant land uses in the Project Zone are pastures and sugar cane plantations (and, to a lesser extent, soy), with native forest cover of 8,4% only.

In conclusion, none of the public areas, such as the conservation units or the land reform settlements, will be part of the Project Area, only of the Project Zone.

Access to the Project Zone takes the following forms:

- By land: via BR-374 (Rodovia Castelo Branco), SP-294 (Rodovia Comandante João Ribeiro de Barros) and SP-270 (Rodovia Raposo Tavares). The project properties can be accessed via SP-613 (Rodovia Arlindo Bettio) and SP-272 (Rodovia Olímpio Ferreira da Silva).

- By air: regular flights to Presidente Prudente state airport.

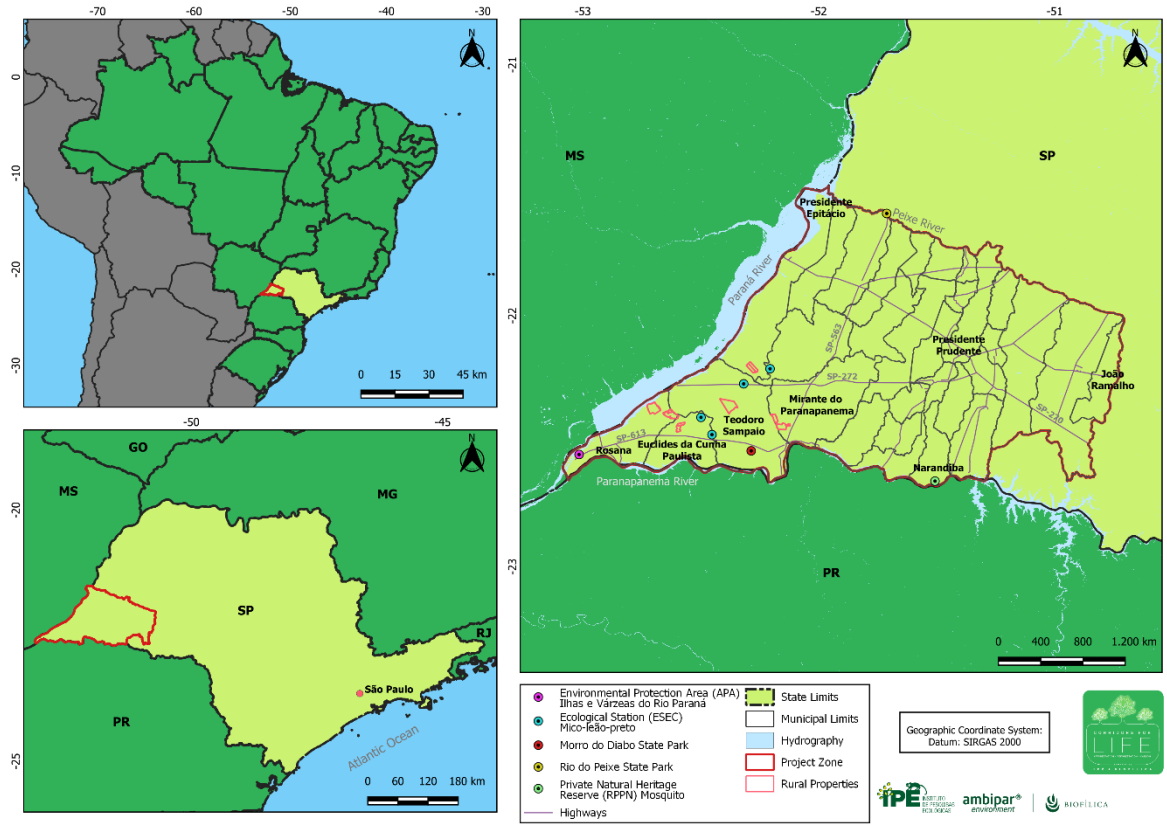

Figure 1 - Project Zone Location

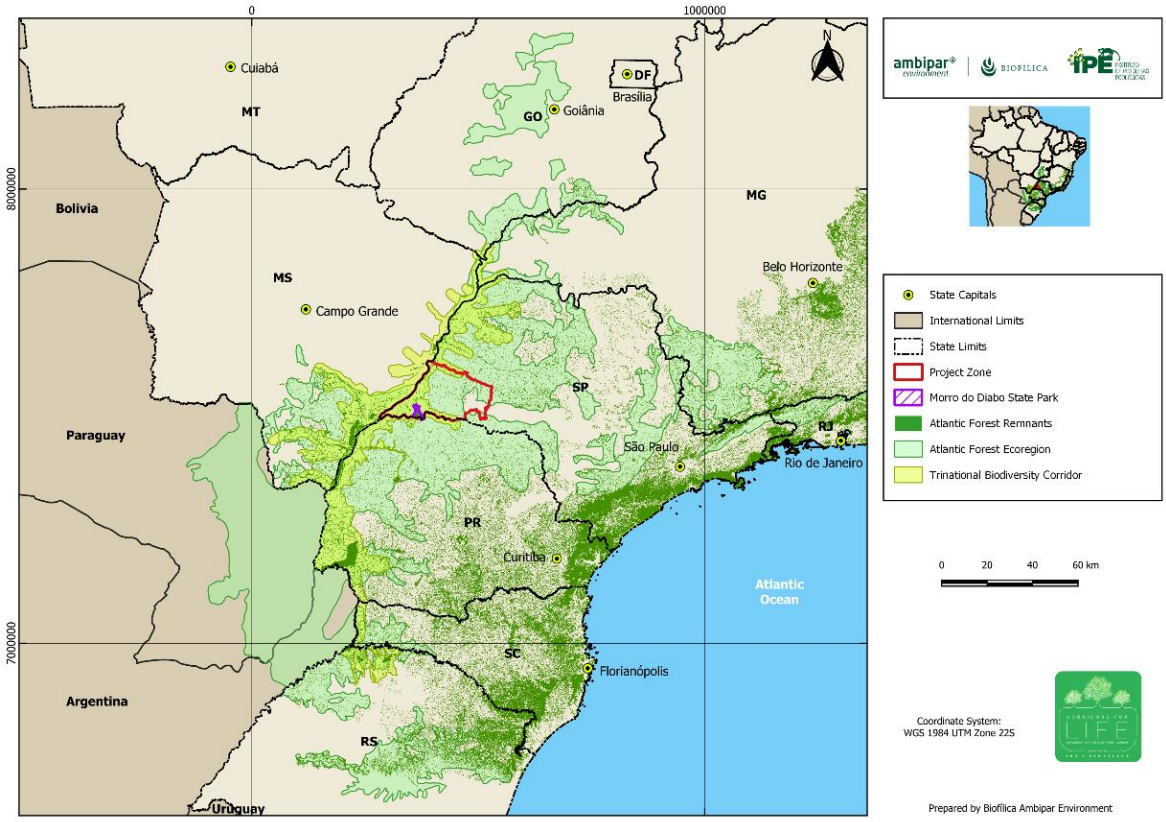

Figure 2 – Location of the project zone in comparison to the Trinational Biodiversity Corridor

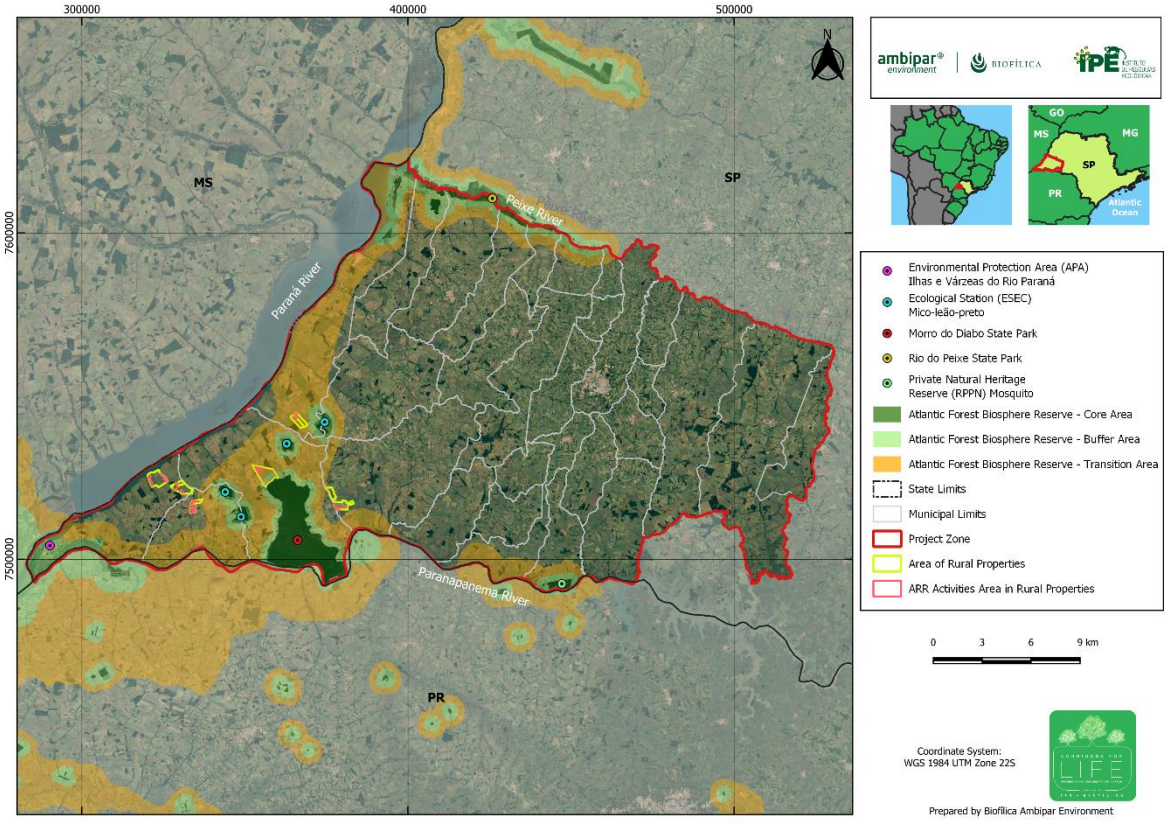

Figure 3 – Location of the project zone in comparison to the Atlantic Forest Biosphere Reserve

Geological Aspects

The lithostratigraphic units outcropping in the Pontal do Paranapanema Region, where the Grouped Project Zone is located, belong to Groups located in the Bauru and Serra Geral basins, except for the Alluvial Deposits. These units were formed in the Cretaceous Period (about 145 to 65.5 million years ago) and the Alluvial Deposits are more recent, being formed in the last phase of the Neogene Period (Holocene, about 10,000 years ago). The most common Group in the Project Zone is the Bauru Group, followed by the Caiuá Group, with both forming the supra basalt neo cretaceous sequence of the Bauru Basin.

On the other hand, the Serra Geral Formation, from the São Bento Group, due to its matrix constitution, gives rise to soils with a medium to clay-like texture, which is more resistant to erosion. However, these soils often present an abrupt texture gradient and are located in regions with a steeper relief, which favors unleashing the erosion process. Due to their position in the relief (close to water stream banks) the Alluvial Deposit areas, in turn, give rise to soils subject to periodic flooding, with upwelling of the water table.

The main characteristics of the Formations found in the Project Zone are described below, organized by Groups and in approximate chronological order, according to the State of São Paulo Geological Map (CPRM, 2006).

São Bento Group

Serra Geral Formation

The Serra Geral Formation occurs in outcrops along the banks of Paranapanema River, one of the main rivers in the Project Zone. It comprises the municipalities of Mirante do Paranapanema, Sandovalina, Narandiba, Taciba, Regente Feijó, Rancharia, and João Ramalho. According to Brazil's Geological Survey (Marconato et al. 2006), the Serra Geral Formation constitutes, together with the Botucatu Formation, the so-called Serra Geral Basin, corresponding to the Gondwana III Supersequence.

This formation results from intense fissural magmatism, represented as a thick cover of lavas, about 1,500 meters thick near the basin central depositional area, associated with an extensive network of dikes and multiple levels of intrusion into the sedimentary stack. The spills settle over the eolian sandstones of the Botucatu Formation, with sub-horizontal slants of up to 5° towards the basin center.

Bauru Group

Vale do Rio do Peixe Formation

The Vale do Rio do Peixe Formation is the one that predominates in the Project Zone, outcropping on the highest portions of the relief, in the hydrographic basin watersheds. It occurs in the municipalities of Teodoro Sampaio, Mirante do Paranapanema, Marabá Paulista, Presidente Epitácio, Presidente Venceslau, Caiuá, Piquerobi, Ribeirão dos Índios, Emilianópolis, Presidente Bernardes, Santo Anastácio Alfredo Marcondes, Santo Expedito, Caiabu, Presidente Prudente, Indiana, Álvares Machado, Tarabai, Pirapozinho, Sandovalina, Narandiba, Taciba, Anhumas, Regente Feijó, Martinópolis, Rancharia, and João Ramalho.

The Vale do Rio do Peixe Formation is the unit with the largest outcropping area of the Bauru Group, forming its basal unit, resting directly on the basalts of the Serra Geral Formation. To the west and southwest it forms a gradual transition with sediments of the Santo Anastácio Formation, covering them. This formation consists of tabular layers of very fine to fine sandstones, with brown, pink and orange color, predominantly showing a good to moderate selection. They can be massive or show a small to medium tabular and cross-stratification or coarse planar-parallel stratification.

The sandstones are interspersed with sandy siltstones or sandy mudstones. Also interspersed tabular layers of massive cream to brown siltstones. Small-size, cross-stratified lenses of conglomeratic

sandstone containing clayish or carbonate intraclasts may occur locally. The depositional environment is essentially eolian, consisting of sand sheets and small aeolian dunes, alternating with loess deposits.

Presidente Prudente Formation

The Presidente Prudente Formation outcrops in the watersheds between the Peixe and Paranapanema basins. In the Project Zone, it occurs in the municipalities of Pirapozinho, Álvares Machado, Presidente Prudente, Anhumas, Regente Feijó, Indiana, and Martinópolis. This formation also comprises the headwaters of rivers near the city of Presidente Prudente and is predominantly made up of very fine to fine sandstones and sandy mudstones. These lithologies are alternated with lens-shaped sandstones with channeled cross-stratification, tabular sandstones with internal sigmoid stratification, sandstones to tabular siltstones with planar-parallel stratification and water-flow structures, and with massive clayish mudstones in tabular strata. The depositional environment is a meandering river system with broad, shallow channels and marginal dike breakthrough deposits. Paleocurrents indicate a southwestward flow.

Caiuá Group

Paraná River Formation

The Paraná River Formation occurs remarkably in the Pontal do Paranapanema lower region, in the plains near the meeting of the Paranapanema and Paraná Rivers. The Paraná River Formation, in the Project Zone, outcrops in the municipalities of Rosana, Euclides da Cunha Paulista, Teodoro Sampaio, Mirante do Paranapanema, Sandovalina, Presidente Venceslau, and Marabá Paulista.

The Morro do Diabo State Park, in the municipality of Teodoro Sampaio, is located in this Formation which composes, together with the Santo Anastácio Formation, the Caiuá Group, and presents 250 meters thick. Its basal contact is by non-conformity with the Serra Geral Formation, and the lateral contact is gradual with the Goio Erê Formation. This unit is composed of reddish-brown, fine to very fine, rarely medium to coarse quartz sandstones. They are mineralogically supermature, with good textural maturity.

The internal selection of laminae or strata is good, with well-rounded grains in the coarser fractions and little silty-clay matrix. It presents cross stratification or lamination formed by alternating bands of millimeter to centimeter thickness, of good internal selection and bimodal character, produced by grain fall. They exhibit medium to large tabular and tangential cross stratification, with sets of cuneiform geometry, limited by truncation surfaces. The sediments of the Paraná River Formation represent amalgamated deposits of large aeolian dunes (draas), components of a sand sea in a desert environment.

Santo Anastácio Formation

The Formation markedly occurs in the municipalities of the Project Zone, Teodoro Sampaio, Mirante do Paranapanema, Sandovalina, Estrela do Norte, Pirapozinho, Presidente Epitácio, Presidente Venceslau, Marabá Paulista, Caiuá, Piquerobi, Ribeirão dos Índios, Presidente Bernardes, Emilianópolis, Santo Expedito, Presidente Prudente, and Caiabu. The Rio do Peixe State Park lies over this formation.

It presents gradual and recurrent passages to the Rio Paraná and Vale do Rio do Peixe Formations (Bauru Group), with maximum preserved thicknesses of 70 to 100 meters. It is composed of subarcosean quartz sandstones, fine to very fine, poor selection and little silty-clay matrix. Usually massive, they may locally exhibit incipient plano parallel and small cross stratification. Grains are sub-angular to sub-rounded, matte color, covered by an iron oxide film. Mudstone and claystone intercalations rarely occur.

The depositional context is that of essentially dry sand sheet deposits, accumulated on extensive desert plains, located at the edge of the large sand dune complexes of the Caiuá Desert. Deposits from sporadic torrential rains run-off (wadis) rarely occur.

Alluvial Deposits

Alluvial Deposits, in the Project Zone, are found along the banks of the Paraná River (Rosana, Mirante do Paranapanema, Marabá Paulista, and Presidente Epitácio), the Paranapanema River (Rosana, Euclides da Cunha Paulista, Mirante do Paranapanema, Teodoro Sampaio, and Sandovalina), and the final portion of do Peixe River (Presidente Epitácio, Presidente Venceslau, Caiuá, Piquerobi, Ribeirão dos Índios, Emilianópolis, and Santo Expedito). They constitute deposits on the riverbanks, channel bottoms, and flood plains, presenting sands, gravels, silts, clays and, locally, peat, resulting from the erosion, transport, and deposition processes from diverse source areas.

Geomorphological Aspects

The Project Zone landscape is characterized by the combination of shallow hills and slopes with altitude between 250 and 500 meters above sea level. The physical boundaries of the Paranapanema Project Zone are given to the north with the Peixe River, to the south with the Paranapanema River, to the west with the Paraná River and to the east with the Laranja Doce River and the Gaúchos Creek. The region is predominantly located on the Paraná Basin Central Plateau, with a stretch closer to the Paranapanema River, characterized by river plains.

Most of the Project Zone is formed by gentle slope terrain, with broad, dissected hills or mounds, in addition to river plains. Except for these latter ones, most of these terrains are associated with sandstones, which confers a good drainage and medium to high susceptibility to erosion, depending on the declivity.

As to the fluvial terraces and plains, the position of the water level is shallow and water pumping is made easy. However, in places where the water table rises or is located very close to the surface, the drainage is slower, with low oxygenation and reduced potential for self-depuration; so they are terrains more vulnerable to the concentration of contaminants from diffuse sources, such as sediments coming from the slopes, or punctual, such as industrial effluents, domestic sewage dumping, etc. These more fragile areas are found on the banks of the Peixe, Paranapanema, and Paraná Rivers.

Next, based on the publication of the State of São Paulo Geodiversity (Martinelli, 2009; Peixoto, 2010), the main relief forms present in the State of São Paulo State Geomorphological Mapping are characterized, seeking to locate them spatially within the Project Zone, and relate them to the corresponding geological substrate, pointing out their potentials and limitations regarding anthropic activities.

Dissected Hills and Low Mounds

The Dissected Hills and Low Hills Domain is present in the Project Zone and is generally located in the upper (hilltops) and middle portions of the relief (slopes), with declivities varying from 5 to 20º, and a topographic amplitude of 30 to 80 meters. This unit is associated with sandstones of the Marília, Presidente Prudente, and Araçatuba Formations, from the Bauru Group, both formed by intercalations of sandy, silty-clay sediments and shales; and the Santo Anastácio and Vale do Rio do Peixe Formations, from the Caiuá Group, formed by thick sandstone packages of mixed (eolian and fluvial) deposition. The association of this relief form with the Vale do Rio do Peixe Formation is the one with the largest occurrence in terms of area in the Project Zone. Such areas are favorable to pedogenesis, with a predominantly deep alteration mantle, producing excessively sandy, friable, permeable soils which are very susceptible to erosion. Due to the fact that the original material presents, in its composition, sandstones with a high clay content and carbonate matrix, the soils originating from these

sandstones present textural characteristics and fertility potential for intensive agricultural and mechanized use, even in regions with more undulated relief.

Gentle Broad Hills

The Broad and Gentle Hills Domain is located on the plains near the water courses and presents declivities varying from 3 to 10º and a topographic amplitude of 20 to 50 meters. This unit is associated with sandstones of the Marília and Araçatuba Formations, from the Bauru Group, both formed by intercalation of sandy, silty-clayish sediments and shales; of the Santo Anastácio, Vale do Rio do Peixe and Rio Paraná Formations, from the Caiuá Group, formed by thick sandstone packages of mixed (eolian and fluvial) deposition; and of the Serra Geral Formation, from the São Bento Group, formed by igneous rocks (predominantly basalts).

Like the Dissected Hills and Low Mounds, the association of the Gentle Broad Hills unit with sandstone rocks favors pedogenesis, producing sandy, friable, permeable soils which are susceptible to erosion, although such susceptibility is relatively lower at this unit due to a lower declivity. The soils originating from these sandstones present textural characteristics and fertility potential for intensive and mechanized agricultural use, especially in regions with a smoother relief.

River or River/Lake Plains

The River or River/Lake Plains occur at the final portion of the Peixe River (and where it meets the Paraná River), besides being found on the banks of the Paraná and Paranapanema Rivers. This relief form is associated with the sandstones of the Santo Anastácio Formation, from the Caiuá Group; the Alluvial Deposits on the banks of the Paraná River, in the municipality of Presidente Epitácio. In Presidente Epitácio municipality the unit occurs on the banks of the Paraná River and in Euclides da Cunha Paulista, Mirante do Paranapanema, and Sandovalina it occurs on the banks of the Paranapanema River.

In the municipalities of Teodoro Sampaio and Rosana, the unit occurs on the banks of both rivers. In summary, it is predominantly flat terrains (with a declivity ranging from 0 to 3º), without topographic variation, with a low density of drainage channels. Just like the Fluvial Terraces unit, these terrains are characterized as recent alluvial plains, composed of unconsolidated sediments of variable thickness, very susceptible to flooding.

From the bottom to the top of these plains deposits of gravel, sand and clay occur, with a potentiality for mining activities. Due to periodic flooding and the sandstone origin material, these terrains present a high porosity and often soils with renewed natural fertility, rich in organic matter, with high nutrient fixing capacity. However, there is a risk of occurring groundwater and surface drainage contamination by agrochemicals.

Fluvial Terraces

The Fluvial Terraces occur at the final portion of the Peixe River, immediately before it discharges into the Paraná River, and are associated with the Santo Anastácio Formation and Paraná River, from the Caiuá Group. The terrains present a declivity ranging from 0 to 3º, and a topographic amplitude from 2 to 20 meters, characterized as recent alluvial plains, composed of unconsolidated sediments of variable thickness.

From the bottom to the top of these plains deposits of gravel, sand and clay occur, with a potentiality for mining activities. These relief forms have poorly developed soils, acidic, with a high concentration of organic matter and reduced drainage, being regions with great potential for forming long lasting floods, especially if not protected with native vegetation.

Tablelands

The geomorphologic unit of Tablelands occurs on hilltops on the eastern margin of the Project Zone, in the municipalities of Marabá Paulista, Presidente Bernardes, Presidente Epitácio, Santo Anastácio, Mirante do Paranapanema, Sandovalina and Teodoro Sampaio, associated with sandstones of the Rio do Peixe Valley Formation, from the Bauru Group.

These are flat to gentle undulating terrains, with declivities varying from 0 to 3º and a topographic amplitude of 20 to 50 meters. Compared to the other units occurring in the region, they are regarded as presenting a low susceptibility to water erosion and natural mass movements, because the declivity is gentle and the soils originating from these sandstones of eolian or fluvial origin have a high clay content and are generally deep. For these reasons, they are suitable for multiple uses such as more intensive and mechanized agriculture, as well as urban occupation.

Pedologic Aspects

The State's Ecological Economic Zoning - ZEE classifies 43% of the Pontal do Paranapanema region as unsuitable for agriculture, mainly because of its sandy soils and vulnerability to erosion. Pastures, subsistence crops and sugarcane plantations cover most of the landscape, and the pedology is characterized by the extension of poor soils, with little availability of nutrients and excess of aluminum (Brazilian Institute of Geography and Statistics, 2012). Below are described the main pedological units of the Project Zone (as per Figure 4), organized by Order and by Suborder, based on Rossi (2017) and the Brazilian Soil Classification System (Embrapa, 2006).

Argisols

Comprise soils made up of mineral material, which main characteristic is the presence of a B textural horizon of low or high activity clay combined with low base saturation or allytic character. The B textural horizon (Bt) is located immediately below any type of surface horizon, except the hystic one without, however, presenting the requirements to be classified as Luvisols, Planosols, Plintosols or Gleisols (Embrapa, 2006). In the Project Zone, the suborders of the type Red-Yellow Argisol and Red Argisol occur in all municipalities.

Latosols

Comprise soils made up of mineral material, with a latosol B horizon immediately below any of the superficial diagnostic horizon types, except hystic. They are soils with a high level of weathering, highly evolved, as a result of energetic transformations of the origin material, therefore, devoid of primary or secondary minerals less resistant to weathering (Embrapa, 2006). The Latosol suborders in Pontal do Paranapanema are of the type Red-Yellow Latosol and Red Latosol, occurring in areas of less rugged relief in all municipalities of the Project Zone, except Álvares Machado, Presidente Prudente and Caiabu.

Nitosols

Comprise soils made up of mineral material, with lithic B to A horizon with clay of low activity or allytic character in most of the B horizon, within 150 cm from the soil surface. They have a clayish or very clayish texture (clay content greater than 350 g/kg of soil from the A horizon onwards, and a textural ratio equal to or less than 1.5). The Nitosols occur along the banks of the Paranapanema River, in the municipalities of Pirapozinho, Narandiba, Taciba, and Rancharia, presenting the Red Nitosol suborder.

Neosols

Comprise soils made up of mineral material, or organic material not very thick, that do not present significant changes in relation to the originating material due to the low intensity of action by the pedogenetic processes, either because of characteristics inherent in the origin material, such as greater resistance to weathering or chemical/mineral composition, or because of the influence by other

formation factors (climate, relief or weather), which can prevent or limit the soil evolution. The Litholic Neosols, Fluvial Neosols, and Quartz Neosols suborders are found in the Project Zone.

Planosols

Comprise mineral soils that are imperfectly or poorly drained, with a surface or subsurface eluvial horizon, and a lighter texture, which contrasts abruptly with the B horizon or with an abrupt transition combined with a sharp difference in texture from the A horizon to the immediately underlying B horizon, dense, generally with a marked clay concentration, slow or very slow permeability, sometimes constituting a horizon responsible for the formation of an overlying (suspended) water table, of periodic existence and a variable presence all year long. The Haplic Planosol type suborder occurs in the Project Zone.

Gleisols

Comprise hydromorphic soils, composed of mineral material, which present a gley horizon within 150 cm from the soil surface, immediately below the A and E horizons (with or without gleization), or of a hystic horizon with insufficient thickness to define the class of Organosols; do not present exclusively sand or free sand texture in all horizons within the first 150 cm from the soil surface or up to a lithic contact, nor a vertic horizon, or textural B horizon with an abrupt textural change above or coinciding with the gley horizon or any other type of diagnostic B horizon above the gley horizon. The suborder of the Haplic Gleysol type occurs in the Project Zone.

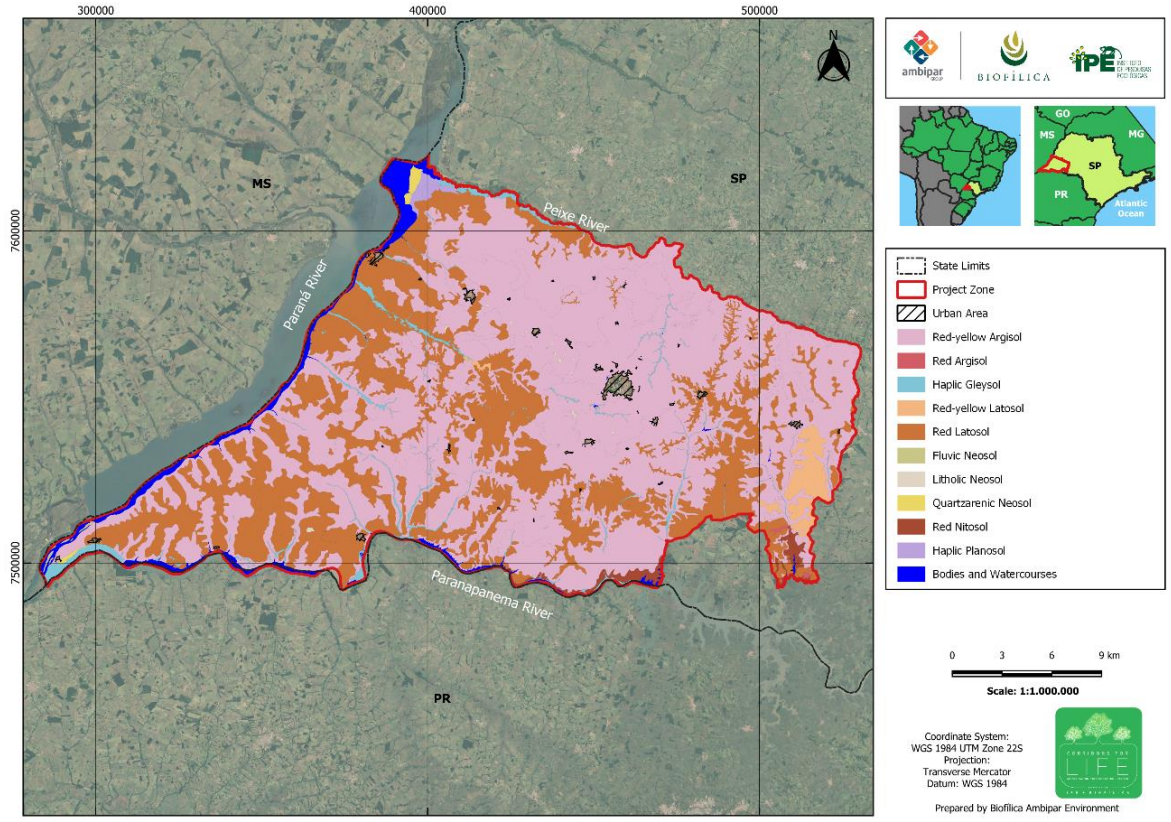

Figure 4 - Soil characterization in the Project Zone

Climatic Aspects

The climate of the State of São Paulo western region is of type Aw, characterized as humid tropical climate called savanna climate, with dry winter (Sparovek et al., 2007). The rainy season occurs in the

summer, from November to April. The average annual temperature is 21°C and the average temperature of the coldest month is above 18°C, presenting precipitations higher than 750 mm annually, reaching 1,300 mm (Faria et al., 2006).

As one moves westward and southward of the Project Zone, the total annual precipitation tends to increase (1,360.1 mm in Rosana). The distribution of rainfall throughout the year also changes according to geographic position, with the easternmost municipalities in the study area presenting drier months with rainfall below 30 mm (Presidente Bernardes). The municipalities located further to the west, on the other hand, present a precipitation in the driest month above 35 mm, with the highest value being found for Rosana (44 mm in the month of July).

The temperature behavior also changes according to the geographic position, with higher average annual temperatures in the northern municipalities of the Project Zone (Presidente Bernardes, all above 23.8°C) and lower in the south (Marabá Paulista, Mirante do Paranapanema, Euclides da Cunha Paulista and Rosana, the latter with an average temperature of 23.1°C). Average minimum temperatures also decrease as one approaches the southernmost region of Pontal do Paranapanema, with the lowest found for the month of July being in Rosana (13.3°C).

Hydrographic Aspects

The Project Zone is located between the mouths of two large rivers, which run practically parallel in the east-west direction in the State of São Paulo, discharging into the Paraná River, already on the border with the State of Mato Grosso do Sul, namely Peixe and Paranapanema Rivers (Figure 5).

Law 9.034/1994 divided the State of São Paulo into 22 UGRHIs. The Project Zone belongs to the Water Resources Management Unit 22 (UGRH-22) and has a drainage area of 12,395 km². Its rivers run both in the east-west direction, discharging into the Paraná River, as is the case of the Santo Anastácio River, Lagoa Stream and the Anhumas Stream, and in the north-south direction, discharging into the Paranapanema River, such as the Pirapozinho Stream, the Anhumas Stream, the Bonito River, the Caiuá Stream, the Laranja Doce Stream, among others.

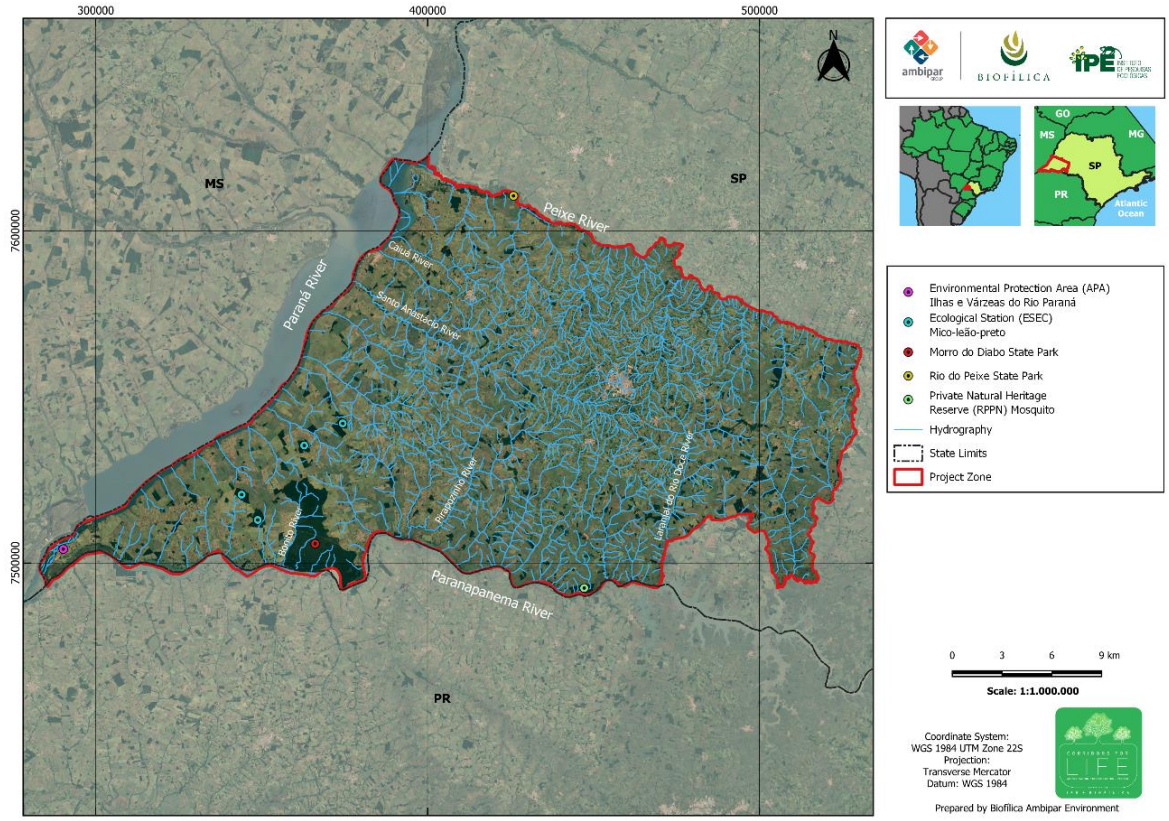

Figure 5 - Hydrographic Characterization in the Project Zone

Vegetation Aspects

Originally, the Pontal do Paranapanema region was mostly covered by the Atlantic Forest biome, with some Cerrado enclaves (tropical savanna). Today, the Project Zone landscape is characterized by small, scattered, and isolated forest remnants inserted in an agricultural landscape, and is regarded as a priority area for conservation. The region has one of the lowest percentages of vegetation cover in the State and the largest Legal Reserve deficits (Rodrigues and Galvão, 2006). Coupled with this situation the presence of isolated Conservation Units weakens the region's ecological sustainability.

Among the protected vegetation remnants in the Pontal do Paranapanema, there are two state Conservation Units (Morro do Diabo State Park and Rio do Peixe State Park), and two federal ones (Mico Leão-Preto Ecological Station and the Environmental Protection Area of Paraná River Islands and Floodplains), representing islands of disconnected forests and within a region of low vegetation cover. The Morro do Diabo State Park stands as the most representative Conservation Unit of the study area and the largest remaining continuous area of Semideciduous Forest covering the western São Paulo.

Despite the intense anthropization to which the entire area of West São Paulo was historically subjected due to the usable soils and favorable topography, this region presents different phytophysiognomies depending on the soil and terrain conditions. Generally speaking, the Semidecidual Formations predominate in the Project Zone. This type of vegetation is conditioned by the double climatic seasonality, a tropical one with summer rainy periods followed by accentuated droughts and a subtropical one without dry periods, so that the percentage of deciduous trees in the forest is between 20% and 50%. These forests are up to 20 meters tall, in addition to the large emerging trees that can reach 30 meters. The presence of vines is abundant and epiphytes are rare.

Considering the Project Zone, phytophysiognomies of the Atlantic Forest and Cerrado were identified, including the Alluvial Semidecidual Seasonal Forest, Submontane Semidecidual Seasonal Forest, Montane Semidecidual Seasonal Forest, Wooded Savanna, Forested Savanna, Pioneer Formation with River and/or Lake Influence, as well as Secondary Vegetation covers and Afforestation/Reforestation (as per Figure 6). The following described are the main characteristics of each physiognomy, according to the classification of (Veloso et al., 1991).

Semidecidual Seasonal Alluvial Forest

It is a formation found more frequently in depressions, on riverbanks and floodable areas. This formation contains several abundant species of the Tabebuia genus, besides the ecotypes *Calophyllum brasiliens*e, *Tapirira guianensis*, *Inga* sp., *Podocarpus sellowii*, *Cedrela lilloi*, *Guarea guidonia*, among others.

It can occur in valley bottoms, due to specific edaphic conditions, and its vegetation varies from herbaceous in areas with an upwelling water table and permanently flooded to forests in periodically flooded areas. These formations include the Marsh Forests (permanently flooded) and the Riparian Forests (periodically or not flooded) (Rodrigues; Leitão Filho, 2000). The most common species of forest physiognomy in areas under the influence of the water table are: *Croton urucurana*, *Cecropia pachystachya*, *Guadua* sp., *Nectandra megapotamica*, *Erythrina crista-galli*, *Inga laurina*, *Inga striata*, *Inga vera*, *Guarea guidonea*, *Ficus insipida*, *Syagrus romanzoffiana*, *Syagrus oleraceae*, *Mauritia flexuosa*, *Triplaris brasiliana*, *Allophylus edulis*, *Luehea divaricata* and *Tabebuia dura*.

Submontane Semidecidual Seasonal Forest

It is the predominant phytophysiognomy in the Project Zone, occurring in sandy areas and deciduous ecotones, with the occurrence of the genuses Hymenaea (jatobá), Copaifera (oleo-red), Peltophorum (canafistula), Astronium, Tabebuia, Aspidospenna, with its ecotype A. polyneuron (rosewood), among others.

In these forests, the following species predominate in the tree stratum: *Anadenanthera colubrina*, *Aspidosperma polyneuron*, *Albizia niopoides*, *Cariniana estrellensis*, *Cedrela fissilis*, *Copaifera langsdorffii*, *Gallesia integrifolia*, *Hymenaea courbaril*, *Myracrodruon urundeuva*, *Ceiba speciosa*, *Handroanthus impetiginosus* and *Zeyheria tuberculosa*.

They also occur in soils that overlie slopes and less deep, gently undulating terrain with a higher sand content. However, in these environments, they generally present a lower size and greater predominance of species *Machaerium* spp. and Lonchocarp*us* spp. (Martins, 1993).

Montane Semideciduous Seasonal Forest

Formations established in areas above 500 meters of altitude, where the genera and ecotypes of wide dispersion predominate, among them Cassia, *Anadenanthera peregrina*, Astronium and others.

Wooded Savanna

This formation is characterized by a sparse nannophanerophytic physiognomy and a continuous graminoid hemicryptophyte, subject to annual fire. These dominant syncytia form a physiognomy on degraded land. The floristic composition, although similar to that of the Wooded Savanna (Cerradão), has dominant ecotypes that characterize the environments according to the geographic space taken, such as *Stryphnodendron astringens* (Barbatimão).

Forested Savanna

This formation occurs more frequently in sandy areas leached with deep soils, and is a characteristic of tropical seasonal climate. It presents woody synusia of tortuous micro- and nanophanerophytes with irregular branching, provided with perennial or semideciduous sclerophyllous macrophylls, rigid corticolous exfoliated rhytidome or massively suberous cortex, with underground reserve organs or

xylopodium. It does not show a clear camphyllous synus, but rather a hemicryptophytic relief, permeated with stunted woody plants and dwarf palms. Its floristics is characterized by typical phanerophyte dominants, such as: - *Caryocar brasiliense* (pequi), *Salvertis convallariodora* (pau-decolher), *Boldichia virgilioides* (sucupira-preta), *Dimorphandra mollis* (faveiro), *Qualea grandiflora* (pau-terra-de-folhas-grandhas), *Qualea parviflora* (pau-terra-defolhas-miúdas), *Anadenanthera peregrina* (angico-preto) and *Kielmeyera coriacea* (pau-santo).

Pioneer formation with river and/or lake influence

This formation is composed of plant communities of alluvial plains that reflect the effects of river flooding in the rainy seasons or, alternatively, of permanently floodable depressions. In these floodable terrains, the plant communities range from cryptophytic swampy (hydrophytes) to temporarily floodable terraces, depending on the water quantity and seasonality.

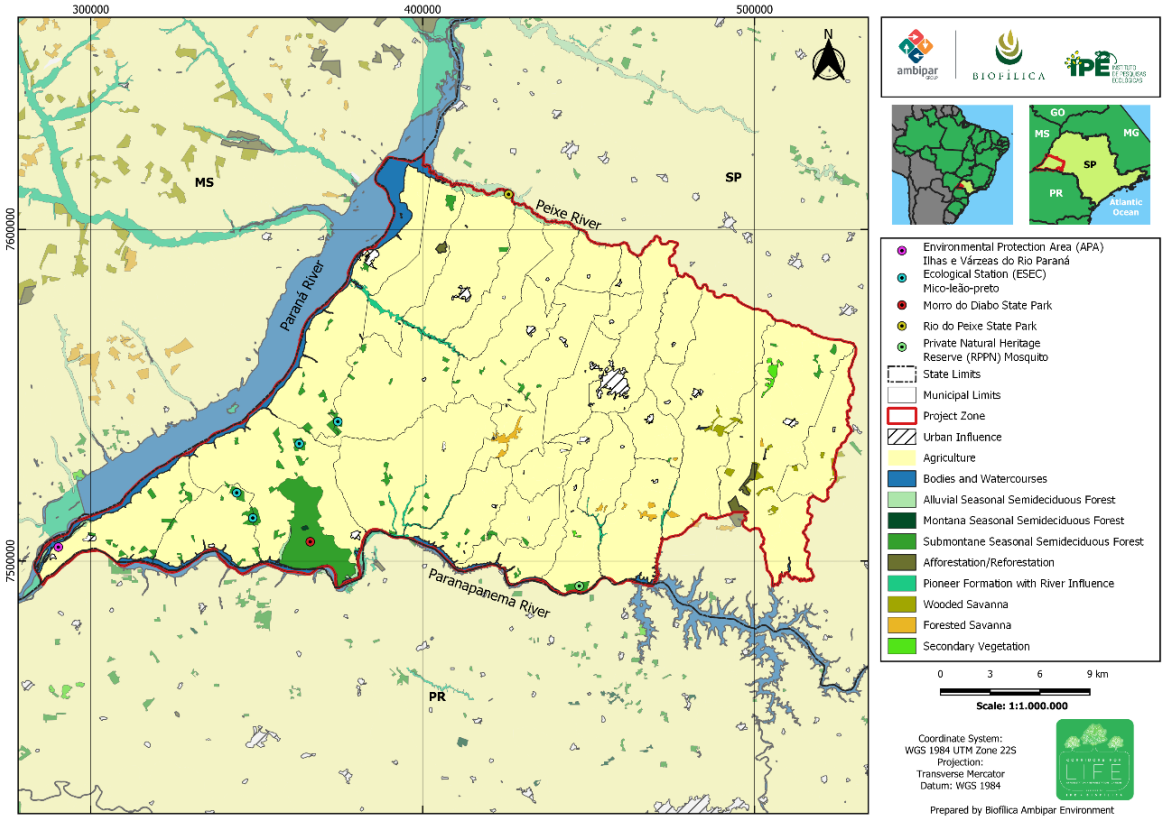

Figure 6 - Characterization of the vegetation in the Project Zone

2.1.6. Social Parameters (G1.3)

The project area comprises 30 municipalities: Alfredo Marcondes, Alvares Machado, Anhumas, Caiabu, Caiuá, Emilianópolis, Estrela do Norte, Euclides da Cunha Paulista, Indiana, João Ramalho, Maraba Paulista, Martinópolis, Mirante do Paranapanema, Narandiba, Piquerobi, Pirapozinho, Presidente Bernades, Presidente Epitácio, Presidente Prudente, Presidente Venceslau, Rancharia, Regente Feijó, Ribeirão dos Índios, Rosana, Sandovalina, Santo Anastácio, Santo Expedito, Taciba, Tarabai e Teodoro Sampaio. The total area in the Project Zone is approximately 1,752,371 hectares (Figure 7).

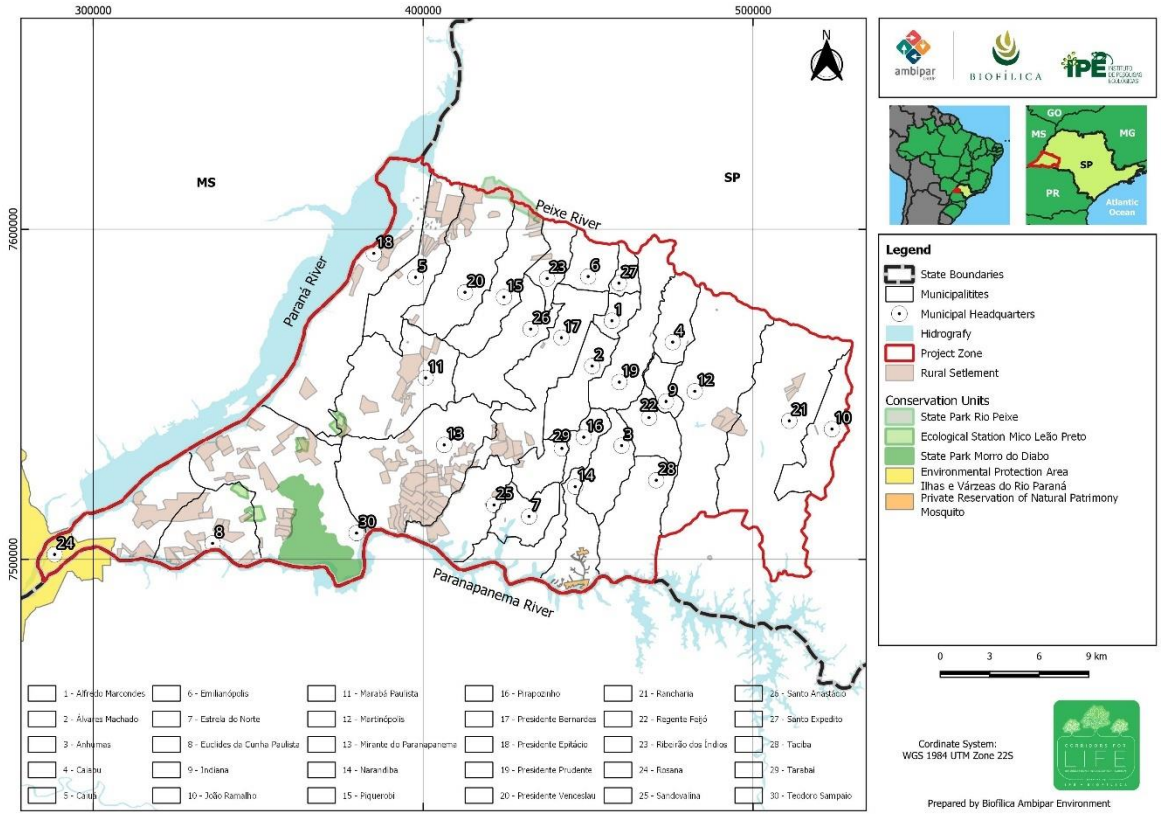

Figure 7 – Municipalities in the Project Zone

Relevant historical conditions

In the late nineteenth century, the Project Zone underwent processes of intense landscape transformation through the opening of forests for pastures, followed by the planting of coffee (which had its peak in the 1920s), causing deforestation and loss of biodiversity (Verges, 2017). These economic activities were accelerated by the construction of the Sorocabana Railway in the 19th century, connecting the region to the city of São Paulo, the state capital, fostering the occupation of the territory, deforestation, and inequality in land distribution. The Figure 8 shows the estimated forest cover in São Paulo state in 1907.

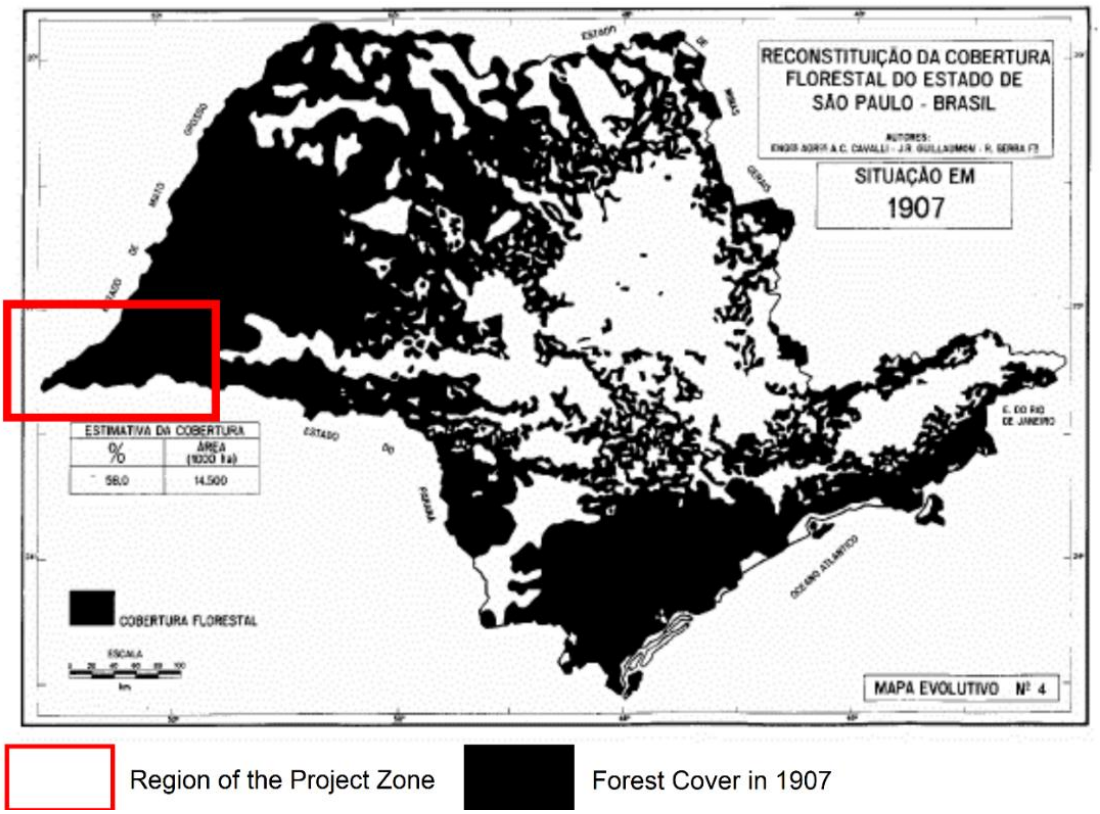

Figure 8 – Forest Coverage in the São Paulo State in 1907. Source: Victor and collaborators (2005)

Even with these expansive activities, the region remained mostly forested until 1942, when the first environmental policies emerged with the establishment of three conservation units by the state of São Paulo as a refuge for the unique flora and fauna of this subregion of the Atlantic Forest. The largest of these was the Grande Reserva do Pontal, with 260,000 hectares (Chazdon et al., 2020). With the decline of coffee production, a new economic cycle was consolidated in the 1940s, based on cattle grazing and cotton cultivation, associated with the donation of land in the region for expansion of these activities, motivating population growth in the region. This period was also marked by the establishment of companies and the settlement of workers' families. This scenario led to problems with the land governance structure and intensification of deforestation (Silva et al., 2018), promoting major change in the regional socioeconomic organization. This wave of immigration from 1945 to 1965 was mostly encouraged by the state government, leading to the deforestation of more than 80% of forest reserves for the establishment of large-scale pastures.

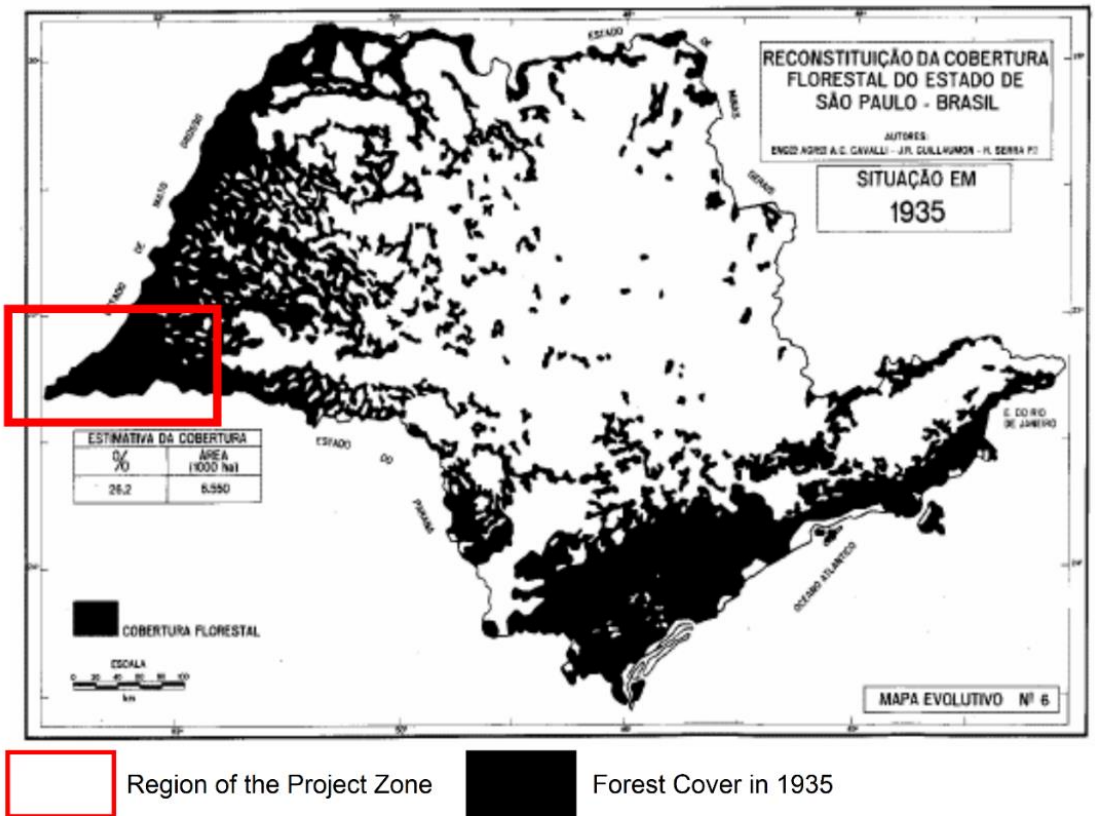

Figure 9 – Forest Coverage in the São Paulo State in 1935. Source: Victor and collaborators (2005)

In the 1970s and 1980s, the Programa Nacional do Álcool [National Alcohol Program] (Proálcool) was the landmark that defined land use and deforestation in the Project Zone, through the introduction of sugarcane mills in the region and four large hydroelectric plants that altered forest cover and urban areas (Silva, 2018). In 1986, Morro do Diabo State Park was created on a 36,000-hectare native forest remnant in the Project Zone. Today this is the largest remnant of the Atlantic Forest hotspot in the Project Zone and serves as a habitat for endemic and threatened species.

In the history of the disorderly occupation of the Project Zone, some rural properties were established under problems of legitimacy, often with the encouragement of the state (Fernandes & Ramalho, 2001), with the consequence being uneven development that culminated in conflicts over land ownership (Sobreiro Filho, 2012). Starting in the 1980s, popular movements occupying so-called unproductive areas with irregular titles intensified, trying to guarantee land tenure for families willing to produce, but unable to acquire the property legally. Despite the constant conflicts with landowners at the time, these movements were organized and grew, giving rise to what is now known as the Movimento Sem Terra [Landless Movement] (MST) (Fernandes, 1994). Intense confrontations between the MST, landowners, and the state took place in the decades of '1980s, '1990s, and '2000s. Gradually, the conflicts eased and are currently rare or nonexistent in the Project Zone.

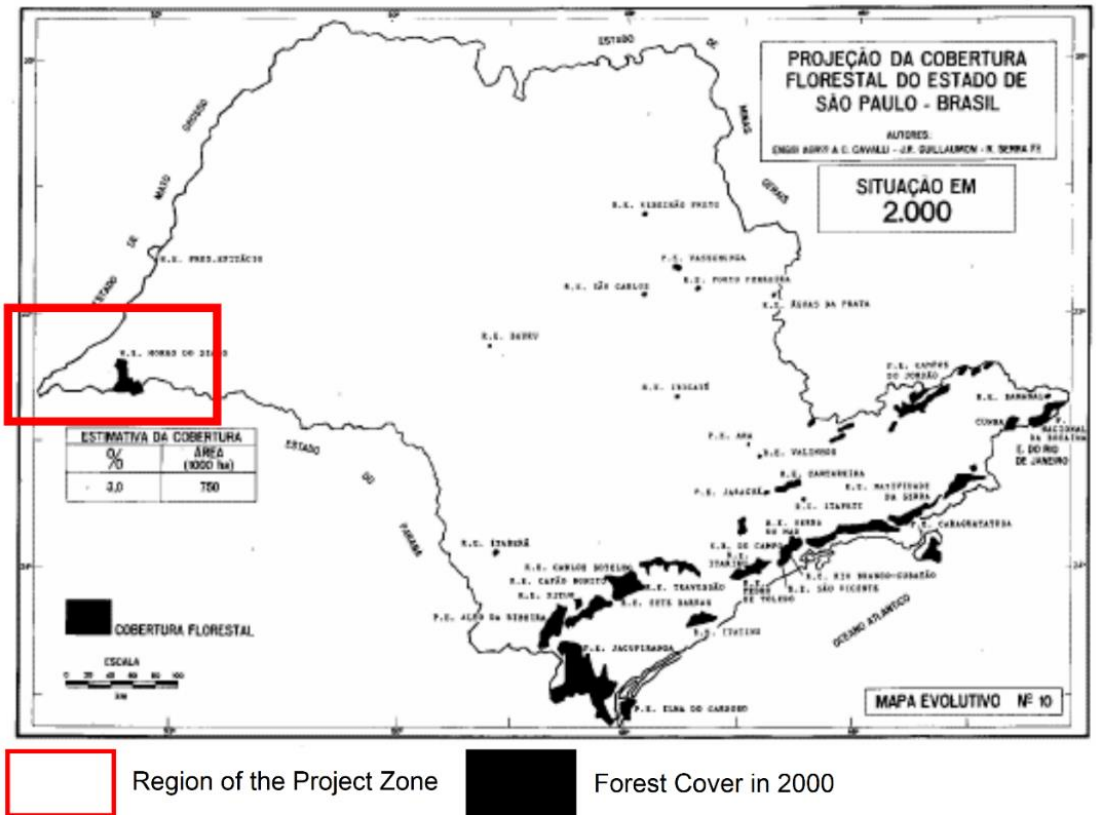

Figure 10 – Forest Coverage in the São Paulo State in 2000. Source: Victor and collaborators (2005)

Given the scenario of systematic loss of native vegetation, in the decades of 1990s and 2000, environmental public policies were implemented focused on forest recovery, sustainable economic growth, and agrarian reform, through the 'State Land Collection Plan', aiming to regularize land tenure in rural settlements, encouraging the adoption of more sustainable agricultural practices and promoting forest recovery (Silva, 2018). Mico-Leão-Preto Ecological Station was created in 2002, consisting of four forest remnants, totaling 6,200 hectares, with the goal of conserving populations of *Leontopithecus chrysopygus*, an endemic and endangered species in the Project Zone.

In opposition to prior environmental public policies, more modern conservation policies were implemented. As the federal law 12.651 took effect in 2012, there was a 58% reduction in legal demands for restoration on rural properties, which significantly reduced the potential for restoration in the Project Zone. Additionally, there has been a weakening of funding and performance of environmental public policies on a federal scale in Brazil. These recent changes in legal demands for restoration and public policies may discourage landowners from restoring their areas, based on the expectation of future additional reductions in legal demands for restoration.

Land Use

Land use in the Project Zone is mainly intended for agriculture, which occupies 84.4% of the area, while only 8.4% of the area is covered by native vegetation. More specifically, 45.7% of the Project Zone is occupied by pastures for livestock, 21.8% by agriculture and 16.6% by mosaic of agricultural uses[13] (Figure 11). Since 1985, extensive livestock farming has been the predominant productive activity in the Project Zone, however, since the beginning of the 21st century, its extension has been reduced and

[13] "Mosaic of uses" refers to areas of agricultural use where it was not possible to distinguish between pasture and agriculture: Legenda Coleção 7 - Descrição Detalhada.pdf (storage.googleapis.com)

replaced by agricultural crops, mainly sugarcane and soybeans. There is still productive activity based on forestry for commercial purposes, but it has been a little significant activity since 1985 (Figure 12).

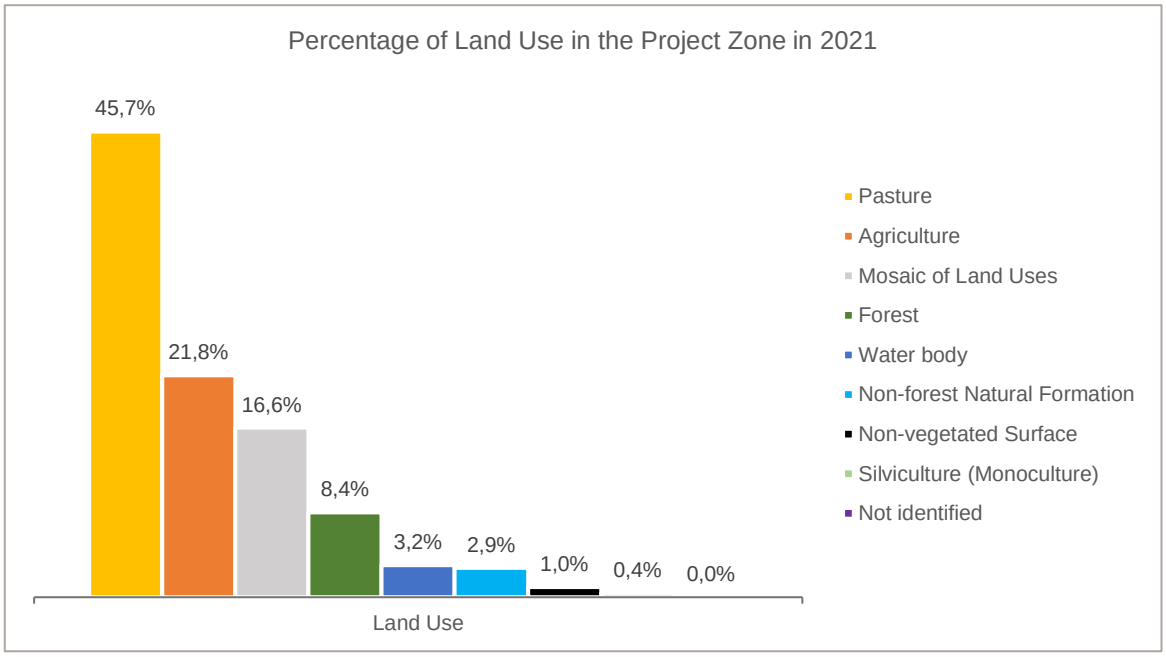

Figure 11 – Percentual of the Land Use in the Project Zone in 2021

Considering only the areas occupied by agriculture and livestock, which are the areas likely to receive forest restoration activities, 54.1% are destined for livestock, 20.2% for sugarcane, 19.7% for area is classified as a “mosaic of uses”, 4% is used for soybeans and 1.4% for other temporary crops. Less representatively, 0.5% of the area is occupied by forestry and 0.2% by perennial crops, mainly coffee and citrus.

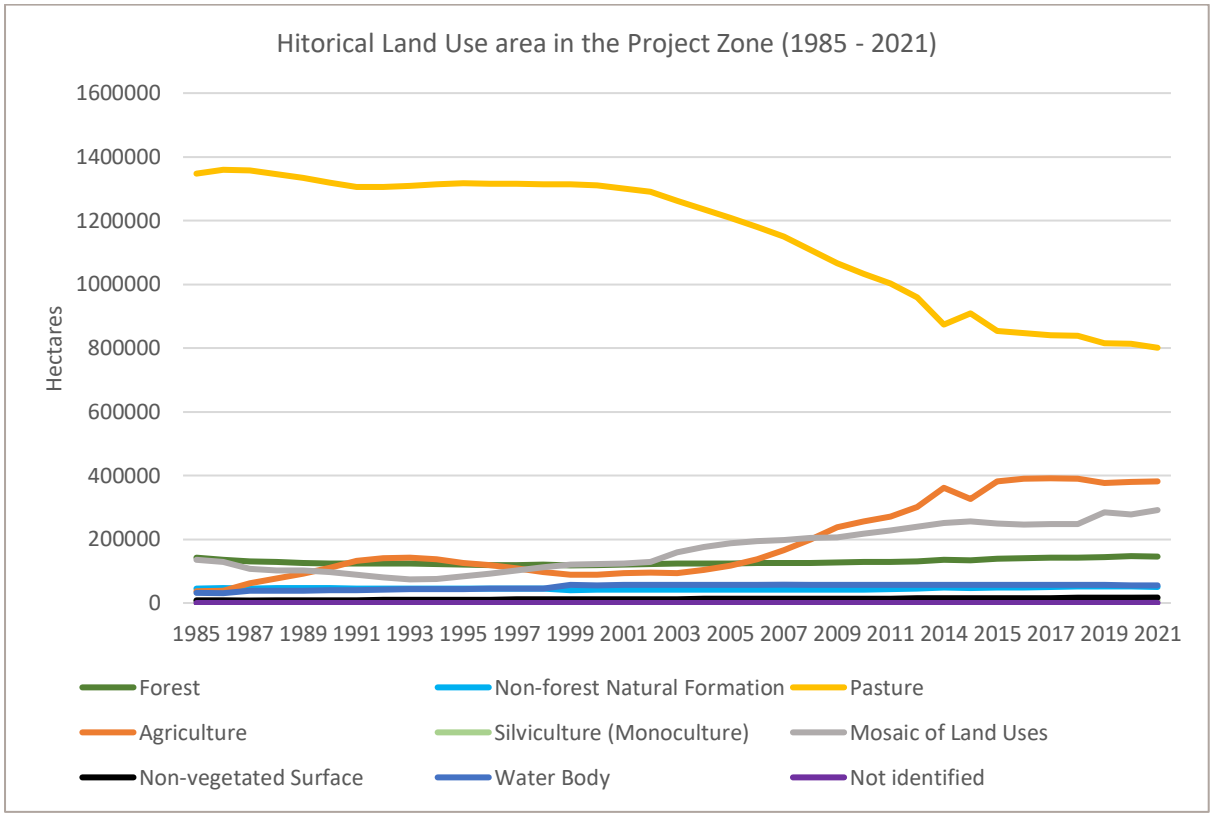

Figure 12 - Soil usage history in the project zone (1985 - 2021)

In Figure 13 it is possible to see the spatialization of land use and land cover data in the Corridors for Life ARR Grouped Project Zone.

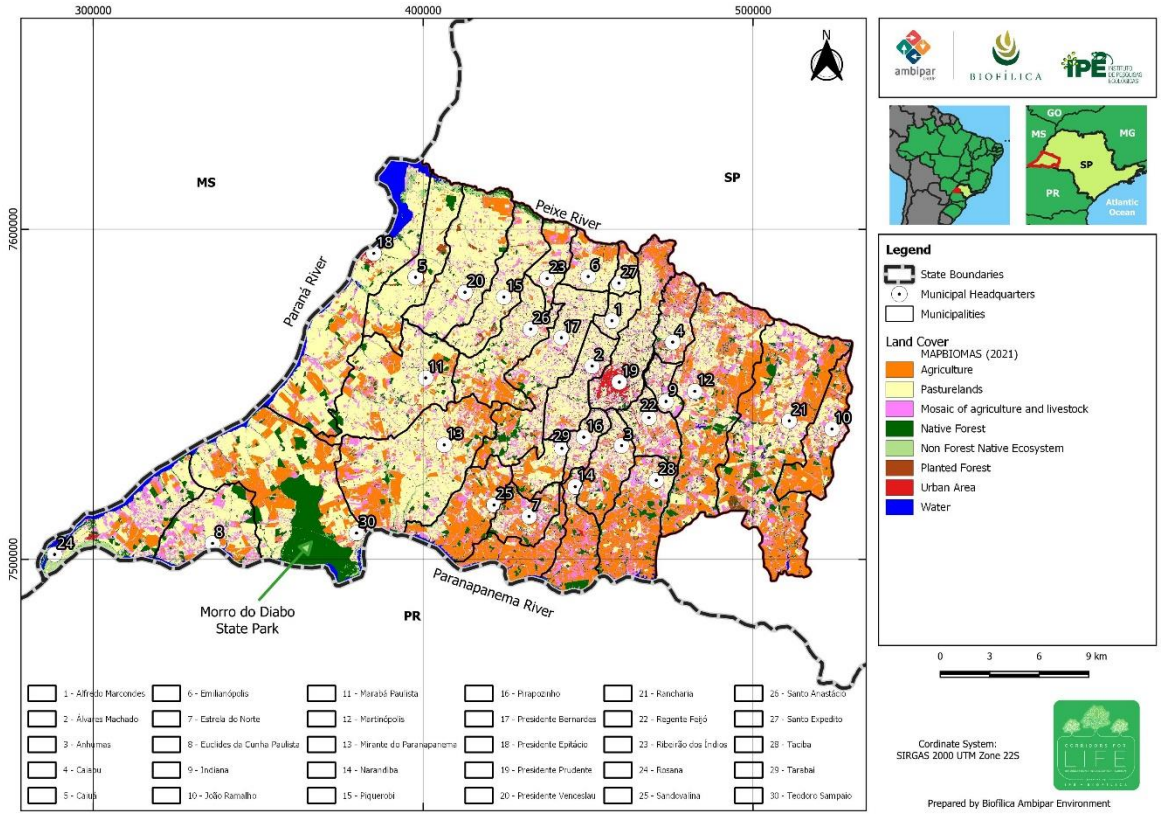

Figure 13 – Land-use in the project zone (2021)

In addition to the native vegetation cover having stagnated at 8.4% in the last 35 years, most of it is found in a single forest remnant, the Morro do Diabo State Park (PEMD).

Other conservation units included in the Project Zone also contain an area of significant and crucial native forest for the preservation of Biodiversity, they are: Rio Do Peixe State Park, Mico-Leão-Preto Ecological Station and the Mosquito Private Natural Heritage Reserve (Figure 1). There are still other forest remnants on private properties, but most of them are small and isolated in the agricultural matrix (Figure 13).

Socio-Economic Characterization

According to data from Fundação SEADE[14], the total estimated population for the Project Area is 574,381 inhabitants, with the municipality of Presidente Prudente standing out with a population of 222,807 inhabitants, while the other municipalities have a population between 3,000 and 25,000 inhabitants. The total population of this area represents 1.22% of the population of the state of São Paulo, and the total territory of the state of São Paulo is equivalent to 24,800 hectares, characterizing this region as one of the least populated in the state. The proportion between men and women is balanced in all the municipalities (Figure 14), with the exception of Marabá Paulista, which has a larger male population (62%) than female (38%).

[14] https://www.seade.gov.br/

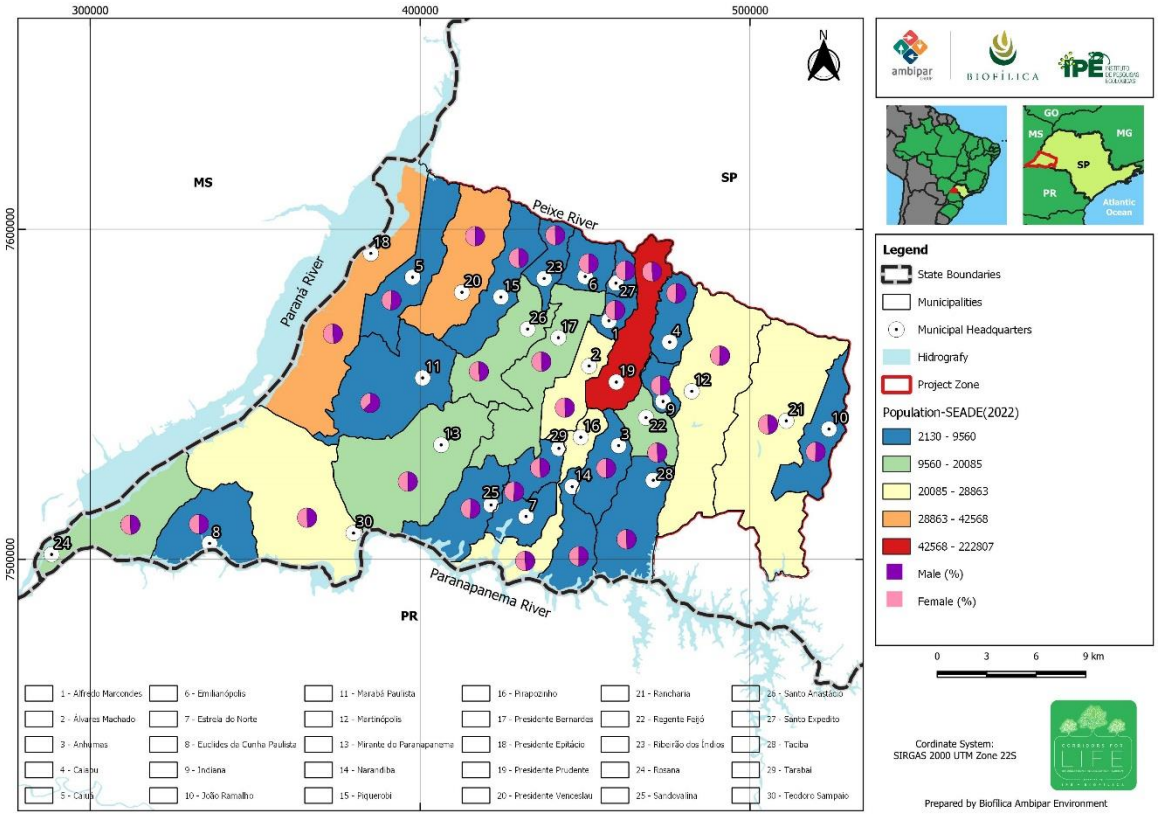

Figure 14 – Population and gender in the Project Zone municipalities in 2022. Source: SEADE (2022)

The population by age range presents similar distributions in all municipalities, with most of the population in the 30 to 59 age range. The only exception is the municipality of Marabá Paulista, which presents a higher proportion of younger population, in the 15 to 29 age range (Figure 15).

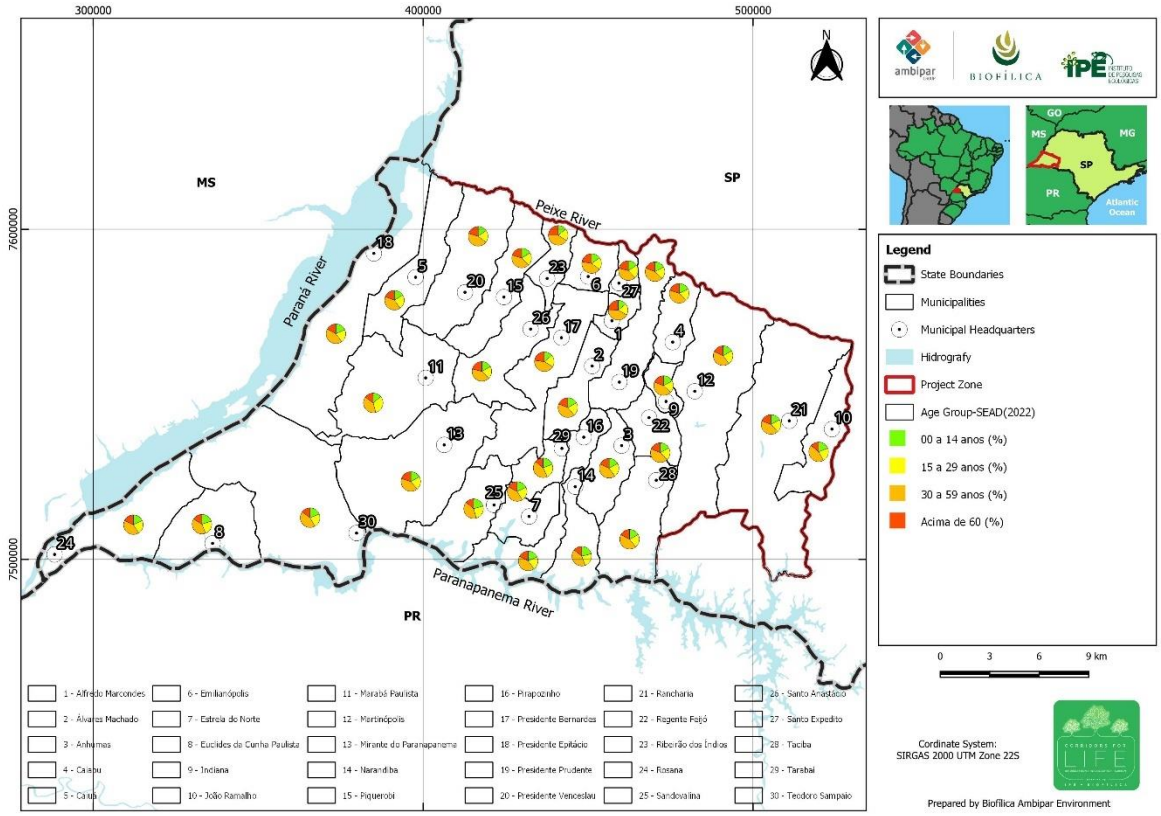

Figure 15 - Age range per municipality in the Project Zone. Source: SEADE (2022)

The ethnic characterization of the inhabitants of the region (Figure 16) is based on the data declared in the 2010 Census, when in most municipalities, more than 50% of the population declared themselves "White." The second category that appears most is "Parda" (mixed race), with emphasis on the municipality of Euclides da Cunha, where this category appears in more than 50% of the population. The categories that presented less than 10% of the declarations in all municipalities were "Black", "Yellow", and "Indigenous." This distribution follows the proportion found in the State of São Paulo, where 64% of the inhabitants of São Paulo declared themselves white, 29% brown, 6% black, 1% yellow, and 0.1% indigenous.

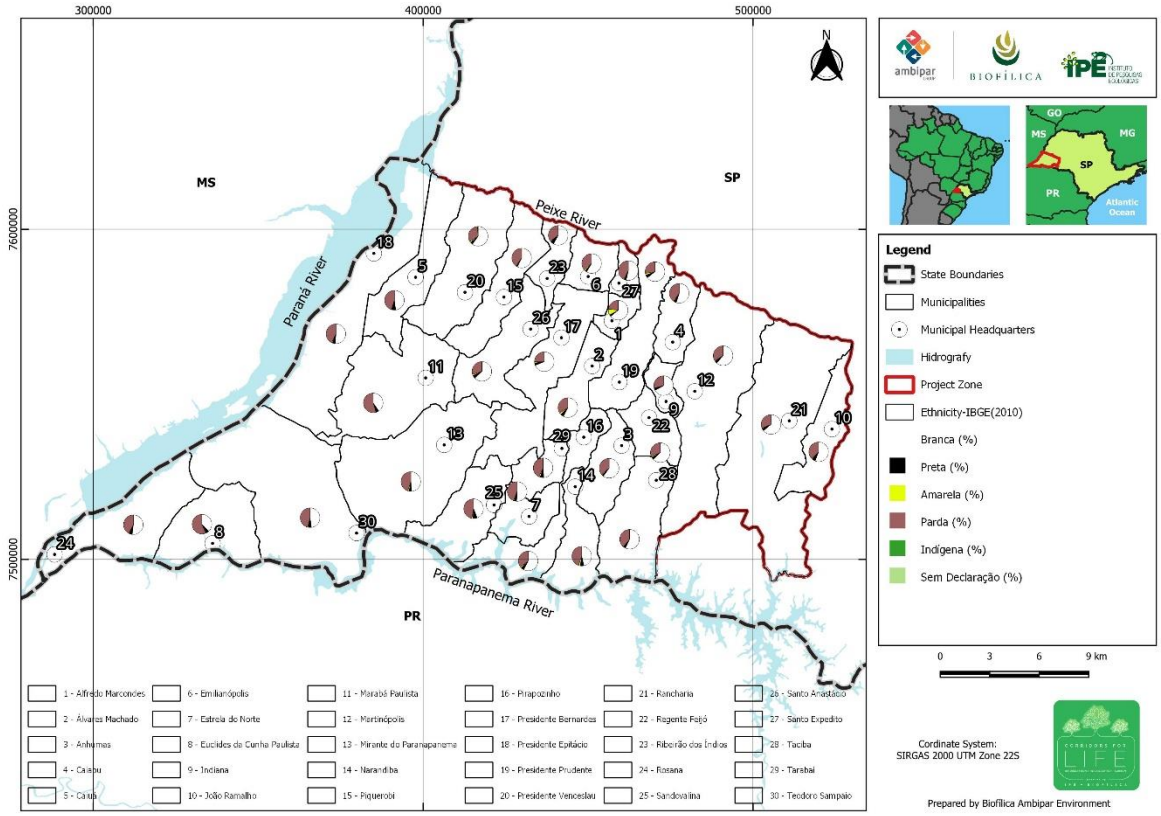

Figure 16 – Ethnicity in the municipalities of the Project Zone. Source: IBGE Censo (2010)

Regarding the distribution of the population in the territory, the demographic density of the region is below the state average, estimated at 181.9 inhabitants/km² in 2022. The only exception is the municipality of Presidente Prudente, which stands out with 395.9 hab/km². The municipalities with the lowest density, below 12.5 hab/km², are Anhumas, Caiuá, Estrela do Norte, João Ramalho, Marabá Paulista, Ribeirão dos Índios, Sandovalina and Taciba (Figure 17).

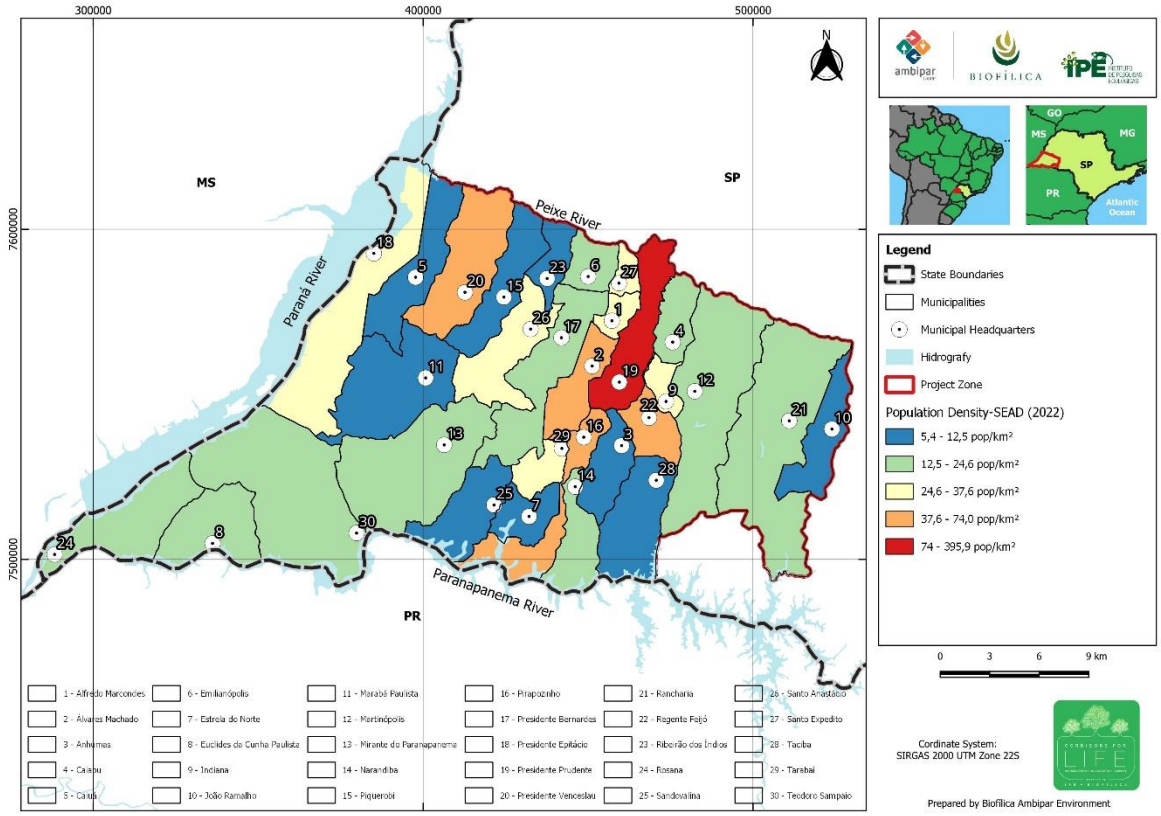

Figure 17 - Demographic density in 2022. Source: SEADE (2022)

The highest percentage of this population lives in urban areas, although the municipalities of Caiuá and Marabá Paulista stand out for the low degree of urbanization, which is below 40%. Most other municipalities present amounts above 80%, especially Presidente Prudente, which presents as amount 98%, above the state average for 2022, which is 96.6% (Figure 18).

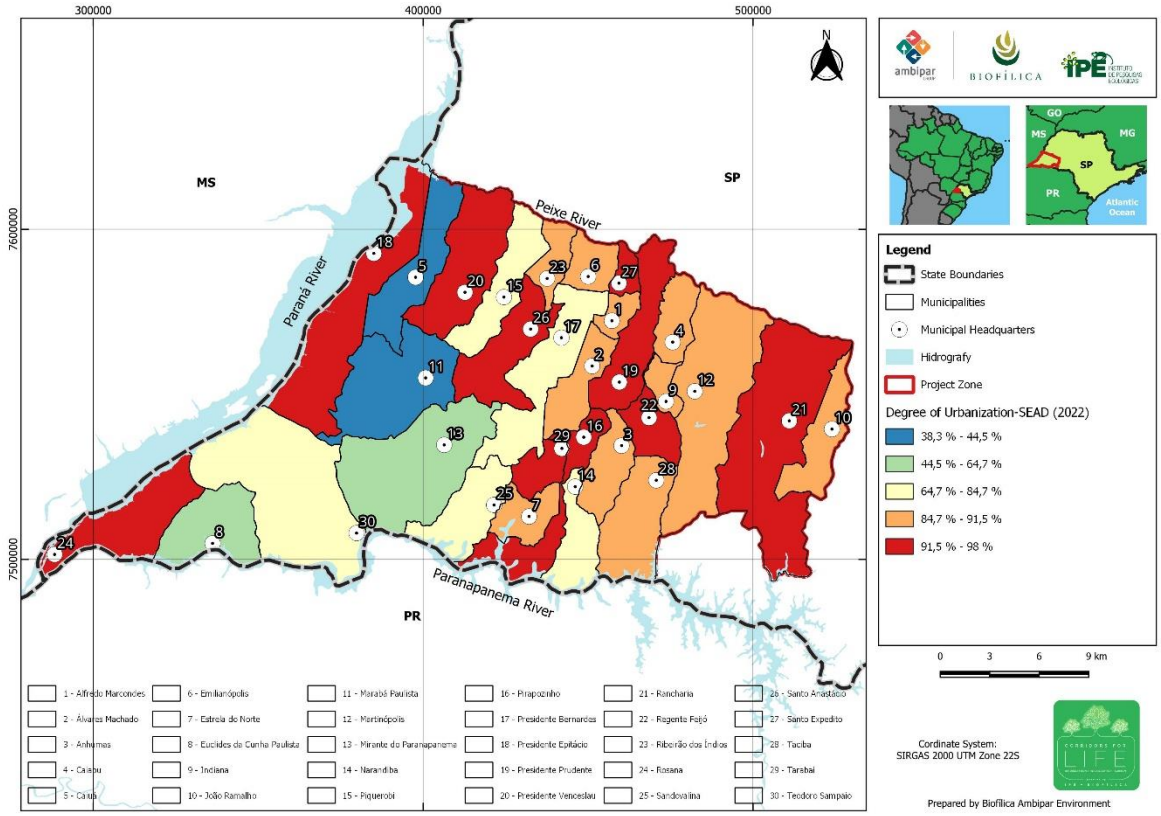

Figure 18 - Degree of Urbanization in 2022. Source: SEADE (2022)

The population's living conditions were analyzed based on São Paulo social responsibility index (IPRS). This index was calculated by Fundação SEADE (Fundação Seade, 2019) and is based on the same human development terms considered by the Human Development Index - HDI. The IPRS values range from 0 to 100 and are categorized into wealth, education, and longevity, and serve as a parameter for measuring the degree of human development of municipalities. In 2018, most municipalities presented equivalent schooling scores or above the state average. However, for the wealth index, most municipalities presented values below the state average (Figure 19).

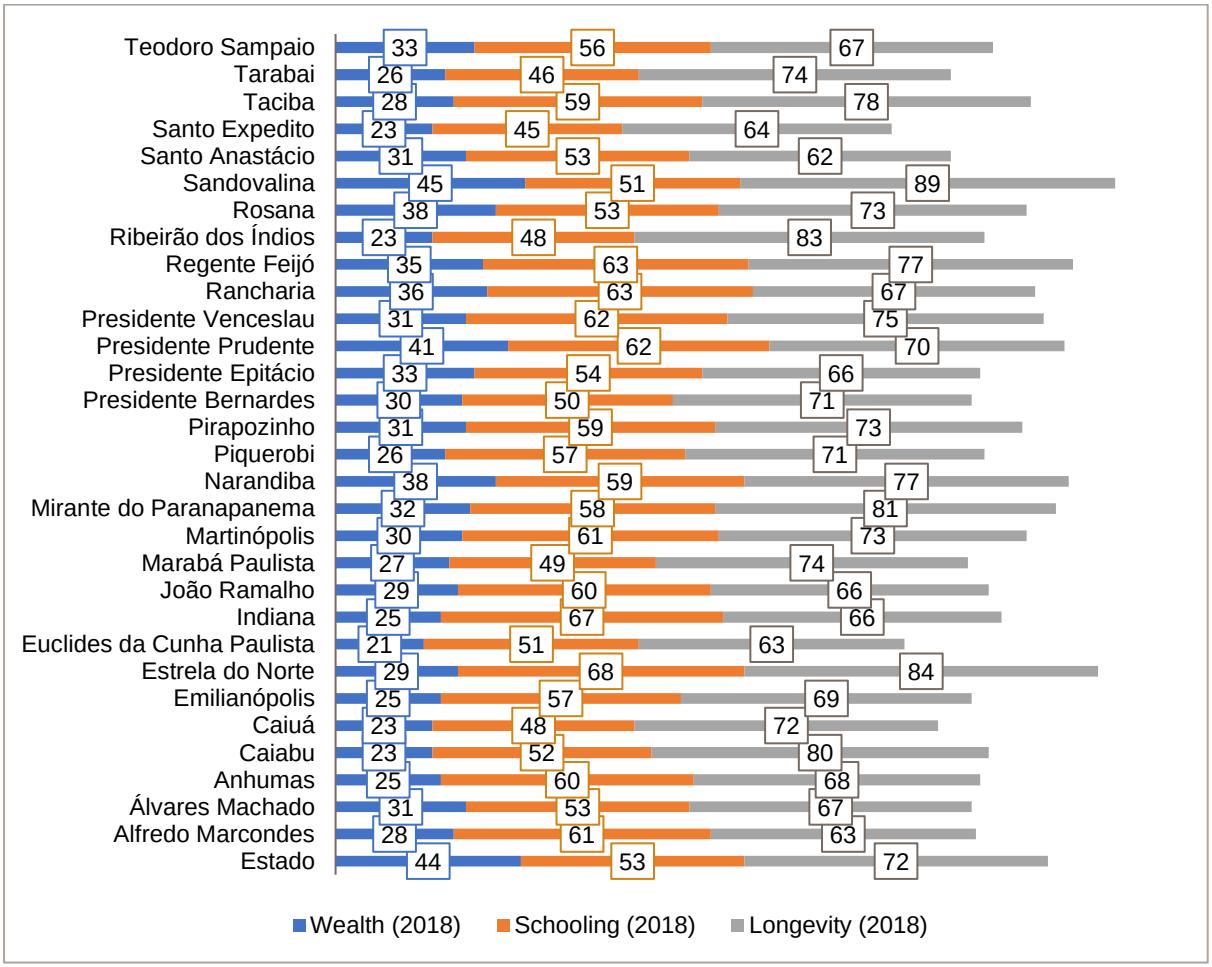

Figure 19 - Paulista Index of Social Responsibility (IPRS) 2018. Source: SEADE

Figure 20 shows the classification of the municipalities of the project area in the IPRS Groups. Presidente Prudente stands out for being the only one in the Dynamic Group, for presenting high values for the three IPRS indexes. Most other municipalities rated as Equitable or In Transition with average values for the three indexes. Only the municipality of Sandovalina rated as Unequal for presenting high values for Wealth and low or medium values for Longevity and Schooling. Euclides da Cunha Paulista and Santo Expedito stand out for their classification in the Vulnerable Group for presenting low values for the three IPRS indexes.

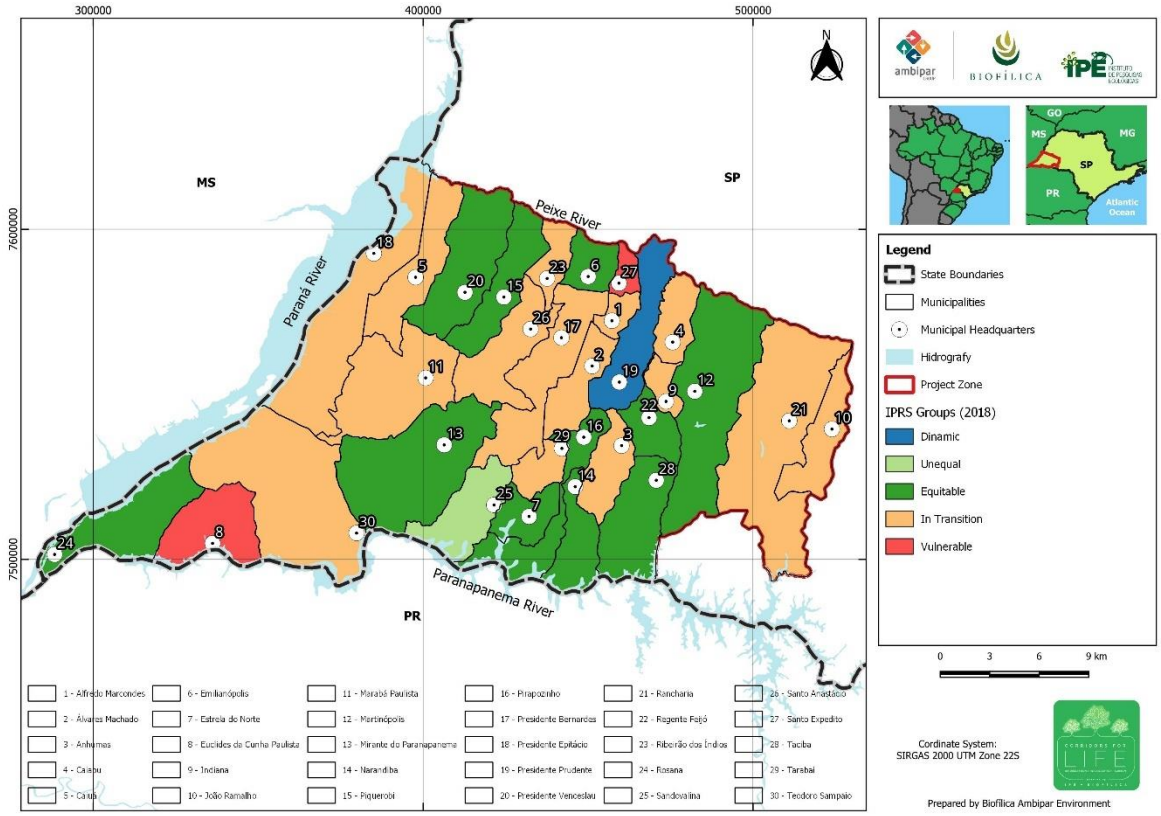

Figure 20 – IPRS 2018. Source: SEADE

In 2019, most municipalities' GDP per capita below the state amount (52,992.00 R$) and the predominance of the Services category in the composition of the municipal GDP (Figure 21). The municipalities of Rosana and Sandovalina stand out with the GDP highest GDP per capita in 2019, 81,545.00 R$ and 87,011.00 R$, respectively, and also by Industry playing the critical role. These values are effects of the ethanol production and hydroelectric power industries present in these municipalities, and low population values. It is worth mentioning that this high GDP is not followed by the Schooling and Longevity indexes, as shown in Figure 19. The industrial sector also plays a critical role in the economies of the municipalities of Mirante do Paranapanema, Narandiba, Piraposinho, Presidente Epitáfio and Teodoro Sampaio. Regarding the agricultural sector, it has an important participation in the economies of the municipalities of João Ramalho, Marabá Paulista, Taciba and Anhumas.

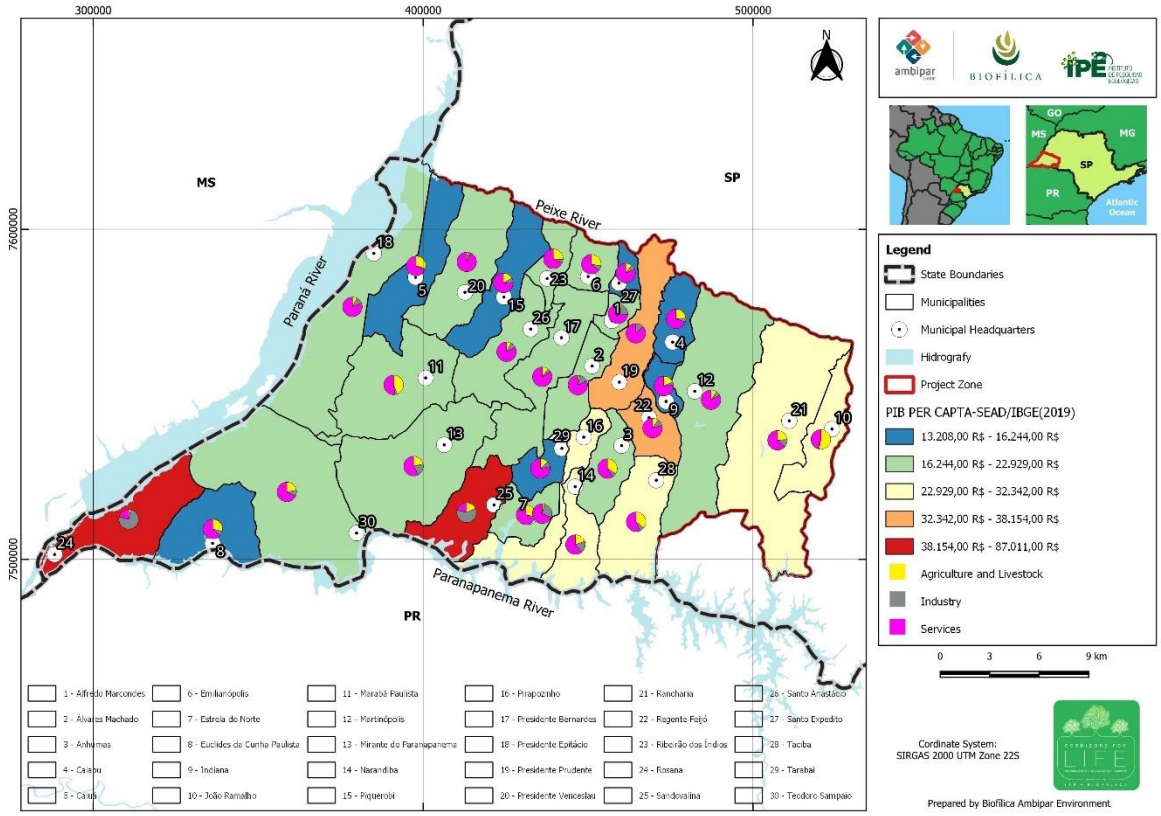

Figure 21 – PIB 2019. Source: SEADE

As presented in Figure 21, in 2019 most municipalities' GDP per capita below the State value (52,992.00 R$) and the predominance of Services category in the composition of the municipal GDP. The municipalities of Rosana and Sandovalina stand out with the GDP highest GDP per capita in 2019, 81,545.00 R$ and 87,011.00 R$, respectively, and also by Industry playing the critical role. These values are effects of the ethanol production and hydroelectric power industries present in these municipalities, and low population values. It is worth mentioning that this high GDP is not followed by the Schooling and Longevity indexes, as shown in Figure 19. The industrial sector also plays a critical role in the economies of the municipalities of Mirante do Paranapanema, Narandiba, Piraposinho, Presidente Epitáfio and Teodoro Sampaio. Regarding the agricultural sector, it has an important participation in the economies of the municipalities of João Ramalho, Marabá Paulista, Taciba and Anhumas.

Within the GDP generated by agricultural activities, sugar cane stands out as the main production in most of the municipalities. Next, the soy production also stands out, as it is an important export product (Figure 22).

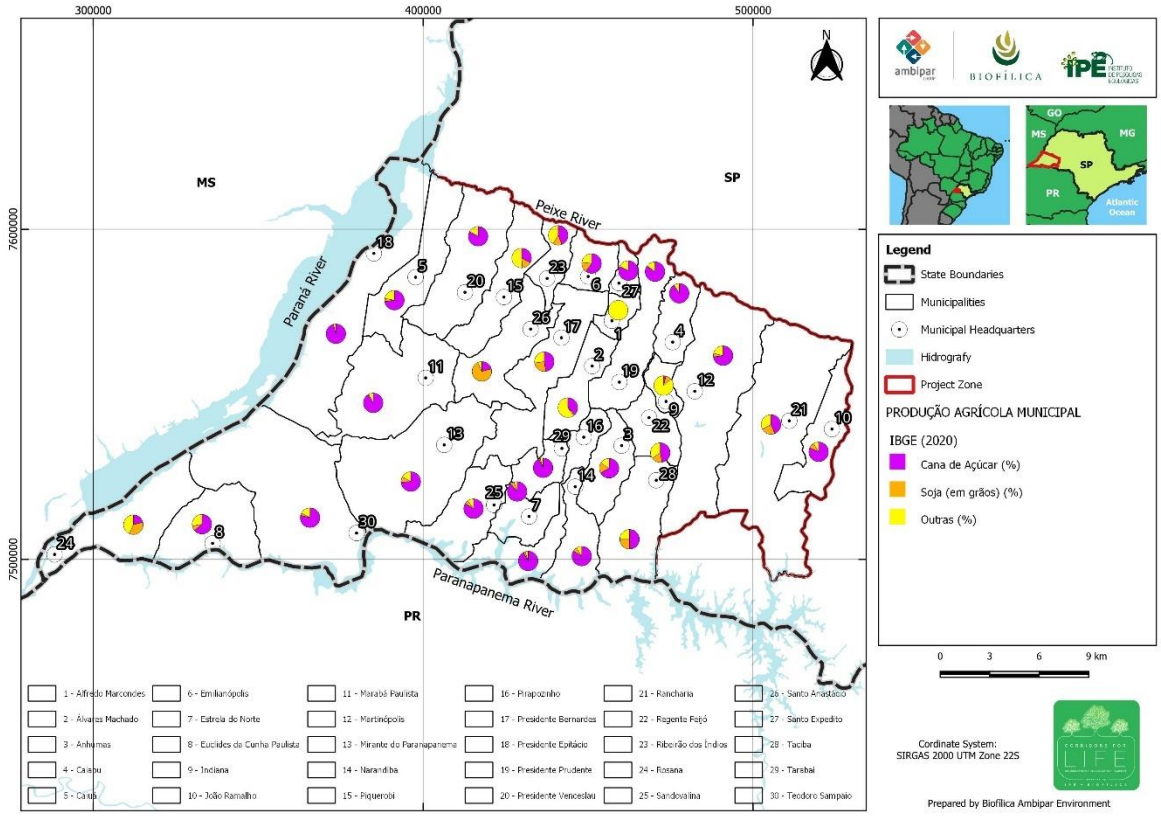

Figure 22 - Municipal agricultural production, the category 'Other' includes crops such as corn, cotton, sweet potato, cassava and others. Source: IBGE (2020)

Sugarcane has been an important economic product since the beginning of Brazilian colonization, with the first plantation occurring in 1532 with the implementation of sugar mills (Brazil, 2018). Sugar was the main product made of sugar cane, until the 1970s when Brazil started investing in ethanol through Proálcool (National Alcohol Program) as an alternative to fossil fuels, due to the oil crisis. The Project Zone stands out in this context for both production and logistics infrastructure (Brazil, 2018). According to São Paulo (2015), the investment in sugarcane crops between 2002 and 2012 resulted in a significant increase in the composition of municipal GDP. In 2012 sugarcane accounted for 76.6% of the value of agricultural and livestock production in the region's municipalities. Moreover, in the same year, alcohol and sugar manufacturing activities were the two largest employers in this sector, accounting for 29.03% of formal jobs (São Paulo 2015).

Besides agricultural production, cattle raising is still very relevant in the region (Figure 11). This production is predominantly extensive with most of the cattle herd sustained on pasture, however, according to Dias-Filho (2011), the management of these pastures intensifies their degradation, reducing the production potential of these areas in the Project Zone (Figure 23).

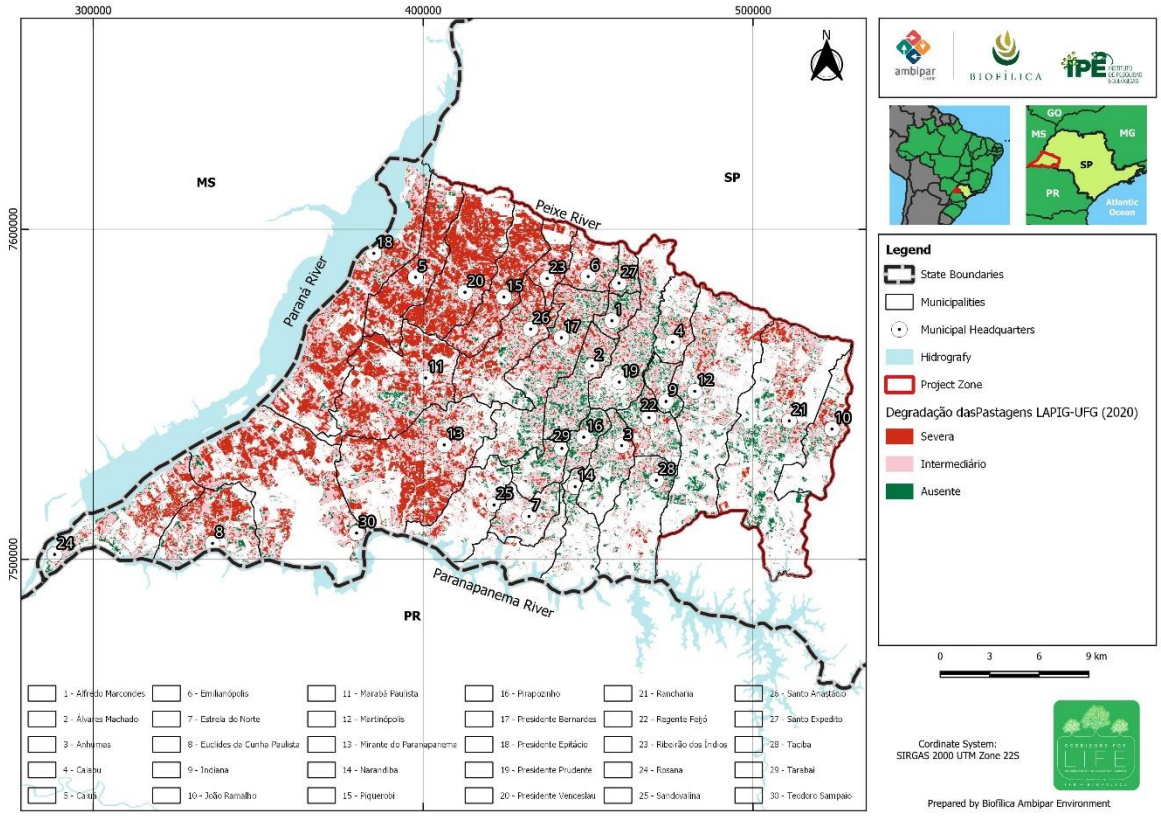

Figure 23 - Degree of pasture degradation in the Project Zone | Source: LAPIG-UFG (2020)

Land Ownership

Rural properties in the Project Zone are characterized based on the classification between rural settlements and rural properties declared in the Rural Environmental Registry (CAR, Figure 24). CAR is regulated by the Native Forest Protection Law (Law No. 12.651/2012), and is a national electronic public registry, self-declaratory and mandatory for all rural properties. The municipalities with the largest number of private farms are Presidente Prudente, Presidente Bernardes, Álvares Machado, Rancharia, and Mirante do Paranapanema. Regarding the average area, the municipalities with the highest values are Marabá Paulista, Sandovalina and Teodoro Sampaio.

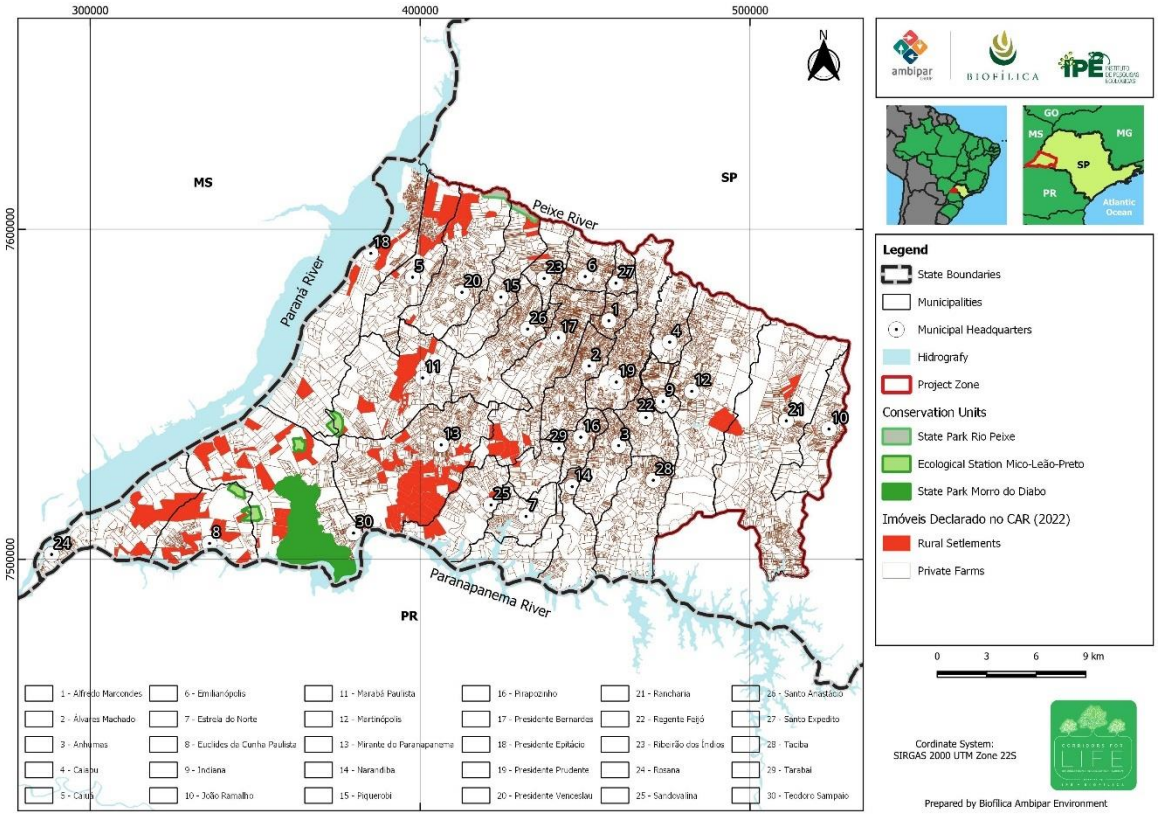

Figure 24 - Land Governance in the Project Zone | Source: CAR (MAPA)

Table 3 - Number and area of private properties in the Project Zone declared in the CAR on 08/10/2022.

Municipality	Private Farms (qty)	Smallest Farm Land Area (ha)	Average Farm Area (ha)	Largest Farm Land Area (ha)
Alfredo Marcondes	544	0.14	21.75	716.58
Álvares Machado	1,162	0.10	27.46	896.88
Anhumas	485	0.89	63.64	3,392.45
Caiabu	499	1.20	44.64	2,607.42
Caiuá	413	0.78	105.90	2,542.89
Emilianópolis	375	0.86	60.36	1,342.88
Estrela do Norte	207	2.03	118.98	3,006.54
Euclides da Cunha Paulista	247	0.25	125.44	9,080.46
Indiana	374	0.80	36.22	929.15
João Ramalho	315	2.00	150.17	4,651.11
Marabá Paulista	335	0.46	263.14	3,664.70
Martinópolis	929	0.92	122.00	6,803.94
Mirante do Paranapanema	1,010	0.51	82.95	6,416.67
Narandiba	262	2.01	178.42	8,637.91
Piquerobi	381	1.33	109.97	1,538.88
Pirapozinho	469	0.50	82.31	1,650.43
Presidente Bernardes	1,325	0.93	49.24	2,691.83
Presidente Epitácio	742	0.40	115.73	3,921.44
Presidente Prudente	1,418	0.17	32.98	2,775.76
Presidente Venceslau	614	0.25	106.57	2,767.53
Rancharia	1,074	0.33	153.51	14,378.77
Regente Feijó	666	0.53	40.24	3,101.08
Ribeirão dos Índios	281	1.89	63.88	2,718.44
Rosana	390	0.01	170.01	13,948.74

Sandovalina	208	2.00	262.22	12,958.76
Santo Anastácio	892	1.24	64.25	3,720.57
Santo Expedito	210	0.31	42.67	949.85
Taciba	508	0.39	168.83	26,709.43
Tarabai	243	1.05	86.25	2,428.96
Teodoro Sampaio	348	2.03	252.47	7,698.65

In Brazil, the agrarian reform policy is the set of measures conducted by the public power with the purpose of promoting the distribution of land among rural workers, as stated by the Land Statute - Law n°4.504/64. This policy is conducted nationally by the Instituto Nacional de Colonização e Reforma Agrária [National Institute of Colonization and Agrarian Reform] (INCRA), and in the state of São Paulo by the Fundação de Terras de São Paulo [Foundation Institute of Land of São Paulo] (ITESP). As response to the confrontations mentioned in the previous paragraphs, INCRA and ITESP, within the agrarian reform program, created several rural settlements for landless workers' families. In these rural settlements, the families develop agro-pastoral activities and cannot sell their lots to third parties. It is common for workers from different lots to cooperate in the planning and implementation of crops, as well as in the sales strategy to reach potential markets in the region.

A rural settlement is a set of plots, or lots, installed on a rural property, each for a family that cannot afford to buy a property. According to available data on INCRA[15] website, among 247 rural settlements in the state of São Paulo, 115 are in the Pontal do Paranapanema region and serve 5,909 families (Table 4, Figure 25). Of the 30 municipalities in the project, 15 have at least one settlement in their territory, with the municipalities of Mirante do Paranapanema and Teodoro Sampaio standing out with almost half of the total number of settlements in the region.

Table 4 – Settlements and families by municipalities.

Municipality	Settlements (qty)	Families (qty)
Caiuá	8	443
Euclides da Cunha Paulista	9	491
João Ramalho	1	26
Marabá Paulista	6	255
Martinópolis	2	121
Mirante do Paranapanema	**35**	**1,534**
Piquerobi	3	83
Presidente Alves	2	56
Presidente Bernardes	8	250
Presidente Epitácio	4	335
Presidente Venceslau	8	369
Rancharia	2	174
Rosana	4	739
Sandovalina	2	190
Teodoro Sampaio	**21**	**843**
Total	115	5,909

[15] https://www.gov.br/incra/pt-br

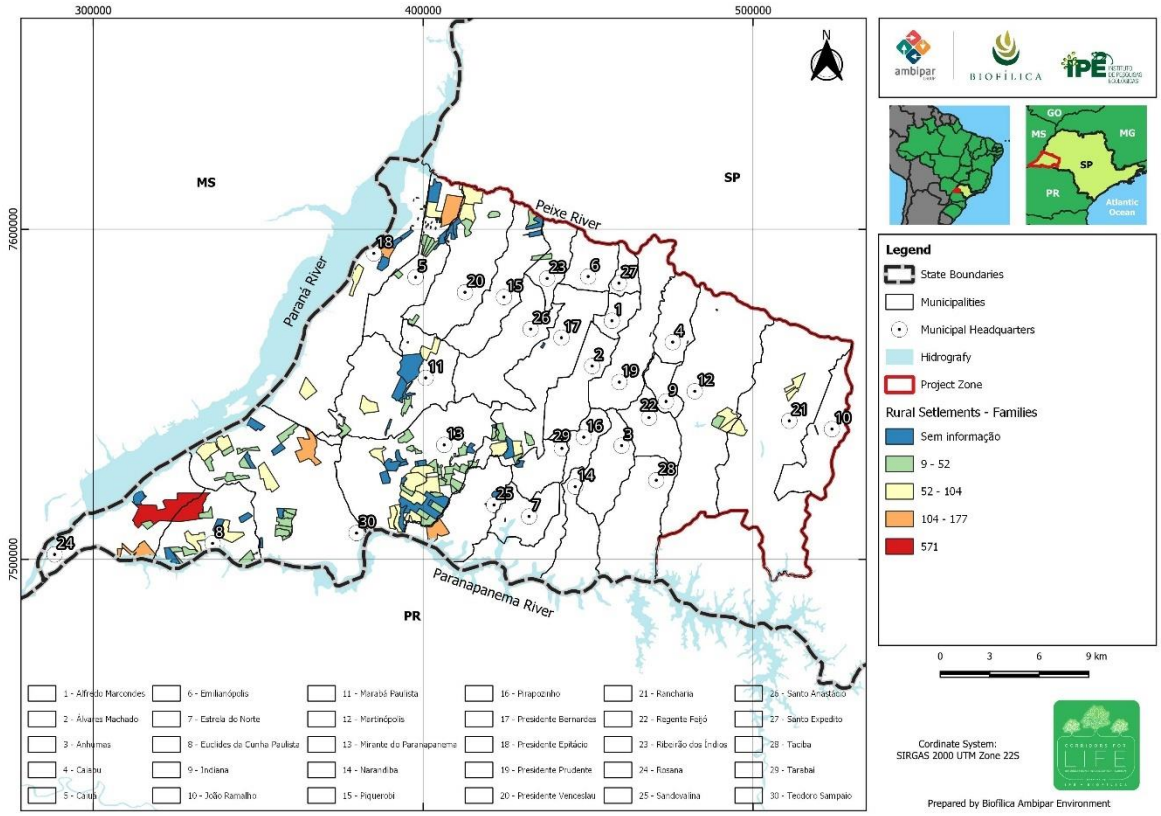

Figure 25 – Rural Settlements and Private Farms. Source: CAR(MAPA)

Agricultural production in the settlements of Teodoro Sampaio occupies 43% of the productive area, and the predominant crops are sugarcane, cassava, cotton, corn, banana and napier grass (Silva, 2008). The remaining productive areas are for pastures for dairy cattle. The settled families have low schooling levels and an average age between 25 and 37 years old. Almost all of the settled families come from the countryside and the ethnicity is composed by white and brown people. Based on the value of production, the author estimated the average income of the settled families at 1.5 minimum wages/month or R$ 622.00 reais in 2008.

These social and economic characteristics are recurrent in other settlements in the region. In Mirante de Paranapanema, milk production is the main economic activity, followed by cassava and coffee. Regarding internal organization, a particularity of the Margarida Alves settlement is a relevant participation and influence of women in decision and leadership roles within the settlement (Moal, 2013).

2.1.7. Project Zone Map (G1.4-7, G1.13, CM1.2, B1.2)

By identifying potential areas to be restored in Pontal do Paranapanema, the Dream Map was developed, a work to set the map of priority areas for the allocation of forest corridors in rural properties in the Project Zone. For the diagnosis, it assumed that the allocation for forest recovery should be based on variables of the Brazilian legislation, landscape connectivity, of species ecology, land use and coverage. The first variable would indicate whether the landowner is obliged to restore the native vegetation on his farm and what would be the area (ha) to be restored, while the second variable would help to allocate restoration in places in the farm to promote the conservation and flow of fauna and flora between forest remnants and, finally, the third variable would be for mapping the existing forest cover in the project region.

Therefore, the Dream Map methodology consists of a cartography of overlapping layers from the results of the variables previously mentioned, and the final cartographic layer consists of the map of areas

suitable for forest corridors. This work was carried out in two main methodological stages: calculation of forest liabilities and definition of priority areas for corridors.

For the step of calculating the forest liability, the CAR geographical data were collected regarding the rural properties of the 30 municipalities in the Project Zone. The database used was the Sistema Nacional de Cadastro Ambiental Rural [National Rural Environmental Registry System] (SICAR) and 16,609 properties were surveyed. In Pontal do Paranapanema these properties are divided between Rural Property (IRU), Settlement (AST) and Traditional Peoples and Communities (PCT). The polygons of the properties were unified in a common geographic base, where the registration information, location and type of property registered by the owner in SICAR were stored. The calculation of forest cover of the properties was performed based on the geographic data of Land Use and Land Cover from Collection 5 of the MapBiomas Project, for the year 2019. From the information available in the collection, the forest cover class was selected to represent the Atlantic Forest fragments present in the project region, characterized by vegetation of the Semideciduous Seasonal type.

The identification of properties suitable for restoration activities was based on the criteria set out in the Brazilian Forest Code (Law No. 12.651 of May 25, 2012). This law establishes that every rural property located in the Atlantic Forest biome must have 20% of its area preserved under the name of Legal Reserve (RL), and that all areas marginal to the components of the hydrography (springs, reservoirs, water bodies and courses) are intended for environmental preservation through metric strips of native vegetation in its surroundings, under the name of Permanent Preservation Area (APP). Then, the size of these APPs range varies according to the width of the bed of water resources.

To estimate the Legal Reserve area, the area (ha) corresponding to 20% of each property was calculated, corresponding to the minimum mandatory size of the Legal Reserve. And to delimit the area of APPs, the polygons of hydrographic APPs of the Fundação Brasileira para o Desenvolvimento Sustentável [Brazilian Foundation for Sustainable Development] (FBDS) were considered. Then, by crossing the forest cover of MapBiomas with the boundaries of the properties, the forest deficit of each farm was calculated, consisting of the sum of the forest deficit of the Legal Reserve and the forest deficit of APPs. Based on the Brazilian Forest Code, which allows the APP with vegetation as part of the percentage calculation of the Legal Reserve, the areas of APP limits with vegetation subtracted from the areas of Legal Reserve liabilities.

The restoration obligation is not uniform for all types of properties, varying according to the type of property (private, settlements and of traditional peoples and communities) and the size of the fiscal module of the municipality under analysis. In addition, the Brazilian Forest Code establishes that the environmental readjustment activities of properties with less than 4 fiscal modules differ from the legal obligations of properties with a larger territorial scope. For the Corridors for Life ARR Grouped Project, private rural properties with more than 4 fiscal modules required to have a Legal Reserve were prospected. Based on these criteria and metrics mentioned above, the properties in the Project Zone were categorized as follows:

- Farms with forest surplus and up to 4 fiscal modules - 493 properties exempt from restoration.
- Farms with a deficit of native forest vegetation and up to 4 fiscal modules - 13,388 properties presented environmental liabilities, but are exempt from restoration.
- Farms with forest surplus and more than 4 fiscal modules - 108 properties exempt from restoration.
- Farms with a deficit of native forest vegetation and more than 4 fiscal modules - 2,487 properties have environmental liabilities and require restoration.

For the stage of definition of priority areas for forest corridors, the following data were subject to cartographic overlay: connectivity of forest fragments, APPs layer and layer of properties with more than 4 fiscal modules and forest deficit (2,487 properties). The production of this information resulted in a layer in matrix format, and the definition of priority areas for corridor allotments completed by crossing and modeling the pixel statistics based on these three layers.

First, the production of the distance layer in meters of APP included the application of Euclidean distance calculation method. This variable indicated the location of PPA areas by means of location classes expressed in meters. The assumption adopted was that the allocation of restoration areas should prioritize the recovery of strips around the hydrographic components of the farms.

Then, to produce the forest connectivity layer, a matrix file was generated corresponding to the areas of forest cover in the project region, covering the vegetation present on the properties and in the conservation units of the region.

For relevance estimation of these fragments for forest connectivity, Conefor software was applied, taking into account two main criteria: the fragments area (ha) and the distances between them. To model this scenario, Conefor works with graph structures, where fragments sorted by area (ha) understood as graphs and the possible distances between these fragments are represented by line vectors - simulating the probable flow of flora and fauna species between the fragments.

For the project, the index that was applied to represent the importance of the fragments was the Integral Connectivity Index (IIC), with which a layer produced in which the forest remnants of the Project Zone categorized as either slightly relevant or extremely relevant to forest connectivity. Therefore, in a scenario where a forest patch is small in area (ha) and geographically isolated, the IIC for that patch is low. In a second scenario, where a fragment has a large area (ha) and is close to other fragments, the IIC for this fragment is high.

In this sense, theoretical and practical knowledge on biodiversity conservation in the Atlantic Forest were considered, based on previous studies conducted by IPÊ. According to Paese et. al (2012), a rule was applied for Conefor to consider fragments that are close to other fragments in a radius of 1 kilometer at most, since larger distances hinder the chances of biodiversity dispersion among fragments.

The third and last step was carried out by applying pixel statistics on the matrix layers. This procedure was carried out by crossing the pixel values of the APP, IIC and farms with more than 4 fiscal modules. For this, the pixel values of the matrix layers were standardized so that they were represented between number intervals from 0 to 1, so that each layer had the same weight of influence in the assignment of restoration areas. Aiming that the area (ha) indicated for restoration corresponded to 20% of the rural property, a threshold value of 20% was defined on the pixels with greater importance for forest connectivity. This process resulted in the final map to assign forest corridors called the Dream Map and where the project intends to expand its ARR activities (Figure 26). Therefore, the inclusion of new areas to the project shall be guided by the Dream Map and respect the requirements stated in section 2.1.21.

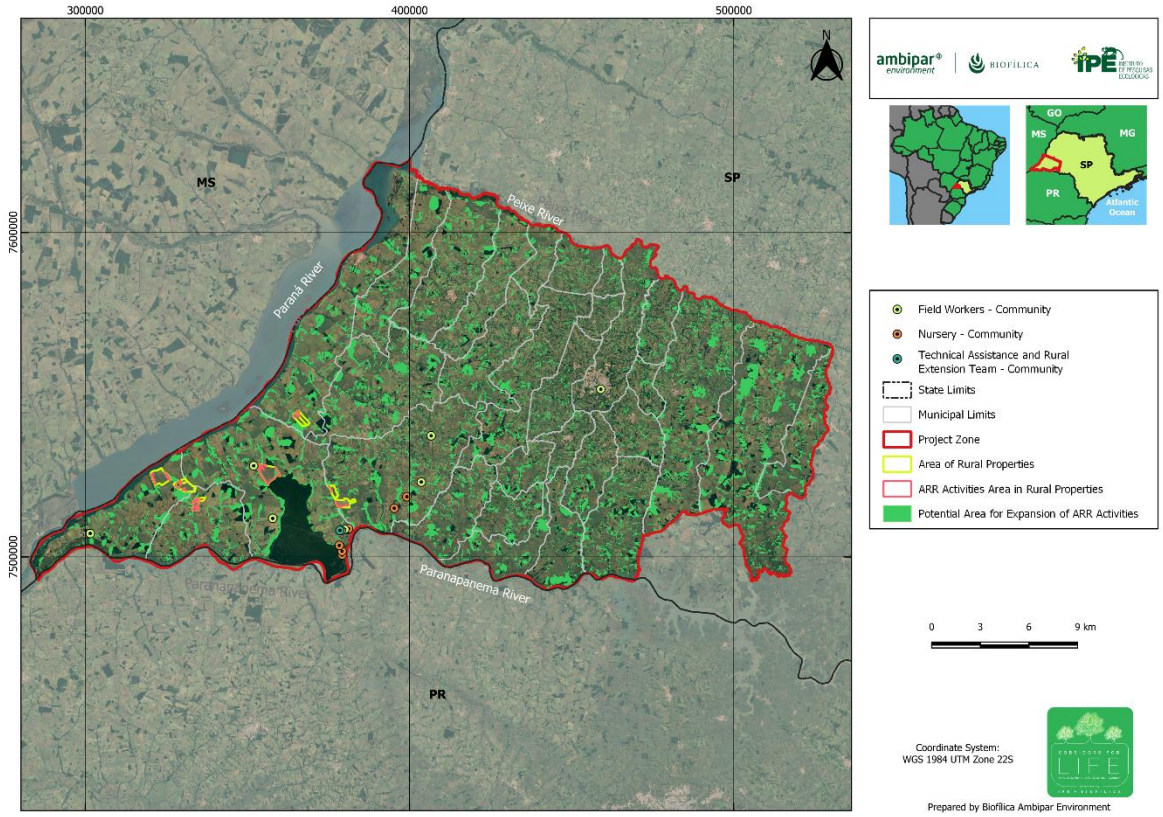

Figure 26 - Dream Map - Corridors for life ARR Grouped Project

In summary, the application of these variables together establishes a scenario in which the restoration areas of farms in the Project Zone are allocated close to each other and to important forest remnants in the region, performing the function of forest corridors. This strategy was considered, as the analyzes mentioned in this Section revealed that, in addition to the presence and relevance of Conservation Units, other forest remnants in the Project Zone, including those existing on private rural properties, cover approximately 55,000 hectares, which are fundamental for the conservation of local biodiversity. Therefore, the restoration activities implemented under the Brazilian Forest Code enhance the environmental regularization of the property and the conservation of biodiversity in the project region. Considering properties with more than 4 forest modules and forest deficit, the Project Zone contains 227,131.3 ha that need to be reforested.

Figure 27 presents the boundary of the Project Zone (geographical boundary of the project grouped with 30 municipalities of Pontal do Paranapanema), the potential areas where the project intends to expand its ARR activities (forest corridors of the Dream Map), the boundary of the rural properties of the first instance, Project Area in the first instance (areas eligible for execution of ARR activities), High Conservation Values for communities, High Conservation Values for biodiversity, and the location of the Communities, represented by local forest nurseries, local companies that provide restoration services and the Technical Assistance and Rural Extension team. New communities that may be part of the project may be present throughout the entire Project Zone and haven't been mapped until project's validation. The inclusion of new communities to the project shall respect the following criteria:

- Be a new and local Forest Nursery, Service Provider or member of the Technical Assistance and Rural Extension Team, as described in section 2.1.9 and characterized in section 4.1.
- Located within the Project Zone.

- Be in compliance with the national and local laws, as pointed in section 2.5.

The first instance of the Project comprises 10 properties, summing up total 9,745.3 ha, and considering the areas initially allocated for ARR activities within these properties, the total project area in the first instance is 1,855.3 ha.

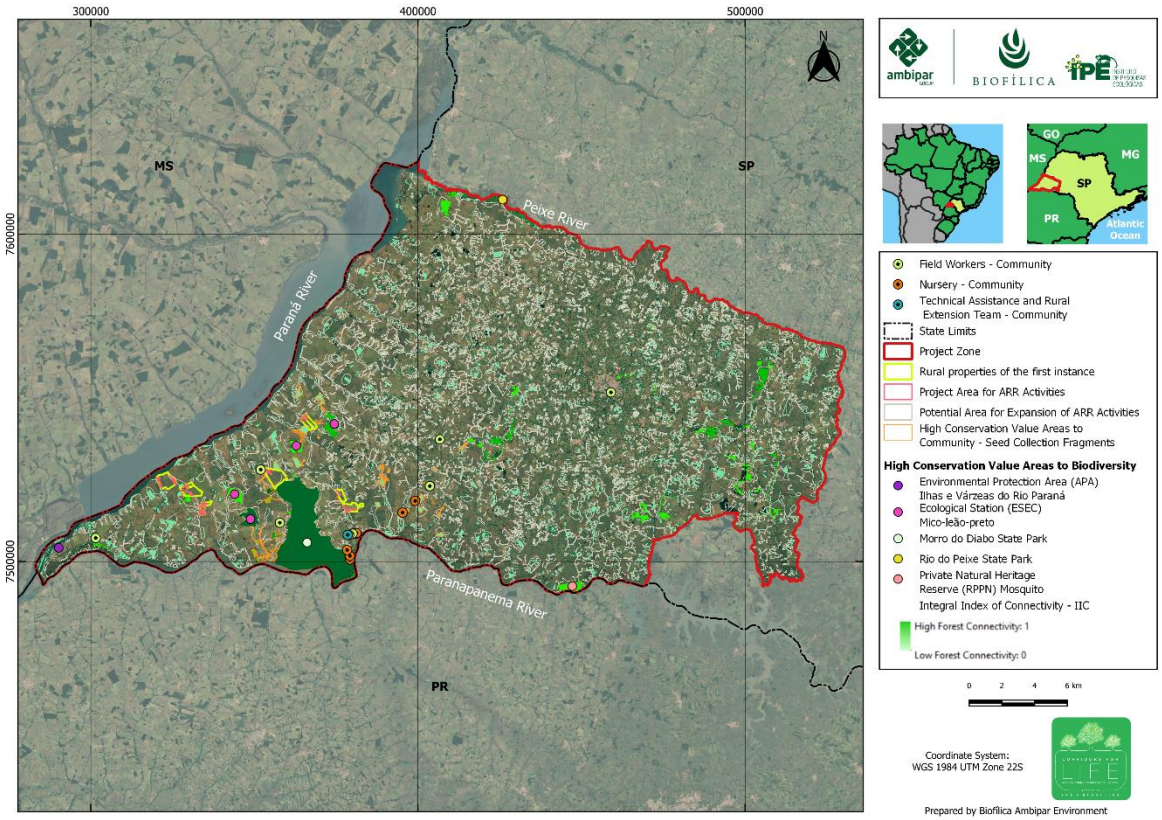

Figure 27 - Project Zone Map - Corridors for life ARR Grouped Project

In addition to the Project Zone Map, areas of high conservation value (biodiversity and community) are also mapped and presented in sections 4.1.3 (High Conservation Values for communities) and 5.1.2 (High Conservation Values for biodiversity). As specified in section 4.3 Other Stakeholder Impacts, negative impacts on other project stakeholders are not predicted or are unlikely. In addition, as specified in section 5.3, areas of biodiversity impacts outside the project zone are not predicted, as no potential negative effects outside the project zone are anticipated from the activities planned by the Corridors for Life ARR Grouped Project. Similarly, off-site climate impacts are not anticipated.

2.1.8. Stakeholder Identification (G1.5)

The identification of the stakeholders of Corridors for Life ARR Grouped Project has been occurring for the last 30 years. During these years, IPÊ has been active in several integrated initiatives in the Pontal do Paranapanema region, from the conservation of endangered fauna species to the restoration of degraded landscapes in private properties in the Atlantic Forest (Chazdon et al., 2020). Since 1994, the organization has developed communication, mobilization, and community involvement actions with different groups of local actors, as well as directly involved in agendas of environmental conservation and restoration, environmental and scientific education and regional socioeconomic development. Within these actions, a relationship network was built over the years through individual interactions among certain categories of actors and interviews, which created bridges of dialogue and influence with municipal, state and federal governmental institutions in Pontal do Paranapanema and identified new

stakeholder individuals and groups to be included into the project. This method of stakeholder identification and involvement is called “The Snowball Method”, as described by Reed et al. (2009).

In this sense, the Corridors for Life ARR Grouped Project, in the process of identifying and characterizing the communities and other stakeholders in the Project Zone, took into account historical events carried out by IPÊ, which had the active participation of local social actors in the involvement on issues environmental, social and economic aspects of the territory. For example, in 2002, the workshop “Econegociação: Um Pontal Bom para Todos” aimed at structuring basic conditions for the development of the Pontal do Paranapanema region as a sustainable socio-environmental model. In 2019, the "Oficina de definição de possíveis cenários de conectividade entre Unidades de Conservação e demais áreas protegidas no Oeste Paulista" sought community integration in the consolidation of actions for regional development. On both occasions, different social segments (rural producers, settlers, civil servants, researchers) from the region participated in critical reflection on current conditions and future actions for the territory in which they are inserted. Over the years, the cooperation and engagement of these actors were promoted by IPÊ's credibility in the Project Zone and strengthened by the “snowball” effect, that is, by the mobilization and maintenance of connections. It is worth mentioning that this process takes place until the present moment, as observed in the ECOnsulta, detailed in Topic 2.3.7.

These historic events of collective involvement for the planning and creation of participatory strategies for environmental preservation and restoration in Pontal do Paranapanema and developed by IPÊ in the region considered the social groups present and active in the socio-environmental agenda. Therefore, attendance lists of the communities and other stakeholders in these episodes served as the basis for the validation exercise by the proponents of the Corridors for Life ARR Grouped Project in the listing, identification and characterization of local actors in the Zone of the Project for the design and development of the carbon project.

With all this relationship network, the project proponents held two meetings in the city of Piracicaba - SP (July 26 and August 02, 2022) to define which stakeholders are key to the Corridors for Life ARR Grouped project and what are their Rights, Interests and Relevance of participation in the project, as shown in Table 5 of section 2.1.9. After this definition round, a validation meeting was held at IPÊ's office in Teodoro Sampaio – SP with the technical assistance team.

2.1.9. Stakeholder Descriptions (G1.6, G1.13)

As described in topic 2.1.6, the Project Zone presents several social groups with complex historical interactions. The communities benefited by the project are essentially composed of forest seedling producers, service providers related to the planting and maintenance of restorations and the Technical Assistance and Rural Extension team linked to IPÊ. These communities are, in their majority, rural settlers and small family producers that were established in the colonization and agrarian reform process developed by the Brazilian government mainly in the early 1980s. Historically, ITESP and IPÊ have fostered the inclusion and participation of these communities in the Project Zone, in order to promote the socio-economic development of these locations in environmental services related to the restoration chain.

The communities identified in the Corridors for Life ARR Grouped Project are:

Forest Nurseries: nurseries owned and managed by rural settlers and small local producers, who were trained and stimulated by IPÊ in seed collection and production of forest seedlings as an alternative income and to supply the demand for seedlings for the implementation of restoration activities of the Project and other clients in the Project Zone. Currently, nine autonomous nurseries supply seedlings to the project, four of them run by local rural settlers and five depend on restoration initiatives for income generation in the Project Zone.

Technical Assistance and Rural Extension Team: a team of extensionists and forest restoration specialists made up of local inhabitants and rural settlers that work directly with IPÊ, coordinating and monitoring the project activities, as well as communicating and disseminating information about the project activities to other interested parties.

Service Providers: companies founded by rural settlers and local entrepreneurs that, with the technical support and training provided by IPÊ over the years, develop and benefit from restoration implementation and maintenance activities by generating income and employment.

Besides the communities, other stakeholders were identified, such as:

Rural Landowners: landowners who received or descend from farmers who obtained government land in the past, or who acquired land in the Project Zone. In general, they are large private landowners (>300 ha) whose main activities are cattle ranching, leasing, and planting sugarcane, soybean, and peanut crops. Although their farming activities and teams are in the Project Zone, most does not reside in this coverage area.

Institutions of ATER and Land and Environmental Regularization: Public and State Institutions responsible for Technical Assistance and Rural Extension, infrastructure management and the development of rural properties and settlement areas. They also carry out the regularization of rural and urban properties.

Private Sector: companies from the hydroelectric, sugar and ethanol, and agribusiness sectors installed in the region.

NGOs and Other Social Movements: NGOs are institutions that look after the environment, socio-cultural resources, biodiversity conservation, and natural resources. The Social Movements are characterized as movements that fight for land and social inclusion.

Public Bodies: responsible for the planning, implementation, and inspection of social, environmental, economic actions, and projects.

Research and Extension Institutions: several Brazilian teaching and research institutions, such as the Escola Superior de Conservação Ambiental e Sustentabilidade [School for Environmental Conservation and Sustainability] (ESCAS), the University of São Paulo (USP), and the Fundação Getúlio Vargas [Getúlio Vargas Foundation] (FGV), which collaborate in monitoring the project's activities and research for the development of scientific knowledge.

It is worth pointing out that all interested parties were invited to the discussions of the Corridors for Life ARR Grouped Project, with the purpose of articulation and communication between the proponents and the social actors involved in the Project.

Table 5 - Description of the actors involved in the Corridors for Life ARR Grouped Project

Group of actors involved in the Project	Rights regarding the Project	Interests in their participation in the Project	Relevance of participation in the Project
Rural Landowners	They have ownership and operation rights for the area and the right to decide the restoration location within the property concerning the Legal Reserve.	Regularize the rural property through restoration of APPs and RLs, increase the property value as a result.	High - Provide areas eligible for restoration and, therefore, job and income opportunities for the communities.

Group of actors involved in the Project	Rights regarding the Project	Interests in their participation in the Project	Relevance of participation in the Project
ATER Institutions and Land and Environmental Regularization	Coordinate and act with rural landowners and project proponents for environmental and land title regularization of rural properties.	Contribute to meeting the objectives of the environmental agendas and commitments, strengthening the legal security and productive chains.	High - These are the actors officially responsible for enabling and approving requests for environmental and land title regularization.
Private Sector: Sugar and Alcohol Plants and Hydroelectric Power Plants	If owner of the land, They have ownership and operation rights for the area and the right to decide the restoration location within the property concerning the Legal Reserve.	Environmentally adequate rural properties and promote the maintenance of natural resources.	Medium - Facilitate the prospecting of areas by influencing rural landowners in the environmental regularization of their properties and IDP (Research, Development and Innovation) financiers.
NGOs and Other Social Movements	Possible future service providers and seedling producers	Contribute to meeting the objectives of the environmental agendas, development of public policies, expansion of activities and improvement of local governance, production and dissemination of knowledge. Participate, represent and articulate policies to enhance the good standing of rural settlements and family agriculture as a whole.	Medium to High - Influence the development of public policies and support to structure the restoration chain.
Public Agencies	Coordinate with other actors to improve the implementation and permeability of public policies, support complementary	Bring the government closer to the community demands and strengthen governmental relations, which	Medium to High - These are the actors officially responsible for developing and implementing socio-environmental and

Group of actors involved in the Project	Rights regarding the Project	Interests in their participation in the Project	Relevance of participation in the Project
	actions to implement the Project.	currently present themselves as fragile. Contribute to meeting the objectives of the environmental agendas, promoting job generation, expanding the action and improving local governance, producing and disseminating knowledge, and mitigating environmental risks.	economic public policies.
Research and Extension Institutions	Develop research and extension actions related to the scope of the project.	Develop research to contribute to professional training, scientific advancement, biodiversity conservation and socioeconomic development.	Medium - Contribute to the monitor, generate scientific information for the project and share the knowledge produced.
Technical Assistance and Rural Extension Team	Beneficiaries of the project activities.	Coordinate the project activities, generating social, economic and environmental benefits to achieve the project benefits. Generation of employment and income.	High - Enable the implementation of the project activities through operational capability building, interlocution and engagement between stakeholders and project proponents.
Forest Nurseries	Beneficiaries of the project activities.	Technical capacity building and socio-economic benefits (employment and income generation) through seedling production	High - Responsible for producing native seedlings supplied for restoration in a viable and scalable way
Service Providers	Beneficiaries of the project activities.	Technical training and socio-	High - Responsible for implementing and

Group of actors involved in the Project	Rights regarding the Project	Interests in their participation in the Project	Relevance of participation in the Project
		economic benefits (generation of employment and income) related to the implementation and maintenance of restoration	maintaining restoration in a viable and scalable way

New instances of the nested project are unlikely to incorporate new stakeholder groups, as the stakeholder categories identified are broad and encompass institutions and groups that operate throughout the project zone. Therefore, it is more likely that new members within stakeholder groups (e.g., more nurseries, landowners, and research institutions) will join the project, rather than new categories of stakeholders.

2.1.10. Sectoral Scope and Project Type

The Project is grouped under Sector Scope 14, Agriculture, Forestry and Other Land Uses (AFOLU), and under the category of Forestation, Restoration and Revegetation (ARR) Project, in which activities are carried out for planting seedlings of forest species and conducting human-assisted natural regeneration.

2.1.11. Project Activities and Theory of Change (G1.8)

The Corridors for Life ARR Grouped Project seeks to promote joint actions in the Climate, Community and Biodiversity scopes; aiming to generate net benefits for all three purposes. This set of interconnected strategies will enable social development and biodiversity conservation, seeking to ensure appropriate funding for the fulfillment and achievement of the objectives proposed in this PDD, as well as enabling the maintenance of the carbon project throughout its life cycle. Therefore, the activities outlined in the project primarily seeks to planting seedlings and providing regeneration; training local communities regarding the reforestation chain; environmental awareness; acquiring native forest seedlings; contracting forest recovery and maintenance services from local communities; research, development and innovation of project activities; research, and management of endangered fauna species. Such activities were created and defined after a thorough evaluation of the knowledge accumulated for the Project Zone by its proponents, valuing local understandings.

Reforestation through seedling planting and facilitation of natural regeneration:

Considering that rural properties in the Project Zone do not fully comply with the current legislation, the forest restoration initiative will implement legal adjustment measures at rural properties in the Permanent Preservation Areas and Legal Reserves regarding the Native Vegetation Protection Law (Law No. 12.651/2012), comprising the consolidation of reforestation chain in the Project Zone, removal of GHGs from atmosphere by fostering the growth of trees, to increase native vegetation coverage, increase of landscape connectivity and conservation of in situ species of fauna and flora.
For this, will be applied in the field, according to the particular characteristic of each site to be recovered, forest restoration techniques widely disseminated and conceptualized in the industry. The restoration technique to be employed, whether by planting seedlings of native tree species or by combining active restoration with the facilitation of natural regeneration (details of the methods explained in Table 6), will depend on the diagnosis and resilience of the area to be restored. This strategy will ensure more

effective actions, ensuring that these areas become self-sustaining in the long term and favoring the structural and ecological rehabilitation of the landscape. In association, management and maintenance practices will also be carried out in these areas, such as the control of competing exotic grasses and the combat against leaf-cutting ants.

It is worth mentioning that, eventually, according to the demand and interest of the rural owner, exotic species adapted and non-invasive to the Project Zone may be implemented in the Project Area in order to promote climatic and environmental benefits to rural properties and the Project. The carbon stock of these species must not exceed 25% of the project's carbon stock.

Table 6 - Restoration methods implemented in the field according to the previous diagnosis of the area, based on the local resilience capacity.

Restoration Diagnosis	Methodology Applied
Potential for null or very limited natural regeneration. Areas normally occupied by mechanized agriculture or pastures dominated by exotic grasses, with few regenerating seedlings and / or isolated trees.	**ACTIVE Restoration:** Planting in a total area of 2,000 seedlings/ha (spacing 2.0 x 2.5 m) using at least 100 native forest species divided into filling[16] lines (approximately 40 species) and diversity[17] lines (at least 60 species). In addition, area isolation, firebreaks, control of competing exotic grass and combat against leaf-cutting ants are carried out.
Potential for intermediate natural regeneration. Abandoned pastures and or fields normally with small "patches" of regenerating seedlings and or forests with isolated native trees.	**MIXED Restoration:** Encouraging the regeneration of approximately 1,200 individuals of native trees and shrubs per hectare through manual or chemical control of invasive exotic grasses and active restoration of patches not covered by spontaneously regenerating seedlings or isolated native trees. Whenever necessary to fill the gaps in restoration and ensure effectiveness of the actions employed and sustainability to the areas, these fast-growing species may be intercropped with green manure, as pigeon pea (*Cajanus cajan*). In addition, the area is isolated and firebreaks and leaf-cutting ant combat is carried out.
Fair potential for autogenic restoration: spontaneously regenerating seedlings or isolated native trees covering most of the site.	**PASSIVE Restoration:** Encouraging the regeneration of approximately 500 individuals of native trees and shrubs per hectare. Isolation of the site from disturbances mediated by humans (e.g. direct action of animals) and, when necessary, encouraging the regeneration of native trees and shrubs individuals by manual or chemical control of invasive exotic grasses. In addition, the area is isolated and firebreaks and leaf-cutting ant combat is carried out.

[16] Fast-growing species with the ability to form a dense canopy and shade the soil.
[17] Slow growing species, fundamental for the temporal perpetuation of the area in the restoration process, because they gradually replace the species of the filler group when these enter senescence.

Figure 28 - Aerial photo of the Legal Reserve of a rural property from the first instance of the Corridors for Life ARR Grouped Project with the predominance of moderate resilience (abandoned dirty pasture), being restored by the mixed method.

Figure 29 - Soil preparation and seedling planting operations in the development of the forest restoration activity of the Corridors for Life ARR Grouped Project in the field.

Whenever gullies occur in result of the baseline scenario practices in the Legal Reserve or Permanent Protection Areas that the project aims to restore, the project will take the following steps to facilitate natural regeneration and achieve forest restoration.

1. Assess the site: start by assessing the gully and its surrounding environment. Understand the existing vegetation, soil conditions, water flow patterns, and any potential sources of erosion or degradation. This assessment will help the project team to develop an appropriate plan for restoration.

2. Control erosion: implement erosion control measures to prevent further degradation and soil loss. This may include techniques such as contour plowing, terracing, mulching, or the construction of check dams to slow down water flow and promote sediment deposition.

3. Restore vegetation around the gullies: enhance the natural regeneration process in and around the gullies by reintroducing the appropriate native plant species. Focus on selecting species that are adapted to the local gullies conditions and promote biodiversity. Plant trees, shrubs, and ground cover plants to stabilize the soil, improve water retention, and provide habitat for other organisms, as demonstrated by Mendes et al. 2021.

4. Manage invasive species: control invasive plant species that may compete with native vegetation and impede natural regeneration. Regularly monitor the site and remove any invasive plants manually or through appropriate control methods to allow native species to flourish.

5. Provide habitat elements: enhance the habitat by incorporating elements that attract and support wildlife. Structures that provide nesting sites and encourage the presence of pollinators. This will aid in the dispersal of seeds and promote biodiversity.

6. Maintain: address any maintenance needs, such as controlling erosion or managing invasive species, to ensure the long-term success of the restoration efforts.

In general, the forest restoration activities will be implemented in the field according to the schedule pre-established by the proponents of the carbon project, which considered the availability of investment, inputs and human resources in its determination (in addition to the capacity to train labor). This schedule, which is already under full execution, is presented in Table 7 below:

Table 7 - Planting plan for the Corridors for Life ARR Grouped Project.

Year	Annual Planting (hectares)	Cumulative Planting (hectares)
Nov/21 - Nov/22	500	500
Nov/22 - Nov/23	1,250	1,750
Nov/23 - Nov/24	2,000	3,750
Nov/24 - Nov/25	2,750	6,500
Nov/25 - Nov/26	3,500	10,000
Nov/26 - Nov/27	3,500	13,500
Nov/27 - Nov/28	4,000	17,500
Nov/28 - Nov/29	4,000	21,500
Nov/29 - Nov/30	4,000	25,500
Nov/30 - Nov/31	4,500	30,000
Nov/31 - Nov/32	4,500	34,500
Nov/32 - Nov/33	4,500	39,000
Nov/33 - Nov/34	4,500	43,500
Nov/34 - Nov/35	4,500	48,000
Nov/35 - Nov/36	4,500	52,500
Nov/36 - Nov/37	4,500	57,000
Nov/37 - Nov/38	4,500	61,500
Nov/38 - Nov/39	4,500	66,000
Nov/39 - Nov/40	4,500	70,500

Nov/40 - Nov/41	4,500	**75,000**

Training of local communities in the reforestation chain and environmental awareness:

It will be conducted through lectures, workshops and training, will focus on local communities and other stakeholders and will be done in partnership with public and private organizations. This training will cover various topics related to conservation and ecological restoration, such as forest restoration techniques, best practices and innovation in restoration and the importance of environmental recovery and conservation of standing forest to maintain natural resources: the articulation with local communities and the identification and improvement of the skills of the participants in the appropriate and qualified development of the initiatives of implementation and maintenance of restorations; the professional qualification for access to job opportunities; the contribution in improving the perception of the population of the Project Zone regarding forests and their resources; the stimulation of critical sense for a more sustainable society; and strengthening the promotion of equity for young people and women.

In parallel, this initiative will also seek to strengthen the governance and engagement of all stakeholders so that the chances of success of restoration activities are enhanced and the risk of non-permanence of ARR activities developed in the Project Area is reduced. “Friday with Science", an event idealized and consecrated by IPÊ, will be one of the channels for theoretical-practical interaction among all stakeholders. The collective commitment, besides helping to achieve the important objective of removing GHGs from the atmosphere, will also help in the conservation of biodiversity, mainly regarding the preservation of the native vegetation cover and the conservation of fauna and flora species, especially those threatened with extinction.

Acquisition of native forest seedlings and contracting forest restoration and maintenance services from local communities:

From the growing demand for the implementation of restorations and facilitation of areas of natural regeneration, the project foresees the increasing need for inputs and skilled labor, especially seedlings and service providers, for the implementation and proper maintenance of areas under ecological restoration process. Thus, in order to properly meet this imminent expansion, the project will value and enhance the performance and knowledge of local communities, expanding and stimulating the social and economic development of the Project Zone.

In this sense, associated with the qualification provided by the initiative of training the community and other stakeholders, it is expected the expansion of community nurseries, the consolidation of technical assistance and rural extension organizations and the emergence of new local companies for the implementation and maintenance of forest areas. Thus, it is expected the strengthening of the local economy by promoting new jobs in the labor market, the equal access to opportunities by young people and women, the increase in income of the local population, the incentive to entrepreneurship, and the improvement in the quality of life of the population in the Project Zone.

In addition to socioeconomic development, this strategy will also contribute to a better perception of local communities and other stakeholders about the relevance of forest restoration in generating opportunities, fostering direct and indirect social benefits and helping to build a sustainable society.

Research, development, and innovation of project activities:

Considering the relevance of this carbon project for the region and the opportunity to develop research related to the various themes that permeate the project activities (such as increasing forest cover, maintenance of natural resources, conservation of the biological diversity of fauna and flora species, mitigation of climate change, environmental education and socioeconomic development), partnerships with universities and research centers are expected (and will be encouraged) for the generation of scientific articles, studies and technical manuals, which will be published and made available to local

communities, other stakeholders and civil society through the project's website. These studies will serve as inputs to the monitoring of the project, since they will collect and provide data, information and results associated with the various activities implemented by the project.

In addition to the generation of an accessible and communicable database that covers the various themes of the project, this activity also provides for the training of human resources for the development of research and innovation, including the improvement of seedling production techniques and other practices associated with restoration for continuous improvement of project activities, as well as contributing to the training of undergraduate and graduate students who are involved in these researches, as well as those who will have access to the published studies.

Moreover, in addition to the achievement of the objectives desired and mentioned above, this database can also support the development of public policies aimed at the expansion of restoration initiatives and the continuous improvement of these actions.

Research and management of endangered wildlife species:

As shown in section 5 (Biodiversity), in the Project Zone there is a wide diversity of fauna and flora species that use the forest fragments and areas under restoration. Thus, with the increase of native vegetation cover and the increase of forest connectivity, it is expected an improvement in the metapopulations of fauna and flora species present in situ, including those endemic, vulnerable and threatened with extinction. Therefore, research that includes partnership with academia will promote the construction of a robust database on the ecology and behavior of fauna and flora species in the Project Zone, through field expeditions to collect useful data that will foster understanding of the population viability of these species.

With regard to the biological diversity of fauna and flora species threatened with extinction, the results of these surveys and research will enable strategic decision-making for the integrated management of metapopulations, fostering the conservation of endangered species, the long-term population viability of biological diversity, and the reduction of threat levels, considering the IUCN Red List.

Table 8 – Activities, results, and relevance of activities planned by the Corridors for Life ARR Grouped Project for Climate, Community, and Biodiversity.

Theme			Description of Activity	Expected Outcomes for Climate, Community and Biodiversity			Relevance to Project Objectives
Climate	Community	Biodiversity		Short Term	Medium Term	Long Term	
X	X	X	Reforestation through seedling planting and facilitation of natural regeneration	- Increase in native forest cover and in situ conservation of dozens of native species, including vulnerable species - Generation of reforestation	- Creating habitat for fauna - Contribute to the protection of water resources from the impacts of surrounding human activities by reforesting riparian areas - Providing	- Removal of GHGs from the atmosphere - Increase the connectivity between forest remnants, favoring gene flow and consequently the conservation	<u>Climate</u> - Removal of GHGs from the atmosphere by growth of trees from reforestation activities. <u>Community</u> - Encouragement of the

				services and consequently new jobs	native tree seeds for community nurseries. - Contributing to soil protection through forest cover	of flora and fauna in the landscape - Environmental and productive regularization of rural properties	reforestation chain. - Source of seeds for community nurseries. - Environmental compliance of rural properties according to the law 12.651/2012 <u>Biodiversity</u> - Increase of native forest cover and habitat for fauna - Increased connectivity between forest remnants - In situ conservation of native tree species - Contribution to the conservation of endangered species
X	**X**	**X**	Capacity building of local communities in the reforestation chain and environmental awareness	- Fostering, expanding, and sharing knowledge about reforestation activities - Disseminating the importance of reforestation and environmental conservation - Building capacity in best practices and innovation in reforestation	- Maintaining and increasing the skills of local communities in developing activities in the chain of production and maintenance of reforestation - Promoting the gain of scale of reforestation activities	- To contribute to improve the awareness by the population in the project area about the importance of forests and the opportunities generated by reforestation activities - To stimulate a critical sense for a sustainable society	<u>Climate</u> - Capacity building and training increase the chances of success of reforestation activities and consequent GHG removal - Strengthening engagement with stakeholders and reducing the risk of non-permanence in project areas <u>Biodiversity</u> - Training for seed collection and production of various native tree species, favoring the

							species richness of the plantations. <u>Community</u> - Support and encouragement for entrepreneurship in the reforestation chain - Qualification for access to professional opportunities - Actions to strengthen the promotion of equity for young people and women - Communication of project results and stakeholder engagement
	X		Acquisition of native forest seedlings and contracting forest restoration and maintenance services from local communities	- Empowerment of local communities through the expansion of existing community nurseries, technical assistance, and rural extension companies, and forest planting and maintenance companies - Generation of employment and income for local communities through involvement in reforestation activities	- Incentive for the establishment of new enterprises and jobs	- Stimulating the reforestation market in the region and empowering community initiatives, making them independent from the project - Contribute to improving the perception of the population in the project area about the importance of forests and the opportunities generated by reforestation activities.	Community - Income and employment generation for local communities. - Empowerment of local communities - Promotion of gender equity and opportunities for youth - Strengthening the regional economy

X	**X**	**X**	Research, development, and innovation of project activities	- Training of human resources, and structuring of funds for research, development and innovation - Development and improvement of seedling production and reforestation techniques	- Enhancement of project activities and monitoring protocols - Adaptive management recommendations for the project - Consolidation of database and communication of results	- Assurance to meet the project goals - Guidelines for public policies	<u>Climate, Community, and Biodiversity</u> - Continuous improvement and adaptive management of the project - Contribution to the conservation of endangered species
		X	Research and management of endangered wildlife species	- Information on the ecology and behavior of the species	- Understanding the population viability of species	- Integrated metapopulation management	<u>Biodiversity</u> - Contribution to the conservation of endangered species - Long-term population viability of endangered species - Reduction of threat levels according to IUCN

2.1.12. Sustainable Development

Goal 1. End poverty in all its forms, everywhere		
1.4	By 2030, ensure that all men and women, particularly the poor and vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technologies and financial services, including microfinance	
Project's planned activities associated with the "Purchase of native forest seedlings and contracting of local communities forest restoration and maintenance services" and "'Capacity building of local communities in the restoration chain and environmental awareness" will assist local communities in accessing professional opportunities, improving income through involvement in restoration activities, promoting equity of youth and women for entry into the labor market, and strengthening the regional economy. These socio-economic benefits are in line with the project's goals, which are to enable large-scale restoration initiatives by prioritizing the acquisition of local resources and labor, stimulating the establishment of new enterprises and jobs to ensure the benefits to the communities targeted by the project. Reinforcing the importance of the initiatives and the long-term commitment to the desired benefits, the Project, in its Monitoring Plan, will monitor the following parameters (table 25): number of events held, number of participants (women and young people), number of trained people who		

are employed in extension and rural assistance, number of people employed in companies providing catering services (women and young people), number of people employed in forest nurseries (women and young people). The monitoring and reporting of the sustainable development objectives will follow the same provisions established for the community indicators, as established in section 4.4.		
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		
4.4	By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, proper work and entrepreneurship	
4.7	By 2030, ensure that all learners acquire the knowledge and skills necessary to promote sustainable development, including, but not limited to, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development	
Project promotes and encourages access to inclusive, equitable, and quality education by means of capacity-building focused on the environmental and socioeconomic areas, with a special focus on activities, good practices, and innovation in restoration; the importance of forest recovery and conservation of the standing forest; and entrepreneurship. For this, it relies on the support and collaboration of specialized partners, including those from ATER, to ensure the effectiveness of the proposed qualifications and the engagement of all stakeholders. These activities associated with education and training promoted by the ARR project will foster critical thinking for a sustainable society, qualification for access to professional opportunities, income and employment generation for local communities, empowerment of local communities, promotion of gender equity and opportunities for youth, and strengthening of the regional economy. In addition, the ARR Project will also encourage the scientific training of human resources for the development of research and innovation, leading to continuous improvement and adaptive management of the project, as well as the contribution of biological diversity in the Project Zone. Reinforcing the importance of the initiatives and the long-term commitment to the desired benefits, the Project, in its Monitoring Plan, will monitor the following parameters (table 25): number of events held, number of participants (women and young people), number of trained people who are employed in extension and rural assistance, number of people employed in companies providing catering services (women and young people), number of people employed in forest nurseries (women and young people). The monitoring and reporting of the sustainable development objectives will follow the same provisions established for the community indicators, as established in section 4.4.		
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and proper work for all		
8.3	Promote development-oriented policies that support productive activities, decent employment generation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro, small and medium-sized enterprises, including through access to financial services	

Certain project activities, in particular, "Acquisition of native forest seedlings and contracting forest restoration and maintenance services from local communities" combine the socio-economic demands of local communities with the opportunities unleashed by the implementation of the restoration project in the Project Zone. Growing need for resources and labor by the activities of planting seedlings of native species and facilitating areas of natural regeneration will trigger an incentive for the establishment of new enterprises and jobs through the expansion of community nurseries and the increase of forest planting and maintenance companies; improving income, inclusion and equity in the Project Zone. In parallel, the qualification provided by the activity "Capacity building of local communities in the restoration chain and environmental awareness" will also help the community members to access professional opportunities. Reinforcing the importance of the initiatives and the long-term commitment to the desired benefits, the Project, in its Monitoring Plan, will monitor the following parameters (table 25): number of events held, number of participants (women and young people number of trained people who are employed in extension and rural assistance, number of people employed in companies providing catering services (women and young people), number of people employed in forest nurseries (women and young people). The monitoring and reporting of the sustainable development objectives will follow the same provisions established for the community indicators, as established in section 4.4.		
Goal 12. Ensure sustainable production and consumption patterns		
12.2	By 2030, achieve sustainable management and efficient use of natural resources	
12.8	By 2030, ensure that people everywhere have relevant information and awareness for sustainable development and lifestyles in harmony with nature	
Project will raise environmental awareness among all stakeholders about sustainable development, the importance of restoration and conservation of standing forest, and the value of the rational use of natural resources. For this, it will foster, expand, and disseminate knowledge about the relevance of forests and the opportunities generated by restoration activities; stimulating a critical sense for a more sustainable society. Thus, the project will ensure the conservation of fauna and flora species, including those threatened with extinction; as well as the protection of soil and water resources. Reinforcing the importance of the initiatives and the long-term commitment to the desired benefits, the Project, in its Monitoring Plan, will monitor the following parameters (table 25 and table 36): number of events held, number of participants (women and youth), number of trained people who are employed in extension and rural assistance, number of species planted in restoration, number of seedlings of endangered species planted, restoration coverage, tree density in natural regeneration, species diversity in natural regeneration, relative increase in integral landscape connectivity index , number of faunal species (birds and medium and large mammals), number of endangered faunal species, number of scientific publications, number of wild species in HCVs, landscape connectivity to wildlife, habitat conservation. The monitoring and reporting of the sustainable development objectives will follow the same provisions established for the community (section 4.4) and biodiversity (section 5.4) indicators.		
Goal 13. Take urgent action to combat climate change and its impacts		
13.2	Integrate climate change measures into national policies, strategies and planning	
13.3	Improve education, raise awareness and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	

13.b	Promote mechanisms for building capacity for climate change planning and effective management in least developed countries, including a focus on women, youth, local and marginalized communities	
In general, all activities foreseen by the project seek to foster initiatives to mitigate climate change and its impacts and, consequently, reduce environmental degradation in the Project Area. In this sense, besides the "Restoration through seedling planting and facilitation of natural regeneration" that will promote the increase of the native vegetation cover and, consequently, the removal of GHGs from the atmosphere by the growth of trees; it will also promote capacity building and training for the local communities and other stakeholders so that the chances of success of the restoration planting and facilitation of areas in natural regeneration are enhanced. In addition, the project proponents will strive to encourage and strengthen participatory and engaged stakeholder governance of the project strategies, decreasing the risk of non-permanence of the project's restoration areas. Reinforcing the importance of the initiatives and the long-term commitment to the desired benefits, the Project, in its Monitoring Plan, will monitor the following parameters (table 25 and table 36): number of events held, number of participants (women and youth), number of trained people who are employed in extension and rural assistance, number of species planted in restoration, number of seedlings of endangered species planted, restoration coverage, tree density in natural regeneration, species diversity in natural regeneration, relative increase in integral landscape connectivity index , number of faunal species (birds and medium and large mammals), number of endangered faunal species, number of scientific publications, number of wild species in HCVs, landscape connectivity to wildlife, habitat conservation. The monitoring and reporting of the sustainable development objectives will follow the same provisions established for the community (section 4.4) and biodiversity (section 5.4) indicators.		
Goal 15. Protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss		
15.1	By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in accordance with obligations under international agreements	
15.2	By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests, and substantially increase afforestation and reforestation globally	
15.3	By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought, and floods, and strive to achieve a land degradation neutral world	
15.5	Take urgent and significant action to reduce the degradation of natural habitats, halt biodiversity loss, and, by 2020, protect and prevent the extinction of endangered species	
15.8	By 2020, implement measures to prevent the introduction and significantly reduce the impact of invasive alien species in terrestrial and aquatic ecosystems, and control or eradicate priority species	
15.a	Mobilize and significantly increase, from all sources, financial resources for the conservation and sustainable use of biodiversity and ecosystems	

Taking into account the relevance of the Project Zone for local biodiversity, the Project expends efforts to increase forest cover by incorporating regional native species, eventually exotic species adapted and non-invasive to the Project Zone, in restoration areas; promoting connectivity between forest fragments, both recovering and remaining; providing habitat for fauna and flora species and favoring gene flow. This initiative, besides stimulating the conservation of species in situ, especially those threatened by extinction, will also promote the protection of soil and water resources. In parallel, the project foresees the engagement, involvement, and sensitization of all stakeholders regarding the importance of biological biodiversity in the provision of ecosystem services, the maintenance of native vegetation cover, the control of environmental degradation, and the limitation of the excessive use of natural resources through environmental education initiatives. In association, the encouragement of "Research and management of endangered wildlife species" through periodic monitoring will also consolidate a robust database that will assist in the conservation of endangered species and in strategic decision making to ensure positive impacts to biodiversity in the Project Area. Reinforcing the importance of the initiatives and the long-term commitment to the desired benefits, the Project, in its Monitoring Plan, will monitor the following parameters (table 36): number of species planted in restoration, number of seedlings of endangered species planted, restoration coverage, density of trees in natural regeneration, diversity of species in natural regeneration, increase relative in the integral landscape connectivity index, number of fauna species (birds and medium and large mammals), number of endangered fauna species, number of scientific publications, number of wild species in HCVs, connectivity from landscape to wildlife, habitat conservation. The monitoring and reporting of the sustainable development objectives will follow the same provisions established for the biodiversity indicators, as established in section 5.4.	

2.1.13. Implementation Schedule (G1.9)

The summarized schedule of these activities can be found in the table below (Table 9).

Table 9 - Detailed schedule for the development and implementation of the main activities related to the Corridors for Life ARR Grouped Project.

Date	Milestone(s) in the project's development and implementation
1 to 1.5 years prior to validation	Formalization of the Partnership Contract
	Construction of the Dream Map
	Preparation of the economic model
	Operational Planning
	Formalization of Agreements with Owners in priority areas
	Beginning of Planting in priority areas
	Definition of baseline strata
	Determination of baseline and potential for credit generation
	Survey of studies, records and diagnostics
	Definition of monitoring procedures and indicators

Date	Milestone(s) in the project's development and implementation
In the validation year	Project consolidation, management plan and preparation of the project description document
	Public consultation with the Communities and other stakeholders
	Feedback with communities and other stakeholders
	Selection and hiring of validator/verifier and credit register platform
	Validation Audit
	Registration and Certification
Years 3 to 30	Development and monitoring of environmental and social activities
	Credit verification (Selecting and hiring of verifying body; Production of the Monitoring Report for the Verification process; Field audit follow-up; Credit register).
	Conduction of credit marketing processes

2.1.14. Project Start Date

The start date for the Corridors for Life ARR Grouped Project has been set for November 18, 2021, as this is the day when planting activities for the Project began.

2.1.15. Benefits Assessment and Crediting Period (G1.9)

The start date of the Corridors for Life ARR Grouped Project crediting period is November 18, 2021, and the end date will be November 17, 2071, completing 50 years. There will be ongoing monitoring of climate, community, and biodiversity benefits and verification with the CCB preferably every 3 years throughout the duration of the Project.

2.1.16. Differences in Assessment/Project Crediting Periods (G1.9)

There will be no difference between the evaluation period and the crediting period for the Corridors for Life ARR Grouped Project.

2.1.17. Estimated GHG Emission Reductions or Removals

Table 10 - Estimate of Reduction or Removal of GHG Emissions from the Corridors for Life ARR Grouped Project.

Year	Estimated net GHG emission reductions or removals (tCO_2e)
Nov/2021-Nov/2022	-10,077
Nov/2022-Nov/2023	-18,854
Nov/2023-Nov/2024	-12,933
Nov/2024-Nov/2025	9,964
Nov/2025-Nov/2026	49,357

Year	Estimated net GHG emission reductions or removals (tCO_2e)
Nov/2026-Nov/2027	119,880
Nov/2027-Nov/2028	186,357
Nov/2028-Nov/2029	267,009
Nov/2029-Nov/2030	350,615
Nov/2030-Nov/2031	421,585
Nov/2031-Nov/2032	506,411
Nov/2032-Nov/2033	593,870
Nov/2033-Nov/2034	678,451
Nov/2034-Nov/2035	760,153
Nov/2035-Nov/2036	838,977
Nov/2036-Nov/2037	914,922
Nov/2037-Nov/2038	987,988
Nov/2038-Nov/2039	1,058,175
Nov/2039-Nov/2040	1,125,484
Nov/2040-Nov/2041	1,189,914
Nov/2041-Nov/2042	1,341,610
Nov/2042-Nov/2043	1,341,876
Nov/2043-Nov/2044	1,291,710
Nov/2044-Nov/2045	1,240,723
Nov/2045-Nov/2046	1,188,915
Nov/2046-Nov/2047	1,137,107
Nov/2047-Nov/2048	1,084,752
Nov/2048-Nov/2049	1,032,397
Nov/2049-Nov/2050	980,042
Nov/2050-Nov/2051	927,140
Nov/2051-Nov/2052	874,237
Nov/2052-Nov/2053	819,628
Nov/2053-Nov/2054	762,777
Nov/2054-Nov/2055	704,165
Nov/2055-Nov/2056	644,271
Nov/2056-Nov/2057	583,576
Nov/2057-Nov/2058	525,119
Nov/2058-Nov/2059	467,194
Nov/2059-Nov/2060	411,828
Nov/2060-Nov/2061	359,020

Year	Estimated net GHG emission reductions or removals (tCO_2e)
Nov/2061-Nov/2062	311,989
Nov/2062-Nov/2063	267,836
Nov/2063-Nov/2064	226,562
Nov/2064-Nov/2065	188,166
Nov/2065-Nov/2066	152,649
Nov/2066-Nov/2067	120,011
Nov/2067-Nov/2068	90,251
Nov/2068-Nov/2069	63,371
Nov/2069-Nov/2070	39,368
Nov/2070-Nov/2071	18,245
Total estimated ERs	**29,213,780**
Total number of crediting years	**50**
Average annual ERs	**584,276**

2.1.18. Risks to the Project (G1.10)

Using the "AFOLU Non-Permanence Risk Tool v4.0" tool, the likely internal, external and natural risks to climate benefits were verified. The risks were reported in the Non-Permanence Risk Report of the Corridors for Life ARR Grouped Project to the auditors and are summarized in the table below (Table 11). The analysis of the Risk of Non-Permanence through this tool generated a buffer of 12%.

Table 11 - Final non-permanence risk score for the Corridors for Life ARR Grouped Project

Category	Score
Internal Risk (a)	0.00
External Risk (b)	10.00
Natural Risk (c)	1.50
Overall Score (a + b + c)	12

2.1.19. Benefit Permanence (G1.11)

All activities planned and proposed by the Corridors for Life ARR Grouped Project and their short, medium, and long-term positive impacts were designed in conjunction with local communities and other stakeholders and considered the prospect of becoming self-sustaining over time. The strategies associated with each activity for benefits to occur during the life cycle of the Corridors for Life ARR Grouped Project and beyond are:

Restoration through seedling planting and facilitation of natural regeneration: the project aims to increase native forest cover and connectivity between forest fragments through field implementation of widely accepted and widespread forest restoration techniques in environmental suitability programs, which have been successful in establishing native forests indefinitely in Brazil (Rodrigues et al., 2009). Eventually, according to the rural owner's demand and interest, exotic species adapted and non-invasive to the Project Zone may be implemented in the Project Area in order to promote climatic and environmental benefits to rural properties and the Project. It is worth pointing out that individuals of exotic species will be planted in the field in considerably smaller numbers than the native ones, according to the demand and interest of the rural owner; as detailed in 5.2.5 and 5.2.7 of this document. The use of exotic species in the reforestation project activity individuals of exotic species will be in specific cases (especially windbreaks and hedges in reforestation areas), and in small quantities. The Project does not foresee the extraction of exotic individuals for the economic gain of its products and by-products, only for the previously mentioned benefits. In parallel, by providing training for local communities and other stakeholders on the importance of restoration and preservation of standing forest, to demonstrate that in addition to the benefits for climate change mitigation and conservation of species of fauna and flora, forest restorations can also enable the generation of jobs and improved income. Finally, although not very effective in promoting restoration actions in the Project Zone, Brazilian legislation prohibits the deforestation of forests established in the project area (Permanent Preservation Areas and Legal Reserves).

Capacity building of local communities in the restoration chain and environmental awareness: the promotion, dissemination, and sharing of knowledge about restoration activities, and their directly associated opportunities, will help to spread understanding about the relevance of forest restoration and standing forest conservation to strengthen the local economy, generate employment, and improve the quality of life of local populations. The nurseries and service providers from the local communities engaged in the project are encouraged by the project activities to exchange information and techniques without the intervention of the project team, which already demonstrates that actions for building capability extend beyond the activities foreseen in the project. In association, environmental education will also contribute to a more sustainable society that helps in the conservation of the biological diversity of the regional fauna and flora. The "Friday with Science" event, idealized and consolidated by IPÊ, will remain beyond the project as a crucial instrument of theoretical and practical exchanges for sharing knowledge and experiences on the themes proposed in this PDD.

Acquisition of native forest seedlings and contracting forest restoration and maintenance services from local communities: due to the growing demand for environmental regularization through restoration of private rural properties, there will be the need to acquire a progressive number of seedlings, inputs, and labor for the development of forest restoration implementation and maintenance initiatives. The nurseries and service providers from the project communities are also trained to seek other markets for their activities, and some already provide services, to a lesser extent, in related activities for other customers. Therefore, the financial benefits to the communities will not be extinguished at the end of the project's term. In addition, this activity will also help in the empowerment and improvement of the lives of local communities by strengthening the local economy, qualifying and enhancing environmental awareness of the population about the importance of restoration and its opportunities.

Research, development and innovation of project activities: the Institute for Ecological Research (IPE) has a track record in developing studies in the Project Zone in conjunction with its extension and community articulation partners and will continue to act beyond the project period. Similarly, as mentioned above, the project communities will also be encouraged throughout the project to develop innovation and exchange of experiences spontaneously, maintaining the long-term benefits of the project. The "Friday with Science" event will also remain an important vehicle for communicating the

results obtained in the scientific work, studies and research to stakeholders in order to engage stakeholders and promote the benefits to the climate, communities and local biodiversity.

Research and management of endangered fauna species: In line with the activity mentioned above, the project will stimulate scientific research specifically focused on endangered fauna species in the Project Zone, considering the biological importance of this region for local biodiversity. Considering the unique characteristics of threatened and endemic species, and the complexity and dynamism of the landscape in the Project Zone, as well as the need to monitor the long-term results of project activities, the IPE and its partners will continue to conduct research in the Project Zone.

Thus, in the long term, the understanding derived from this database will assist in effective recommendations and initiatives for management of fauna populations, human resource training, conservation of endangered species, and their population viability.

2.1.20. Financial Sustainability (G1.12)

The Project proponents have a strong partnership signed in 2020 with the goal of scaling up restoration in the Project Zone through the commercialization of carbon credits. The Corridors for Life ARR Grouped Project is an initiative that should allow in the medium and long term the continuous investment of resources directed exclusively to restoration, the conservation and sustainable development of the region.

Considering the current assumptions of the carbon market and the potential for generating GHG Emissions Removals, the financial flow of the Corridors for Life ARR Grouped Project Information related to the financial analysis of the Project and the financial health statements of the partner institutions (project proponents) is considered as sensitive business information and will be shared with the audit team on a confidential basis.

2.1.21. Grouped Projects

1) Eligibility Criteria for Grouped Projects (G1.14)

New instances of the grouped project shall meet the following eligibility criteria within one of the designated geographic areas specified in the project description (Sections 2.1.5 and 2.1.7):

- Adopt and apply the project activities, technologies, and/or measures in the same way as specified in the project description documentation.
- New instances of the project will be reforested by planting seedlings or facilitating natural regeneration.
- Meet the applicability conditions established in the methodology.

New project instances will meet the criteria defined in Section 3.1.2. Applicability of Methodology. Additionally, new instances shall:

- Demonstrate that project activities are under the control of the project proponents;

- Be a Permanent Preservation Area (PPA) or Legal Reserve (LR), as defined by Brazilian federal Law no. 12.651/2012.

- Have proof of right of use, in relation to each instance of project activity, held by the project proponent as of the respective start date of each project activity instance.

- Not have been allocated to another carbon project.

- Be subject to the same community and biodiversity conditions in the without-project scenario as determined for the project.

New instances will be located in the Project Zone (i.e., Pontal do Paranapanema). The climate, community, and biodiversity scenarios described in Sections 4.1 and 5.1 extend across the Project Zone.

- They are subject to the same baseline scenario determined by the project description for the project activities and geographic region.

The stratification methods used in the project first instance can be replicated for future instances and encompass the possible strata in areas eligible for project activities in the Project Zone.

- Possess characteristics with regard to additionality that are consistent with the initial instances for the specified project activity and geographic area.

The barriers identified in Section 2.2. Without-project Land Use Scenario and Additionality pervades potential new instances throughout the Project Zone and are commonly observed in other APP and Legal Reserve areas in the Brazilian Atlantic Forest as well.

- They are subject to the same stakeholder engagement processes described in Section 2.3 and respect for rights to lands, territories and resources, including free, prior and informed consent described in Section 2.5.

In addition to ongoing dialog with stakeholders in the project zone, through the project's Communication Plan, new instances will undergo further consultation with directly involved stakeholders and signing of commitment agreements with landowners.

- Have similar monitoring elements.

All project instances will be monitored as described in Sections 5.4 and 5.5. throughout the project duration.

2) Scalability Limits for the Grouped Projects (G1.15)

The scalability of the Corridors for Life ARR Grouped Project is limited to APPs and RLs without forest on private rural properties that were identified by the Dream Map, located in the Pontal do Paranapanema region and within the Project Zone, and that meet the eligibility criteria described above. The owners of the farms that participate in the project sign a contract that obliges them to preserve the areas reforested by the project for 30 years. Associated with this is the fact that the project scalability will also be restricted essentially by financial resources. The strategy for gaining scale of the Corridors for Life ARR Grouped Project will thus be based on field prospecting of areas eligible for restoration within the scope of the Dream Map, and negotiations for enabling investments that foster the activities proposed by the project.

3) Risk Mitigation Approach for Grouped Projects (G1.15)

The risks associated with the non-continuity of benefits will be minimized by involving areas with owners who are committed to the project goals and meet the eligibility criteria. New instances will only be added to the project when financial and human resources are available for their restoration and maintenance within a schedule of activities. Finally, new instances will only be incorporated into the grouped project if they present a similar or lower risk than that listed in Section 2.1.18 Risks to the Project.

2.2. Without-project Land Use Scenario and Additionality

2.2.1. Land Use Scenarios without the Project (G2.1)

Described in Section 3.1.4 Baseline Scenario.

2.2.2. Most-Likely Scenario Justification (G2.1)

As shown in Figure 12 of this document, since the mid-1980s extensive livestock farming has been the predominant productive activity in the Project Zone, which is being gradually replaced by agricultural crops from the 21st century onwards. This dynamic of land use and occupation reflected in the stagnation of a low native forest cover in the region over the last 35 years, where the forest remnants are found mostly in Conservation Units (especially the Morro do Diabo State Park and the Mico-Leão-Preto Ecological Station) and in private rural properties isolated by the agricultural matrix. In this regard, the most likely without project land-use scenario in the Project Zone is the continuation of the pre-project land use: predominance of unmanaged grasslands and some annual croplands, as detailed described in Section 3.1.5 (Additionality). Under the without-project scenario, tree-related CO2 sequestration increases would not have happened because of the continuation of pre-project activity. In other words, with the continuation of the pre-project scenario, unmanaged pasturelands of invasive grasses and some annual croplands (mostly sugarcane), would be the dominant land use, accumulating less CO2e than the areas under forest restoration implemented by the project and also shown in Figure 12 of this document.

In addition to the historical panorama, other factors reinforce the maintenance of the current scenario of land use and occupation in the Project Zone by agricultural activities to the detriment of the possibility of reforestation within the limits of the project carried out without being registered as an ARR VCS project activity (scenario alternative), such as: non-compliance with environmental legislation, legal insecurity, opportunity cost of land, high cost of restoration, lack of economic incentives, lack of qualified human resources and presence of invasive species and degradation factors that inhibit reforestation due to natural regeneration. Thus, in view of the historical background and other factors mentioned above, large-scale forest restoration in the Project Zone becomes unfeasible in the scenario without the project, strengthening the continuity of agricultural activities in the region (especially in areas with environmental liabilities) and making it impossible to remove CO_2 from the atmosphere related to trees.

2.2.3. Community and Biodiversity Additionality (G2.2)

The current scenario, which considers the absence of the Project, would be limited in generating climate, community and biodiversity benefits. This landscape without ARR Project activities tends to induce and leverage the historical and inappropriate practices under current environmental legislation, associated with irregular land use and conversion in the Project Zone, especially with respect to the occupation of Permanent Preservation Areas and Legal Reserves by poorly managed extensive pastures, sugarcane and soybean crops in these locations, which are governed by the Native Vegetation Protection Law. This legal instrument values the recovery of forests that were historically eliminated from protected areas on private rural properties, fostering the provision of essential environmental services for biodiversity, climate regulation and socioeconomic development (BRANCALION et al., 2016). However, despite its force, obligation and applicability, the majority of landowners are reluctant to comply with said legislation, claiming, in short, the impracticability of agricultural production and the loss of competitiveness in the agribusiness market (BRANCALION and RODRIGUES, 2010). This discourse is also strengthened by the incipient inspection, slowness of justice, lack of transparency, lack of economic incentives, local culture of non-compliance with laws, lack of engagement, lack of qualified human resources and insufficient technological means according to the Forestry Code Observatory (2021). These factors were even reinforced by the prosecutor

interviewed during the field audit process for the validation of the aforementioned carbon project. Thus, according to the same organization, the scenario of non-compliance with the Law for the Protection of Native Vegetation entails negative effects in the environmental, social and economic spheres, in particular with regard to the reduction of biodiversity, imbalance of ecosystems, water shortages, increased health problems, low agricultural productivity, food insecurity and rural exodus. With this, environmental degradation and forest fragmentation would be enhanced by the continuity of current land uses in the project region, affecting local socio-economic development. This context is best presented and detailed in Sections 3.1.5 (Additionality), 4.1.4 (Non-project Scenario: Community) and 5.1.3 (Non-project Scenario: Biodiversity).

The scenario with the development of the Corridors for Life ARR Grouped Project, through climate, community, and biodiversity focused activities would be positive from an environmental, social, and economic perspective. Promotion of restoration initiatives through the planting of native tree seedlings, eventually/in rare cases non-invasive exotic species, and the facilitation of natural regeneration is an important and appropriate way for the environmental suitability and recovery of private rural properties and for the socioeconomic development of the communities in the region. Additionally, this project seeks to expand, improve, and monitor the techniques of collection, processing, and production of seedlings of native tree species, implementation and maintenance of restorations in the field, and innovation and entrepreneurship in the chain of forest restoration with reduced impacts to natural resources. For this, through the gain in scale of the proposed initiatives and the prioritization of seedling acquisition and services from local communities by this ARR project, the growing demand for inputs, labor and services along with the technical improvement of production and maintenance of the restorations and training on best practices in forest restoration, could stimulate the strengthening of the local economy through the expansion of community nurseries, generation of new jobs, formation of new organizations (e.g., technical assistance and rural extension institutions and planting and forest maintenance companies) and increased income for the local communities involved, providing socioeconomic improvements for the region's population in consonance with the environment.

The support and incentive to environmental awareness and capacity building in the scenario with the Corridors for Life ARR Grouped Project are determining and extremely relevant, since the access to courses, workshops and lectures, informative including the continuity of "Fridays with Science", should provide the qualification for access of the region's community members to professional opportunities, empowerment of local communities, promotion of equity for young people and women, better living conditions; as well as awareness about the importance of restorations and maintenance of forest cover and its ecological aspects; engaging and enhancing the territorial bond.

In parallel, the growing establishment of ecological corridors stimulated by the Corridors for Life ARR Grouped Project will also drive the containment of the negative effects of fragmentation of forest landscapes for biodiversity, providing transit, shelter and food source for animal species; seed dispersal; interactions between species, maintenance of the population rate, especially of species with some degree of threat, gene flow and genetic variability of the fauna and flora taxa; diversity of the trophic chain; and conservation of local biological diversity.

At the same time, this forest connectivity will encourage the training of human resources interested and specialized in restoration, especially its techniques, its biological diversity, and its socioeconomic opportunities in the project region. Research and theoretical and practical immersion in partnership with the ARR project stakeholders, such as ATER and universities, will allow for assertive decision making regarding the proposed objectives of the carbon project, ensuring a more adequate and secure adaptive management of environmental and social aspects, whenever necessary. Regarding the richness and diversity of animal and plant species, the incentive for studies and academic training will help in the creation of a vast and communicable database with information about the long-term population viability of species present in the Project Zone, providing the pertinent direction regarding the maintenance of

habitats and the conservation of biological diversity, especially those that are endemic and threatened with extinction.

Therefore, the Corridors for Life ARR Grouped Project, through a set of technical, governance and management mechanisms; aims to ensure the formation of ecological corridors through forest restoration of degraded areas, providing, consequently, benefits to biodiversity conservation, maintenance of ecosystem services, climate regulation and local socioeconomic development. Thus, the irregular conversation and occupation of Permanent Preservation Areas and Legal Reserves in private rural properties is a historical reality in the scenario without the Project, and tends to remain so, making the environmental, social and economic sustainability of the Project Zone unfeasible. This is different from the context with the implementation and execution of ARR Project activities, as demonstrated above.

In view of the scenarios presented "with" and "without" the ARR Project, and through primary and secondary information collected and verified with the IPÊ team and in studies executed in Pontal do Paranapanema, it is clear the importance of the Project implementation and development in the territorial extension of the Dream Map. Therefore, considering that the positive impacts of the Corridors for Life ARR Grouped Project are essentially due to the environmental regularization of private rural properties before the current environmental legislation, connectivity between forest fragments and reforested areas, improvement of production practices, implementation and maintenance of restorations, stimulus to research, innovation and entrepreneurship; biodiversity monitoring, environmental awareness, incentive to strengthen the local economy and consolidation of governance; the main net benefits of the community and biodiversity project that would not occur in its absence are:

For Communities:

- Environmental and productive regularization of private rural properties in the face of the Native Vegetation Protection Law (Law 12.651/2012);

- Local economic strengthening and generation of new opportunities and jobs through the gain of scale of the restoration chain;

- Improvement of human skills, knowledge and capacity about restorations and their good practices;

- Access to training, capacity building and qualifications on the restoration chain; fostering empowerment, access to employment opportunities, improvement in income and promotion of equity for young people and women;

- Stimulus to research, innovation and entrepreneurship; bringing independence and emergence of new organizations, nurseries and companies;

- Setting up of partnerships, strengthened social organization, efficient communication and improved joint work;

- Improved perception about the importance of restorations in generating opportunities and promoting a sustainable society.

For Biodiversity:

- Increasing the native vegetation cover, fighting forest fragmentation;

- Increased forest connectivity, stimulating the creation of habitats and promoting gene flow;

- Improved protection of natural resources, especially soil and water resources, such as springs and waterways;

- Promoting the conservation of fauna and flora biodiversity, with emphasis on endangered species;

- Conservation of high conservation value attributes (HCVAs), including those that present some degree of threat;

- Reducing threat levels according to the IUCN and the risk of extinction of fauna and flora species, guaranteeing genetic diversity;

- Stimulating, deepening and improving knowledge of local biodiversity through academic research, studies and long-term monitoring of fauna and flora populations, especially those with some degree of threat.

2.2.4. Benefits to be used as Offsets (G2.2)

There are no distinct community or biodiversity benefits to be used as an offset in the Corridors for Life ARR Grouped Project.

2.3. Stakeholder Engagement

2.3.1. Stakeholder Access to Project Documents (G3.1)

The availability of the full description of the PDD documentation of the Corridors for Life ARR Grouped Project when validated and the verified monitoring reports will be available to the community and other stakeholders throughout the life of the project, both via the internet (on the project page on the Biofílica Ambipar Environment website), with the possibility of download, and available in hard copies at locations close to the project. Both in the ECOnsulta (public consultation) and in the feedback, it was agreed that physical access points to the project design document, monitoring reports and other information about the carbon project will be available to the communities and other stakeholders at the following locations:

- Head Office of Instituto de Pesquisas Ecológicas (IPÊ), in Teodoro Sampaio (São Paulo, Brazil): Rua Ricardo Fogarolli, nº 387, Vila São Paulo;
- Viveiro Alvorada, in Teodoro Sampaio (São Paulo, Brazil): Estrada vicinal Carlos Rubens Herling, km 6/7;
- Escritório Pacianotto, Chelli & Lotfi Advogados, in Presidente Prudente (São Paulo, Brazil): Rua Vicente Furlaneto, nº 387, Parque Higienópolis.

At any time during the life of the project, interested individuals, communities, and institutions will be able to access and consult project documents transparently and free of charge.

It is worth mentioning that in the Project's public consultation events “ECOnsulta”, which took place in person, printed documents with the contents presented by the developers of the Corridors for Life ARR Grouped Project were hand-delivered to community members and other stakeholders present at the events. These materials contained information about project objectives, activities, zone, impacts, benefits, risks, communication plan and other specific project and certification concepts. In addition, at the referred physical points of access to the documents, didactic folders were made available with the summarized content of the Project's general information.

2.3.2. Dissemination of Summary Project Documents (G3.1)

The access of the communities and other stakeholders to the PDD summary and other carbon project documents will be physically available at the locations detailed in the item 2.3.1, and online, on the website also mentioned in the previous topic after validation, so that all interested individuals, communities, and institutions in the Project Zone can access these documents in a free and transparent way.

ECOnsulta will provide printed copies of the carbon project documents and the verified monitoring reports at selected locations for communities and other stakeholders, and feedback, as well as to partners interested in acting in restoration activities and landowners, as the contracts for new planting areas are signed. Digital copies of the carbon project documents and verified monitoring reports will be available online for download on the website of Biofílica Ambipar Environmental Investments, which will also be forwarded through messaging app channels and e-mail groups to all the stakeholders involved.

In parallel, the main project documents will also be provided in open events for the public, workshops and ECOnsulta organized by the project management team. Other forms to spread information can also be used to give full transparency and communication of the project, such as social networks and informative folders, according to the demands.

It is worth reinforcing that in the public consultations of the Project, which took place in person on September 16, 2022 and October 6, 2022, printed documents with the contents presented by the developers of the Corridors for Life ARR Grouped Project were hand-delivered to the community members and other stakeholders present at the events. These materials contained summaries of the concepts, context, history, objectives, schedule, responsibilities, actors involved, activities, risks, impact, and expectations of the referred carbon project for the Project Zone. These instruments, both digital and physical, were of great relevance for the communities and other stakeholders to learn about the Project. In addition, for brief consultations, at the referred physical points of access to the documents, didactic folders were made available with the summarized content of the Project's general information for the immediate reading of the social actors.

2.3.3. Informational Meetings with Stakeholders (G3.1)

Meetings, gatherings and workshops among the proponents of the Corridors for Life ARR Grouped Project and stakeholders for dialogue about the planning, structuring, and reporting of the carbon project initiatives with community members and other stakeholders will run throughout the design, development, execution, and monitoring phases of the activities. These events will happen more intensively in the first years of the project, especially among the staff.

“Sexta consCIÊNCIA” (in English, “Friday with Science”), the project's usual informative meeting, will take place four times over the course of a year, while ECOnsulta, an event focused on public consultation with the project's social actors and with time set aside for feedback to stakeholders, will take place at each verification event (expected to occur every three years, as noted in section 2.1.15) throughout the project's crediting period. Corridors for Life ARR Grouped Project; these events are widely notified in advance to the individuals, groups and other stakeholders directly and indirectly involved in the project. It is worth mentioning that the frequency of these meetings was agreed upon face-to-face with the communities and other stakeholders during the first feedback from ECOnsulta, in October 2022

Whenever necessary, informative meetings and workshops will take place with the proponents of the Corridors for Life ARR Grouped Project and the social actors of this carbon project, depending on local demand and availability. The meeting planning will be disclosed in advance by invitations and letters by hand to the interested parties, as well as via mail, e-mail, messaging app, and calls.

2.3.4. Community Costs, Risks, and Benefits (G3.2)

Exchanges, discussions, and plenaries about the potential costs, risks and benefits of Corridors for Life ARR Grouped Project with the communities and other stakeholders will take place at ECOnsulta, periodically planned by the carbon project, according to the section 2.3.3.

In these meetings there will be a presentation, by the project proponents, about the concepts, roles, activities, and risks of the project to the social actors of the Project Zone. At the same time, a transparent

and participatory plenary will be open so that all interested parties can express their doubts and suggestions; for immediate clarification by the proponents and a possible adaptive management of the carbon project design by its creators. Next, a dynamic in discussion spaces based on guiding questions in specific groups, according to the affinities of their performances (nursery men, service providers/field workers, rural landowners, rural technical assistance professionals, public power representatives, local associations and cooperatives, and researchers) will be conducted to capture expectations, concerns, and new questions and suggestions regarding the development of the project for each social group. Finally, all the points and demands raised and captured in the interactions together will be validated in plenary for subsequent referrals by the carbon project proponents.

It is worth noting that all relevant information is provided to the community on timely basis and in the appropriate media in order to allow to make crucial decisions.

2.3.5. Information to Stakeholders on Validation and Verification Process (G3.3)

Community members and other stakeholders will be informed about the validation and verification audit processes during the regular Friday with Science events. The schedule during the audit and the auditor's agenda will be informed via websites (Biofílica and IPÊ), e-mail, phone, and messaging app. Other forms of communication may also be adopted, depending on demand and as required. The validation audit process was notified to all communities and other stakeholders who attended the ECOnsulta, both in the informative and consultative stage, and in the feedback.

2.3.6. Site Visit Information and Opportunities to Communicate with Auditor (G3.3)

As informed, there will be opportunities for conversations and exchanges among community members, others stakeholders and the external auditor, during the validation and verification processes of the Corridors for Life ARR Grouped Project, regarding the visit to the Project Area. The visit of the audit team in the field will be previously informed to the community and other stakeholders, through transparent channels and in an appropriate language for all those involved in the context, ensuring better understanding of the reality of the carbon project.

Therefore, the communities will be informed in person by the IPÊ team, while other stakeholders who are not close to the team will be informed via calls, messaging app or e-mails.

2.3.7. Stakeholder Consultations (G3.4).

An overall analysis was carried out by the project team to define all social actors in the Project Zone. To this end, four face-to-face meetings were held, two of them at the proponents' work HUB in Piracicaba - SP (July 26 and August 02, 2022) for in-depth discussion on the stakeholders' profile and their adhesion to the project. The third meeting, held at IPÊ's office in Teodoro Sampaio - SP, included the validation of the stakeholders' list by the institution's team, focusing mainly on the characteristics and relations of the communities and stakeholders with the project. The fourth meeting was the EConsulta itself, which followed the interaction of the proponents of the Corridors for Life ARR Grouped Project with the social actors through a presentation of the carbon project, followed by a plenary session for questions and suggestions, at the headquarters of Morro do Diabo State Park (Teodoro Sampaio - SP)

The list of invited community members and other stakeholders included:

Nurseries in Teodoro Sampaio - SP

- Viveiro Alvorada
- Viveiro Campos Alvorada

- Viveiro Floresta
- Viveiro Mata Nativa
- Viveiro Viva Verde
- Viveiro Manaain

Nurseries in Mirante do Paranapanema - SP

- Viveiro Sol Nascente
- Viveiro Quarteto Florestal

Restoration service providers in Teodoro Sampaio - SP

- Cícero Natércio da Silva
- Bispo Serviço de Restauração Ecológica Ltda
- Floresterra Consultoria Ltda
- ZC Reflorestamento - Carvalho Reflorestamento Ltda
- Mico-leão-preto Team

Restoration service providers in Mirante do Paranapanema - SP

- A M Engenharia e Soluções Ambientais Ltda
- CA Manutenção e Serviços Florestais

Restoration service providers in Rosana - SP

- Mafran

Restoration service providers in Presidente Prudente - SP

- 3M Soluções Ambientais Ltda

Other Stakeholders in Teodoro Sampaio – SP

- Seeds and Seedlings Producers Association (APMS)
- Foundation for Forest Conservation and Production of the State of São Paulo (Fundação Florestal) - Teodoro Sampaio
- Fire Department - Teodoro Sampaio
- Environmental Policies Coordination Office - Teodoro Sampaio
- Municipal Agriculture and Food Supply Secretariat - Teodoro Sampaio
- Integral Technical Assistance Coordination (CATI) - Teodoro Sampaio
- Technical Coordination Group (GTC) of the São Paulo State Land Institute Foundation (ITESP) - Teodoro Sampaio
- Public Ministry of the State of São Paulo - Prosecutor's Office of Teodoro Sampaio
- Military Environmental Police 3rd Gr/3rd cia/2nd Environmental Police Batallion - Teodoro Sampaio

Other Stakeholders in Presidente Prudente – SP

- Foundation Institute of Land of the State of São Paulo (ITESP) - Presidente Prudente

- Board of Education - Presidente Prudente

Other Stakeholders in Mirante do Paranapanema - SP

- Board of Education - Mirante do Paranapanema
- Fire Department - Mirante do Paranapanema
- Environment and Land Reform Division - Mirante do Paranapanema
- Agriculture Division - Mirante do Paranapanema
- Integral Technical Assistance Coordination (CATI) - Mirante do Paranapanema
- Land Institute of the State of São Paulo (ITESP) - Mirante do Paranapanema
- São Paulo State Prosecutor's Office - Mirante do Paranapanema
- Atvos - Conquista do Pontal Power Plant
- Environmental Military Police 3rd Pl / 3rd cia / 2nd Battalion of Environmental Military Policy - Mirante do Paranapanema (same Teodoro Sampaio)
- Cooperative of Women Settlers (COOPER AMAS)
- Associação de Desenvolvimento dos Assentados do Pontal (ADAP) [Development Association of the Settled People of Pontal]

Other stakeholders in Euclides da Cunha Paulista - SP

- Municipal Secretariat of Environment - Euclides da Cunha Paulista
- Municipal Department of Agriculture and Livestock - Euclides da Cunha Paulista
- Integral Technical Assistance Coordination (CATI) - Euclides da Cunha Paulista
- Foundation Institute of Land of the State of São Paulo (ITESP) - Euclides da Cunha Paulista
- Public Ministry of the State of São Paulo - Prosecutor's Office of Euclides da Cunha Paulista
- Fire Department - Euclides da Cunha Paulista
- Environmental Military Police 3rd Gr/3rd cia/2nd Environmental Military Police Batallion - Euclides da Cunha Paulista (same Teodoro Sampaio)
- Associação Produtores Rurais e Aquicultores Novo Tempo [Tempo Novo Rural and Aquaculture Producers Association]

State and Federal Institutions

- Public Ministry of the State of São Paulo - Special Action Group for the Defense of the Environment (GAEMA)
- Brazilian Institute of Environment and Renewable Natural Resources (IBAMA)
- Chico Mendes Institute for Biodiversity Conservation (ICMBio)
- Committee for Hydrographic Basins of Pontal do Paranapanema (CBH PP)
- Coordination of Inspection and Biodiversity (CFB)
- Integral Technical Assistance Coordination (CATI), specifically the Agro-environmental Sustainability Department

- Environmental Company of the State of São Paulo (CETESB)
- Secretary of Environment of SP
- Secretary of Infrastructure and Environment (SIMA)
- National Institute of Colonization and Agrarian Reform (INCRA) - São Paulo

Educational and Research Institutions

- School of Environmental Conservation and Sustainability (ESCAS) of the Institute for Ecological Research (IPÊ)
- São Paulo State University (UNESP)
- University of São Paulo, School of Agriculture "Luiz de Queiroz" (USP/ESALQ)
- Universidade do Oeste Paulista (UNOESTE)

Social Movements

- Landless Rural Workers Movement (MST)
- National Front of Struggle (FNL)

Landowners

- Fazenda Daniel
- Fazenda Vida
- Fazenda Santa Rosa
- Fazenda Matuto
- Fazenda Negrão
- Fazenda Cachoeira
- Fazenda San Diego
- Fazenda Junqueira I
- Fazenda Santa Amalia
- Fazenda São Paulo
- Fazenda Rio do Peixe
- Fazenda Newton Teixeira
- Fazenda Santa Maria
- Fazenda União
- Fazenda Bartira
- Fazenda Santa Marina
- Fazenda Jatai
- Fazenda Timbori
- Fazenda Alcidia do Bolete
- Fazenda São Geraldo

NGOs

- Associação em Defesa do Rio Paraná, Afluentes e Mata Ciliar (APOENA)
- Casa da Floresta Assessoria Ambiental
- Fundação SOS Mata Atlântica

It is worth mentioning that the whole process of engagement of the communities and other stakeholders with IPÊ has been built over the last 30 years of the institution's activities in Pontal do Paranapanema (SP) and precedes the initial phase of the Corridors for Life ARR Grouped Project. This history intensified and helped in the planning, conception, and development of the project in the region, due to the proximity of the organization with the social actors.

ECOnsulta (public consultation) attended by the project proponents, the community and other local stakeholders, held on September 16, 2022, at the headquarters of Morro do Diabo State Park (Teodoro Sampaio, SP, Brazil), was attended by 60 participants.). The invitations to community members and other stakeholders were delivered in person, through invitation letters and letters, as well as by mail, phone calls, and online (e-mails and messaging app).

On the day of the event, the activities followed the presentation of the concepts, initiatives, responsibilities, and risks of the Corridors for Life ARR Grouped Project by the proponents of this carbon project to the local social actors. During the whole presentation, the event moderator encouraged the expression of doubts and suggestions by the participants, to be answered in a participative and transparent plenary session by the project developers. Afterwards, a dynamic session in specific groups, according to the affinity of the activities developed in the Project Zone, allowed the gathering of expectations, concerns, doubts, and suggestions from the specific work groups regarding the development of the project based on guiding questions. Notes from all teams were presented by the groups' representatives, so that the proponents could capture all the points to be better clarify in the feedback stage.

The community and stakeholder groups and their main points raised at public consultation moderated by a professional trained in this process are described in Table 12, below:

Table 12 – Points of the specific working groups raised in the public consultation.

Group	Concern about the project	Without the project	Expectations	Doubts	Suggestions
Service Providers	Meeting project expectations, especially in the long term	There wouldn't be many of these companies	Technological innovation and increased profitability	-	Supporting the definition of values for the restoration service, as each area has its own peculiarities Training in logistics, financial management and recruitment of people Searching for the possibility of forest insurance

Group	Concern about the project	Without the project	Expectations	Doubts	Suggestions
Seedling producers	Being able to meet the project's growing demand in terms of structuring the nursery, training people, expanding the nursery, updating knowledge	Lack of rationale for the creation of nurseries and sustainability of nurseries	Gain from improved quality of life and carbon sequestration.	Uncertainties about the future with the change of politicians in power. Alternation of government changes public policies.	Review seedling price update model Providing qualification for seed collection, handling of manure and fertilizers, and financial administration Partnerships for collecting seeds in Conservation Units Searching for the possibility of forest insurance Promoting environmental education Improving project dissemination to populations in the project area
Associations	Being able to participate in the project with economic benefits	There is no income alternative. Environmental degradation through erosion and loss of forest cover	They can participate in the project	Associations can produce seedlings for the project	Legal discussions with public bodies and institutions so that public settlements can be restored through carbon projects Strengthening dialogue with national bodies for the eligibility of areas in Settlement Fostering the implementation of new nurseries via associations

Group	Concern about the project	Without the project	Expectations	Doubts	Suggestions
					and cooperatives
Landowners	-	-	Regularization of the area Compliance with environmental agencies Adding value to the property Protection of the area, how many interventions	What is the support of the IPE after 30 years of the project for the maintenance of the area? Can we manage? How is the project if resources run out in the middle? If the contract with IPE is terminated, is there a fine? Can already established forests enter the project? What is the value of a ton of carbon?	Hold specific events for the owner Preventive plan for firebreaks and fire control Providing reports with environmental and social results of the project Conducting an environmental education program with tree planting Training at SENAR (you can request the course) Adjusting clauses in the contract to facilitate understanding and make legal information more accessible Union of efforts to create a certification for the valorization of products
State	Juridical insecurity Low ownership by owners (expect changes to the law) Insecurity with the carbon credit market	-	Accelerating the process of environmental regularization in the state Regional development (tourism, green/blue project)	-	Availability of project data in broad formats Incorporate the Dream Map into state restoration policies (e.g.: Nascentes Program) Aligning strategies to restore public

Group	Concern about the project	Without the project	Expectations	Doubts	Suggestions
					areas, such as ITESP rural settlements Establishing partnerships for teacher training
ATER and research	Raising awareness for engagement Unpreparedness for the increase in the appearance of wild animals	Commitment to the conservation of conservation areas Negative impact on income generation Negative impact on climate change Commitment of water and soil resources Decline of genetic variability and conservation of biodiversity	income generation Increase in biodiversity Stimulus for resolving environmental liabilities climate improvement Improved quality of life/regional development	Guarantee of permanence of restored areas (resources/ policy may compromise the permanence of forests) Where will resources come from? Will they be kept after decades?	Permanent training in forest restoration Incentive to training courses for biodiversity Possibility of new jobs in ATER Encouraging scientific production and partnership with universities Fostering bee breeding in the territory Inclusion of ETEC Agribusiness for environmental education and development of studies Monitoring of bioindicator species Connection between monitoring programs (Meta analysis)

The following is an illustration of the informative stage of the ECOnsulta, which followed the presentation of the Corridors for Life ARR Grouped Project by the proponents, and the plenary session to answer questions and suggestions from the social actors.

Figure 30 – Informational stage of the ECOnsulta of the Corridors for Life ARR Grouped Project, held in Teodoro Sampaio, SP.

Below are images from the ECOnsulta, highlighting the dynamics between the working groups of the communities and other stakeholders present.

Figure 31 - Dynamics between the working groups of the ECOnsulta of the ARR Corridor Project, held in Teodoro Sampaio, SP (From left to right: Service Providers, Associations and Cooperatives, Landowners, State and public institutions, Nurserymen and ATER and research).

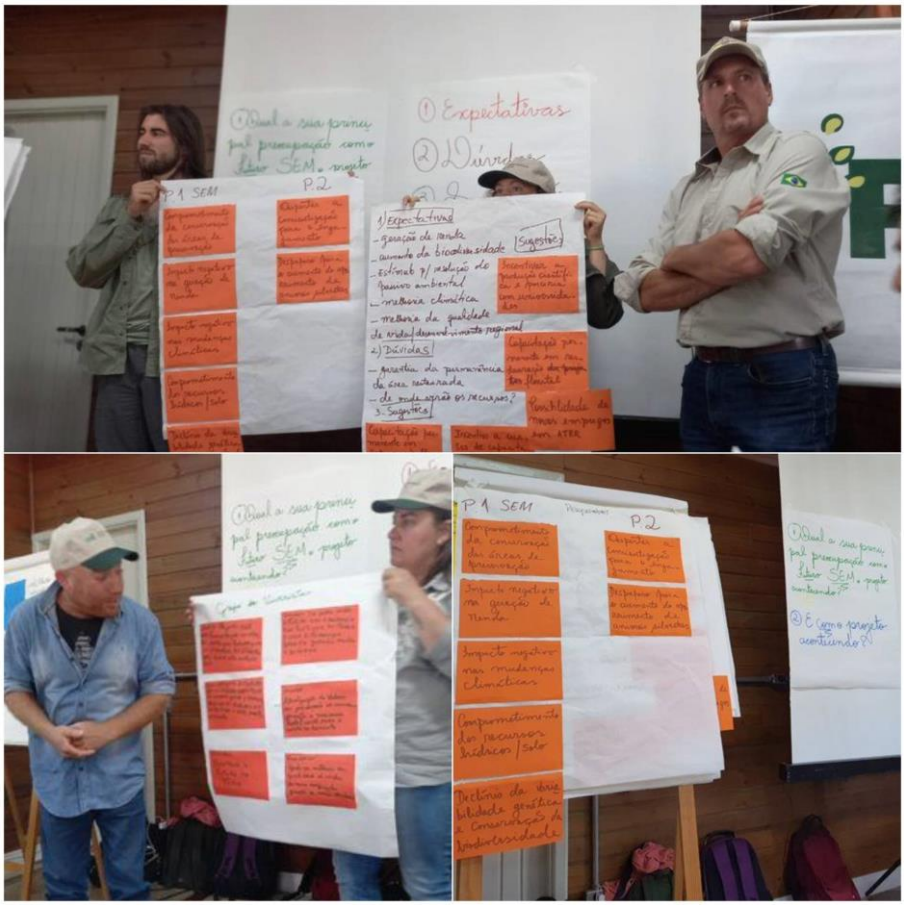

Figure 32 – Points resulting from the dynamics between the working groups of the EConsulta of the ARR Corridor Project, held in Teodoro Sampaio, SP.

It is worth pointing out that during the feedback event, on October 6, 2022, at the headquarters of Morro do Diabo State Park (Teodoro Sampaio - SP), all the doubts raised in the informative stage were studied by the carbon project proponents and clarified to the community and other interested parties in the form of a presentation, giving the social actors the opportunity to make new suggestions and ask questions about the conception, development, and implementation of the Corridors for Life ARR Grouped Project. Again, these notes were exhibited in plenary for general knowledge and collective discussion, as well as collected and evaluated by the developers for possible adaptation of the referred carbon project.

Figure 33 – Feedback of doubts, suggestions and feebacks from the EConsulta of the Corridors for Life ARR Grouped Project, held in Teodoro Sampaio, SP.

Figure 34 – Assessments of social actors for the feedback and ECOnsulta events of the Corridors for Life ARR Grouped Project, held in Teodoro Sampaio, SP, in September and October 2022.

2.3.8. Continued Consultation and Adaptive Management (G3.4)

Corridors for Life ARR Grouped Project has been developed and implemented through a process of engagement, interaction, and continuous consultation between the proponents of the carbon project and local social actors. Throughout the project's life cycle, several activities will be conducted by the project, according to the demands and needs of the communities and other stakeholders. In this sense, the communication strategy established in joint agreement between the project developers and the

stakeholders, and the continuous informative and consultative interaction with the social actors of the project, will allow a better understanding of the social needs and, consequently, a greater capacity for adaptive management by the carbon project developers.

Therefore, the following initiatives and communication channels are planned, involving consultation and adaptive management on an ongoing basis throughout the life cycle of the Corridors for Life ARR Grouped Project:

- “Sexta com Ciência” (Friday with Science);
- “ECOnsulta”;
- Biofílica Ambipar Environment Investments’ website communication channels;
- E-mail groups;
- Direct channel via communication application.

2.3.9. Stakeholder Consultation Channels (G3.5)

The main channels used in the consultation process with community members and other stakeholders are face-to-face meetings between the proponents of the Corridors for Life ARR Grouped Project to define the social actors of the Project Zone, highlighting the main cultural and regional characteristics of the local population. The first two meetings between the developers took place in Piracicaba (SP) (July 26 and August 02, 2022) for detailed discussion about the stakeholders' profile and their adhesion to the carbon project. The third meeting, held at IPÊ's office (Teodoro Sampaio - SP), followed for the validation of the list of social actors by the team of the locally based organization, highlighting the characteristics and relations of the communities and stakeholders with the project. At the fourth meeting (ECOnsulta), the community and other stakeholders were consulted based on the presentation of the carbon project by the Corridors for Life ARR Grouped Project, at the headquarters of Morro do Diabo State Park (Teodoro Sampaio - SP), in the participatory plenary and in the dynamics in specific working groups, in order to register the potentialities and challenges from the point of view of the local actors. For this event, invitations to community members and other stakeholders were delivered in person, by mail, by e-mail and Whatasapp messages, and also by phone calls.

In addition, it was defined at ECOnsulta that the main channels of communication between the stakeholders and the project proponents, as well as for interaction between the stakeholders, will be:

- Project website (linked to Biofílica Ambipar Environmental Investments’ website); including ombudsman number, online form (for complaints, doubts, suggestions, compliments, denunciations and requests) and informative materials about the project in digital form;
- Physical space (detailed in topic 2.3.1), containing a ballot box for complaints, doubts, suggestions, compliments, wristblowing, and requests;
- Virtual space for direct dialogue (e-mail and messaging app groups);
- Informative event "Friday with Science";
- Consultation events with social actors "ECOnsultas";
- Committees and Thematic Groups will be structured according to the demands throughout the project's duration.

Besides the means to communicate with the interested parties listed above, IPÊ, in its headquarters in Teodoro Sampaio (SP), already holds face-to-face meetings with some stakeholders, such as rural landowners for signing contracts. It is worth reinforcing, in this sense, that the organization's history in

the project's region happens before the conception of the carbon project, interacting with stakeholders for approximately 30 years. Thus, IPÊ is available to social actors for any eventual need for consultation, suggestions and clarification of doubts in person.

2.3.10. Stakeholder Participation in Decision-Making and Implementation (G3.6)

The participation of the community and other stakeholders in the decision-making for the development and implementation of the Corridors for Life ARR Grouped Project will be fully provided, through direct contact between the project proponents and the social actors. Furthermore, all notes and suggestions directed to the developers will be analyzed for possible adaptive management of the carbon project, taking into account the local context and demands.

Finally, different cultural values and gender issues will be respected in the implementation of participatory methodologies (posters, records of contributions, plenaries, and conversation circles), reinforcing the importance of moderation for the unfolding of actions among stakeholders, communities, and project proponents.

2.3.11. Anti-Discrimination Assurance (G3.7)

Corridors for Life ARR Grouped Project has an anti-discrimination policy for all its project management staff, including service providers and partners. This procedure is supported mainly by the various policies, statutes and regulations related to governance and ethics to which employees, suppliers and service providers of Ambipar Biofílica Environment and the Ecological Research Institute are subject, as detailed in the topic 2.4.6.

According to the guidelines, values and principles of the policies, statutes and regulations of both institutions, respect for people and their individual choices and identities is advocated, rejecting any kind of discrimination.

For both institutions, the standards and organizational principles are submitted to all entities involved in the design and implementation of the carbon project, such as: founders, employees, suppliers, administrators, representatives, service providers and other partners. IPÊ, in the first paragraph of the third article of its Bylaws, observes: "*In the development of its social activities, the Institute will not make any distinction regarding race, color, sexual orientation, social condition, political or religious creed and will not participate in campaigns of political-partisan or electoral interest, under any means or forms.*" While Biofílica, a company of the Ambipar Group, bases the following rigors: "*Respect for people regardless of their hierarchical position, origin, color, ethnicity, culture, age, social level, physical capacity, religion and sexual orientation, rejecting any practice of discrimination.*" and "*The Company forbids any type of discriminatory act, focusing, in particular, on equality and diversity among its employees.*", emphasizing the appropriate measures applicable in case of non-compliance by the actors, such as contract termination.

In this sense, the developers of the carbon project reinforce their commitment not to tolerate any kind of discriminatory practice in the management and development of the project and throughout its life cycle. Likewise, it undertakes to act with the necessary and appropriate measures upon becoming aware of any demonstration of discriminatory acts, according to the procedures described in the item 2.3.12.

In parallel, assuring its commitment to avoid and reject any and all types of discriminatory acts throughout the term of the Corridors for Life ARR Grouped Project and in all its spheres, the contracts established between the proponents of said carbon project with their service providers designates the following clause: "*The Parties declare that they do not use, in any of their sectors and in any of their activities, labor analogous to slavery, degrading labor and child labor; comply with the rules of protection of children and adolescents, workers and the environment in force in the country; comply with the*

Brazilian legislation of personal data protection, especially Law 13.709/2018 (LGPD); do not practice any form of negative discrimination with their stakeholders."

For this perspective, preventive and combative measures to deal with any type of conduct characterized as discriminatory act will be implemented in the scope of the aforementioned carbon project, such as:

- Anonymous communication channel, in physical and online form, for reporting and registering complaints about demonstrations and discriminatory acts that occurred throughout the planning, development, implementation and monitoring of the Corridors for Life ARR Grouped Project;
- Taking of appropriate and legal measures by the proponents of the project, when they become aware of the demonstrations and discriminatory acts in the management and development of the project;
- Communication channel for receiving suggestions and improvements aimed at combating discriminatory practices and harmful conduct in the scope of the project by all the parties directly and indirectly involved;
- Contractual guarantee between the bidders and service providers of the carbon project to reject and combat any and all types of demonstrations and discriminatory acts.

2.3.12. Feedback and Grievance Redress Procedure (G3.8)

Corridors for Life ARR Grouped Project, throughout its life, it will have procedures and tools for feedback on doubts, suggestions, compliments and requests, as well as a policy of redressing complaints and denunciations. This mechanism of demonstration and formalization of notes will take place online, through an online form hosted on the project's website (linked to the website of Ambipar Environmental Investments), through an ombudsman telephone number, and in ballot boxes hosted in the physical spaces mentioned in the topic 2.3.1. It is worth mentioning that all reports, requirements, proposals and complaints that may arise during the planning, development, implementation and monitoring of this carbon project may be made anonymously, according to the wishes of the social actors. All complaints will be analyzed by an institutional committee constituted by stakeholders to take care of mediation and resolution attempts.

The proponents, upon becoming aware of complaints, doubts, suggestions, compliments, grievances, and requests related to the Corridors for Life ARR Grouped, will consider the following processes within the complaints feedback and redress procedure: receipt, analysis, response, and attempted resolution within a reasonable timeframe for the complaints and grievances, making use of traditional methods used by the community and other stakeholders for conflict resolution whenever possible.

There will be time limits for feedbacks, complaints and denunciations to be considered regarding the greater conflict resolution efforts in the first stage of the three different phases that comprise the process: attempted resolution, mediation, and trial in courts. In cases where there is no resolution at the first stage, there will be an attempt of mediation, and if this is not effective to solve upon a neutral consultation with the parties involved, there will be arbitration as a last resort, applied in extreme cases with trial.

2.3.13. Accessibility of the Feedback and Grievance Redress Procedure (G3.8)

As mentioned in the previous topic, the Corridors for Life ARR Grouped Project will adopt the reception of feedbacks, complaints and denunciations through a form in an online channel, in an ombudsman phone number, and in ballot boxes present in physical locations previously agreed upon. Its developers will ensure that the entire history of complaints, doubts, suggestions, compliments, and requests, and

their respective developments in procedures and decision-making, are disclosed and accessible in a clear and transparent way to all individuals, communities, and institutions.

It is worth reinforcing that, in all the channels for receiving feedbacks, complaints and denunciations, the records may be anonymous, except in cases in which the individuals require identification. In general, a time limit of 7 days for urgent cases and 30 days for less urgent cases will be considered.

2.3.14. Worker Training (G3.9)

The Corridors for Life ARR Grouped Project will prioritize local labor for the development of the restoration activities proposed in this document, with a primary focus on the participation of youngsters and women from the region's communities. In this regard, it is estimated that this carbon project can impact 600 people, including 180 women, directly in the actions planned in the Project Area.

The dissemination of the opportunities of empowerment, qualifications and technical training promoted by the Corridors for Life ARR Grouped Project will be directed, as a priority, to the project direct workers (for example, nursery workers and service providers of planting and maintenance of restorations). These social players will be reported on these events in person by the project team, as well as by means of invitation letters, emails or application messages.

The technical training and empowerment will be carried out for instructional and occupational purposes, always striving for the dissemination of knowledge and professional qualification, through informative lectures or other participatory approaches, and always in a place accessible to the target audience. All invitees may request access to the records of the training sessions and their respective contents, as well as suggest new themes and topics in other opportunities throughout the life of the carbon project.

It is worth pointing out that traditional knowledge will be preserved and valued in the exchange of experiences, fostering the sharing of learning and experiences among the communities, as well as between older and younger people. This sharing will, whenever possible, be incorporated into the training sessions.

2.3.15. Community Employment Opportunities (G3.10)

The employment opportunities generated by the demands of the Corridors for Life ARR Grouped Project (for example, seedlings and implementation and maintenance services for restorations) are managed by IPÊ only with regard to the Technical Assistance and Rural Extension team. In this case, the organization has the hiring of local professionals as a premise.

Internally, IPÊ, for all stages of the selection processes, including the procedure for hiring the professional, considers the criteria established in the description of positions offered and publicly disclosed, ensuring reliability on and transparency to the selection process.

As for the nurseries and service providing companies, the proponents of the Corridors for Life ARR Grouped Project do not manage the selection and hiring processes of manpower and professionals and have no intention of managing this stage. On the other hand, the project strategically seeks to foster equal opportunities to local community members and other stakeholders that can access job opportunities via the carbon project.

In this regard, the project will guide and support communities and other stakeholders in business management, people management, and recruitment by means of the previously outlined activity "empowerment of local communities in the restoration chain and environmental awareness".

In this way, the project will be able to expand its acting in the Project Zone and to obtain scale gains through a fair, transparent, and equal selection of manpower and trained professionals. In parallel, this mechanism will also make it possible for the local communities' values to be respected.

2.3.16. Relevant Laws and Regulations Related to Worker's Rights (G3.11)

In the scope of this project, all workers, employees, and service providers are ensured the compliance with legal standards, specifically with regard to Brazilian labor legislation, as well as international agreements ratified by Brazil aimed at promoting the human rights and welfare of workers.

In this sense, measures will be adopted in order to provide guidance and training to all those involved in the project, seeking to empower agents of the local communities with the purpose of generating useful skills and knowledge that will allow for a greater community engagement and participation in the project's development and implementation.

Precisely because of this, the workers will also be exposed to the importance of restoration projects, their impacts on carbon capture and, consequently, on the mitigation of climate change faced by the Planet, besides the positive impacts on the social sphere.

This set of policies will be paramount to the success of the project, with a greater engagement and active participation that favors the success and obtaining the maximum potential of this project.

These activities are to be undertaken with the purpose of comprising the diversity of the population as a whole, taking into account the existing peculiarities and vulnerabilities, paying special attention to risk groups, such as women and marginalized people, and thus promoting isonomy. That is, with an attentive look at the existing particularities and with the necessary training for local agents, everyone will have a fair chance of exercising the positions for which they are trained.

Furthermore, in order to guarantee the continuous respect for the workers' protection legal rules both Biofílica Ambipar Environmental Investments and IPÊ – Institute for Ecological Research conduct specialized audits every year, which are supported by an assessment report. Contributing to this agenda and corroborating the duty of transparency to which the project is committed, these reports will be published in nationally recognized physical and digital periodicals.

It should also be noted that after being hired and before starting their activities, the workers are given a training and qualification on the technical procedures they will deal with in developing their tasks.

Also, in order to strengthen and unite the labor category, employees are advised to join different institutions that promote their rights such as, but not limited to, the respective category's unions.

In addition, to ensure the engagement and well-being of those involved, an open communication channel will be ensured, in which emerging issues and concerns can be raised by workers, and the project will always strive for an effective communication, with active listening to the demands presented to it, observing the perceptions put forward regarding the implementation of the project, the tasks undertaken, and the significant changes that have occurred since then.

In this regard, the following are contemplated: ombudsman channels, online forms for complaints, doubts etc., availability of instructional material, virtual spaces for direct dialog, informative events - "Friday with Science", at least 4 times a year, and "ECOnsultas", every verification event (expected to occur every three years, as noted in section 2.1.15) - and the structuring of Committees and Theme Groups, all in keeping with the terms already put forward throughout this project.

It is important to point out that all the activities herein described will be explained in different ways, in order to encompass the different levels of understanding of the community of workers, ensuring a broad understanding by those involved. In addition, different communication strategies will be adopted to ensure that as many people as possible have access to the information, which will be done verbally, in writing, and virtually.

The relevant laws and regulations protecting the workers' rights in Brazil, as well as international agreements ratified by Brazil on labor issues, are listed below:

Federal Legislation and Regulations:

- Decree-Law No. 5.452, of May 1, 1943: Approves the Consolidation of Labor Laws.

- Law 605/1949: Paid Weekly Rest.

- Law 2.959/1956: Contract for Fixed Work or Service.

- Law 3.030/1956: Discount for Food Supply.

- Law 4.090/1962: Christmas Bonus.

- Law 4.749/1965: 13th salary (Year-End Bonus)

- Law 4.950-A/1966: Pay of Professionals (Engineering, Chemistry, Agron. and Veter.).

- Law 5.889/1973: Rural Labor.

- Law 6.514 of December 22, 1977: Amendments to Chapter V, Title II of the Consolidation of Labor Laws, on occupational safety and medicine and other measures.

- Law 7.418/1985: Transportation ticket.

- Law 9.601/1998: Time Bank and Contract for a Determinate Time

- Law 10.101/2000: Workers' Profit Sharing Program.

- Law 10.820/2003: Discount of Benefits in Payroll.

- Regulatory Standard no. 31, of 3/3/2005: regulates on the safety and health at work in the agriculture, silviculture cattle rasing, forest exploration and aquaculture.

International agreements ratified by Brazil:

- International Labor Organization Convention no. 12 of 1921, ratified by Brazil on April 25, 1975: Provides for compensation for work accidents in agriculture.

- International Labor Organization Convention no. 29 of 1930, ratified by Brazil on Thursday, April 25, 1957: Provides for the abolition of forced labor.

- International Labor Organization Convention no. 97 of 1949, ratified by Brazil on Friday, June 18, 1965: Provides for migrant workers.

- International Labor Organization Convention no. 98 of 1949, ratified by Brazil on Tuesday, November 18, 1952: Provides for the right to organize unions and collective bargaining.

- International Labor Organization Convention no. 100 of 1951, ratified by Brazil on Thursday, April 25, 1957: Provides for equal pay for men and women.

- International Labor Organization Convention no. 102 of 1952, ratified by Brazil on Monday, June 15, 2009: Provides for minimum social security rules.

- International Labor Organization Convention no. 103 of 1952, ratified by Brazil on Friday, June 18, 1965: Provides for maternity protection.

- International Labor Organization Convention no. 105, ratified by Brazil on June 18, 1965: Provides for the abolition of forced labor.

- International Labor Organization Convention no. 111 of 1958, ratified by Brazil on Monday, March 1, 1965: Regulates on discrimination with respect to employment and occupation.

- International Labor Organization Convention No. 131, of 1970, ratified by Brazil on May 04, 1983: Provides for the minimum wage stipulation, especially in developing countries.

- International Labor Organization Convention no. 132 of 1970, ratified by Brazil on Wednesday, September 23, 1998: Provides for paid vacations.

- International Labor Organization Convention no. 135 of 1971, ratified by Brazil on Friday, May 18, 1990: Provides for the protection of workers' representatives.

- International Labor Organization Convention no. 138 of 1973, ratified by Brazil on Thursday, June 28, 2001: Provides for minimum age for admission.

- International Labor Organization Convention no. 141 of 1975, ratified by Brazil on Tuesday, September 27, 1994: Provides for rural workers' organizations.

- International Labor Organization Convention no. 142 of 1975, ratified by Brazil on Tuesday, November 24, 1981: Provides for human resources development.

- International Labour Organization Convention no. 143 of 1975: Provides for immigration under abusive conditions and the promotion of equal opportunities for migrant workers.

- International Labor Organization Convention no. 154 of 1981, ratified by Brazil on Friday, July 10, 1992: Provides for the promotion of collective bargaining.

- International Labor Organization Convention no. 155 of 1981, ratified by Brazil on Monday, May 18, 1992: Provides for safety and health for workers.

- International Labor Organization Convention no. 161 of 1985, ratified by Brazil on Friday, May 18, 1990: Provides for occupational health services.

- International Labor Organization Convention no. 168 of 1988, ratified by Brazil on Wednesday, March 24, 1993: Provides for the promotion of employment and protection against unemployment.

- International Labor Organization Convention no. 169 of 1989, ratified by Brazil on Thursday, July 25, 2002: Provides for indigenous and tribal rights.

- International Labor Organization Convention no. 182, ratified by Brazil on February 2, 2000: Provides for the ban on the worst forms of child labor and immediate action for their elimination.

- International Covenant on Civil and Political Rights (ICCPR) Article 8 of 1966: Established the prohibition of slave labor.

- International Covenant on Economic, Social and Cultural Rights (ICESCR, Articles 6 and 7)

- The Convention on The Elimination of All Forms of Discrimination Against Women (CEDAW, Articles 6 and 11): acknowledges that "extensive discrimination against women continues to exist" and emphasizes that such discrimination "violates the principles of equality of rights and respect for human dignity."

- The Convention on The Rights of The Child (CRC, art. 32): aims to ensure that the child is protected from all forms of discrimination or punishment based on the status, activities, expressed opinions or beliefs of the child's parents, legal guardians or family members.

- The Convention on The Rights of Persons with Disabilities (CRPD, Art. 27.2) also contains provisions to the same effect.

2.3.17. Occupational Safety Assessment (G3.12)

The service providers of the Institute for Ecological Researches, responsible for technical and operational initiatives in the field (e.g. implementation and maintenance of restorations) are ensured a safe and healthy work within the Corridors For Life ARR Grouped Project, by means of legal contract, stressing the importance of mutual commitment in meeting the labor requirements of health and safety.

In addition, all service providers who perform the restoration activities in the project areas, as well as community members of the forest nurseries and ATER team, will be encouraged to participate in trainings on standards and procedures for occupational health and safety. The trainings should contemplate all the activities performed by these workers, ensuring the integrity and health of people and suiting the operations to the following standards:

- Decree no. 3.048 - INSS: provides on the Technical Expertise Report on Occupational Environmental Conditions (L.T.C.A.T);
- Decree no. 3.048, of May 6th, 1999: provides on the Social Security Regulation;
- SEPRT Min. Directive No. 8.873, of July 23, 2021: provides on the Occupational Risk Management;
- SEPRT Min. Directive No. 22.677, of October 22, 2020: provides on the Safety and Health at Work in Agriculture, Cattle Ranching, Forestry, Forest Exploration and Aquaculture);
- Regulatory Standard (NR) 01: provides on Service Order (SO) and Safety Integration;
- Regulatory Standard (NR) 06: provides on the Use, Safekeeping and Conservation of Personal Protective Equipment (PPE);
- Regulatory Standard (NR) 07: provides on First Aid and the Occupational Health Medical Control Program (P.C.M.S.O.);
- Regulatory Standard (NR) 09: provides on accident prevention;
- Regulatory Standard (NR) 12: provides on Machine and Equipment Operation;
- Regulatory Standard (NR) 17: provides on Manual Weight Lifting and Transportation;
- Regulatory Standard (NR) 31: provides on the Program for Risk Management in Rural Work (P.G.R.T.R), Prevention of accidents with pesticides, Safety in the Operation of Chainsaws and Mowers and Safety in the Operation of Farming Machinery – Tractor.

It is worth mentioning that, throughout the duration of the Corridors for Life ARR Grouped Project, visits to service providers in the field restoration activities by a Labor Safety Technician will occur from time to time to prepare a photographic record report, issue technical opinions on the environmental working conditions, and provide technical advice to workers and service providers on Occupational Safety Health (OSH). In addition, the professional will perform the Daily Safety Dialog (D.D.S) and other activities under their competence and responsibility.

2.4. Management Capacity

2.4.1. Project Governance Structures (G4.1)

Biofílica Ambipar Environmental Investments and Institute for Ecological Research (IPÊ) will be responsible for managing the project. In this regard, the obligations and commitments of parties are described below:

Responsibilities of Biofílica Ambipar Environmental Investments: responsible for the relationship and management of the project's investors (clients) and for carrying out all operations associated with carbon management and certification (construction of the Project Design Description, conduct of validation/verification audits, project registration and management of RVEs generated).

Responsibilities of IPÊ: responsible for field activities, resource management, contracting of companies and teams for seedling production and planting, social and environmental monitoring,

relationship with owners of the restored areas, production of activity reports and infrastructure and logistics support to Biofílica and other professionals involved in the project. In addition, it should provide all the necessary support for the audit processes, construction of promotional materials, and other business processes.

It is worth mentioning that the project governance will ensure the involvement of participating rural producers, who will sign agreements that include all terms of responsibility, rights, and informed consent.

During the project conception and development, other organizations (mentioned in the item 2.1.4) were involved to carry out certain studies, diagnostics, and information compilation. Thereby, their responsibilities are following described:

TEK Plantio de Mudas: preliminary inventory of the project's baseline.

Embira Consultoria Ambiental: final inventory of the project's baseline.

Fabio Bueno de Lima: socioeconomic and environmental diagnosis of the project region based on secondary studies.

Rovera Consultoria Florestal Ltda: Analysis of carbon stock estimates and review of the project's carbon project design document.

Verde Perto Socioambiental Ltda: moderation and mediation of the public consultation (ECOnsulta) and feedback with the communities and other stakeholders of the carbon project, and information systematization.

Hence, as demonstrated in this section, the Corridors for Life ARR Grouped Project is backed by a solid governance and its structure allows for the appropriate project implementation.

2.4.2. Required Technical Skills (G4.2)

In general, the main technical skills required for the implementation of the Corridors for Life ARR Grouped Project are: a. knowledge about the methodologies, management and development of forest restoration projects in the Atlantic Forest biome; b. experience in initiatives of articulation and engagement of rural landowners and nurseries, through technical assistance and environmental education; and c. knowledge about forest monitoring. All of the proponents involved in the project rely on the technical skills necessary for the successful development of the Corridors for Life ARR Grouped Project.

In this regard, it is worth highlighting the goals and missions of the companies involved, in addition to their characteristics and history of operation, which make evident how they are technically qualified for the proposed undertaking.

First of all, Biofílica Ambipar Environment is a Brazilian company that promotes initiatives of preservation, management and rehabilitation of forest areas in the most different biomes in Brazil, especially the Amazon and the Atlantic Forest. The company is a benchmark in the design, implementation and management of REDD+ projects in the Amazon. And, currently, it is also including Afforestation/Reforestation projects in its portfolio. In this regard, the company aims to promote large-scale ecological restoration, mitigate carbon emissions into the atmosphere, conserve biodiversity and water resources, and promote social inclusion and development of local communities in the Atlantic Forest. This will occur through the sale of credits for environmental services, development and financing of scientific research activities, and development of sustainable business chains. In summary: Biofílica aims to make environmental recovery an economically interesting activity for rural landowners, communities and investors. To this end, it has a team highly specialized in developing projects for forest recovery and conservation, thus ensuring the quality and effectiveness of the ARR activities undertaken.

As to IPÊ, this a Brazilian Non-Governmental Organization that has been acting in the Pontal do Paranapanema region, since 1989, with fauna conservation and forest restoration. Throughout this period, it has involved about 400 families of rural settlers in training, environmental education, agroforestry, and restoration. Working closely with local rural settlers, the NGO has contributed to the establishment of six community nurseries and three forest restoration ventures among rural settlers, which are now financially independent. The organization also partners with private farmers and State agencies, achieving to date the restoration of more than 2,000 hectares of tropical rainforest and 60 hectares of agroforestry systems. The team includes members from local communities. IPÊ has recently received the following awards: Whitley Gold Award (2020), Society for Restoration Ecology (2019), National Geographic Society Award for Leadership in Conservation (2019), UBS Global Visionaris (2019), The Margot Marsh Award for Excellence in Primate Conservation (2016), Wildlife Conservation (Cincinnati Zoo & Botanical Garden) (2016) among dozens of other local and international awards throughout their history.

Finally, still in this respect, it should be noted that the Pontal do Paranapanema region is marked by the large presence of rural properties, with extensive areas of pasture and sugar cane. In this context, the vegetation cover found is mostly composed of forest remnants existing in such properties and also in conservation units, such as: the Ecological Station (ESEC) Black Lion Tamarin; the Private Reserve of Natural Heritage (RPPN) Mosquito; the Rio Peixe State Park (PE); the Environmental Protection Area (APA) of the Paraná River Islands and Floodplains; and especially the Morro do Diabo PE, which has 36,000 hectares of Atlantic Forest.

In this scenario, the need and importance of recovering and connecting the Pontal vegetation, and the activities under the Corridors for Life ARR Grouped Project will also strengthen the goals of socioeconomic development and improvement of living conditions, besides ensuring the generation of carbon credits by Biofílica Ambipar Environment.

2.4.3. Management Team Experience (G4.2)

Cláudio Pádua - Scientific Director of Biofílica Ambipar Environmental Investments and Vice-President of the Institute for Ecological Researches:

Cláudio Pádua has a degree in Business Administration and Biology, has a master's degree in Latin American Studies and PhD in Ecology from the University of Florida in Gainsville (USA). A retired professor from the University of Brasilia, Pádua is currently dean of the School of Conservation and Sustainability and vice-president of the Institute for Ecological Researches (IPÊ). He is also a Senior Associate Researcher at the Center for Environment and Conservation Studies at Columbia University (USA) and Director of International Conservation at the Wildlife Trust Alliance, and a consultant of the Brazilian Biodiversity Fund (FUNBIO) and WWF Brazil. Pádua represents Brazil before the International Advisory Group (IAG) of the G7 Pilot Program. In 2003, together with his wife, Suzana Pádua, he was named "Hero of the Planet" by Time magazine for his activities in favor of biodiversity conservation. Between 1997 and 2007, he won six conservation awards, three national and three internationals. Pádua has published two books and more than 30 articles in national and international scientific journals. Since 2008 he directs the scientific involvement and production of Biofílica as Scientific Director and advisor.

Biofílica Ambipar Environmental Investments

Plínio Ribeiro - Executive Director and Project Proponent

Plínio Ribeiro has a degree in Business Administration from Instituto de Ensino e Pesquisa - INSPER and a Master in Public Administration and Environment from Columbia University and the Earth Institute (USA). He has participated in several conservation projects in the lower Negro River, through the Institute for Ecological Researches - IPÊ since 2005, and was one of the producers of the documentary

"Return to the Amazon", by Jean Michel Cousteau. He works at Biofílica Ambipar since 2008, where he has led Projects, Operations and Business Management. He is currently the Company's Executive Director and shareholder.

Caio Gallego - Operations Manager

Caio Gallego is a Forest Engineer graduated from the University of São Paulo (USP/ESALQ). He is a specialist in geoprocessing and remote sensing for environmental conservation, mapping, and analysis of changes in soil use. He has knowledge focused on Sustainable Forest Management, environmental modeling and use of alternative GIS for forestry and agribusiness. He has advanced knowledge in the use of GIS software and analysis of changes in land use and ground cover, such as ArcGIS, QuantumGIS and DynamicsEGO.

Leonardo Ferreira - Finance Manager

Economist graduated at Unicamp and currently taking his MBA in Business Management at FIA. Experience of more than 15 years, 9 of them in leadership positions, working in the segments of carbon credit, advertising, communication and audio visual; in companies of different sizes and nationalities; besides two entrepreneurial experiences: Financial Consulting and T-shirt sales company. A fortress in conflict management with internal and external clients and in supplier management, analytical capacity and construction of indicators focused on decision making.

Laion Pazian - Commercial Manager

Laion Pazian has a degree in Economics from the University of São Paulo (USP/ESALQ), and an MBA in Business Management from Fundação Getúlio Vargas. He manages the carbon credits commercial team, key accounts, and the commercial policy and strategy of Biofílica Ambipar. He also monitors and directs the analysis of carbon market intelligence, and is responsible for the pricing policy and the area planning policy.

Paula Conde - Administrative Manager

Paula Conde has a degree in Business Administration from PUC São Luís and a graduate course degree in Accounting and Financial Administration from FAAP. She has an extensive experience, mostly in one of the largest media and education groups in Latin America - Editora Abril, where she worked with Financial Control and Reporting, Treasury, Accounting and Financial Reconciliation, Accounts Payable and Receivable and Royalties. At Biofílica Ambipar, she is responsible for administrative and financial activities, logistical support to the team and projects.

Leonardo Almeida - Projects Coordinator

Leonardo Almeida is a Forest Engineer, graduated from Paulista State University (Botucatu Campus) with extension in Hochschule Weihenstephan-Triesdorf in Germany. Certified in Green Belt, he is experienced in project management and process improvement in the forest production chain. He has also worked with sustainable forest management, wood panel production and environmental licensing. At Biofílica Ambipar he is the coordinator of the Corridors for Life ARR Grouped Project and of another grouped project under development, that will work on sustainable management practices in cattle ranching following ALM (Agriculture and Land Management) methodologies.

Luana Geraldini - Project Coordinator

Luana Geraldini is a Forest Engineer, graduated from the Paulista State University (Botucatu Campus) and with a graduate course in Project Management from USP/ESALQ. During her undergraduate studies she worked with environmental education projects and research on forest restoration. She has extensive experience in the environmental area as an environmental analyst in environmental licensing and geoprocessing projects. At Biofílica Ambipar she coordinated the Corridors for Life ARR Grouped Project and is currently focused on coordinating REDD+ AUD projects in the Brazilian Amazon.

Ricardo Cordeiro - Communication Coordinator

Ricardo Cordeiro is an advertising man, on and off-line arts director, with over 10 years of experience, he has worked in digital agencies, trade and live marketing. Experience in UX, planning and digital strategies. Specialization in Digital Marketing and Web Project Management. At Biofílica Ambipar he acts as communication coordinator, responsible for the actions of digital marketing, branding and institutional communication.

Susane Rasera - ARR Specialist

Susane Rasera is a Forest Engineer with a master's degree in Forest Resources, both from the University of São Paulo (USP/ESALQ). She is experienced in Forest Ecosystem Conservation, mainly in Forest Restoration and forest biomass and carbon allocation. At Biofílica Ambipar she is ARR Project Specialist.

Raphael Ramiro - FP&A Specialist

Raphael Ramiro is an administrator, graduated from Paulista State University with a graduate course in Corporate Finance from the Federal University of São Carlos. He has over twelve years of professional experience in project analyses and assessments from an economic/financial point of view.

Rafael de Oliveira Costa – Lawyer

Rafael has been practicing law for 18 years (OAB/SP nº 244.677), graduated from PUCCAMP, having completed his Master's Degree in Political and Economic Law from Universidade Presbiteriana Mackenzie-SP, Doctorate in Public International Law from the University of São Paulo and Post-Doctorate in Democracy and Human Rights by the University of Coimbra. He has worked in national and international Compliance projects, served as Legal Manager of a large company (Farma Conde) and currently holds the position of Senior Lawyer at Biofílica Ambipar Environment. He also performs functions of undergraduate and graduate academics (Law and Business).

Amanda Fiallos - Project Analyst

Amanda Fiallos is a Forest Engineer, graduated from the University of São Paulo (USP/ESALQ). She is experienced in forest restoration and conservation projects, environmental education, geoprocessing and remote sensing applied to the planning of planted forests.

Samara Silva - Project Analyst

Samara Martins Silva is an Environmental Manager graduated from the University of Brasilia (UnB) and Master in Forest Resources from the University of Sao Paulo (USP/ESALQ). Currently she is a student with a Professional Master Degree in Economic Management of the Environment (UnB) and PhD in Forest Resources from USP (ESALQ campus). She is experienced in general climatology and global climate change, Brazilian forest policy and legislation, conservation of forest ecosystems, and management of native tropical forests with a focus on the Cerrado and Amazon. She works specifically with environmental quantification and economic valuation of services aiming at the use of related economic instruments in the public and private sectors.

Taísi Sorrini - Project Analyst

Taísi Sorrini is an Agricultural Engineer, graduated from the University of São Paulo (ESALQ campus) and Master of Science from the same institution. She is experienced in conservation and recovery of forest ecosystems, with a focus on ecological restoration project management, and corporate consulting in sustainability and environmental management.

Marco Antonio Martins - Geoprocessing Analyst

Marco Antonio Martins is a Geographer, graduated from the University of São Paulo (FFLCH-USP). During his undergraduate studies he worked with geoprocessing and remote sensing projects applied

to forest monitoring, land planning, mapping of coastal habitats and restored areas in protected areas. He is currently a graduate student at the University of São Paulo (FFLCH-USP).

Institute for Ecological Research (IPÊ)

Eduardo Ditt - Executive Director

Eduardo Ditt is the executive director of IPÊ - Institute for Ecological Researches. His activities in this organization started in 1992, year of its foundation. Initially, he was coordinator of research and conservation projects on themes related to forest fragmentation and ecosystem services. These themes were the object of his master's research at Procam/USP, completed in 1999, and doctor's degree at Imperial College London, completed in 2008. Since then, he has dedicated himself to issues of institutional development, management and governance of the organization, besides supervision of social/environmental projects. During his 30 years at IPÊ, Eduardo has also collaborated as coordinator of courses and professor at the same institute, through ESCAS - School of Environmental Conservation and Sustainability.

Laury Cullen - Operations Coordinator

Laury Cullen Junior is a Forest Engineer and scientific researcher at IPÊ - Institute for Ecological Researches. He has a Master's degree in Conservation Biology from the University of Florida, his Ph.D. from the University of Kent, England, and a graduate course from Columbia University, USA. He is a researcher and associate professor at ESCAS-IPÊ (School of Conservation and Sustainability) and a Fellow of the ASHOKA Foundation. He has focused his research on large mammal ecology and applied conservation biology concepts to the restoration of fragmented landscapes and community engagement. More recently he has been coordinating projects in Climate, Community and Biodiversity. He has published above 60 articles in national and international journals. Among the awards he has been given are the Rolex Awards for Interprize, the Whitley Gold Award 2002 received by the hands of Princess Anne of England and considered in Europe as the conservation.

Alexandre Uezu - GIS Expert

Alexandre Uezu is a Biologist graduated from the Institute of Biosciences/USP, with a Masters and PhD in Ecology from the same university. His researches focus on Landscape Ecology, biodiversity conservation and ecosystem services as well as the prioritization of areas for conservation and restoration. He has published above 30 articles in national and international publications. He is a professor and permanent researcher at ESCAS and has already taught dozens of courses on Geographic Information Systems, Spatial Analysis and Landscape Ecology, for more than 1,000 students, professionals in Conservation Biology. He has participated in the training of more than 30 master's and doctor's degree students as advisor or co-advisor.

Haroldo Gomes - Field Coordinator

Haroldo Borges Gomes is an agricultural technician, graduated in Biological Sciences. Master in Agronomy from the Paulista State University, "Júlio de Mesquita Filho" Campus, of Ilha Solteira specializing in production systems and is pursuing his PhD in Environment and Regional Development from the Oeste Paulista University (UNOESTE). He has been working at IPÊ - Institute for Ecological Researches for almost 21 years now. His assignments are related to the development of Rural Extension activities, acting mainly on the following themes: family agriculture, agroforestry and agroecological systems, ecological restoration, forest seedling production, interconnected projects for biodiversity conservation, rural development and community involvement.

Amanda Ceballos - Field Coordinator

Amanda Garbim Ceballos is an agricultural technician from ETEC Professora Carmelina Barbosa - Dracena (SP); and Forest Engineer from Faculdade de Ensino Superior e Formação Integral de Garça

- FAEF. She is part of the Forest Restoration team at IPÊ since December 2021, institution where she worked as internee in 2015 and 2016, during her undergraduate studies. She worked as an Environmental Consultant at ATR Agroambiental, in Dracena (SP).

Aline Souza - Field Technician

Aline dos Santos Souza is a biologist graduated from Unoeste - Oeste Paulista University. Master's student in Biodiversity Conservation at ESCAS - School of Environmental Conservation and Sustainability. She has worked as an educator in the public, state, and private education systems with education for rural youth and adults. Works at IPÊ - Institute for Ecological Researches, since 2015, in the area of landscape restoration with a focus on agroforestry systems, ecological corridors and community involvement.

Nivaldo Campos - Field and Community Nursery Technician

Nivaldo Ribeiro Campos is an Environmental Technician, graduated in agronomy, responsible for nurseries of forest seedling production, also works as an extensionist in projects of agroforestry systems and ecological restoration developed by IPÊ - Institute for Ecological Researches with family farmers in rural settlements in Pontal do Paranapanema region (SP).

Marcela Paolino - Administrative/Financial

Marcela Paolino has a Bachelor's degree in Business Administration from EASP-FGV, with specialization in Finance from the same institution, and an MBA in Management of Third Sector Organizations from CEATS_FIA. She developed her career in the financial area at multinational companies such as Pirelli, Johnson & Johnson and Dupont. In 2006 she made her career transition to work in the Third Sector. She currently works as Controller at IPÊ - Institute for Ecological Researches. She also dedicates herself to the study of themes related to the Culture of Peace and Non-Violence.

Wiliana Marin - Administrative/Financial

Williana Marin is graduated in Biology from UNOESTE, Specialist in Project Management - PMI, Strategic and Economics Business Management, Executive Business Management, Business and Executive Coaching - by IBC. Works in projects at IPÊ Pontal do Paranapanema site since 2004, with over 14 years of experience as project manager.

Erika Bechara - Legal

Érika Bechara has a Bachelor's degree in Law, Master's and PhD in Environmental Law from the Pontifical Catholic University of São Paulo (PUC-SP). She is a partner at SBSA Advogados. She is a professor of Environmental Law and assistant coordinator of the Specialization course in Environmental Law and Strategic Sustainability Management, both at PUC-SP. Member of the boards of Master's, Doctorate and qualification examinations. She is a lecturer at events promoted by educational institutions, professional education and training entities. Legal and Administrative Coordinator of the Brazilian Association of Environmental Law Professors - APRODAB. Author of books and several articles on Environmental Law and Third Sector Law, published in specialized magazines, collective works and newspapers.

Rafael Lotfi - Legal

Rafael Mortari Lotfi graduated in Law from Pontifical Catholic University of Campinas, specialized in Environmental Law and Management at PUC-SP, with a master's degree in Environmental Conservation and Sustainability from ESCAS. He has more than 20 years of experience advising Projects and Companies in the Environmental Legal Area, especially focused on forest legislation and sustainability. He was a professor of Environmental Legislation at the Schools of Environmental Engineering and Architecture of UNESP - Presidente Prudente (SP), between 2012 - 2016, collaborator

of the Institute for Ecological Researches - IPE and founding partner of a firm Pacianotto, Chelli e Lotfi Advogados.

Paula Piccin - Communications Coordinator

Paula Piccin is a Journalistic Communications Coordinator from the Methodist University of São Paulo, with a specialization in Environment and Society from FESP/SP and an MBA in Corporate Communications from Aberje/SP. She is experienced in communication media such as TV Cultura, Companhia de Notícias, Diário do Grande ABC and Notícias Populares newspapers, and in institutional communication for the Third Sector. She works at IPÊ since 2003, in the coordination of the communication core since 2011.

Cibele Quirino - Communication Analyst

Cibele Quirino is an Institutional Communication Advisor, a journalist with more than 15 years of experience, specialized in Environment and Society by Fundação Escola de Sociologia e Política de São Paulo. She has dedicated more than five years to the Communication Coordination area, including two years in the Semeando Água Project, from IPÊ. She also signs the third edition of the magazine Boas Práticas na Gestão de Unidades de Conservação (Good Practices in Conservation Areas Management), a publication of ICMBio - Chico Mendes Institute for Biodiversity Conservation. Currently, she is a member of IPÊ's Institutional Communication team.

2.4.4. Project Management Partnerships/Team Development (G4.2)

The Corridors for Life ARR Grouped Project has all the necessary partnerships for the design and implementation of the restoration activities of the forest asset. Currently, the partner institutions, mentioned in sub-item 2.4.1 Project Governance Structures, are responsible for the studies, analysis and systematization of the information in the Socioeconomic and Environmental Diagnostics, Forest Inventories, Carbon Stock and Baseline, which make up the Project Design Document, through service supply contracts.

If necessary, during the project development, new technical knowledge and the establishment of new partnerships, the proponents will articulate with different actors, such as governmental and non-governmental organizations, and the private sector, all with the purpose of causing net positive impacts to the climate, society and biodiversity.

2.4.5. Financial Health of Implementing Organization(s) (G4.3)

Documents evidencing the financial health of both institutions are classed as commercially sensitive information and will be shared with the audit team on a confidential basis.

2.4.6. Avoidance of Corruption and Other Unethical Behavior (G4.3)

Biofílica Ambipar Environment supports annual financial auditing processes, ensuring that its resources are applied in a responsible and corruption-free manner. Complying with the duty of transparency, the financial statements and minutes of the company's general meetings are published on the JusBrasil website, the largest open legal community in Latin America.

In addition, the Ambipar Group, of which Biofília is part, has countless policies, statutes and regulations that value governance and ethics. These guidelines are binding upon the employees, suppliers and service providers with which the company establishes relationships.

In this regard, the company's Code of Conduct & Compliance is a public document, guiding and valuing good conduct practices by employees and third parties. Thus, the organization's internal guidelines are

in line with the Brazilian legislation, setting non-negotiable standards that should guide the behavior and relationships within the institution.

As an example, it is worth mentioning that Biofílica has the following points as values and guidelines:

a) correct and transparent integration;

b) integrity and honesty in conducting business;

c) ban on and combat of acts of corruption; respect for people and their choices;

d) fighting all and any form of discrimination.

With regard to the ban on corrupt practices and/or conducts that prioritize personal benefits, the Code of Conduct & Compliance ensures the fulfillment and observance of the Integrity Program and of the Anti-corruption and Money Laundering Policy, based on Brazil's Anti-corruption Law. Furthermore, it encourages anti-corruption training for employees and third parties, all in order to avoid bribery, embezzlement, and the granting of undue advantages, as well as the concealment of these acts and the hindering of investigation and inspection activities.

In order to implement and ensure the effectiveness of the precepts set out here, the Ambipar Group has a Conduct Committee which manages all the documents indicated herein, overseeing their execution, effectiveness and publicity. Also, with the purpose of conferring effectiveness to such commandments, there is a channel for registering occurrences and complaints, which is done electronically and confidentially. These demands are analyzed by the Conduct Committee, which adopts the necessary corrective actions and measures, in line with the moral and ethical principles that guide the company's actions.

IPÊ's actions are in the same line, and its Statute is notarized and it has a public commitment to the principles of legality, impersonality, and morality. Moreover, the organization also watches over any and all forms of discrimination and unethical behavior, and opposes any form of undue granting of privileges. In order to implement these precepts, the organization counts on the participation and collaboration of an Executive Board, Board of Directors, Board of Auditors, Advisory Council and General Meeting.

2.4.7. Commercially Sensitive Information (Rules 3.5.13 – 3.5.14)

Some information required by the VCS and/or CCB standards is regarded as confidential or commercially sensitive, and may not be publicly disclosed by the Project proponents. This information was fully provided to the audit team during the validation process attached to this document, but was not included in the public version. Below is a list of information that was made available:

- Land and legal status documents;
- Financial statements from Biofílica Ambipar Environmental Investments and Institute of Ecological Researches – IPÊ;
- Spreadsheet with the economic model and financial performance of the project and other related documents;
- Agreements and contracts signed between the concerned parties;
- Internal regulatory compliance procedure.

2.5. Legal Status and Property Rights

2.5.1. Statutory and Customary Property Rights (G5.1)

Firstly, it should be noted that the right to property is constitutionally guaranteed, being inscribed as a fundamental right in the Brazilian legal system. In this regard, it is worth clarifying that, according to the Civil Code, the owner is the one who has the right to use, enjoy, and dispose of things, and the right to reclaim them from whoever unjustly possesses or holds them.

Specifically in the scope of the Corridors for Life ARR Grouped Project, it is noted that all the areas are private property, having been acquired regularly by means of Title Registry, according to the registration in the respective Real Estate Registry Office – the relevant documentation was made available for access and consultation in order to consolidate the validation process. To assure statutory and customary property rights, the rights of tenure, use, access and management of lands, territories, and resources in the project area were verified in the project's due diligence process that was carried out by the project's legal team through request and evaluation of the property and landowner's documents. Through signing a Memorandum of Understanding between the parties, the project had legal access to estate, socio-environmental, tributary and judicial documents and processes of the rural properties and owners, such as rural property registration certificate (CCIR), negative certificates of tax debts (ITR/ITCMD/ITBI) and environmental rural registration (CAR). Only after analyzing the documents, understanding the risks and assuring the statutory and customary property rights the project signs contracts to include a new farm to the project instance.

In this perspective, the legitimate landowners, who are also the direct owners of the areas, were previously contacted, on which occasion they got to know the project and its potential as well as the activities that will be undertaken. This was done in a detailed manner, with meetings, consultations and other forms of exposure of the project and negotiation.

From this initial contact, the negotiations began and culminated in the signing of the contractual agreement, which are signed by the parties and also by two witnesses, forming an extrajudicial execution instrument, as per the terms of Article 784, item III, of the Code of Civil Procedure. It is also important to highlight that the signing of contracts ensures keeping with the relevant legal precepts and the free, prior, and informed consent of all parties involved – Biofilica Ambipar Environmental Investments, Institute for Ecological Researches, and the owners – was observed.

Thus, it is possible to conclude that there is a full compliance with VCS standard, version 4.3, specifically number 6 of item 3.6.1, which states: *"An enforceable and irrevocable agreement with the holder of the statutory, property or contractual right in the land, vegetation or conservation or management process that generates GHG emission reductions or removals which vests project ownership in the project proponent."*

Regarding the legal regulation concerning properties and restoration and restoration projects, the following can be highlighted:

- The principles set out by the Federal Constitution of 1988;
- Legislative Decree No. 01 of 1994, approving the text of the United Nations Framework Convention on Climate Change;
- Federal Law No. 12.187 of 2009, which establishes the National Policy on Climate Change;
- Federal Decree 7.390, of 2010, which regulates the National Policy on Climate Change;
- Federal Law No. 6.938 of 1981, establishing the National Policy on the Environment;

- Federal Law No. 12.651, of May 25, 2012, which provides for the protection of Brazilian native vegetation (Brazilian Forest Code);
- State Decree No. 66.650 of 2022, which addresses the REFLORESTA-SP Program;
- State Law No. 17.557 of 2022, which provides for the State Land Regularization Program.

2.5.2. Recognition of Property Rights (G5.1)

The property rights for each property are recognized, respected and regulated. All the landowners involved in the project have ownership titles and rural property registrations that certify and guarantee rights over the land. It should also be noted that, in the selection of contractual partners, areas were chosen where there are no collective conflicts over land tenure or pending similar actions.

2.5.3. Free, Prior and Informed Consent (G5.2)

This project is being carried out through free, prior, and informed consent of the landowners, community, and other stakeholders. It is worth stressing that the Corridors for Life ARR Grouped Project will be developed in a region where IPÊ historically carries out actions related to nature conservation, environmental education, rural extension and socioeconomic development.

Therefore, IPÊ and the Biofílica Ambipar Environmental Investments, as proponents of the referred carbon project, have entered into a contractual partnership for the preparation and execution of Carbon Projects in the ARR Model for restoration in private rural properties within the region of Pontal do Paranapanema, State of São Paulo, with the purpose of generating and marketing carbon credits. Both parties signed the cooperation contract freely, previously and informed.

In relation to private rural landowners, who own the areas where the restoration actions will be carried out, they were mobilized for face-to-face informative talks about the activities intended by the carbon project, about the importance of compliance with current environmental legislation, the relevance of observing the forest restoration for the environmental suitability of Permanent Preservation Areas and Legal Reserves under the law, the direct and indirect benefits of the restorations for the environment, society and local economy, and general explanations about the implementation and development of the carbon project. In the same meeting, in direct contact with the Project developers, the farmers also had the opportunity to solve potential doubts and questions.

Informed and aware of the Corridors for Life ARR Grouped Project and its programmed actions, the landowners had access to the partnership contract, so that they could have consent on all their rights and duties concerning the carbon project before signing the document. Moreover, this step is of utmost importance to ensure clarity and transparency about the responsibilities and duties of the parties.

Finally, local communities and other stakeholders of the Project Zone were informed and consulted about the Corridors for Life ARR Grouped Project in the events of ECOnsulta and feedback, better detailed in topic 2.3.7, in person with the proponents of said carbon project.

2.5.4. Property Rights Protection (G5.3)

Under this project, no activity will result in the involuntary removal or relocation of landowners. That is, activities important to the local culture and to their livelihood will be maintained as they were originally found, and will be not only respected but supported. In order to guarantee the success of this endeavor, the aforementioned socialization workshops were held, in which both parties committed themselves to identifying and defining the activities that will be developed on each of the farms, which ensures that the owners were not forced to relocate the aforementioned activities. Despite this prior agreement, it

should be noted that the project maintains open and constant communication with the landowners, so that their rights and needs are constantly respected and taken into account.

2.5.5. Illegal Activity Identification (G5.4)

As presented in Section 2.1.6 Social Parameters, deforestation of native vegetation in the Project Zone has occurred intensively in the last century, and in recent years is no longer commonly practiced, keeping the forest levels stable. As areas that should be forested and protected by law were cleared, in this case the Permanent Preservation Areas and the Legal Reserves, this condition caused problems to the property owners, who are precisely participating in the project so as to have their lands environmentally made regular. Thus, as to illegal deforestation, the project does not present risks, as well as specific strategies for containment. The same occurs with regard to poaching which, due to the excessive hunting practiced in the past and the greater action of the environmental enforcement agencies in this century, is no longer a common practice. Anyway, the project team always advises the farm owners to contact the Environmental Police in case they identify any poaching in the areas, since it is common practice for all owners to forbid any kind of hunting in their areas.

2.5.6. Ongoing Disputes (G5.5)

Currently, there are no ongoing conflicts or disputes that have not been resolved, either with regard to property rights or existing resources. Thus, all partnering properties have as legitimate owners and proprietors those described in the relevant documents (registrations, CAR etc.). Thus, there is no impact of this project in terms of conflicts or disputes, since they do not exist.

Two discriminatory actions have been developed in the last twenty years regarding some of the properties, namely the Discriminatory Action no. 777/85, which was filed in the county of Teodoro Sampaio (SP), and the Discriminatory Action no. 68/72, the latter before the county of Mirante do Paranapanema.

It is important to point out here the advent of State Law 17.557, of 2022, which provides for the State Land Regularization Program. Thus, contingent discussions regarding the legitimacy of rural property ownership or possession are covered by such regulation, which allows the execution of agreements in the scope of discriminatory, claiming processes, and regularization of possession of unsettled lands, even after the sentence in the declaratory phase of the discriminatory lawsuit has become final and unappealable.

Moreover, in the event of future disputes over land ownership, the project will implement activities to assist in their resolution and to clarify emerging claims, in order to pacify the situation and allow the consolidation of the developed enterprises.

2.5.7. National and Local Laws (G5.6)

The importance of mitigation actions and adaptation to climate changes, and the conservation of biodiversity and its services, is internationally addressed in international conventions such as the Kyoto Protocol and the Paris Agreement, of which Brazil is a signatory.

The Brazilian legislation, whether at federal, state, or municipal level, moves in the same direction providing, in its rules, economic instruments that help achieve the goals of the climate commitments undertaken.

It is in this scenario that the Corridors for Life ARR Grouped Project is inserted, which fosters the formation of ecological corridors and the generation of carbon credits, promoting environmental conservation and connectivity among the remaining forest fragments.

Thus, the purpose is to implement the environmental readjustment of properties with forest liabilities, according to the criteria set forth in the New Brazilian Forest Code (Law No. 12.651 of May 25, 2012), meeting the normative precepts inscribed nationally and internationally.

As for the carbon market, there is a Bill (PL No. 528 of 2021) in progress at the House of Representatives, which aims to establish the Brazilian Market for Emissions Reduction (MBRE) and to regulate the purchase and sale of carbon credits in the country arising from activities of Reduction of Emissions from Deforestation and Forest Degradation, for example. The promotion of this voluntary carbon market is contemplated in the Law that instituted the National Policy for Climate Change (Law no. 12.187, dated 12/29/2009).

After years of discussion and stagnation of the PL No. 528 of 2021 in the National Congress, more recently Decree No. 11.075 of May 19, 2022 was enacted, which addresses the implementation of a regulated carbon credit market in Brazil, through the creation of the National System for Reduction of Greenhouse Gas Emissions (Sinare). Procedures are also established for the preparation of Sectoral Plans for Climate Change Mitigation. Besides these measures, the document brings new concepts related to methane credit, registration of the carbon footprint of processes and activities, carbon from native vegetation, soil carbon and blue carbon.

In order to assure compliance with the legislation and regulations, the project team consists of duly trained professionals - registered at their respective professional councils - to analyze the feasibility of implementing activities in compliance with the laws, as well as to monitor execution while maintaining compliance. In addition, other institutions and their respective processes contribute to maintaining compliance. Since the project's restoration activities take place in areas of environmental liability for the regularization of rural properties, official bodies such as CETESB and CRB must regularly inspect the areas, which must be duly registered in the SIGAM monitoring system via Rural Environmental Registry for compliance with the Environmental Regularization Programs and Recovery Plans of Degraded Area. As for social regulations compliance, the project has some proper mechanisms. In addition to the contractual requirements between the project proponents and their suppliers or partners (such as the landowners), which clearly specify the regulatory compliance obligations, the project has an outsourced Technician of Security of the Work company to guarantee the execution of the legal orientations in field. Finally, the project has internal policies, statutes and internal regulations on compliance, conduct, ethics and governance that reinforce national and state laws that must be followed by all parties involved in the project. An internal procedure that demonstrates regulatory compliance for each of the relevant laws was shared with the VVB as commercial sensitive information.

Below, the main relevant legislation and regulations at federal and state levels are listed and detailed. In addition, a brief analysis of the international climate agreements that have been driving the creation and development of ARR initiatives around the world is provided.

INTERNATIONAL AGREEMENTS

LAW No. 58.054, of 1966: enacts the Convention for the protection of flora, fauna and scenic beauty of the American countries.

CITES of 03/03/1973: "Convention on International Trade in Endangered Species of Wild Fauna and Flora", signed in Washington D.C. on March 03, 1973, amended in Bonn on June 22, 1979.

DECREE NO. 99.280, OF JUNE 6, 1990: Enactment of the Vienna Convention for the Protection of Ozone Layer and the Montreal Protocol on Substances that Destroy the Ozone Layer.

DECREE No. 2.544, of April 13, 1998: Enacts the Constitutive Agreement of the American Institute for Research on Global Changes, concluded on May 13, 1992, in Montevideo.

DECREE NO. 2.519, of March 16, 1998: Enacts the Convention on Biological Diversity signed in Rio de Janeiro, on June 5, 1998.

DECREE No. 2.652, of July 1st, 1998: Enacts the United Nations Framework Convention on Climate Change, signed in New York, on May 9, 1992.

DECREE No. 5.208, September 17, 2004: Enacts the Mercosur Framework Agreement on Environment.

FCCC/CP/2005/Misc.1: Reducing emissions from deforestation in developing countries: approaches to stimulate action. Submission from Parties. (Translation: Reduzindo emissões de desmatamento em países em desenvolvimento: abordagem para estimular ação. Submissão das partes. COP 11, Montreal, 2005).

DECREE NO. 5.445, OF MAY 12, 2005: Enacts the Kyoto Protocol to the United Nations Framework Convention on Climate Change, opened for signatures in Kyoto, Japan, on December 11, 1997, on the occasion of the Third Conference of the Parties to the United Nations Framework Convention on Climate Change.

FCCC/CP/2007/6/add.1: Report of the Conference of the Parties on its thirteenth session, held in Bali from December 3 to 15, 2007. Addendum. Part two: Action taken by the Conference of the Parties at its thirteenth session. (Translation: Relatório da Conferência das Partes sobre sua décima terceira sessão, ocorrida em Bali de 3 a 5 de dezembro de 2007. Addendum. Part Two: Action taken by the Conference of the Parties at its thirteenth session ou “Action Bali Plan”. COP 13, Bali, 2007).

FCCC/CP/2009/Add.1: Report of the Conference of the Parties on its fifteenth session, held in Copenhagen from December 7 to 19, 2009. Addendum. Part two: Action taken by the Conference of the Parties at its fifteenth session. (Translation: Relatório da Conferência das Partes sobre sua décima quinta sessão, ocorrida em Copenhagem de 7 a 19 de dezembro de 2009. Addendum. Part Two: Action taken by the Conference of the Parties in its fifteenth session or “Copenhagen Accord”. COP 15, Copenhagen, 2009).

FCCC/CP/2010/7/Add.1: Report of the Conference of the Parties on its sixteenth session, held in Cancun from November 29 to December 10, 2010. Addendum. Part two: Action taken by the Conference of the Parties at its sixteenth session. (Translation: Relatório da Conferência das Partes sobre sua décima sexta sessão, ocorrida em Cancun de 19 de novembro a 10 de dezembro de 2010. Addendum. Part Two: Action taken by the Conference of the Parties in its sixteenth session or “Cancun Agreement”. COP 16, Cancun, 2010).

FCCC/CP/2011/9/Add. 1: Report of the Conference of the Parties on its seventeenth session, held in Durban from November 28 to December 11, 2011. Addendum. Part two: Action taken by the Conference of the Parties at its seventeenth session. (Translation: Relatório da Conferência das Partes sobre sua décima sétima sessão, ocorrida em Durban de 28 de novembro a 11 de dezembro de 2011. Addendum. Part Two: Action taken by the Conference of the Parties in its seventeenth session. COP 17, Durban, 2011).

FCCC/CP/2012/8/Add.1: Report of the Conference of the Parties on its eighteenth session, held in Doha from November 26 to December 8, 2012. Addendum. Part two: Action taken by the Conference of the Parties at its eighteenth session. (Translation: Relatório de Conferência das Partes sobre sua décima oitava sessão, ocorrida em Doha de 26 de novembro a 8 de dezembro. Addendum. Part Two: Action taken by the Conference of the Parties in its eighteenth session.

FCCC/CP/2013/Add.1: Warsaw Framework for REDD-plus, held in Warsaw, Poland, from November 11 to 22, 2013 (Translation: Warsaw Package for REDD+, occurred in Warsaw, Poland, from November 11 to 22, 2013), particularly the following decisions:

DECISION 9/CP.19: Work programme on results-based finance to progress the full implementation of the activities referred to in decision 1/CP. 16, paragraph 70. (Translation: Programa de trabalho em financiamento baseados em resultados para o progresso da implementação completa das atividades referidas na decisão 1/CP. 16, paragraph 70).

DECISION 10/CP.19: Coordination of support for the implementation of activities in relation to mitigation actions in the forest sector by developing countries, including institutional arrangements. (Translation: Coordenação do suporte para a implementação de atividades relacionadas a ações de mitigação no setor florestal por países em desenvolvimento, incluindo arranjos institucionais).

DECISION 12/CP.19: The timing and the frequency of presentations of the summary of information on how all the safeguards referred to in decision1/CP.16, appendix I, are being addressed and respected. (Translation: O tempo e a frequência na qual são apresentadas as informações resumidas de como todos as salvaguardas referidas na dicisão1/CP.16, apêndice I, estão sendo abordadas e respeitadas.)

DECISION 13/CP.19: Guidelines and procedures for the technical assessment of submissions from Parties on proposed forest reference emission levels and/or forest reference levels. (Translation: Guia e procedimentos para avaliação técnica das submissões das Partes em propostas de níveis de referência em emissões florestais e/ou níveis de referência florestal)

DECISION 14/CP.19: Modalities for measuring, reporting and verifying. (Translation: Modalidades para medir, reportar e verificar.)

DECISION 15/CP.19: Addressing the drivers of deforestation and forest degradation. (Abordagem dos vetores de desmatamento e degradação florestal.)

FCCC/CP/2015/Add.1: Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015. Addendum. Part two: Action taken by the Conference of the Parties at its twenty-first session. (Translation: Relatório de Conferência das Partes sobre sua vigésima primeira sessão, ocorrida em Paris de 30 de novembro a 13 de dezembro. Addendum. Part Two: Action taken by the Conference of the Parties in its twenty first session.

BRAZILIAN NATIONALLY DETERMINED CONTRIBUTION (NDC) submitted in September 2015 to the United Nations Framework Convention on Climate Change for mitigation, adaptation and means of implementation, consistent with the purpose of contributions to achieve the ultimate objective of the Convention, under the terms of decision 1/CP.20, paragraph 9.

BRAZILIAN NATIONALLY DETERMINED CONTRIBUTION (NDC): First Brazilian NDC submitted in in September 2015 to the UN Framework Convention on Climate Change for mitigation, adaptation and means of implementation, in a manner consistent with the purpose of contributions to achieve the ultimate objective of the Convention, pursuant to Decision 1/CP.20, paragraph 9. The updated Brazilian NDC was presented at the COP26 on December 8th, 2022.

FCCC/CP/2015 PARIS AGREEMENT: Global, legally-binding agreement that sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. Entry into force on 4 November 2016.

LAW NO. 13.123 OF 2015: Regulates the Convention on Biological Diversity (CBD), provides for access to genetic heritage, protection of and access to associated traditional knowledge, sharing of benefits for conservation and sustainable use of biodiversity, and provides other measures.

DECREE NO. 8.772 OF 2016: Regulates Law No. 13.123 of May 20, 2015, which provides for the access to genetic heritage, on the protection of and access to associated traditional knowledge, and on benefit sharing for conservation and sustainable use of biodiversity.

FCCC/CP/2016 DECISIONS ADOPTED BY THE CONFERENCE OF THE PARTIES (COP): Especially decisions 1 (preparation into force of the Paris Agreement), 3 (Warsaw International

Mechanism for Loss and Damage associated with the Climate Change Impacts), 6 (National adaptation plans) and 7 (Long-term climate finance).

FCCC/CP/2017, FCCC/CP/2018, FCCC/CP/2019 DECISIONS ADOPTED BY THE COP: Especially decision 1 reporting on developments of the implementation of the Paris Agreement.

ARTICLE 6 OF THE PARIS AGREEMENT (2021): Decision 1/CP.21 mandated the SBSTA to operationalize the provisions of this Article through recommending a set of decisions to the COP serving as the meeting of the Parties to the Paris Agreement at its first session. At COP26, the Parties to the Paris Agreement at its third session (CMA 3) adopted three main decisions related to Article 6: decision 2 (on Article 6.2), decision 3 (on Article 6.4) and decision 4 (on Article 6.8).

GLASGOW LEADERS' DECLARATION ON FORESTS AND LAND USE (2021): Signatories (including Brazil) promise to reverse and end deforestation by 2030.

NATIONAL POLICIES

LAW NO. 6.938 OF 1981: Regulates the National Environment Policy, its purposes and formulation and application mechanisms, and provides other measures.

LAW NO. 9.795/1999: Regulates the environmental education, sets up the National Environmental Education Policy, and provides other measures.

DECREE NO. 4.281 OF 2002: Regulates Law no. 9.795, of April 27, 1999, which sets up the National Environmental Education Policy, and provides other measures.

DECREE NO. 4.339, OF AUGUST 22, 2002: Establishes principles and guidelines for implementation of the National Biodiversity Policy.

LAW NO. 12.187 OF 2009: Establishes the National Policy on Climate Change - PNMC, and provides other measures.

LAW NO. 12.651 OF 2012: Provides for the protection of native vegetation; amends Laws No. 6.938, of August 31, 1981, No. 9.393, of December 19, 1996, and No. 11.428, of December 22, 2006; revokes Laws No. 4.771, of September 15, 1965, and No. 7.754, of April 14, 1989, and Provisional Act No. 2.166-67, of August 24, 2001; and provides other measures.

DECREE No. 9.578 OF 2018: consolidates normative acts issued by the federal Executive that regulates the National Fund on Climate Change, referred to in Law No. 12.114 of 2009, and the National Policy on Climate Change, referred to in Law No. 12.187 of 2009.

LAW NO. 14.119 OF 2021: Establishes the National Policy of Payment for Environmental Services; and amends Laws nos. 8.212, of July 24, 1991, 8.629, of February 25,, and 6.015, of December 31, 1973, in such a way to adapt them to the new policy.

DECREE NO. 10.828 OF 2021: Regulates the issue of Rural Product Certificates, related to the activities of conservation and recuperation of native forests and their biomes, as addressed in item II of § 2 of art. 1 of Law Nº 8.929, of August 22, 1994.

OTHER RELEVANT ITEMS OF THE FEDERAL LEGISLATION

LAW NO. 5.197 OF 1967: Provides for the fauna protection and provides other measures.

LAW NO. 7.347 OF JULY 1987: Regulates the public civil action for liability for damages caused to the environment, the consumer, to goods and rights of an artistic, aesthetic, historical, touristic, and landscaping value, and provides other measures.

IBAMA NORMATIVE INSTRUCTION No. 3, 1992: Recognizes the Brazilian List of Flora Species Threatened with Extinction.

CONSTITUTION OF THE FEDERATIVE REPUBLIC OF BRAZIL, OF 1988: Article 225

LAW NO. 9.393 OF 1996: Tax on Rural Territorial Property (ITR)

LAW NO. 9.605 OF 1998: Provides for the penal and administrative sanctions derived from conducts and activities that are harmful to the environment and provides other measures.

LAW NO. 9.985 OF JULY 18, 2000: Regulates Art. 225, § 1o, Sections I, II, III and VII of the Federal Constitution, establishes the National System of Nature Conservation Units, and provides other measures.

REGULATORY STANDARD NO. 31, OF 3/3/2005: Approves the regulatory standard for occupational safety and health in agriculture, cattle ranching, forestry, forest exploitation, and acquafarming.

CONAMA RESOLUTION NO. 378 OF 2006. It defines undertakings potentially responsible for national or regional environmental impact for purposes of item III, Paragraph 1, Art. 19 of Law 4771 of September 15, 1965, and other measures.

CONAMA RESOLUTION NO. 379 OF 2006: Creates and regulates data and information system on forest management within the National Environment System - SISNAMA.

NORMATIVE INSTRUCTION IBAMA N° 112 OF 2006: Regulates the Forest Origin Document - DOF, stipulated by Min. Directive 253, by the Ministry of Environment, of August 18, 2006. (Amended by IBAMA Normative Instruction No. 134 of November 22, 2006).

ADMINISTRATIVE REGULATION BY THE MINISTRY OF ENVIRONMENT N° 06 OF 2006: Provides for restoration and consumption of forest raw materials, and other measures.

DECREE NO. 6.514 OF 2008: Provides for administrative offenses and penalties regarding the environment, sets out the federal administrative proceeding for the investigation of these offenses, and provides other measures.

LAW NO. 12.188 OF 2010: Establishes the National Policy for Technical Assistance and Rural Extension for Family Agriculture and Land Reform - PNATER and the National Program for Technical Assistance and Rural Extension in Family Agriculture and Land Reform - PRONATER, amends Law no. 8.666, of June 21, 1993, and provides other measures.

DECREE NO. 7.215 OF 2010: Regulates Law no 12.188, of January 11, 2010, to regulate on the National Program of Technical Assistance and Rural Extension in Family Agriculture and Land Reform - PRONATER.

IBAMA NORMATIVE INSTRUCTION No. 4 OF 2011: Set out procedures for preparing a Degraded Area Recovery Project - PRAD or Altered Area, for the purpose of complying with the environmental legislation, as well as the Terms of Reference contained in Annexes I and II to this Normative Instruction.

LAW NO. 12.651 OF MAY 2012: Provides for the protection of native vegetation; amends Laws No. 6.938, of August 31, 1981, No. 9.393, of December 19, 1996, and No. 11.428, of December 22, 2006; revokes Laws No. 4.771, of September 15, 1965, and No. 7.754, of April 14, 1989, and Provisional Act No. 2.166-67, of August 24, 2001; and provides other measures.

LAW NO. 12.727 OF 2012: APP and RL protection and management of such areas - Amends Law No. 12.651 of May 25, 2012, which provides for the protection of native vegetation; amends Laws Nos. 6.938 of August 31, 1981, 933 of December 19, 1996, and 11.428 of December 22, 2006; and revokes Laws Nos. 4.771, of September 15, 1965, and 7.754, of April 14, 1989, Provisional Act No. 2.166-67, of August 24, 2001, item 22 of item II of article 167 of Law No. 6.015, of December 31, 1973, and Paragraph 2, Article 4 of Law No. 12.651, of May 25, 2012.

DECREE NO. 7.830 OF 2012: Provides for the Rural Environmental Registration System, the Rural Environmental Registry, establishes rules of a general nature for the Environmental Regularization Programs, addressed in Law No. 12.651, of May 25, 2012, and provides other measures.

MINISTRY OF ENVIRONMENT NORMATIVE INSTRUCTION No. 1,896 OF 2013: Establishes the MMA Standard no.31, rule 1/1996: provides for Mandatory Restoration and Integrated Forest Plan.

DECREE NO. 8.235 OF 2014: Establishes general rules supplementing the Environmental Regularization Programs for the States and the Federal District, as addressed in Decree No. 7.830, of October 17, 2012, establishes the Program Mais Ambiente Brasil, and provides other measures.

SPECIAL LEGISLATION FOR THE ATLANTIC FOREST

LAW No. 11.428 OF 2006: Provides for the use and protection of the Atlantic Forest Biome's native vegetation, and provides other measures.

CONAMA RESOLUTION No. 218 OF 1989: Provides for exploration in native forests and successor forest formations in the Atlantic Forest, and provides other measures.

CONAMA RESOLUTION NO. 011 OF 1990: The NATIONAL COUNCIL ON THE ENVIRONMENT - CONAMA, by virtue of the assignments conferred upon it by Law no. 6.938, of August 31, 1981, amended by Law No. 8.028, of April 12, 1990, regulated by Decree no. 99. 274, of June 6, 1990, and bearing in mind the provisions of its Internal Regulations, and Considering Decree no. 99.547, of 05/25/90, which regulates the ban on cutting and respective exploitation of the Atlantic Forest native vegetation, as well as MIn.Directive/IBAMA/no. 218, of 05/04/89;

CONAMA RESOLUTION NO. 011 OF 1993: The PRESIDENT OF THE NATIONAL COUNCIL ON THE ENVIRONMENT - CONAMA, AD REFERENDUM of the Plenary, by virtue of the assignments conferred upon him by Law no. 6.938, of 31 August 1981, amended by Law no. 8.028, of April12, 1990, regulated by Decree no. 99.274, of June 06, 1990, and Law no. 8.746, of 09 December 1993, considering the provisions of Law no. 8.490, of 19 November 1992, and bearing in mind the provisions of its Internal Regulations, decides: Art. 1 Extend the time under § 1, of Art. 1, of CONAMA Resolution No. 10, of October 1, 1993, for thirty (30) days. Art. 2 This Resolution takes effect on its publishing date.

CONAMA RESOLUTION NO. 010 OF 1993: The NATIONAL COUNCIL ON THE ENVIRONMENT - CONAMA, by virtue of the assignments conferred upon it by Law no. 6.938, of August 31, 1981, with the changes introduced by Law no. 8.028, of April 12, 1990, Law no. 8.490, of November 19, 1992, and by Provisional Ac No. 350, of September 14, 1993, and based on Decree No. 99.274, of June 6, 1990, and on the Internal Regulations approved by CONAMA Resolution No. 025, of December 3, 1986, considering the deliberation contained in CONAMA Resolution No. 003, of June 15, 1993, decides: Art. 1 For the purposes of this Resolution, and considering the provisions of Articles 3, 6 and 7 of Decree No. 750, of February 10, 1993, the following basic parameters are established for the analysis of the Atlantic Forest succession stages:

CONAMA RESOLUTION NO. 001 OF 1994: The PRESIDENT OF THE NATIONAL COUNCIL ON THE ENVIRONMENT - CONAMA, AD REFERENDUM of the Plenary, by virtue of his assignments, and considering the provisions of Art. 9, of Decree no. 99.274, of June 6, 1990; Considering the joint action between the State of São Paulo Environment Bureau, by virtue of the assignments conferred upon him by Article 94 of State Decree no. 30.555, of October 3, 1989, and the Superintendent of the Brazilian Institute of Environment and Renewable Natural Resources – IBAMA, in São Paulo, by virtue of the assignments conferred upon him by Article 68 of the Internal Regulations approved by Ministerial Directive no. 445, of August 16, 1989;

CONAMA RESOLUTION NO. 012 OF 1995: The NATIONAL COUNCIL ON THE ENVIRONMENT - CONAMA, by virtue of the assignments conferred upon it by Law no. 6.938, of August 31, 1981, as amended by Law no. 8.028, of April 12, 1990, regulated by Decree no. 99.274, of June 6, 1990, and in view of the provisions of its Internal Regulations, and considering the need to streamline the implementation of the National Environmental Policy; Considering the provisions of § 4, Art. 225 of the Federal Constitution; Considering the patent intention of the Federal Executive, represented by the Ministry of Environment, Water Resources and the Legal Amazon, as well as by the Brazilian Institute of Environment and Renewable Natural Resources, to forward a Draft Bill to the National Congress on the subject, decides: Art. 1 Create the Temporary Technical Chamber for Atlantic Forest Issues.

CONAMA RESOLUTION NO. 003 OF 1996: The NATIONAL COUNCIL ON THE ENVIRONMENT - CONAMA, by virtue of the assignments conferred upon it by item I, Article 4 of Law no. 6.938, of August 31, 1981, items II and X, Article 7 of Decree No. 99.274, of June 6, 1990, with a view to clarifying the application of Decree no. 750/93, decides: Art. 1 It is understood that: The remaining vegetation of Atlantic Forest, expressed in the sole paragraph of Article 4, Decree No. 750 of February 10, 1993, comprises the entirety of primary and secondary vegetation at initial, medium, and advanced stages of regeneration.

CONAMA RESOLUTION NO. 249 OF 1999: Published in the DOU (Federal Register) dated February 1st, 1999, Section 1, page 60, Guidelines for the Conservation and Sustainable Development Policy of the Atlantic Forest.

CONAMA RESOLUTION NO. 278 OF 2001: Published on the DOU at 138-E, dated July 18, 2001, Section 1, pages 51-52. Correlations: - Complemented and amended by CONAMA Resolution No. 300/02 (amending the captions and § 2 of Art. 2) - Regulated by CONAMA Resolution no 317/02, provides for the cutting and exploitation of endangered flora species of the Atlantic Forest.

CONAMA RESOLUTION NO. 317 OF 2002: Published in the DOU no 245, December 19, 2002, Section 1, page 224 Correlations: - Regulates Art 1 of CONAMA Resolution no 278/01 Regulates Resolution no 278, of May 24, 2001, which provides for the cutting and exploitation of endangered flora species of the Atlantic Forest.

CONAMA RESOLUTION NO 388 OF 2007: Published in the DOU no. 38, of February 26, 2007, Section 1, page 63 Correlations: - Validates CONAMA Resolutions nos. 10/93, 1, 2, 4, 5, 6, 25, 26, 28, 29, 30, 31, 32, 33 and 34/94, 7/96 and 261/99 Provides for the validation of the resolutions defining the primary and secondary vegetation at the initial, medium, and advanced stages of the Atlantic Forest regeneration for the purposes of the provided in Art. 4o § 1o of Law no. 11.428, of December 22, 2006.

STATE LEGISLATION

Decree No. 49.723, of 6/24/2005: Sets up the Recovery Program of Riparian Zones in the State of São Paulo.

Decree No. 49.369, of 2/11/2005: Sets up the Paulista Forum on Global Climate Change and Biodiversity.

Law No. 12.927, OF 4/23/2008: Provides on the legal reserve recomposition, within the State of São Paulo.

CONAMA RESOLUTION NO. 8 of January 31, 2008: Sets the guidelines for heterogeneous restoration of degraded areas and provides related measures.

Decree No. 53.939, of 1/6/2009: Provides for the maintenance, recomposition, facilitation of natural regeneration, compensation and composition of the Legal Reserve area of rural properties in the State of São Paulo.

Law No. 13.798, OF 11/9/2009: Sets up the State Policy on Climate Changes - PEMC.

Decree No. 55.947, of 6/24/2010: Regulates Law No. 13.798, of November 9, 2009, which provides for the State Policy on Climatic Changes.

Decree No. 58.107, of 6/5/2012: Sets up the Strategy for the State of São Paulo Sustainable Development 2020, and provides related measures.

Decree No. 59.261, of 6/5/2013: Sets up the the State of São Paulo Environmental Rural Registry System SICAR-SP, and provides related measures.

SMA RESOLUTION NO. 32 Of April 3, 2014: Sets up the advices, guidelines and criteria on the ecological restoration in the State of São Paulo, and provides other related measures.

Decree no. 60.521, of 06/05/2014: Sets up the Program of Incentives to the Recovery of Riparian Forests and Vegetation Recomposition in the Basins that Form Water Sources, creates the standard unit Tree-Equivalent and provides related measures.

Law No. 15.684, OF 1/14/2015: Provides -- on a specific and supplementary basis, pursuant to Articles 23, III, VI and VII and 24, VI and paragraphs of the Federal Constitution and pursuant to Articles 191, 193, XVI, 194, sole paragraph, 197, 205, III, 209, 213, of the Constitution of the State of São Paulo -- for the Environmental Regularization Program - PRA for rural properties and real estate, created by Federal Law No. 12651 of May 25, 2012 and for the application of Federal Supplementary Law No. 140 of December 8, 2011, within the State of São Paulo scope.

Joint Resolution Department of Agriculture and Supply and Department of Infrastructure and Environment (SAA/SIMA) No. 3, of 9/16/2020: Provides for the regeneration, recomposition and monitoring measures of native vegetation, as well as those for compensation of the Legal Reserve, in the Recomposition Projects of Degraded and Altered Areas - PRADAs, within the scope of the Program for Environmental Regularization of rural properties in the State of São Paulo - PRA, regulated by State Law 15.684, of 1/14/2015, and State Decree 64.842, of 3/5/2020.

CBRN Min. Directive 01/2015: Sets up the Monitoring Protocol for Ecological Restoration Projects, considering the provided in § 2, Article 16 of SMA Resolution 32, dated April 3, 2014.

SMA Resolution 51/2016, of May 31, 2016: Regulates the procedure for conversion of a simple administrative fine into environmental service.

Decree No. 62.914, of 11/8/2017: Reorganizes the Incentive Program for Recovery of Riparian Forests and Vegetation Recomposition in the Basins that Form Water Sources, and provides related measures.

SMA RESOLUTION NO. 2020 of August 6, 2020: Defines requirements for the approval of ecological restoration projects, and provides other measures for the implementation of the Water Sources Program, whose organization was set up in Decree No. 62.914, of November 8, 2017.

Decree No. 65.182, of 09/16/2020: Sets up the Agro Legal Program, regulates Articles 27 and 32 of Law No. 15.684, of January 14, 2015, which provides for the environmental regularization of rural properties in the State of São Paulo, and amends Decree No. 64.842, of March 5, 2020, which regulates Law No. 15.684, of January 14, 2015.

Resolution by the State of São Paulo Department of Agriculture and Supply (SAA) no. 55, of 09/18/2020: Provides for guidelines, criteria and procedures to, within the scope of the Agro Legal Program, regularize the Legal Reserve of rural properties in the State of São Paulo, not located in Conservation Units of public domain, and in territories of indigenous peoples and traditional communities, as provided in Articles 67 and 68 of federal Law 12.651/12 and 27 and 32 of state Law 15.684/15, and Decrees 65.182/2020 of 16-09-2020 and 64.131, of 11-03-2020.

Decree No. 66.550, of 3/7/2022: Reorganizes the "Remaining Forest Program", referred to in Article 23 of Law no. 13.798, of November 9, 2009, and Law no. 13.798, of November 9, 2009, and Articles 51 to 67 of Decree no. 55.947, of June 24, 2010, starting to be called "REFLORESTA-SP Program", and organizes the "Program of Incentives to the Recovery of Riparian Forests and to the Recomposition of Vegetation in the Basins Forming Water Sources" addressed in Decree no. 62.914, of November 8, 2017, starting to be called "Water Sources Program", and provides other measures.

Decree No. 66.549, of 3/7/2022: Regulates the application, within the State of São Paulo, of the Federal Law no. 14.119, of January 13, 2021, creates the State Policy of Payment for Environmental Services - PEPSA, the State Program of Payment for Environmental Services - PPSA and the State Registry of Projects of Payment for Environmental Services, and provides related measures.

2.5.8. Approvals (G5.7)

The historical presence of IPÊ in the Pontal do Paranapanema region, coupled with community engagement initiatives, such as communication, has provided for a good relationship between the organization and the social players in the Project Zone. This favorable context of active and participatory action, besides fostering credibility to the institution, also enabled socioeconomic development opportunities for local communities and stakeholders regarding the forest restoration chain.

In this regard IPÊ, together with the Biofílica Ambipar Environmental, a company recognized for its successful performance in the environmental services market, held meetings for understanding, recognition and approval regarding the design, development and implementation of the Corridors for Life ARR Grouped Project. These meetings also brought together local communities and other stakeholders for consultation and validation of the actions and initiatives outlined by the Project, as better described in topic 2.3.

For such, five face-to-face meetings were held between the developers of the Corridors for Life ARR Grouped Project, two of them at IPÊ's physical office in Piracicaba (SP) (on July 26 and August 02, 2022) to discuss the profile of communities and stakeholders of the Project, as well as their relevance for such. The third meeting took place at IPÊ's head offices in Teodoro Sampaio (SP) (August 08, 2022) for validation of the list and description of the community members and other stakeholders by the organization's local team, considering their field acting in the region, focusing on the characteristics and relations of these social players with the carbon project referred to.

The fourth meeting was the public consultation (ECOnsulta - on September 16, 2022), was attended by the proponents of the Corridors for Life ARR Grouped Project, local communities and other stakeholders. In this fourth meeting, the developers explained about the concepts, activities, responsibilities, and risks of this carbon project, as well as collected doubts, suggestions, and perceptions of the social players present concerning the Project development and implementation. In the event, the communities and other stakeholders were able to interact in specific work groups for notes inherent to their areas of expertise.

In the fifth and last meeting (on October 6, 2022), called feedback, the proponents of the Corridors for Life ARR Grouped Project returned with the answers and remarks raised by the communities and other stakeholders in the previous event. In the plenary session, all doubts were cleared up and the specific working groups' points were discussed, in order to enable the quality and governance desired by the carbon project referred to.

All these meetings and events were of utmost importance for the validation and approval of the design, development, and implementation of the Corridors for Life ARR Grouped Project by the proponents, communities, and other stakeholders, ensuring transparency and active participation of all such players. It is worth mentioning that all information related to the events are formally recorded.

Finally, it should be noted that the invitations to participate in the ECOnsulta and feedback were handed in person (or by mail) and online (emails, messaging app, and phone calls) to local communities and other stakeholders in the Project Zone, strengthening the effort for proximity and engagement between the proponents and stakeholders mentioned.

2.5.9. Project Ownership (G5.8)

In the Corridors for Life ARR Grouped Project the entire Project Area is inserted in private farms whose owners have the legal right to own and operate the land. For operation of the restoration activities and assignment of the right to credits to proponents, a 30-year contract was executed, with transfer of rights between the property legitimate owner and the Institute for Ecological Researches. In parallel, a contract between IPÊ and Biofílica shares these rights.

2.5.10. Management of Double Counting Risk (G5.9)

The Corridors for Life ARR Grouped Project generates benefits to the climate, communities and biodiversity, but only the net GHG removals will be traded after being duly registered in a market platform.

2.5.11. Emissions Trading Programs and Other Binding Limits

Not applicable.

2.5.12. Other Forms of Environmental Credit

The Corridors for Life ARR Grouped Project does not intend to generate any other kind of environmental credits related to the greenhouse gas (GHG) emissions removals. All removals will only be claimed by the Verified Carbon Standard (VCS) on the Verra platform.

2.5.13. Participation under Other GHG Programs

The Corridors for Life ARR Grouped Project has not sought to be registered under any other GHG program, other than submitting the Project for the VCS (Verified Carbon Standard) and CCBS (Climate, Community and Biodiversity Standard) validation.

2.5.14. Projects Rejected by Other GHG Programs

The Corridors for Life ARR Grouped Project has not undergone validation/verification by any other GHG program and, therefore, is not rejected by any GHG program.

2.5.15. Double Counting (G5.9)

The project proponents will use the Verra registry platform to register, issue, and trade Verified Carbon Units (VCUs). In addition, they will have - as guarantee - purchase and sale contracts with buyers and financiers of all credits to be generated by the project. Once registered and issued, the credits will be retired or transferred to buyer's registration account to follow through with the obligations of the purchase and sale contract – with no risk of selling the same credit twice or more to different parties.

In terms of double counting on a national level, the Brazilian regulation does not currently require any voluntary market carbon projects to be registered with local or federal authorities. Recently, Decree 11.075 was published on May 19, 2022, which set out the creation of a national registry, called SINARE (National System for Reducing Emissions of Greenhouse Gases). This national registry will serve as a basis for a regulated carbon market in Brazil, but the Decree's language also implies that projects in

Brazil's voluntary carbon market can register their credits to be able to offer them within this regulated market, i.e., the current legislation provides registry and accounting mechanisms to be developed to avoid double counting of credits against Brazil's emissions reduction targets.

It is important to point out that SINARE is undergoing the construction phase, and it is not expected to go into operation in the next two years. Whether the Project is to be registered with SINARE and how the credits in the registry will (or will not) count towards the Brazilian NDC is yet to be defined by the Federal Government.

Proponents will follow the necessary rules and processes to ensure that Corridors for Life ARR Grouped Project credits are not double-counted, as this is also an obligation to the buyer or financier of the Project credits.

3. CLIMATE

3.1. Application of Methodology

3.1.1. Title and Reference of Methodology

The approved and consolidated methodology for large-scale restoration projects "Afforestation and reforestation of lands except wetlands (AR-ACM0003, version 2.0)", and the approved tools related to this methodology were applied to the project, as follows:

- “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM Project activities (AR-TOOL02, version 1.0)”;

- “Calculation of the number of sample plots for measurements within A/R CDM project activities (AR-TOOL03, version 2.1)”;

- “Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity (AR-TOOL08, version 4.0)”;

- “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities (AR-TOOL12, version 3.1)”;

- “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (AR-TOOL14, version 4.2)”;

- “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity (AR-TOOL15, version 2.0)”;

- “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities (AR-TOOL16, version 1.1)”;

- “Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities (AR-TOOL17, version 1.0)”

- “Demonstration of eligibility of lands for A/R CDM project activities (AR-TOOL19, version 2.0)”

3.1.2. Applicability of Methodology

Appicability conditions of the methodology

The AR-ACM0003 methodology is applicable to the project under the following conditions:

Applicability condition	Compliance
(a) *The land subject to the project activity does not fall in wetland category*	The areas subject to the grouped project activities are Legal Reserve (LR) and Permanent Protection Areas (PPAs), which historically were unduly occupied with agricultural activities, especially extensive pasture and sugar cane plantations. During the eligibility analyses and preparation of the maps of areas for the implementation of the forest restoration activities, sites that presented characteristics of wetlands, as well as periodic flooding and anaerobic conditions, were promptly excluded from the project area boundary. The map and shapefile with wetland areas identified via Mapbiomes for the entire Project Zone, as well as the first instance eligibility maps and shapefiles (considering both Mapbiomes and supervised analysis and field knowledge) were made available to VVB.
(b) *Soil disturbance attributable to the project activity does not cover more than 10 per cente of area in each of the following types of land, when these lands are included within the project boundary:* *(i) Land containing organic soils;* *(ii) Land which, in the baseline, is subjected to land-use and management practices and* *Receives inputs listed in appendices 1 and 2 to AR-ACM003 methodology.*	The areas to be reforested in the referred Grouped Project do not include land with organic soil, as pointed out in section 2.1.5.3/Figure 4 (in which none of the soil classes found in the Project Zone are characterized as organic soils[18]). Furthermore, they are areas characterized mainly by degraded and/or abandoned (unmanaged) pasture with a low percentage of organic matter. In the absence of the project activity, it is expected that the areas, composed in the baseline scenario mostly of unmanaged and degraded pasture, will remain without management and/or improvement initiatives (and, in this sense, without use and management practices and receipt of inputs listed in Appendices 2 and 3 of AR-ACM0003 methodology). As for project activities, the most common practice of soil preparation and disturbance for implementation of project activities involves striping, furrowing or subsoiling in the planting row or often, just opening the planting pits. However, it is important to point out that depending on the state of soil degradation or the amount of grass biomass in the area, due to the absence of management practices in the baseline scenario,

[18] According to the Brazilian Soil Classification System, only "Organosols" are classified as organic soils, which are not found in the Project Zone, as pointed out in Section 2.1.5.3.

	harrowing activities are carried out during soil preparation. It is also important to emphasize that these soil disturbing activities only occur during soil preparation for planting and are not repeated throughout the project.

Table 13 - Applicability conditions of the AR-ACM0003 methodology, version 2.0

Applicability conditions of the Tools

Table 14 - Applicability conditions of the tools applied to the Project.

Tool	Applicability condition	Compliance
AR-TOOL02, version 1.0: "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM Project activities"	*(a) Forestation of the land within the proposed project boundary performed with or without being registered as the A/R CDM project activity shall not lead to violation of any applicable law even if the law is not enforced.* *(b) This tool is not applicable to small-scale A/R project activities.*	(a) Project forestation activity will not lead to violation of any applicable law, as established in Section 2.5.7 (National and Local Laws and Section 3.1.5 - Additionality). (b) Corridors for Life ARR Grouped Project is a Large-Scale project, as stated in Section 2.12.
AR-TOOL03, version 2,1: "Calculation of the number of sample plots for measurements within A/R CDM project Activities"	• *This tool has no internal applicability conditions*	• Not applicable, once "this tool has no internal applicability conditions"
AR-TOOL08, version 4.0: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity"	*- The tool is applicable to all occurrence of fire within the project boundary* *- Non-CO2 GHG emissions resulting from any occurrence of fire within the project boundary shall be accounted for each incidence of fire which affects an area greater than the minimum threshold area reported by the host Party for the purpose of defining forest, provided that the accumulated area affected by such fires in a given year is ≥5% of the project area.*	The use of fire is not part of the activities of the Corridors for Life ARR Grouped Project. However, if fire incidence occurs within the project area boundaries during the life of the Project, this tool will be applied. Specifically, this tool will be applied to calculate the estimated non-CO_2 GHG emissions resulting from the burning of above ground woody biomass if during the life of the Grouped Project fire occurs in an area larger than 1ha (minimum threshold area of forest definition established by Brazil's Designated National Authorities

	Additionally, this tool applies the following assumptions: • (a) *Aboveground biomass of living trees shall be considered not to result in significant non-CO2 GHG emission in case of fire, when* • i) *A forest fire burns through the understory but does not climb into the tree canopy; or* • ii) *A forest fire singes trees but does not cause mortality such that leaf regeneration can be observed within six months (this may be demonstrated in remote sensing imagery);* (b) *60% of the dead organic matter is entirely burnt in all fires.*	(DNA))[19], provided that the total accumulated area is equal or greater than 5% of the project area. In addition, for applicability of the tool and calculation of the associated emissions, the assumptions established in the tool itself will also be considered: (a) Non-CO_2 GHG emissions from wildfires will not be considered significant for above ground biomass of living trees when: i) The forest fire reaches the understory, but not the tree canopy ii) The forest fire reaches the trees, but does not cause mortality, such that leaf regeneration can be observed within six months (remote sensing imagery can be used to demonstrate this regeneration). (b) 60% of the dead organic matter is entirely burnt in the fire.
• AR-TOOL12, version 3.1: "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"	*This tool has no internal applicability conditions*	Not applicable, once "this tool has no internal applicability conditions"
AR-TOOL14, version 4.2: "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"	*This tool has no internal applicability conditions*	Not applicable, once "this tool has no internal applicability conditions"
AR-TOOL15, version 2.0: "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity"	• • *This tool is not applicable if the displacement of agricultural activities is expected to cause, directly or indirectly, any drainage of wetlands or peat lands*	Project activities will be implemented mostly in areas of abandoned pasture, besides a few areas of agricultural crops, mainly sugar cane. In situations where the pasture was managed or where there was agricultural production, the production will be interrupted or relocated to another area of the property (in an already consolidated agricultural or cattle

[19] CDM: Designated National Authorities (DNA) (unfccc.int)

		raising area). In this way, the displacement of pre-project activities is not foreseen in the Grouped Project. • Additionally, in this sense, there will be no leakage from agricultural activities that can cause, directly or indirectly, the drainage of wetlands or peatlands. • As a complementary measure, the project will carry out annual monitoring of the native forest cover on each rural property involved in the project. In this way, it will be possible to monitor whether there has been a loss of native vegetation and consequent leakage from farming activities within the boundaries of the rural property.
AR-TOOL16, version 1.1: Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities	• *This tool is applicable when the areas of land, the baseline scenario, and the project activity meet the following conditions:* • *(a) The areas of land to which this tool is applied:* • *i) Do not fall into wetland category; or* • *ii) Do not contain organic soils as defined in Annex A: glossary of the IPCC GPG LULUCF 2003;* *iii) Are not subject to any of the land management practices and application of inputs as listed in the Tables 1 and 2 of the tool.* • *(b) The A/R CDM project activity meets the following conditions:* • *i) Litter remains on site and is not removed in the A/R CDM project activity; and* • *ii) Soil disturbance attributable to the A/R CDM project activity, if any, is:* • *• In accordance with appropriate soil conservation*	Regarding condition (a), the areas that encompass the project limits do not fall into the category of wetlands or organic soils (as shown in Table 8 of applicability of the AR-ACM0003 methodology). Furthermore, the tool will not be applied to areas that are subject to the management practices and inputs listed in Tables 1 and 2 of the tool. Regarding condition (b), the Corridors for Life ARR Grouped Project will maintain the litter on the ground, follow contour lines for soil preparation and planting, soil disturbance will be limited to the pre-planting soil preparation stage (soil will be mostly striped or furrowed, as noted in Table 8) and will not occur again in the area.

	practices, e.g. follows the land contours; *• Limited to soil disturbance for site preparation before planting and such disturbance is not repeated in less than twenty years*	
AR-TOOL17, version 1.0: Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities"	• *This tool has no internal applicability conditions*	• Not applicable, once "this tool has no internal applicability conditions"
AR-TOOL19, version 2.0: "Demonstration of eligibility of lands for A/R CDM project activities"	*This tool has no internal applicability conditions*	Not applicable, once "this tool has no internal applicability conditions"

3.1.3. Project Boundary

Relevant carbon pools and GHG sources applicable to the Corridors for Life ARR Grouped Project boundary are presented in the tables below.

Table 15 - Carbon pools included within the Corridors for Life ARR Grouped Project boundary.

Carbon Pool	Included/ Excluded	Justification/Explanation
Aboveground Biomass	Included	Major carbon pool subjected to project activity
Belowground Biomass	Included	Carbon stock in this pool is expected to increase due to the implementation of the project activity
Deadwood	Included	Carbon stock in this pool may increase due to implementation of the project activity
Litter	Included	Carbon stock in this pool may increase due to implementation of the project activity
Soil Organic Carbon	Included	Carbon stock in this pool may increase due to implementation of the project activity

Table 16 - GHG sources included or excluded within the boundaries of the Corridors for Life ARR Grouped Project.

Source		Gas	Included?	Justification/Explanation
Baseline		CO_2	No	CO_2 emissions due to burning of biomass are accounted as a change in carbon stock

Source		Gas	Included?	Justification/Explanation
	Burning of wood biomass	CH_4	No	Burning of wood biomass for site preparation will not occur in this Grouped Project.
		N_2O	No	Burning of wood biomass for site preparation will not occur in this Grouped Project.
Project	Burning of wood biomass	CO_2	No	CO_2 emissions due to burning of biomass are accounted as a change in carbon stock
		CH_4	No	The use of fire is not part of the activities of the Corridors for Life ARR Grouped Project. However, if the incidence of fire occurs within the limits of the project area during its lifetime, the AR-TOOL08 tool will be applied and the non-CO_2 gases resulting from the burning will be accounted for and reported, considering the significance of these emissions.
		N_2O	No	

Geographical boundary of the Corridors for Life ARR Grouped Project, represented by the Project Zone itself, the boundaries of the 10 rural properties that comprise the first instance, as well as the areas eligible for development of ARR activities within these properties, are represented in the images below (Figure 35, Figure 36 and Figure 37).

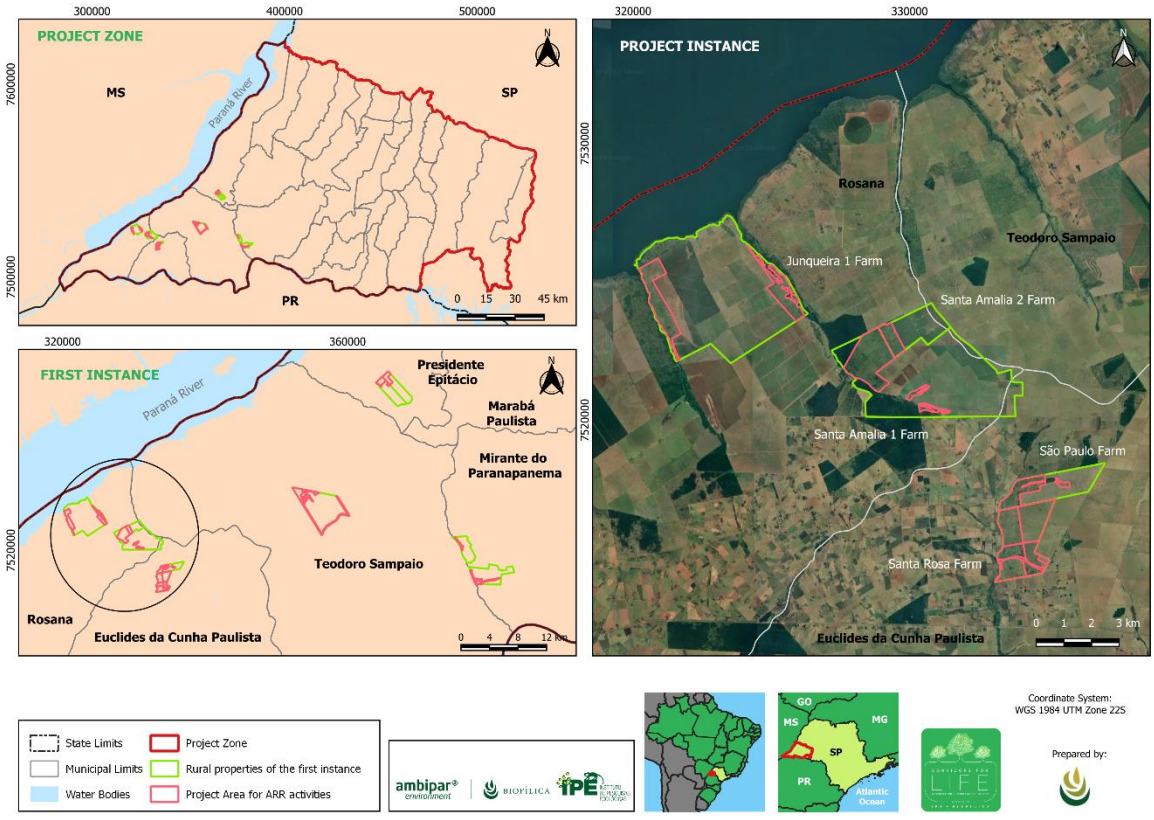

Figure 35 – Location of the Junqueira 1, Santa Amalia 1, Santa Amalia 2, São Paulo and Santa Rosa properties, included in the first instance, and the eligible areas to implement ARR activities within these properties.

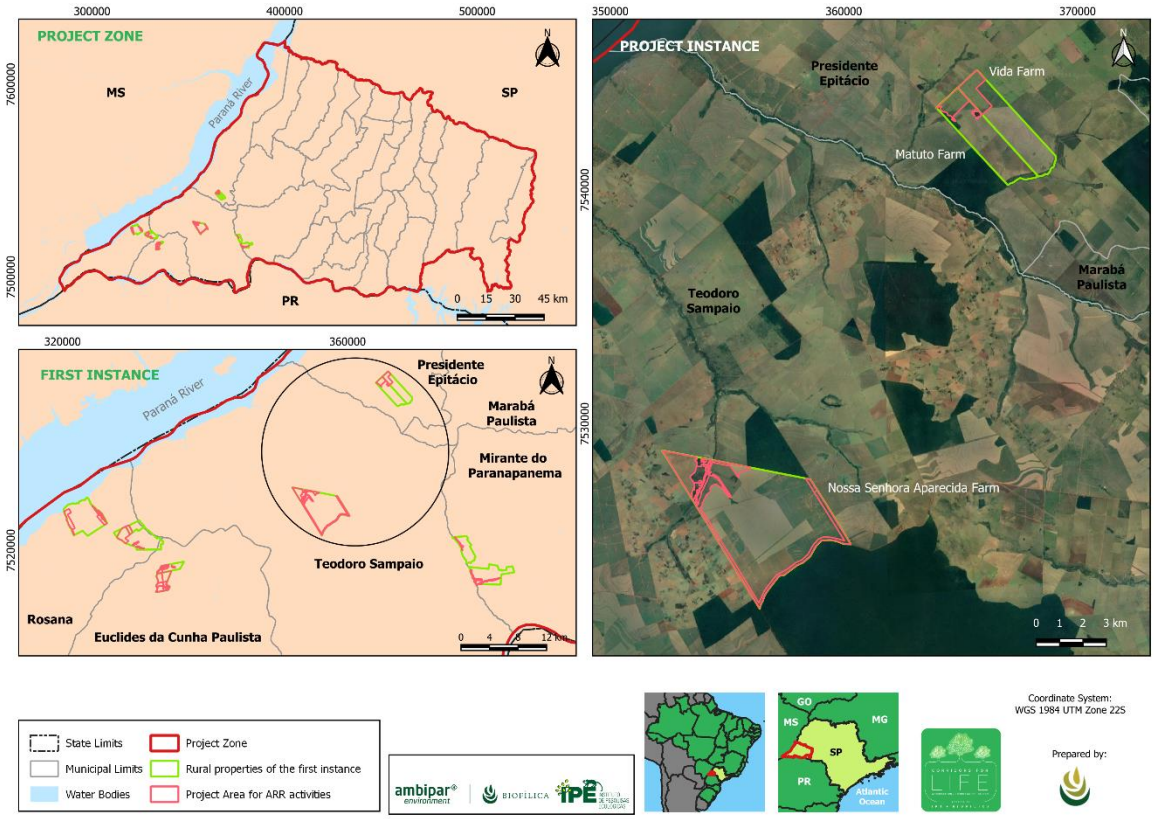

Figure 36 – Location of the Nossa Senhora Aparecida, Matuto, and Vida properties included in the first instance, and the eligible areas to implement ARR activities within these properties.

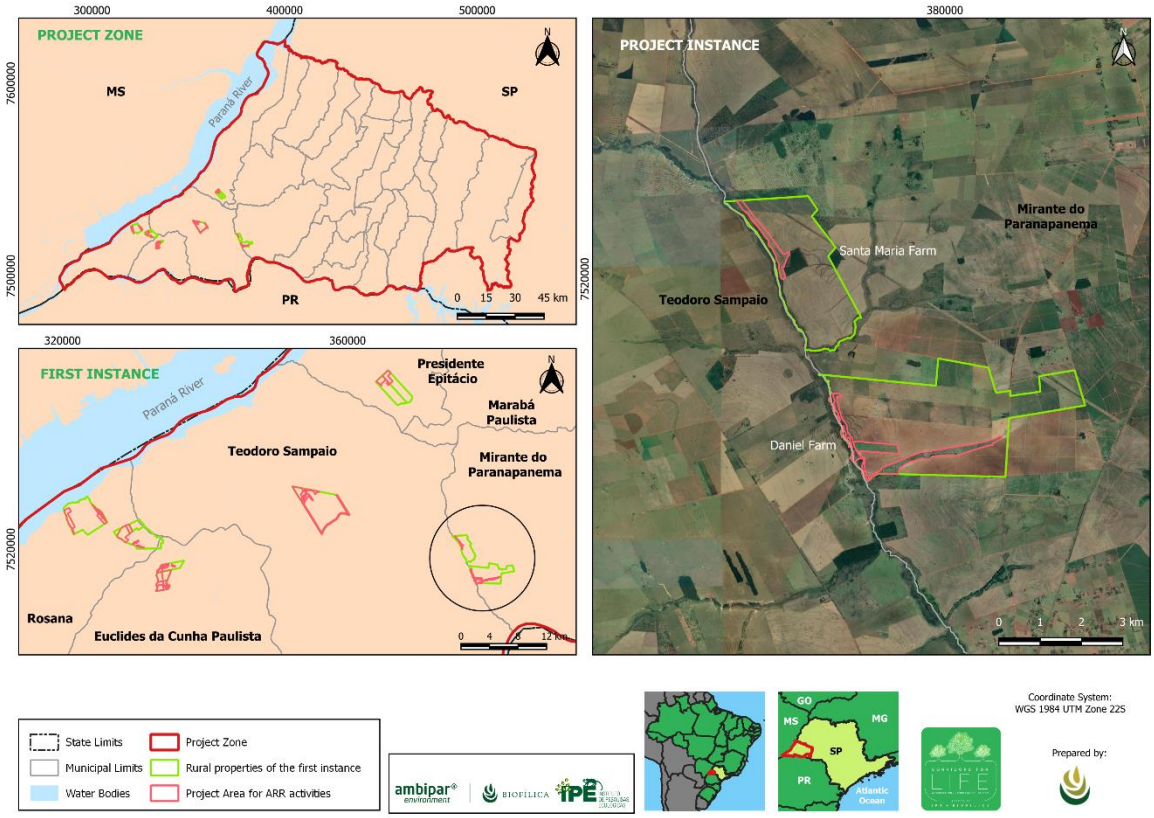

Figure 37 – Location of the Santa Maria and Daniel instances, included in the first instance, and the eligible areas to implement the ARR activities within these properties.

3.1.4. Baseline Scenario

Definition of the baseline scenario, followed by the determination of additionality, is given by the tool "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (AR-TOOL02, version 1.0)". Steps of the tool are presented in the following additionality section (Section 3.1.5).

As pointed out throughout this document, the baseline scenario at the project boundary is characterized by pre-project land use mostly composed of unmanaged and degraded pasture, and some areas with annual crops, mainly sugarcane. Further details on land use and land cover are presented in Section 2.1.6.

Baseline Stratification

AR-ACM0003 methodology establishes that if the distribution of biomass in the project area is not homogeneous, stratification should be performed to increase the precision of the ex-ante estimates of the baseline and ex-post estimates of project removals.

Baseline stratification was performed in the project areas (eligible areas for planting in the initial properties), which were classified into 3 strata according to the existing vegetation cover and the greater or lesser presence of herbaceous vegetation:

Stratum 1: "Herbaceous" (predominance of herbaceous vegetation, but with the presence of some shrub and/or tree individuals, having an approximate upper limit of 10% crown coverage)

Stratum 2: "Irregular-herbaceous" (predominance of herbaceous vegetation, but with the presence of some shrub and/or tree individuals, having an approximate upper limit of 30% crown coverage)

Stratum 3: "Irregular-arboreal" (predominance of tree and/or shrub vegetation at an approximate upper limit of 60% crown coverage, with clearings and presence of herbaceous vegetation)

For the stratification of the project area, Sentinel-2 satellite bands and calculated metrics were used for the areas of the first instance of the project. In these areas a one hectare grid was established, where 400 hectares were randomly classified among the three strata mentioned above. A model was developed using the 'random forest' machine learning method to stratify the entire project area. Details of this methodology were shared with the VVB, as well as some are presented in Section 3.2.1.1.

With the classification of the strata in the polygons, sample plots were randomly drawn in each identified stratum to conduct an initial inventory in order to obtain an approximate value for the variance of carbon stock in each stratum, required to perform the sample sufficiency calculation, as determined by the AR-TOOL03 tool (version 2.1): “Calculation of the number of sample plots measurements within A/R CDM project activities”.

Note that with these steps, the assumptions established in this tool were met, which are:

(a) Approximate value of the area of each stratum within the project boundary is known;

(b) Approximate value of the variance of biomass stocks in each stratum is known from a preliminary sample, existing data related to the project area, or existing data related to a similar area;

(c) The project area is stratified into one or more strata.

A second baseline inventory was conducted after the sample sufficiency calculation, with sample plots randomly distributed in the first instance of the project.

With the field result it was possible to determine the average initial stock in each stratum and the associated uncertainty and consider them in the ex-ante GHG removal estimates of the Corridors for Life ARR Grouped Project.

3.1.5. Additionality

To demonstrate project additionality we followed the guidelines and the "step by step" approach established in the specific tool referenced in the AR-ACM0003 methodology (version 2.0) for identifying and demonstrating, rightly called "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM Project activities (AR-TOOL02, version 1.0)".

The guidelines contained in the “Guidelines for objective demonstration and assessment of barriers (Annex 13, version 01)” for the development of the additionality analysis were also considered, in order to make the analysis more objective and reasoned, despite the guidelines have not been explained one by one throughout the section.

As already pointed out in Section 3.1.2, the project is in compliance with the two criteria for applicability of this tool, since the project's forest restoration activities will not lead to violation of any laws and the Corridors for Life ARR Grouped Project is not a Small-Scale project.

The AR-TOOL02 sets out five steps for demonstrating additionality:

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

STEP 1: Identification of alternative scenarios

STEP 2: Barrier analysis

STEP 3: Investment analysis (if needed)

STEP 4: Common practice analysis

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

The restoration project activity has a starting date of 18 November 2021, which means that it has a starting date after 31 December 1999, but before the date of its registration. In this regard, the following requirements and justifications are presented:

- Provide evidence that the starting date of the A/R CDM project activity was after 31 December 1999

- Provide evidence that the incentive from the planned sale of CERs was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available to third parties at, or prior to, the start of the project activity

The Project's start date is November 18, 2021, the date on which the Corridors for Life ARR Grouped Project's forest restoration planting was initiated at Fazenda Santa Rosa and Fazenda Vida in Pontal do Paranapanema.

Memorandum of Understanding, signed on September 24, 2020, and the partnership agreement between the Project proponents, signed on May 27, 2021, evidence that the sale of the RVEs was seriously considered in the decision to develop the Project and ARR activities. Memorandum of understanding and contract between the parties have been made available to the VVB.

STEP 1: Identification of alternative Scenarios

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

Scenario 1: Continuation of the pre-project land use

As noted in Section 2.1.6, 84.1% of the entire Project Zone is characterized as agricultural land, with 45.7% being pasture, 21.8% agriculture and 16.6% a mosaic of agricultural uses[20]. It is also pointed out that the pasture areas are being gradually substituted by agriculture, mainly annual crops, such as sugar cane and soy. However, the forest cover has remained around 8.4% for at least 35 years (Figure 12).

In the properties of the initial instance, the agricultural use represents 94.6% of the area (37.4% with pasture, 39.7% with agriculture and 17.5% with mosaic of agricultural uses). More specifically, in the project area, 66.1% refers to pasture areas, 15,0% to agriculture, and 13.8% to mosaic of agricultural uses.

As evidenced by the land use history itself presented, it is understood that areas that currently have unmanaged pasture and annual crops will continue to have these same land uses in a without project scenario, however they may shift from agricultural crops to pasture or vice versa. The advancement of soybean cultivation in the region in parallel with the recent establishment of a unit of COCAMAR (Coopertiva Agroidustrial) in the municipality of Mirante do Paranapanema, further highlights the trend towards the perpetuation of agriculture as “Business as usual” in the landscape of the project.

Scenario 2: Forestation of the land within the project boundary performed without being registered as a ARR VCS project activity

The Instituto de Pesquisas Ecológicas (IPÊ), as mentioned earlier in this document, has been working in the region for 30 years and in the last 18 years restored approximately 2 thousand hectares of APP and Legal Reserve of medium and large landowners and 60 hectares of agroforestry systems, implemented in areas of small landowners and rural settlers. Costs associated with restoration, mainly

[20] Mosaic of uses” refers to areas of agricultural use where it was not possible to distinguish between pasture and agriculture: Legenda Coleção 7 - Descrição Detalhada.pdf (storage.googleapis.com)

through the planting of seedlings, are important barriers to restoration and, associated with the opportunity cost of land, it is the biggest obstacle to the gain of scale in the recovery of areas of environmental liabilities of PPA and LR.

It is also known the performance of other non-governmental organizations in the region, also working with fundraising and partnership with landowners to enable the restoration of environmental liabilities.

However, as much as these efforts have been employed, including via “small grants” from international donors (i.e. WeForest, One Tree Planted, Ecosia, etc.) and public policy resources, such as the Nascentes Program[21], these resources are not very representative when we analyze all the environmental liabilities existing in the Project Zone (54,457ha of Permanent Protection Area and 172,674ha of Legal Reserve) and the lack of increase in forest areas in the last 35 years in the region (Figure 12).

Thus, in view of the existing forest liabilities, the history of land use and occupation in the region, and the cost associated with forest restoration of these liability areas, it is unlikely that this scenario, although credible, will occur on a large scale.

Outcome of Sub-step 1a:

List of credible alternative land use scenarios that would have occurred on the land within the project boundary of the ARR VCS project activity:

- Scenario 1: Continuation of the pre-project land use: mostly unmanaged grasslands and some annual croplands.

- Scenario 2: Project activity on the land within the project boundary performed without being registered as a ARR VCS project activity: small-scale forest restoration and agroforestry

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

Both Scenario 1 and Scenario 2 are not in compliance with the Native Vegetation Protection Law-LPVN (Federal Law no. 12.651 of May 25, 2012), popularly known in Brazil as the "Forest Code".

In summary, the law specifies mainly two types of areas that must be restored:

1. Permanent Protection Areas (PPA): areas that must be restored in critical environmental areas to safeguard natural resources, such as buffering water bodies, springs and in steep slopes to prevent erosion. Production activities are limited and only allowed under certain conditions. The area of restoration and the production activities allowed in PPAs depend mainly on the size and nature of the resources protected (e.g. water bodies, spring), the farm size and other factors.

2. Legal Reserves (LR): minimum forest cover that a farm must have, with the main purpose of safeguarding biodiversity in the landscape. Production in these areas is allowed, even using a percentage of non-native species, as long as the area is not deforested. The restoration requirements for Legal Reserves vary mainly due to the ecological domain where the farm is located and farm size. According to the LPVN the Legal Reserve should be, for each rural property, in the proportion of 80% for Amazon Biome, 35% for Cerrado Biome (the Brazilian Savanna) in the Legal Amazon region, and 20% for other Biomes as Atlantic Forest.

Even though the LPVN has existed in different forms since 1934, enforcement of the law is poor in Brazil. Currently, there is a deficit of 21 million hectares that need to be restored under the requirements of this law (Soares-Filho et al., 2014). Specifically in the Project Zone, there is a deficit of 227,131ha that need to be restored in LRs and PPAs.

[21] Programa Nascentes (infraestruturameioambiente.sp.gov.br)

Due to weak law enforcement, several past changes in the law that reduced restoration demands in 2012 (Brancalion et al., 2016), and a current government that openly dismantles public environmental agencies (Abessa et al., 2019), some farmers are not motivated to carry out restoration in Brazil.

Overall, the law 12.651/2012 establishes the minimum requirements for restoration in private landholdings in Brazil, which should be a minimum of 20% of native forest cover in most cases. To estimate the level of compliance of landholdings with this legislation, it was used national land use map to estimate native vegetation cover in each of the 7846 landholdings in the project zone. Giving potential land use classification errors, we considered a 10% margin of error to classify each landholding as complying with the legislation (i.e., landholdings with 18% forest cover or more were considered as complying with the legislation). Land-use maps were obtained from Mapbiomas and landholding boundaries were obtained from Freitas et al. (2018).

Our results show that of the 7846 private landholdings in the project zone, only 85 (1.1%) have more than 18% native vegetation cover. Even using the less conservative estimate of 18% forest cover (rather than the 20% required by law), there is throughout non-compliance with forest cover requirements in the project zone. This pattern of non-compliance can be found in all municipalities (the smallest administrative unit in the project zone): the average percentage of landholdings non-complying at the municipality scale is 98.9% ± 2.4%. These results are consistent with the literature for the region, such as Soares Filho et al. (2014) that showed that >90% of landholdings in the project zone are not complying with law 12.651/2012. The geospatial data and the R script used for these analyses were shared with VVB.

Therefore, it is pointed out that even though there is legislation for conservation and environmental readjustment of properties, it is not enforced and much less encouraged by technical assistance and rural extension agencies.

Outcome of Sub-step 1b:

List of plausible alternative land use scenarios to the ARR VCS project activity that are in compliance with mandatory legislation and regulations taking into account their enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations:

As these two land use scenarios (scenario 1 and scenario 2) result from systematic lack of enforcement of applicable laws and regulations, both scenarios are results of sub-step 2a, which are:

- Continuation of the pre-project land use: mostly unmanaged grasslands and some annual croplands.

- Project activity on the land within the project boundary performed without being registered as a ARR VCS project activity: small-scale forest restoration and agroforestry.

STEP 2: Barrier analysis

This step serves to identify barriers and to assess which of the land use scenarios identified in the sub-step 1b are not prevented by these barriers.

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

Investment barrier

As pointed out in the description of scenario 2, the Instituto de Pesquisas Ecológicas (IPÊ), a Non-Governmental Organization (NGO)[22], restored in recent years approximately 2 thousand hectares of

[22] Following the "*Guidelines for objective demonstration and assessment of barriers*" (Annex 13, version 01), the nature of IPÊ company, organization and financial information was provided to VVB.

Permanent Protection Area and Legal Reserve of medium and large landowners and 60 hectares of agroforestry systems implemented in areas of small landowners and rural settlers. These activities of forest restoration and implantation of agroforestry systems were only possible due to the great effort exerted by IPÊ in raising funds from several sources, such as donations, environmental compensation via state program, public edicts and socio-environmental actions from sponsors (payment for planted seedlings, mainly) and, therefore, could not be performed on a larger scale (as is the purpose of this Project in question).

Besides IPÊ, it is known that other non-governmental organizations have also been working with fund raising and partnerships with landowners to make the restoration of environmental liabilities in the region feasible.

Investment barrier is the main obstacle to environmental regularization of rural properties. Average cost of forest restoration in the region is currently between R$30,000 and R$40,000 per hectare (with an exchange rate of around R$5.10 per dollar, this represents U$5,800 to U$7,800 per hectare); very similar to the current market value of one hectare of land in the project region. This is expensive for most farmers, even for the large landowners. Comparatively, the minimum wage is around R$1.212/month (or US$240/month) and approximately almost one third of Brazilian population lives with less than the minimum monthy wage (Neri, 2022) (around R$840 or US$165, considering the Purchasing Power Parity of US$5.50/day) or even less. Considering only the state of São Paulo, 17.85% of the population lives with this income.

Credit and financing lines

Plano Safra is the main instrument that directs public policies destined to the farming sector, especially those related to financing and funding lines of credit[23]. The main way for rural producers to access credit lines of financing from banks is through the Programs and, particularly for the development of environmental liability recovery activities in the state of São Paulo, there are the following Programs that can be obtained by landowners and rural producers PRONAF (National Program to Strengthen Family Agriculture), specifically PRONAF Eco (with a limit of 165 thousand reais per agricultural year), PRONAMP (National Program to Support the Medium Rural Producer) (with a limit of 430 thousand reais per agricultural year) and ABC Program, specifically via ABC Environmental Program (with a limit of 2.2 million reais per agricultural year).

However, even though these lines of credit exist to finance the environmental regularization activities of the properties, the demand for these lines has been low (Costa, 2016; Moreira, Neto and Kimura, 2016). According to a study conducted by Moreira, Neto, and Kimura (2016), the existing reasons for the low demand for these lines of credit derive mainly from "uncertainties about the complete regulation of the new forest law, Brazil's economic situation, and the high level of indebtedness of rural producers, combined with the perception, on the part of rural landowners and also of financial agents, that credit for this type of activity to recover environmental liabilities is a burden to the producer. Besides these reasons, the high cost of monitoring - linked to the difficulty in monitoring the progress of forest restoration and its maintenance during the term of the credit agreement - and the need for collateral as complicating factors in obtaining credit for restoration activities and environmental suitability of the property (FEBRABAN and GVces, 2017). Moreover, it is mentioned the requirements demanded to the producer to obtain the credit, the interest rate and the amount available per agricultural year (sometimes lower than necessary).

Specifically for the 2017/2018 and 2018/2019 crops (which were the last crops in which information on the Program was made available by the ABC Observatory[24]), the amount contracted for the ABC

[23] Costing: rural credit to cover normal expenses of production cycles. Investment: rural credit intended to cover goods or services which are extended for several periods of production.
[24] observatorioabc.com.br

Environmental subprogram was around 1% of the total contracted for the ABC Program (OBSERVATÓRIO ABC, 2019), which represents both the low demand for financing environmental adequacy activities and the availability of resources for this modality.

Having exposed that the restoration of PPA and LR areas has occurred mainly through donations and other fund-raising activities, that the cost of restoration is one of the biggest obstacles and that credit lines have not been applied for the realization of environmental regularization activities, we conclude that the expected situation in the territory is that the areas of environmental liabilities will remain unrestored if there is no help or coverage of costs (as through the sale of the VCUs generated by the Project).

Institutional barriers: Risk related to approved law

The restoration of environmental liabilities, established in the Native Vegetation Protection Law, is fundamental for the conservation of biodiversity, soil, water resources and for guaranteeing the provision of ecosystem services. Furthermore, it is fundamental in achieving Brazil's environmental goals and climate commitments.

The implementation of the Forest Code is particularly important for the Atlantic Forest, which concentrates 70% of the Brazilian population and 80% of the GDP. However, it is much more a region predominantly of agriculture, livestock, cities, complex road systems and industrial parks than a region of forests, and can be understood as an anthropogenic biome (Solórzano et al., 2021).

According to a survey published by IMAFLORA (de Faria et al., 2021), 56% of properties located in the Atlantic Forest and registered in the CAR have a deficit of native vegetation, which reflects a deficit of 2.76 million ha in APP and 1, 98 million ha in RL area. Specifically analyzing the state of São Paulo, it has an estimated deficit in more than 60% of the properties, in addition to being the state with the largest deficit of Legal Reserve (28% of the deficit) and the second largest deficit of Permanent Protection Area (20% of the deficit) of the biome.

Despite the expressive deficit area, the regularization of environmental liabilities does not necessarily involve the recomposition of the deficit property itself. This is because the Forest Code, in its article 66, establishes that the owner who held, on June 22, 2008, an LR area lower than the required one, can regularize his situation via Legal Reserve compensation in another rural property.

In this case, the Legal Reserve can be compensated in four ways: i) via the acquisition of an Environmental Reserve Quota - CRA; ii) via leasing an area under an environmental easement regime or Legal Reserve; iii) via donation to the public authority of an area located inside a Public Domain Conservation Unit pending land regularization; and iv) via registration of another area equivalent and exceeding the Legal Reserve, in a property of the same title or acquired in a third-party property, with established native vegetation, in regeneration or recomposition, provided it is located in the same biome.

However, in addition to the compensation being able to be carried out on another property, as pointed out above, it can even occur outside the state or in another forest phytophysiognomy, because the law establishes that the areas to be used for compensation must: i) be equivalent in terms of extension to the Legal Reserve area to be compensated; ii) be located in the same biome as the Legal Reserve area to be compensated; iii) if outside the State, be located in areas identified as priority[25] by the Union or

[25] Article 66, § 7 - The definition of priority areas of which § 6 deals will seek to favor, among others, the recovery of excessively deforested river basins, the creation of ecological corridors, the conservation of large protected areas and the conservation or recovery of threatened ecosystems or species.

the States. It is important to point out that since the STF decision in 2018, compensation via CRA must consider ecological identity criteria and not just the biome[26].

Regarding the Corridors for Life ARR Grouped Project, for example, Legal Reserve liabilities existing in properties inserted in the Project Zone can use this article 66 to offset in other municipalities and even in the coastal region of the state of São Paulo. In this scenario, we would not have an increase in forest cover in the region, which is so necessary for designing optimal human-modified landscapes for forest biodiversity conservation (Arroyo-Rodríguez et al., 2020).

Considering that the estimated surplus of native vegetation in the Atlantic Forest is 12.1 million hectares and that the estimated deficit in the biome is 1.98 million hectares, the surplus is 6.13 times greater than the deficit. If the RL areas of small properties are included (less than 4 fiscal modules), which can be offered for RL compensation through CRA, the proportion becomes 8.55 times more areas available for compensation than the deficit of Legal Reserve in the Atlantic Forest (de Faria et al., 2021).

In the state of SP, the LR deficit is concentrated in some municipalities. Of the 594 municipalities in the state of São Paulo included in the Atlantic Forest, 320, or about 54%, have a LR deficit greater than the total surplus of native vegetation. This analysis shows that large liabilities will not necessarily be compensated in areas with a large deficit of native vegetation if existing compensation criteria are considered.

In view of the above, if all landowners decide to offset their liabilities in areas of surplus forest within the biome, it would no longer be necessary to restore landscapes in the Atlantic Forest biome.

Thus, the resources of the carbon market can be a huge incentive to reverse this scenario and add thousands of hectares to one of the most threatened biomes on the planet (and, mainly, in the region and phytophysiognomy in which the environmental liability was generated).

Institutional barrier: Risk related to changes in government policies or laws

Although there are no signs of change in the main axes of the law that governs the restoration and conservation of native forests on private rural properties (Law for the Protection of Native Vegetation (LPVN), 12,651/2012), some aspects of it are still being defined and may be objects of political pressure. For example, article 68 of the LPVN defines that deforestation that took place without violating the legislation in force at the time of deforestation does not need to be compensated by the owner. The application of this article becomes complex because Brazil has vegetation protection laws since 1812 with different conservation requirements and using different terms to refer to native vegetation, in addition to an accelerated dynamics of land use change.

With the support of research institutes, a task force was established to articulate with local stakeholders an analysis of the effects of considering different legal requirements on current restoration demands in the state of São Paulo (Melo et al., 2020). The study concluded that the use of the two main legal frameworks (1934 and 1965 legislation) would not significantly alter restoration demands. However, the use of the 1934 landmark would delay the implementation of the law due to the difficulty in generating vegetation cover maps for this period. Despite the team responsible for the work - with the consensus of the stakeholders involved - having emphatically suggested the use of the 1965 legislation, the state decision makers overcame this decision and maintained the 1934 milestone through Resolution SAA 55/20, making it even more difficult to application of the LPVN in the state of São Paulo.

[26] In 2018 the Supreme Court defined that compensation via CRA should be carried out between properties of the same ecological identity (not only even biome), but the same does not apply to the other modalities (servitude, donation of area in UC and compensation in property not contiguous of the same owner). Therefore, if the logic of the specialty principle is considered (preponderance of the most specific standard in the conflict with the general norm), in the case of environmental compensation via the Environmental Reserve Quota, the criterion of ecological identity should be used – although this term does not yet have a clear definition. *A-COTA-DE-RESERVA-AMBIENTAL-NO-STF.pdf (mpsp.mp.br)*

Events like the one described above, while not significantly affecting the restoration demand in the project, can generate legal uncertainty in addition to delaying law enforcement and strengthening an understanding among landowners that restoration actions do not need to be carried out in the near future.

Barriers due to social conditions: Lack of skilled and/or properly trained labor force

Due to the high cost associated with the forest restoration activity, some owners try to restore their areas of environmental liability on their own, with the farm's own employees and without specific knowledge or with untrained teams. In this way, many plantations end up not being established, due to the lack of maintenance and technical experience of the team.

These failures are known precisely because IPÊ itself ended up having to intercede again in many PPAs and LR areas whose restoration activities did not perform when they were carried out by an unqualified team.

The forest restoration activity involves several steps and specific knowledge so that there is success in the establishment of the forest. Among others, we can mention the need for: correct soil preparation and control of weed competition and leaf-cutting ants (pre and post planting); good seedling quality; irrigation in dry times and replanting in cases of high mortality; monitoring and maintenance of plantations; implementation of a schedule that is consistent with all stages and the time of year that each stage will be carried out.

The forest restoration practices applied in this project and in other initiatives in Brazil are the result of a long history of investment, experiments and lessons learned. Several forest restoration initiatives in previous decades failed due to inadequate soil preparation, choice of unsuitable species, lack of maintenance and other technical factors (Rodrigues, Gandolfi and Brancalion, 2015). A framework of technical knowledge and experience is needed to implement the various restoration activities and increase the chances of success. Rural landowners and companies not trained in the restoration activity have developed well-intentioned restoration activities in the past, but without success in establishing a native forest, resulting in loss of investment and motivation of some landowners for restoration.

It is not by chance that one of the project's activities is the training of service providers in forest restoration activities, as the technique in operations is essential for the establishment and development of plantations and consequent landscape connectivity.

Another point of considerable attention is the quality of forest restoration when carried out without the support of a specialized team that has knowledge of species and landscape ecology, especially with regard to biodiversity and connectivity. As an example, we cite the Project's practice of trying to allocate LR areas in places with better landscape connectivity, as well as implementing a minimum of 100 native species in each area (in addition to following the guidelines established in the SMA No. 2014 on choice and proportionality of species and ecological groups).

In other words, plantations carried out without technical knowledge - in addition to the risk that they may not work - may be poorly biodiverse plantations and that will not necessarily fulfill their ecological functions foreseen and established in the Forest Code itself and in the aforementioned SMA 32/2014 and that establishes guidelines, guidelines and criteria on ecological restoration in the State of São Paulo, and provides related measures.

Barriers due to ecological conditions

Associated with the investment barrier and the barrier of knowledge and technical experience in carrying out forest restoration activities, there is a barrier due to ecological conditions, related to the existence of invasive exotic grasses (mainly *Panicum maximum*, *Urochloa decumbens* and *Melinis minutiflora*). As pointed out in more detail in Section 5.2.9, invasive exotic grasses are considered one of the biggest filters for the establishment and development of forest restorations in tropical regions, which, in addition

to their allelopathic effects, compete for resources (water, nutrients, luminosity and space) with the implanted seedlings and with the regenerants reducing the growth by approximately half, in addition to favoring the occurrence of fires. Thus, the preventive and periodic control of these grasses is essential in forest restoration areas, especially in the first years after planting or until the shading caused by the closing of the crowns of the planted native trees suppresses the grasses.

The project area was deforested decades ago and uninterruptedly subjected to agricultural activities, depleting the seed bank of native species and the natural regeneration capacity of the native forest without more active restoration methodologies (Zermeño-Hernánde, Pingarroni and Martínez-Ramos, 2016; Crouzeilles et al., 2016). In addition to the lack of local resilience, many of the project areas already had some history of intensive soil use and mechanization compromising the seed bank. Furthermore, many of these areas are beyond 200-300 meters away from native forests, the minimum distance recommended by the literature to facilitate natural regeneration processes, which could serve as a source of propagules. Additionally, the project area is generally not attractive to dispersing fauna, for example, due to the absence of perching structures (e.g., remaining trees) and impermeability of the matrix, drastically reducing the arrival of seeds from native trees (Galindo-González, Guevara and Sosa, 2000; Barnes and Chapman, 2014).

The native tree individuals that eventually manage to overcome the ecological barriers mentioned above and spontaneously establish themselves in the project area, will still be subjected to herbivory and trampling by the cattle present in many of these areas. The presence of cattle reduces the richness and abundance of tree species native to the Atlantic Forest, which is not observed in other land uses, such as eucalyptus silviculture (Souza et al., 2010).

Thus, only with a trained team that understands the management of aggressive exotic grasses in forest restoration areas that these filters can be overcome and this barrier alleviated.

Outcome of Step 2a:

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

- Investment barrier

- Barrier due to social conditions: Lack of skilled and/or properly trained labor force

- Institutional barrier: Risk related to the approved law

- Institutional barrier: Risk related to changes in government policies or laws

- Barrier due to ecological conditions

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

The scenario 2 “Forestation of the land within the project boundary performed without being registered as a ARR VCS project activity” is prevented by the five barriers identified, while the scenario 1 “Continuation of the pre-project land use: mostly unmanaged grasslands and some annual croplands” does not face any of the identified barriers.

Table 17 – Impeding barriers to the identified scenarios.

Scenario	Prevented Barrier
Scenario 1: Continuation of the pre-project land use: mostly unmanaged grasslands and some annual croplands	– No barrier impediment
Scenario 2: Forestation of the land within the project boundary performed without being registered as a ARR VCS project activity	– Investment barrier – Barrier due to social conditions – Institutional barriers

	– Barrier due to ecological conditions

Outcome of Sub-step 2b:

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

- Scenario 1: Continuation of the pre-project land use: mostly unmanaged grasslands and some annual croplands

Sub-step 2c. Determination of baseline scenario (if allowed by the barrier analysis)

As forestation without being registered as an ARR VCS project activity is not included in the list of land use scenarios that are not prevented by any barrier and it is the only land use scenario in outcome of sub-step 2b, this remaining land use is the baseline scenario.

STEP 3. Investment analysis

Not applicable, once it is not mandatory.

STEP 4. Common practice analysis

Project Zone, as pointed out in detail in Section 2.1.6, began its process of landscape transformation and consequent deforestation and loss of biodiversity in the late 19th century, with the opening of pastureland for cattle ranching and later for coffee cultivation. Deforestation intensified over the years with the changes in economic cycles and the development policies instituted, which always led to the conversion of forest areas into pasture areas, cotton cultivation and, already between the 1970s and 1980s, sugar cane areas, besides the loss of forests with the installation of 4 hydroelectric power plants.

As mentioned before, IPÊ has been working in the region for 30 years and, with the purpose of converting deforested areas with environmental liabilities into forest areas and connecting the forest fragments, it started its first restoration planting in 2004 in a private property located near the Morro do Diabo State Park (the largest remnant of Semi-deciduous Seasonal Forest in the State of São Paulo). Since then, in 18 years, it has restored approximately 2,200 hectares and implemented 60 hectares of agroforestry systems.

In order to guide where efforts in the implementation of forest restoration plantings are more of a priority for landscape connectivity, a Dream Map was developed for the Project Zone, which incorporates information about the proximity of riparian forests (PPAs) and Legal Reserves (LRs), property boundaries, species ecology, and existing forest remnants. The Dream Map of large-scale Atlantic Forest restoration is serving as a guide to IPÊ's restoration activities in western São Paulo State, highlighting priority areas for restoration and conservation. The idea of this map, which integrates the proximity of Gallery Forests (PPAs) and Legal Reserves (LRs), property borders, existing forest fragments, and species ecology, largely mirrors the information already gathered by the CAR (Environmental Rural Registry database).

Dib et al. (2020) generated different scenarios for one deforested watershed in Brazil and observed that helping farmers to comply with the restoration requirements of Brazilian legislation would increase forest cover by 18-48% in the watershed and increase mean species abundance by approximately one third when compared to the business-as-usual land management. Therefore, working closely with farmers to carry out the legal requirements of Brazilian legislation can generate additionality for restoration and carbon in Brazil.

Farmers and public agencies alone do not have the technical and financial resources to restore the millions of hectares required by Brazilian legislation. Areas of legal reserve and permanent preservation are areas that have mandatory preservation established by law. However, according to the context presented above (and Sub-step 1.b), without the intervention of a certified project, the restoration of degraded areas could take years, or even not be implemented by the landowner, even more so if the owners decide to offset their Legal Reserve liabilities on other properties (and even in another region of the state or in another phytophysiognomy).

Furthermore, considering that:

(i) there is an urgent need to conserve the forest remnants and restore the areas of environmental liabilities of the properties for the maintenance of fauna and flora species and removal of GHG (acting directly in the mitigation of climate change), this being the decade of ecological restoration instituted by the ONU [27];

(ii) planting success and restoration quality depend on knowledge and skilled labor;

(iii) the restoration approach must consider the whole territory, including not only biodiversity aspects (such as ecology of fauna and flora populations), but also community aspects (identifying who are the key actors that occupy the territory and how they can make them partners in project implementation); and, above all, that;

(iv) the cost of implementation and maintenance of ecological restoration areas is one of the biggest challenges and barriers to the environmental suitability of rural properties and that;

(v) regardless of law enforcement and political instabilities, individual agreements (via contract) are made with each landowner, in which they commit to protect the forests in restoration.

It is understood that the development and implementation of a certified ARR carbon project is the way to leverage, enable and accelerate the forest restoration process in the territory (already started by IPÊ).

Outcome: as similar activities can be observed and essential distinctions between the proposed CDM project activity and similar activities can be made, the proposed ARR VCS project activity is not the baseline scenario and, hence, it is additional.

3.1.6. Methodology Deviations

There was no methodology deviation in the construction of this project.

3.2. Quantification of GHG Emission Reductions and Removals

3.2.1. Baseline Emissions

The “A/R Large-Scale Consolidated Methodology – Afforestation and reforestation of lands except wetlands (AR-ACM0003, version 2.0)” establishes that the baseline net GHG removals by sinks shall be calculated as follows:

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

(Equation 1- AR-ACM0003)

Where:

[27] The UN Decade on Ecosystem Restoration (2021-2030): Flagship Initiatives (unep.org)

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

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

$\Delta C_{SHRUB\_BSL,t}$: Change in carbon stock in baseline shrub biomass within the project boundary, in year t, as estimated in the tool *"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"*; t CO2-e

$\Delta C_{DW\_BSL,t}$: Change in carbon stock in baseline dead wood biomass within the project boundary, in year t, as estimated in the tool *"Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"*; t CO2-e

$\Delta C_{LI\_BSL,t}$: Change in carbon stock in baseline litter biomass within the project boundary, in year t, as estimated in the tool "*Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*"; t CO2-e

3.2.1.1. Stratification

As pointed out in AR-ACM0003 methodology, "if biomass distribution over the project area is not homogeneous, stratification should be carried out to improve the precision of biomass estimation".

It is also pointed out that "for baseline net GHG removals by sinks, it is usually sufficient to stratify the area according to major vegetation types and their crown cover and/or land use types."

In the case of the Corridors for Life ARR Grouped Project (as already pointed out in Section 3.1.4 - Baseline Scenario), the project considered 3 different strata for implementation of ARR activities: (i) "herbaceous; (ii) irregular-herbaceous; and iii) irregular-arboreal.

Methodology

The stratification analysis carried out by the project consisted of applying the Random Forest algorithm to evaluate and measure which types of vegetation strata are present in the project areas. This activity is indicated to increase the accuracy of the baseline biomass estimate and reduce supervised classification efforts.

The procedures can be divided into six steps: 1- identification of vegetation strata classes in areas eligible for the implementation of ARR activities; 2- one hectare polygon mesh establishment; 3- crossing the polygon mesh with satellite image; 4- application of the Random Forest Algorithm; 5- application of accuracy index; and 6- baseline strata area calculation. Each procedure is described below:

1) Identification of vegetation strata classes in areas eligible for the implementation of ARR activities:

The definition of strata classes was established by the subdivision of the current vegetation cover. Through the application of photointerpretation techniques, the four types of strata present in the areas were identified, namely:

"Herbaceous": Predominance of herbaceous vegetation, but with the presence of some shrub and/or tree individuals, having an approximate upper limit of 10% crown coverage;

"Irregular-herbaceous": Predominance of herbaceous vegetation, but with the presence of some shrub and/or tree individuals, having an approximate upper limit of 30% crown coverage;

"Irregular-arboreal": Predominance of tree and/or shrub vegetation at an approximate upper limit of 60% crown coverage, with clearings and presence of herbaceous vegetation; and

"Arboreal": predominance of arboreal vegetation, with little clearing and presence of herbaceous vegetation (crown coverage occupying more than 60% of the area).

Note that the tree stratum was considered in the stratification methodology, but not to receive the ARR activities, so it was not included as a baseline stratum. That is, forest areas with crown coverage greater than 60% are excluded from the calculation of areas to be restored. It is also important to mention that small disturbance areas that are part of the baseline scenario, such as gullies, do not have a specific baseline stratum and were classified by its predominant vegetation cover as the rest of the Project Area.

2) One hectare polygon mesh establishment

Geoprocessing tools were used to create a one hectare polygon mesh over areas eligible for ARR activities. Then, based on satellite images, these polygons were visually classified according to the previously mentioned strata classes. This polygon mesh was created so that the strata identification in satellite images could be standardized in areas of the same size. Furthermore, such polygons were used to train the Random Forest classification model.

3) Crossing the polygon mesh with satellite image

A raster file containing metrics of 15 indices or bands used for vegetation biomass analysis was produced from a Sentinel 2 image. For analysis carried out in the first instance of the baseline, for example, the following bands were obtained for the rainy season (December 2020 to April 2021): red, green, blue, Red Edge 1, Red Edge 2, Red Edge 3, Red Edge 4, Shortwave Infrared (SWIR) 1 and Shortwave Infrared (SWIR) 2. The indexes calculated were: Normalized Difference Vegetation Index (NVDI), Simple Ratio (SR), Soil Adjusted Vegetation Index (SAVI), Atmospheric Resistance Vegetation Index (ARVI), Enhanced Vegetation Index (EVI) and Visible Atmospheric Resistance Index (VARI).

Subsequently, with GIS software, the average of the bands and indices was calculated for each polygon of 1 hectare, in order to obtain the average of each index for each of the strata.

4) Application of the Random Forest Algorithm

The strata polygons with the Remote Sensing metrics were used as samples for the Random Forest classification algorithm. This algorithm was processed in R programming language and considered the patterns of indices and spectral bands for each stratum. From these samples, the algorithm carried out a supervised classification of the one hectare polygons, categorizing them according to the 4 strata classes. This classification also involved the creation of decision trees, which indicate the best threshold values for classifying the strata.

5) Application of accuracy index

With the Software R, the validation of the classifications was carried out from an analysis of accuracy.

6) Baseline strata area calculation

From the generated stratum polygons (in the areas eligible for the development of ARR activities) it was possible to calculate the area of each stratum in the baseline (pre-planting period).

After performing the steps above, for the initial instance, the following proportionality between strata was verified:

Table 18 – Stratification within the eligible areas for the execution of ARR activities for each property composing the first instance.

Farm	Total area	Strata		
		Herbaceous	Irregular-herbaceous	Irregular-arboreal
Daniel	104.7	79.8	24.6	0.3

Matuto	89.8	86.3	1.8	1.8
Nossa Senhora Aparecida	424.1	394.9	26.6	2.7
Santa Amália – Remanescente (1)	259.3	139.7	110.4	9.2
Santa Amália - Desmembrada (2)	57.2	46.6	10.6	0.0
Santa Maria	29.3	26.2	3.1	0.0
Junqueira I	264.8	225.3	33.6	6.0
São Paulo	97.0	49.1	47.9	0.0
Santa Rosa	411.3	377.5	33.8	0.0
Vida	117.8	113.5	4.2	0.0

In view of the baseline stratification, sample plots were installed to measure the existing biomass within these plots and consequent average estimate of the baseline biomass in each stratum. The methodology associated with the installation and measurement of the sample plots is presented in Section 3.3.3.2.2., as well as briefly described in Section 3.2.1.2 below.

3.2.1.2. Estimation of carbon stock in trees and shrubs

Estimation of carbon stocks in trees and shrubs was given by the specific equations established in the AR-AMTOOL14 tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (version 4.2), specifically in sections 8 (Estimating carbon stock in trees at a point of time) and 11 (Estimating carbon stock in shrubs at a point of time).

3.2.1.2.1. Estimating the initial carbon stock in trees

Carbon stock in trees at a point in time can be estimated using one of the following methods (or a combination of them):

(a) Estimation via sample plot measurement;

(b) Estimation via modeling of tree growth and stand development

(c) Estimation via relative canopy cover

(d) Update of previous stock via measurement independent of change

When the estimation is carried out by methods (a), (b) or (d) above, the date of the last sample plot measurement, or canopy cover estimate, is the one that will be used as the date of the carbon stock estimate, even if the whole measurement process extends over a period.

When the estimate of carbon stock in trees at a given time in year t is done by applying different methods in different strata, the value of the $C_{TREE,i}$ is given by the sum of the carbon stock in all strata in which the project area was divided.

Estimation via measurement of sample plots

Estimation of carbon stock in the baseline of the Grouped Project was done via measurement in sample plots, but as pointed out above, other 3 methods can be used.

In this method, the tool establishes that sample plots are installed in one or more strata (and in the case of the Corridors for Life ARR Grouped Project, as mentioned above and in Section 3.1.4. the sample

plots were installed in the three determined strata) and two sampling designs are possible: i) stratified random sampling; ii) double sampling.

Arrangement used by the Grouped Project was stratified random sampling. Under this method, sample plots are installed in the different strata randomly and then these plots are measured.

As pointed out in the tool, this method is most efficient when the sample plots are optimally allocated to the strata, given the expected average biomass per hectare of the trees and their variability in the strata. Number of sample plots and their allocation to strata were estimated using the AR-TOOL03 methodological tool "Calculation of the number of sample plots for measurements within the A/R MDL project activities".

The average carbon stock in trees, given by the estimated tree biomass in the strata, and the associated uncertainty are estimated as follows:

$$C_{TREE} = \frac{44}{12} \times CF_{TREE} \times B_{TREE}$$ (Equation 12 - AR-TOOL14)

$$B_{TREE} = A \times b_{TREE}$$ (Equation 13 – AR-TOOL14)

$$b_{TREE} = \sum_{i=1}^{M} w_i \times b_{TREE,i}$$ (Equation 14 – AR-TOOL14)

$$u_C = \frac{t_{VAL} \times \sqrt{\sum_{i=1}^{M} w_i^2 \times \frac{s_i^2}{n_i}}}{b_{TREE}}$$ (Equation 15 – AR-TOOL14)

Where:

C_{TREE}: Carbon stock in trees in the tree biomass estimation strata; t CO2-e

CF_{TREE}: Carbon fraction of tree biomass; t C (t d.m.)-1. A default value of 0.47 is used unless transparent and verifiable information can be provided to justify a different value.

B_{TREE}: Tree biomass in the tree biomass estimation strata; t d.m.

A: Sum of areas of the tree biomass estimation strata; ha

b_{TREE}: Mean tree biomass per hectare in the tree biomass estimation strata; t d.m. ha^{-1}

w_i: Ratio of the area of stratum i to the sum of areas of tree biomass estimation strata (i.e. $w_i = A_i / A$); dimensionless

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

u_C: Uncertainty in C_{TREE}

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

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

n_i: Number of sample plots in stratum i.

Mean tree biomass per hectare in a stratum and the associated variance are estimated as follows:

$$b_{TREE,i} = \frac{\sum_{p=1}^{n_i} b_{TREE,p,i}}{n_i}$$ (Equation 16 – AR-TOOL14)

$$s_i = \frac{n_i \times \sum_{p=1}^{n_i} b_{TREE,p,i}^2 - \left(\sum_{p=1}^{n_i} b_{TREE,p,i}\right)^2}{n_i \times (n_i - 1)}$$ (Equation 17 – AR-TOOL14)

Where:

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

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

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

n_i: Number of sample plots in stratum *i*.

The tree biomass per hectare in a plot is estimated using one of the plot measurement methods provided in Appendix 1 of the tool (AR-TOOL14, version 4.2). Specifically, the method of "measurement of fixed area plots" was used in the estimation of the carbon stock in the baseline:

Measurement of fixed area plots.

The tool establishes that in this method:

- Sample plots of the same size are installed in a stratum. All trees in a sample plot above a minimum dimension are measured and the biomass of each tree is estimated. The minimum dimension selected can be low (e.g. a diameter of 2 cm) or high (e.g. a diameter of 10 cm) depending upon the applicability of models (e.g. allometric equations or volume equations) to be used for conversion of the tree dimension into tree volume or tree biomass, and upon cost-effectiveness of measurement.

In the Corridors for Life ARR Grouped Project, 900m2 (30 x 30m) sample plots were installed, where the diameters at breast height (DBH) and total height (H) of all tree individuals with more than 5cm of DBH were measured (thus how the canopy projection of individuals of shrub species was measured).

- The biomass of the individual trees is added and the sum is divided by the area of the sample plot to obtain the plot biomass value.

- The plot biomass value (i.e. per-hectare tree biomass at the centre of the plot) is estimated as follows (all time-dependent variables relate to the time of measurement):

$$b_{TREE,p,i} = \frac{B_{TREE,p,i}}{A_{PLOT,i}}$$ (Equation 1 - AR-TOOL14/Appendix 1)

$$B_{TREE,p,i} = \sum_j B_{TREE,j,p,i}$$ (Equation 2 - AR-TOOL14/Appendix 1)

$$B_{TREE,j,p,i} = \sum_l B_{TREE,j,p,i}$$ (Equation 3 - AR-TOOL14/Appendix 1)

Where:

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

$B_{TREE,p,i}$ = Tree biomass in sample plot *p* of stratum *i*; t d.m.

$A_{PLOT,i}$ = Size of sample plot in stratum I; ha

$B_{TREE,j,p,i}$ = Biomass of trees of species *j* in sample plot *p* of stratum *i*; t d.m.

$B_{TREE,l,j,p,i}$ = Biomass of trees *l* of species *j* in sample plot *p* of stratum *i*; t d.m

The biomass of a tree in a sample plot, in turn, is estimated using one of the following equations:

$$B_{TREE,l,j,p,i} = f_J(x_{1,l}, x_{2,l}, x_{3,l}, \ldots) \times (1 + R_j)$$

(Equation 4 - AR-TOOL14/Appendix 1)

$$B_{TREE,l,j,p,i} = V_{TREE,j}(x_{1,l}, x_{2,l}, x_{3,l}, \ldots) \times D_j \times BEF_{2,j} \times (1 + R_j)$$

(Equation 5 - AR-TOOL14/Appendix 1)

Where:

$B_{TREE,l,j,p,i}$ = Biomass of tree *l* of species *j* in sample plot *p stratum i*; t d.m.

$f_j(x_{1,l},x_{2,l},x_{3,l},\ldots)$ *x* $(1 + R_j)$ = Above-ground biomass of the tree retuned by the allometric equation for species *j* relating the measurements of tree *l* to the above-ground biomass of the tree; t d.m.

R_j = Root-shoot ratio for tree species *j*; dimensionless. The value R_j is estimated as $R_j = \frac{e^{(-1.095+0.9256\ x\ ln\ b)}}{b}$ where *b* is the above-ground tree biomass per hectare (in t d.m. ha^{-1}), unless transparent and verificable information can be provided to justify a different value.

$V_{TREE,j}(x_{1,l},x_{2,l},x_{3,l},\ldots)$ = Stem volume of tree *l* of species *j* in sample plot *p* of stratum *i*, estimated frm the tree dimension(s) as entry data into a volume table or volume equation; m³

D_j = Density (over-bark) of tree *j*; t d.m. m³. Values are taken from Table 3A.1.9 of IPCC GPG-LULUCF 2003 unless transparent and verificable information can be provided to justify different values.

$BEF_{2,j}$ = Biomass expansion fator for conversion of tree stem biomass to above-ground tree biomass, for tree species j; dimensionless.

In the Grouped Project, Equation 11 was used, by applying the Brown et al (1989) equation, as pointed out in Table 20.

3.2.1.2.2. Estimation of carbon stock in shrubs

$$C_{SHRUB,t} = \frac{44}{12} \times CF_s \times (1 + R_s) \times \sum_i A_{SHRUB,i} \times b_{SHRUB,i}$$

(Equation 26 - AR-TOOL14)

$$b_{SHRUB,t} = BDR_{SF} \times b_{FOREST} \times CC_{SHRUB,t}$$

(Equation 27 - AR-TOOL14)

Where:

$C_{SHRUB,t}$: Carbon stock in shrubs within the project boundary at a given point of time in year *t*; t CO_2-e

CF_S: Carbon fraction of shrub biomass; t C (t.d.m.)$^{-1}$. A default value of 0.47 is used unless transparent and verifiable information can be provided to justify a different value.

R_S: Root-shoot ratio for shrubs; dimensionless. The default value of 0.40 is used unless transparent and verifiable information can be provided to justify a different value.

$A_{SHRUB,i}$: Area of shrub biomass estimation stratum *i*; ha

$b_{SHRUB,i}$: Shrub biomass per hectare in shrub biomass estimation stratum *i*; t d.m. ha^{-1}

BDR_{SF}: Ratio of shrub biomass per hectare in land having a shrub crown cover of 1.0 (i.e. 100 per cent) and the default above-ground biomass content per hectare in forest in the region/country where the A/R CDM project activity is located; dimensionless. A default value of 0.10 should be used unless transparent and verifiable information can be provided to justify a different value.

b_{FOREST}: Default above-ground biomass content in forest in the region/country where the A/R CDM project activity is located; t d.m. ha^{-1}. Values from Table 3A.1.4 of IPCC GPG-LULUCF 2003 are used unless transparent and verifiable information can be provided to justify different values.

$CC_{SHRUB,i}$: Crown cover of shrubs in shrub biomass estimation stratum *i* at the time of estimation, expressed as a fraction (e.g. 10 per cent crown cover implies $CC_{SHRUB,i}$ = 0.10); dimensionless.

3.2.2. Project Emissions

Actual net GHG removals by carbon sinks

As established in the AR-ACM0003 methodology (version 2.0), The actual net GHG removals by sinks shall be calculated as follows:

$$\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t}$$ (Equation 2 – AR-ACM0003)

Where:

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

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

$GHG_{E,t}$: Increase in non-CO2 GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year *t*, as estimated in the tool "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity"; t CO_2-e

Estimation of emissions of greenhouse gases

The AR-TOOL08 (version 4.0) "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity" established that emission of non-CO_2 GHGs resulting from burning of biomass and forest fires within the project boundary in year *t* shall be estimated as follows:

$$GHG_{E,t} = GHG_{SPF,t} + GHG_{FMF,t} + GHG_{FF,t}$$ (Equation 1 – AR-TOOL08)

Where:

$GHG_{E,t}$: Emission of non-CO_2 GHGs resulting from burning of biomass and forest fires within the project boundary in year *t*; t CO_2-e

$GHG_{SPF,t}$: Emission of non-CO_2 GHGs resulting from use of fire in site preparation in year t; t CO_2-e

$GHG_{FMF,t}$: Emission of non-CO_2 GHGs resulting from use of fire to clear the land of harvest residue prior to replanting of the land or other forest management, in year *t*; t CO_2-e

$GHG_{FF,t}$: Emission of non-CO_2 GHGs resulting from fire in year *t*; t CO_2-e

t: *1, 2, 3, .* years counted from the start of the A/R CDM project activity

It is important to point out that no project emissions are foreseen, since:

- GHG emissions resulting from removal of herbaceous vegetation, combustion of fossil fuel, fertilizer application, use of wood, decomposition of litter and fine roots of N-fixing trees, construction of access roads within the project boundary, and transportation attributable to the project activity shall be considered insignificant and therefore accounted as zero, as established in AR-ACM0003 (version 2.0) methodology.
- use of fire is not part of the activities of the Corridors for Life ARR Grouped Project, as pointed out in sections 3.1.2 and 3.1.3.

Thus, only the emission calculations are shown below and will only be used if the tool is applicable (according to the applicability criteria already set out in Table 14 of Section 3.1.2) in an event of fire occurrence within the area limits of the Project during the life of the Project, such as reaching a minimum area of 1 hectare and representing more than 5% of the project area. The assumptions for non-CO_2

emission calculation for above ground biomass of living trees, also shown in Table 14, should also be considered to assess the significance and necessity of performing the calculations.

Non-CO_2 emissions resulting from forest fires

Emission of GHGs resulting from the burning of aboveground project tree biomass in fire that is not site preparation or burning of harvest residue (defined as "forest fire") is calculated using the aboveground biomass in trees and dead wood of relevant strata in last verification.

$$GHG_{FF,t} = GHG_{FF\_TREE,t} + GHG_{FF\_DOM,t}$$ (Equation 6 – AR-TOOL08)

Where:

$GHG_{FF,t}$: Emission of non-CO_2 GHGs resulting from fire in year *t*; t CO_2-e

$GHG_{FF\_TREE,t}$: Emission of non-CO_2 GHGs resulting from the loss of aboveground biomass of trees due to forest fire, in year *t*; t CO_2-e

$GHG_{FF\_DOM,t}$: Emission of non-CO_2 GHGs resulting from the loss of dead organic matter due to forest fire, in year *t*; t CO_2-e

As established in AR-TOOL08 (version 4.0), "Emission of non-CO_2 GHGs resulting from the loss of aboveground tree biomass due fire is calculated using the above ground biomass in trees of relevant strata in last verification and a combustion factor. For the first verification, emission of non-CO_2 GHGs resulting from the loss of trees due to natural or anthropogenic forest fire is assumed to be zero".

$$GHG_{FF\_TREE,t} = 0{,}001 \times \sum_{i=1}^{M} A_{BURN,i,t} \times b_{TREE,i,t_L} \times COMF_i \times (EF_{CH_4,i} \times GWP_{CH_4} \times EF_{N_2O,i} \times GWP_{N_2O})$$

(Equation 7 – AR-TOOL08)

Where:

$GHG_{FF\_TREE,t}$: Emission of non-CO_2 GHGs resulting from the loss of aboveground biomass of trees due to forest fire, in year *t*; t CO_2-e

$A_{BURN,i,t}$: Area burnt in stratum *i* in year *t*; ha

$b_{TREE,i,tL}$: Mean aboveground tree biomass per hectare in stratum *i* in year t_L which is the year in which last verification was carried out before occurrence of the fire; t d.m. ha^{-1}. Where aboveground biomass of living trees is not burnt by fire, $b_{TREE,i,tL}$ may be set equal to zero.

$COMF_i$: Combustion factor for stratum *i*; dimensionless

$EF_{CH4,i}$:Emission factor for CH_4 in stratum *i*; g CH_4 (kg dry matter burnt)$^{-1}$

GWP_{CH4}: Global warming potential for CH_4; dimensionless. Default value of 21 is used.

$EF_{N2O,i}$: Emission factor for N_2O in stratum *i*; g N_2O (kg dry matter burnt)$^{-1}$

GWP_{N2O}: Global warming potential for N_2O; dimensionless. Default value of 310 is used.

i: 1, 2, 3 . *M* strata

t: 1, 2, 3, . years elapsed since the start of the project activity

The AR-TOOL08 (version 4.0) also states that emission of non-CO_2 GHGs resulting from the loss of dead organic matter due to fire shall be calculated using the dead organic matter stock at the last verification. For the first verification period emission of non-CO_2 GHGs resulting from the loss of dead organic matter due to fire shall be assumed to be zero, and for subsequent verification periods emission of non-CO_2 GHGs shall be estimated as follows:

$$GHG_{FF\_DOM,t} = 0{,}07 \times \sum_{i=1}^{M} A_{BURN,i,t} \times (C_{DW,i,t_L} \times C_{LI,i,t_L})$$

(Equation 8 – AR-TOOL08)

Where:

$GHG_{FF\_DOM,t}$: Emission of non-CO_2 GHGs resulting from the loss of dead organic matter due to forest fire, in year *t*; t CO_2-e

$A_{BURN,i,t}$: Area burnt in stratum *i* in year *t*; ha

$C_{DW,i,tL}$: Carbon stock in dead wood in stratum *i* in year t_L which is the year in which last verification was carried out before occurrence of the fire, as estimated using the .Tool for estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities.; t CO_2-e

$C_{LI,i,Tl:}$ Carbon stock in litter in stratum *i* in year t_L which is the year in which last verification was carried out before occurrence of the fire, as estimated using the .Tool for estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities.; t CO_2-e

i: 1, 2, 3 . *M* strata

t: 1, 2, 3, . years elapsed since the start of the project activity

<u>Change in the carbon stock in the project</u>

In turn, change in the carbon stocks in project, occurring in the selected carbon pools in year t shall be calculated as follows:

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

(Equation 3 – AR-ACM0003)

Where:

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

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

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

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

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

$\Delta C_{SOC\_PROJET,t}$: Change in carbon stock in SOC in project, in year t, in areas of land meeting the applicability conditions of the tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities", as estimated in the same tool; t CO2-e

3.2.2.1. Change in carbon stock of trees and shrubs

Stratification

According to AR-ACM0003 methodology, "for actual net GHG removals by carbon pools, the stratification for ex-ante estimates is based on the project planting/management plan and the stratification for ex-post estimates is based on the actual implementation of the project planting/management plan".

Additionally, if natural or anthropogenic impacts (e.g., local fires) or other factors (such as soil type) significantly alter the pattern of biomass distribution in the project area, then the stratification for ex post estimation should be readjusted.

As the objective of the Project is to perform the restoration plantings and the facilitation of natural regeneration over 20 years, it is previously understood that the distribution of biomass in the project will vary according to the planting year (Table 7) and the restoration method applied. Stratification for ex-post estimation will take into consideration the execution of the planting plan and the development of the restoration areas, using geoprocessing technologies and tools as support in the determination of the strata.

Another possible stratum to be considered in monitoring and calculating the Project's GHG removals refers to plantations of exotic species, intended to be used only in specific cases, in low quantities and at the request of the rural owner, as pointed out in Sections 5.2.5, 5.2.7 and 3.2.4.2.

As occurred for the determination of baseline emissions in each stratum (Section 3.2.1.1), sample plots should be installed to measure the existing biomass within these plots and consequent average estimate of biomass in each stratum.

Estimation of carbon stocks in trees and shrubs will be given by the specific equations established in the AR-AMTOOL14 tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (version 4.2) and already presented in Section 3.2.1.2 (Estimating carbon stock in trees and shrubs).

3.2.2.2. Change in carbon stock in litter

The change in carbon stock in litter is given by the "default method", established in the AR-TOOL12 tool "*Estimation of carbon stocks and changes in carbon stocks in dead wood and litter*" (version 3.1).

This tool states that "If PPs do not wish to make sampling based measurements for estimation of C stock in litter, they may use the default-factor based method described in this section. The default-factor based method is applicable only if litter remains in situ and is not removed from the project boundary through any type of anthropogenic activities".

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

$$C_{LI,i,t} = C_{TREE,i,t} \times DF_{LI} \quad \text{(Equation 15 – AR-TOOL12)}$$

Where:

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

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

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

i = 1,2,3, … biomass estimation strata within the project boundary;

t = 1,2,3, … years elapsed since the start of the A/R CDM project activity

Also, according to the tool, "value of the conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass (DF_{LI}) is selected according to the guidance provided in the relevant table in Section 8 (of AR-TOOL12) unless transparent and verifiable information can be provided to justify a different value".

For the Corridors for Life ARR Grouped Project, which is located in a tropical region, with an altitude lower than 2000m and with a water regime between 1000 and 1600mm per year, the DFLI value is 1%.

3.2.2.3. Change in carbon stock in dead wood

As with litter, the change in carbon stocks in dead wood can be given by the "default method", established in the AR-TOOL12 tool "Estimation of carbon stocks and changes in carbon stocks in dead wood and litter" (version 3.1). To this end, for all strata to which the default-factor based method is applied, the carbon stock in dead wood is estimated as:

$$C_{DW,i,t} = C_{TREE,i,t} \times DF_{DW} \quad \text{(Equation 9 – AR-TOOL12)}$$

Where:

$C_{DW,i,t}$ = Carbon stock in dead wood in stratum *i* at a given point of time in year *t*; t CO_2e

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

DF_{DW} = Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass, per cent

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

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

Again, as the Corridors for Life ARR Grouped Project is located in a tropical region, with an altitude lower than 2000m and with a water regime between 1000 and 1600mm per year, the DF_{DW} value is 1%.

3.2.2.4. Change in soil organic carbon stock

The change in soil organic carbon stock due to the implementation of the Grouped Project activities is estimated by the provisions of the AR-TOOL16 tool *"Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities (version 1.1)".*

To estimate the change in SOC stock in the project scenario, the areas of land meeting the applicability conditions of the tool are stratified according to:

(a) Climate region and soil types given in Table 3 of the tool;

(b) Pre-project management activities on croplands given in Tables 4 and 5 of the tool; and

(c) Pre-project management activities on grasslands given in Table 6 of the tool.

The initial SOC stock at the start of the project is estimated as follows:

$$SOC_{INITIAL,i} = SOC_{REF,i} * f_{LU,i} * f_{MG,i} * f_{IN,i} \quad \text{(Equation 1 – AR-TOOL16)}$$

Where:

$SOC_{INITIALi}$ = SOC stock at the beginning of the A/R CDM project activity in stratum *i* of the areas of land; t C ha^{-1}

$SOC_{REF,I}$ = Reference SOC stock corresponding to the reference condition in native lands (i.e non-degraded, unimproved lands under native vegetation – normally forest) by climate region and soil type applicable to stratum *i* of the areas of lands; t C ha^{-1}

$f_{LU,i}$ = Relative stock change factor for baseline land-use in stratum *i* of the áreas of land; dimensionless

$f_{MG,i}$ = Relative stock change factor for baseline management regime in stratum *i* of the áreas of land; dimensionless

$f_{IN,i}$ = Relative stock change factor for baseline input regime (e.g. crop residue returns, manure) in stratum *i of the areas of land; dimensionless*

i = 1,2,3, ... strata of areas of land; dimenionless

The values of $SOC_{REF,i}$, $f_{LU,i}$, $f_{MG,i}$ $f_{IN,i}$ are taken from the Tables 3.6 of the AR-TOOL16,unless transparent and verifiable information can be provided to justify different values.

For each stratum of the areas of land which is subjected to soil disturbance attributable to project activity and for which the total area disturbed, over and above the area disturbed in the baseline (if any), is greater than 10% of the area of the stratum, the following carbon loss is accounted:

$SOC_{LOSS,i} = SOC_{INITIAL,i} * 0.1$ (Equation 2 – AR-TOOL16)

For all other strata:

$SOC_{LOSS,i} = 0$ (Equation 3 – AR-TOOL16)

Where:

$SOC_{LOSS,i}$ = Loss of SOC caused by soil disturbance attributable the A/R CDM project activity, in stratum *i* of the areas of land; t C ha^{-1}

0.1 = The approximate proportion of SOC lost within the first five Years from the year of site preparation

i = 1,2,3, ... strata of areas of land; dimensionless

The rate of change in SOC stock in project scenario until the steady-state SOC content is reached is estimated as follows:

$$dSOC_{t,i} = 0 \text{ for } t < t_{PREP,i}$$

(Equation 4 – AR-TOOL16)

$$dSOC_{t,i} = \frac{SOC_{LOSS,i}}{1\ year} \text{ for t} = t_{PREP,i}$$

(Equation 5 – AR-TOOL16)

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

(Equation 6 – AR-TOOL16)

Where:

$dSOC_{t,i}$ = The rate of change in SOC stock in stratum *i* of the areas of land, in year *t*; t C ha^{-1}yr^{-1}

$t_{PREP,i}$ = The year in which first soil disturbance takes place in stratum *i* of the areas of land

$SOC_{LOSS,i}$ = Loss of SOC caused by soil disturbance attributable the A/R CDM project activity, in stratum *i* of the areas of lands; t C ha^{-1}

$SOC_{REF,i}$ = SOC stock at the beginning of the A/R CDM project activity in stratum *i* of the areas of land; t C ha^{-1}

i = 1,2,3, ...strata of areas of land; dimensionless

t = 1,2,3, ...years elapsed since the start of the A/R CDM project activity

Considering uncertainties and inherent limitation of the precision of a fator-based estimation used in this tool, value of the rate of change of SOC stock is not accounted as more than 0.8 t C $ha^{-1}yr^{-1}$, that is:

If $dSOC_{t,i} > 0.8$ t C $ha^{-1}yr^{-1}$ then $dSOC_{t,i} = 0.8$ t C $ha^{-1}yr^{-1}$ (Equation 7 – AR-TOOL16)

The change in SOC stock for all the strat of the areas of land, in year *t*, is calculated as:

$$\Delta SOC_{AL,t} = \frac{44}{12} * \sum_i A_i * dSOC_{t,i} * 1\ year \quad \text{(Equation 8 – AR-TOOL16)}$$

Where:

$\Delta SOC_{AL,t}$ = Change in SOC stock in areas of land meeting the applicability condition of this tool, in year *t*; t CO_2-e

A_i = The área of stratum *i* of the areas of land; ha

$dSOC_{t,i}$ = The rate of change in SOC stocks in stratum *i* of the areas of land; t C $ha^{-1}yr^{-1}$

i = 1,2,3, ... strata of areas of land; dimensionless

3.2.3. Leakage

Leakage emissions, as established in AR-ACM0003 methodology (version 2.0), should be estimated as follows:

$$LK_t = LK_{AGRIC.t} \quad \text{(Equation 4 – AR-ACM0003)}$$

Where:

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

$LK_{AGRIC,t}$: Leakage due to the displacement of agricultural activities in year *t*, as estimated in the tool "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity"; t CO_2-e

The leakage emission attributable to the displacement of agricultural activities due to implementation of an ARR project activity is estimated as the decrease in carbon stocks in the affected carbon pools of the land receiving the displaced activity and it will be assessed using AR-TOOL15 (version 2.0). As for the pasture management areas with livestock production, item 10 of the tool shall be applied, which states: "Leakage emission attributable to the displacement of grazing activities under the following conditions is considered insignificant and hence accounted as zero:

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

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

(c) Animals are displaced to cropland that has been abandoned within the last five years; (d) Animals are displaced to forested lands, and no clearance of trees, or decrease in crown cover of trees and shrubs, occurs due to the displaced animals;

(e) Animals are displaced to zero-grazing system."

In all other cases, the lands within the project boundary from which the pre-project agricultural activities to be displaced outside the project boundary are delineated and their area is estimated. Leakage emission resulting from displacement of the activities is estimated as follows:

$$LK_{AGRIC,t} = \frac{44}{12} X (\Delta C_{BIOMASS,t} + \Delta SOC_{LUC,t})$$

(Equation 1 – AR-TOOL15)

$$\Delta C_{BIOMASS,t} = [1.1 X b_{TREE} X (1 + R_{TREE}) + b_{SHRUB} X (1 + R_S)] X CF X A_{DISP,t}$$

(Equation 2 – AR-TOOL15)

$$\Delta SOC_{LUC,t} = SOC_{REF} X (f_{LUP} X f_{MGP} X f_{INP} - f_{LUD} X f_{MGD} X f_{IND}) X A_{DISP,t}$$

(Equation 3 – AR-TOOL15)

Where:

$LK_{AGRIC,t}$ = Leakage emission resulting from displacement of agricultural activities in year t; t CO2e

$\Delta C_{BIOMASS,t}$ = Decrease in carbon stock in the carbon pools of the land receiving the activity displaced in year t; t d.m.

Note. The factor of 1.1 is used to account for the carbon stock in the dead wood and litter pools as a fixed percentage of the carbon stock in living trees.

CF = Carbon fraction of woody biomass; dimensionless

A default value of 0.47 is used unless transparent and verifiable information can be provided to justify a different value.

$A_{DISP,t}$ = Area of land from which agricultural activity is being displaced in year t; ha

b_{TREE} = Mean above-ground tree biomass in land receiving the displaced activity; t d.m. ha-1

The value of this parameter is obtained by applying one of the applicable methods from the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" to the land receiving the displaced activity.

Where the land receiving the displaced activity is unidentified, value of b_{TREE} is set equal to the applicable value of mean aboveground biomass in forest in the region or country where the A/R

CDM project activity is located, as obtained from Table 3A.1.4 of the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC GPG-LULUCF 2003) unless transparent and verifiable information can be provided to justify a different value.

R_{TREE} = Root-shoot ratio for trees in the land receiving the displaced activity; dimensionless.

A default value of 0.25 is used unless transparent and verifiable information can be provided to justify a different value.

b_{SHRUB} = Mean above-ground shrub biomass in land receiving the displaced activity; t d.m. ha-1.

The value of this parameter is obtained by applying one of the applicable methods from the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" to the land receiving the displaced activity.

R_S = Root-shoot ratio for shrubs in the land receiving the displaced activity; dimensionless.

The default value of 0.40 is used unless transparent and verifiable information can be provided to justify a different value.

$\Delta SOC_{LUC,t}$ = Change in soil organic carbon (SOC) stock due to land-use change in the land receiving the displaced activity in year t; tC ha-1.

The value of this parameter may be set to zero if:

(a) The only displaced activity being received in the land is grazing activity; or

(b) The value of the parameter as estimated from Equation (3) is less than zero (i.e. negative).

SOC_{REF} = SOC stock corresponding to the reference condition in native lands by climate region and soil type applicable to the land receiving the displaced activity; t C ha-1.

The value of this parameter is taken from Table 3 of the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities".

$f_{LUP}, f_{MGP}, f_{INP}$ = Relative SOC stock change factors for land-use, management practices, and inputs respectively, applicable to the receiving land before the displaced activity is received; dimensionless.

The value of these parameters is taken from Tables 4, 5, and 6 of the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities".

$f_{LUD}, f_{MGD}, f_{IND}$ = Relative SOC stock change factors for land-use, management practices, and inputs respectively, applicable to the receiving land after the displaced activity has been received; dimensionless.

The value of these parameters is taken from Tables 4, 5, and 6 of the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities".

t = 1, 2, 3, …years elapsed since the start of the A/R CDM project activity

Where pre-project activities are shifted to different types of receiving lands in a year, Equations (1), (2) and (3) shall be applied to each type of land separately and the estimated leakage emissions shall be added to obtain the value of the parameter $LK_{AGRIC,t}$

Project activities will be implemented mostly in areas of abandoned pasture, besides a few areas of agricultural crops, mainly sugar cane. In situations where the pasture was managed or where there was

agricultural production, the production will be interrupted or relocated to another area of the property (in an already consolidated agricultural or cattle raising area).

In this sense, the displacement of pre-project activities - as well as the emissions from leakage - is not foreseen in the Corridors for Life ARR Grouped Project. That is, the project leakage emissions are accounted as zero.

In any case, to check the existence or not of displacement of agricultural activities, the forest cover on the properties involved in the Grouped Project will be monitored annually through satellite imagery.

Additionally, the owner states in the contract that he will comply (during the term of the contract) with the provisions of the Native Vegetation Protection Law - LPVN (Law No. 12,651 of May 25, 2012), therefore, the suppression of native vegetation would imply non-compliance with the Law for the Protection of Native Vegetation, popularly known as the Forest Code. That is, there are contractual security mechanisms that prevent the displacement of agricultural activities - through deforestation - within the rural property.

3.2.4. Net GHG Emission Reductions and Removals

The net anthropogenic GHG removals by carbon pools, according to the AR-ACM0003 methodology (version 2.0), should be calculated as follows:

$$\Delta C_{AR-CDM,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t \quad \text{(Equation 5 – AR-ACM0003)}$$

Where:

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

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

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

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

The actual net GHG removals by carbon pools (ΔC_{ACTUAL}) will be calculated as stated in Section 3.2.2 (Project Emissions), while the calculations associated with net GHG removals at baseline are described in Section 3.2.1 (Baseline Emissions) and the first instance results reported in Section 3.2.4.1 below. In turn, the calculation of GHG emissions from displacement from agricultural activities is presented in Section 3.2.3 (Leakage).

3.2.4.1. Estimated baseline removals

The baseline estimates followed the steps and calculations presented in Section 3.2.1 (Baseline Emissions).

After measuring the sample plots in the 3 strata established for baseline and performing the specific calculations, the following values were obtained (Table 19) in the first instance of the project:

Table 19 - Results found by measuring sample plots for determining the initial carbon stock in the 3 baseline strata of the project.

Stratum	Number of sample plots*	Area (ha)	Average biomass corrected for uncertainty (t/ha)	Average carbon stock corrected for uncertainty (tCO_2/ha)
Herbaceous	26	1539.0	0,61	1,05
Irregular-herbaceous	30	296.5	7,43	12,81
Irregular-arboreal	5	19.8	28,35	48,85

*In all strata there were more plots than the minimum established in the application of the sample sufficiency calculation, applied according to the AR-TOOL03 tool (version 1.0).

The allometric model and the parameters used to estimate the biomass and stock carbon in trees and shrubs at baseline are presented in Table 20.

Table 20 - Parameters used in estimating biomass and carbon of trees and shrubs at baseline.

Parameter	Model and/or Value	Source
Estimated above ground tree biomass for native species at baseline (t)	AGB = exp (-2,4090 + 0,9522 x ln (DBH^2 x H x ρ)) ρ: basic density of wood ($g.cm^{-3}$) DBH: diameter at breast height (cm) H: height (m)	(Brown et al., 1989)
ρ: basic density of wood ($g.cm^{-3}$)	Specific for each species or genus	(Zanne *et al.*, 2009)
R_T: Root-to-shoot radio for tree specie	$R_T = \exp(-1,085 + 0,9256 \times \ln(AGB_{TREE})/AGB_{TREE}$	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*" (Appendix 1 – p.25)
Estimated of above ground shrub biomass (t)	$b_{SHRUB,t} = BDR_{SF} \times b_{FOREST} \times CC_{SHRUB,t}$ (equation details already explained in section 3.2.1.1.2 (Estimation of carbon stock in shrubs)	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*" (Section 11 – p.20)
R_S: Root-to-shoot in shrubs	0.40	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*" (Section 11 – p.21)
CF: Carbon Fraction of dry matter	0.47	(IPCC, 2003, 2006) e AR-TOOL14, version 4.2: "*Estimation of carbon stocks*

		and change in carbon stocks of trees and shrubs in A/R CDM activities"
44/12: Conversion factor from carbon to carbon dioxide (C to CO_2)	44/12	(IPCC, 2003) e AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*"

After performing the baseline calculations, considering the proportionality of the strata, the value of **3.44 tCO_2/ha** was calculated. That is, in the average of the strata, the initial stock existing in the project area of the initial instance is **3.44 tCO_2/ha**.

3.2.4.2. Ex ante estimated project removals

Trees and Shrubs

Ex-ante estimates of project removals by native trees and shrubs were performed through literature review and non-linear regression with the data found in these literatures.

The process began with the selection and literature review of biomass studies and/or carbon stock in restored areas carried out in the Atlantic Forest Semideciduous Seasonal Forest (the same forest typology as the Project), trying to find mainly studies developed in the Project Zone.

Fifteen studies were found in this literature review, 5 of which refer to studies in which the biomass estimate was performed directly, with the generation of allometric equations.

The 15 studies resulted in 88 sample points of ages ranging from 1.1. to 61 years, which were used to generate a quadratic model for estimation of carbon stocks (Figure 38). The 95% confidence interval was calculated using the predict function in R software and the analyses provided a R^2 value of 0.6.

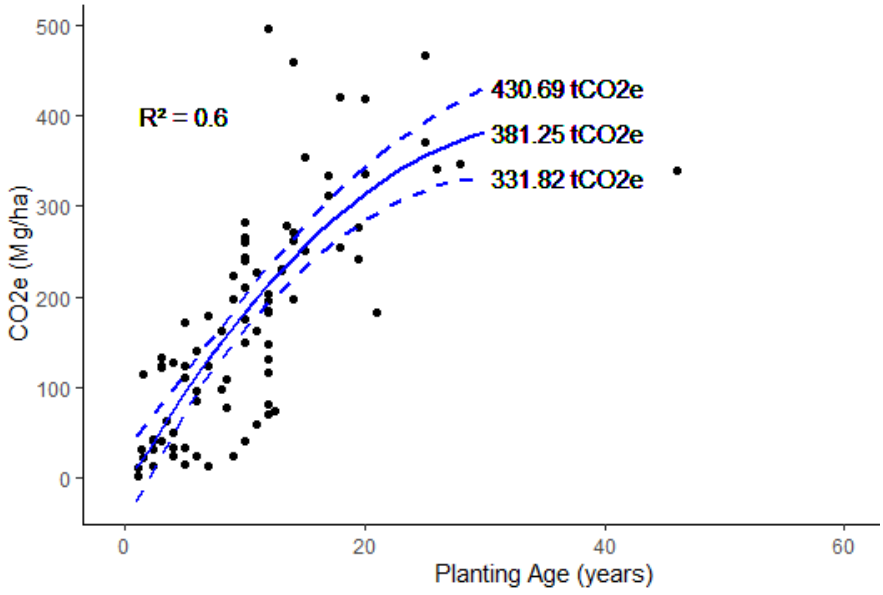

Figure 38 - Non-linear regression derived from 88 sample points of restoration plantings from 1 to 46 years old.

The quadratic model was selected for determining the *ex-ante* estimate of tree and shrub carbon removals (above and below ground) from the Corridors for Life ARR Grouped Project, which resulted in an ex-ante value for the tree-shrub component of **381.25 tCO2/ha**. All the studies analyzed, the sampling points and the statistical analysis were made available to the VVB.

It should be noted that, as the use of exotic species will not occur in any farm of the first instance and will only occur in specific cases (only on those where the owner express this interest), such as live fencing for planting, windbreaks and hedges in reforestation areas, following roads or boundaries of rural properties, the estimated carbon dioxide absorption from these tree individuals was not considered in the calculation of the *ex-ante* removals estimation. When planting of exotic species is planned, the specific *ex-ante* estimations will be presented and validated along new instances validation.

Litter and Deadwood

The AR-TOOL12 tool (version 3.1) presents the possibility of estimating the change in carbon stock in litter and deadwood through the use of a "default-factor", as pointed out previously in Section 3.2.2.2.2 and Section 3.2.2.3.

Considering that the carbon stock in litter and deadwood is, by default, 1% of the carbon stock of the tree component, the ex-ante estimate for litter is 3**.8125 tCO_2/ha** and that of deadwood is also **3.8125 tCO_2/ha**.

Soil Organic Carbon

The AR-TOOL16 tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities (version 1.1)" was used to calculate the ex-ante soil organic carbon estimate, with the calculation formulas and other guidelines presented in Section 3.2.2.4.

As determined by the tool, for the ex-ante estimation, some assumptions for stratification shall be considered:

(a) Climate region and soil types indicated in Table 3 of the tool;

The climate region is "*Tropical Moist*" and the soil in the first instance falls completely into the LAC (*soils with low activity clay*) category. In the Project Zone there is a small patch of HAC (*soils with high activity clay*), which represents less than 5% of the area (Figure 39).

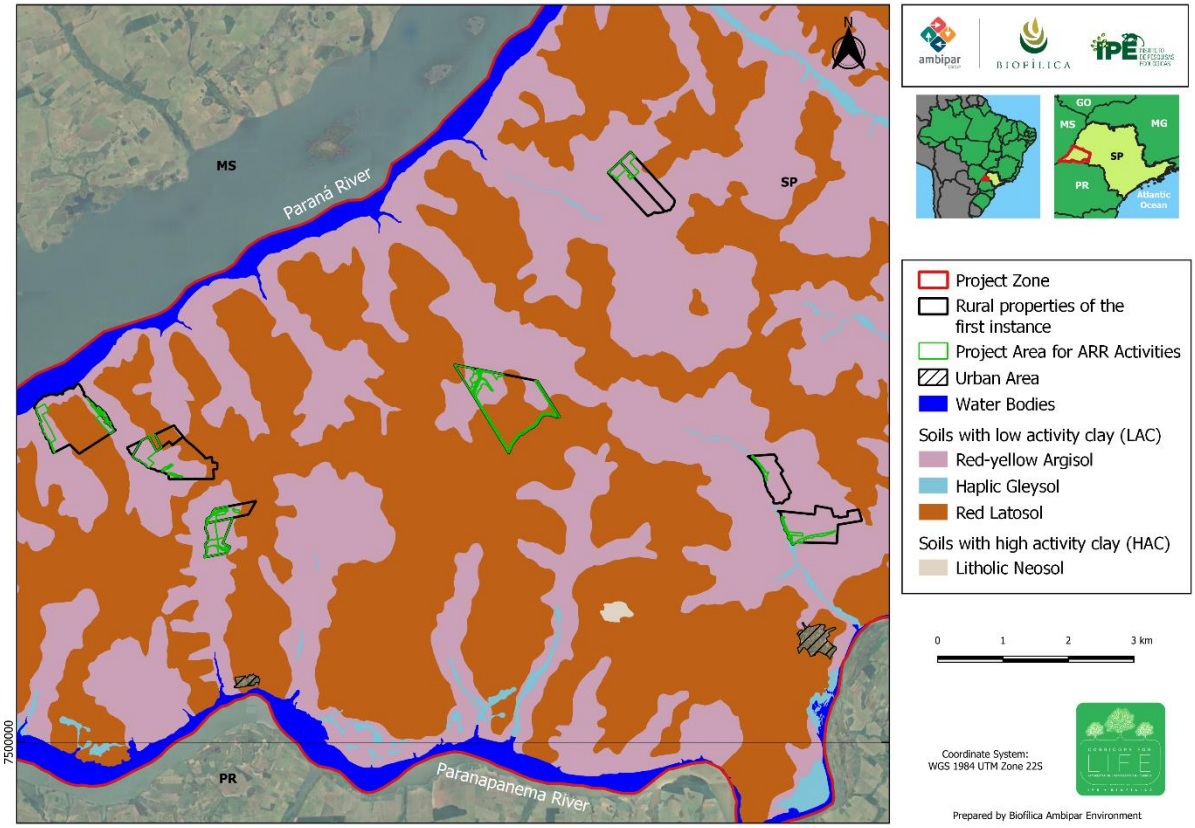

Figure 39 - Clay activity classification in the initial instance of the Corridors for Life ARR Grouped Project.

(b) Pre-project management activities in agricultural crop areas, indicated in Tables 4 and 5 of the tool;

Although we did not consider this stratum in the final calculations, as shown in the paragraphs below, a previous classification and calculation (associated with this classification) were carried out to understand which soil carbon values would be obtained in this stratum. This conservative classification assumed the following items:

- Land Use (f_{LU}): "Short-term cultivated (< 20 yrs) or set aside (< 5 years));
- Management (f_{MG}): "Reduced tillage".
- Input (f_{IN}): "Medium"

(c) Pre-project management activities on grasslands, indicated in Table 6 of the tool.

Conservatively, it was assumed for the ex-ante calculations:

- Management (f_{MG}): "Moderately degraded grassland"
- Input (f_{IN}): "Low/Medium"

After carrying out the previous calculations, which led to lower estimates of carbon removal in the soil in grasslands than in agricultural crop areas (in view of the assumptions for stratification that were considered in this classification reported above), it was decided to consider that the classification of the current land use (at baseline) into pasture and agricultural cultivation would be 100% and 0%, respectively, in order to obtain a conservative value for the entire Project Zone (as most of the areas to be implemented the project activities are expected to be pasture (grasslands) in the pre-project scenario).

It is noted that for the ex-post estimates more detailed stratification will be performed, in which there may be more than one management category (f_{MG}) and even input (f_{IN}) and land use (f_{LU}) in agricultural crops, in addition to including a specific proportionality for pre-project land use (whether grassland or croplands).

Considering all these assumptions, specific calculations were performed, leading to an ex-ante estimate of the change in soil organic carbon stock of **4.08 tCO_2/ha.**

3.2.4.3. Estimated leakage emissions

As mentioned above, in particular in Section 3.2.3, displacement from pre-project activities - as well as emissions from leakage - is not provided for in the Corridors for Life ARR Grouped Project. Thus, the estimated leakage emissions are accounted for as zero.

3.2.4.4. Estimated net GHG removals

Given what was exposed in the previous sections, we have for the project period the following estimates exposed in Table 21, where the total estimated net GHG removals (given by the sum of the carbon stock estimates in the reservoirs included in the project and the subtraction of the average carbon stock estimated in the baseline) is **29,213,780 tCO_2** for the 50 years of the project.

All spreadsheets with the calculations were made available to VVB.

Table 21 – Estimated net GHG removals

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Nov/2021-Nov/2022	1,719	-8,358	0	-10,077
Nov/2022-Nov/2023	4,297	-14,558	0	-18,854
Nov/2023-Nov/2024	6,875	-6,058	0	-12,933
Nov/2024-Nov/2025	9,453	19,417	0	9,964
Nov/2025-Nov/2026	12,031	61,387	0	49,357
Nov/2026-Nov/2027	12,031	131,911	0	119,880
Nov/2027-Nov/2028	13,749	200,106	0	186,357
Nov/2028-Nov/2029	13,749	280,759	0	267,009
Nov/2029-Nov/2030	13,749	364,364	0	350,615
Nov/2030-Nov/2031	15,468	437,053	0	421,585
Nov/2031-Nov/2032	15,468	521,879	0	506,411
Nov/2032-Nov/2033	15,468	609,338	0	593,870
Nov/2033-Nov/2034	15,468	693,919	0	678,451
Nov/2034-Nov/2035	15,468	775,621	0	760,153
Nov/2035-Nov/2036	15,458	854,445	0	838,977

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Nov/2036-Nov/2037	15,468	930,390	0	914,922
Nov/2037-Nov/2038	15,468	1,003,456	0	987,988
Nov/2038-Nov/2039	15,468	1,073,643	0	1,058,175
Nov/2039-Nov/2040	15,468	1,140,952	0	1,125,484
Nov/2040-Nov/2041	15,468	1,205,382	0	1,189,914
Nov/2041-Nov/2042	0	1,341,610	0	1,341,610
Nov/2042-Nov/2043	0	1,341,876	0	1,341,876
Nov/2043-Nov/2044	0	1,291,710	0	1,291,710
Nov/2044-Nov/2045	0	1,240,723	0	1,240,723
Nov/2045-Nov/2046	0	1,188,915	0	1,188,915
Nov/2046-Nov/2047	0	1,137,107	0	1,137,107
Nov/2047-Nov/2048	0	1,084,752	0	1,084,752
Nov/2048-Nov/2049	0	1,032,397	0	1,032,397
Nov/2049-Nov/2050	0	980,042	0	980,042
Nov/2050-Nov/2051	0	927,140	0	927,140
Nov/2051-Nov/2052	0	874,237	0	874,237
Nov/2052-Nov/2053	0	819,628	0	819,628
Nov/2053-Nov/2054	0	762,777	0	762,777
Nov/2054-Nov/2055	0	704,165	0	704,165
Nov/2055-Nov/2056	0	644,271	0	644,271
Nov/2056-Nov/2057	0	583,576	0	583,576
Nov/2057-Nov/2058	0	525,119	0	525,119
Nov/2058-Nov/2059	0	467,194	0	467,194
Nov/2059-Nov/2060	0	411,828	0	411,828
Nov/2060-Nov/2061	0	359,020	0	359,020
Nov/2061-Nov/2062	0	311,989	0	311,989
Nov/2062-Nov/2063	0	267,836	0	267,836
Nov/2063-Nov/2064	0	226,562	0	226,562
Nov/2064-Nov/2065	0	188,166	0	188,166
Nov/2065-Nov/2066	0	152,649	0	152,649
Nov/2066-Nov/2067	0	120,011	0	120,011

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Nov/2067-Nov/2068	0	90,251	0	90,251
Nov/2068-Nov/2069	0	63,371	0	63,371
Nov/2069-Nov/2070	0	39,368	0	39,268
Nov/2070-Nov/2071	0	18,245	0	18,245
Total	**257,801**	**29,471,581**	**0**	**29,213,780**

3.2.4.5. Ex-post estimated project removals

The allometric model and parameters used for the ex-post estimation of tree and shrub biomass and associated carbon stock for native species are presented in Table 22.

For litter and deadwood, the same default value of 1% of the tree carbon stock (noted in Section 3.2.2.2, Section 3.2.2.3 and Section 3.2.4.2) will be used.

For soil organic carbon, the calculations presented in Section 3.2.2.2.4 will be performed, starting from the stratification of the project area into the different categories of land use (f_{LU}), management (f_{MG}) and input (f_{IN}), in addition to the initial stratification into grasslands and croplands.

Table 22 - Parameters used in the ex-post estimation of tree and shrub biomass and carbon.

Parameter	Model and/or Value	Source
Ex-post estimation of above ground tree biomass for native species (t)*	$\ln AGB_{TREE} = -1{,}69421 + 2{,}10406 (\ln DBH) + 0{,}57656 (\ln H) + 1{,}59492 (\ln \rho)$ ρ: wood basic density ($g.cm^{-3}$) DBH: diameter at breast height (cm) H: height (m)	(Rasera, 2019)
Ex-post estimation of below ground tree biomass for native species (t)*	$\ln BGB = -1{,}905 + 0{,}5389 (\ln AGB_{TREE}) + 0{,}9992 (\ln DBH)$ AGB_{TREE}: *Ex-post* estimation of above ground tree biomass (kg) DBH: diameter at breast height (cm)	(Rasera, 2019)
Ex-post estimation of above ground tree biomass for native species (t)**	$AGB_{TREE} = \exp(-2{,}4090 + 0{,}9522 \times \ln(DBH^2 \times H \times \rho))$ ρ: wood basic density ($g.cm^{-3}$) DBH: diameter at breast height (cm) H: height (m)	(Brown et al, 1989)

R_T: Root-to-shoot radio for tree specie**	R_T = exp (-1,085 + 0,9256 x ln(AGB_{TREE}))/AGB_{TREE}	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*" (Apêndice 1 – p.25)
ρ: wood basic density (g.cm^{-3})	Species or genus specific	(Zanne *et al.*, 2009)
Estimated above ground shrub biomass (t)	$b_{SHRUB,t} = BDR_{SF} \times b_{FOREST} \times CC_{SHRUB,t}$ (details of the equation already explained in section 3.2.1.1.2 - Estimation of carbon stock in shrubs)	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*" (Seção 11 – p.20)
R_S: Root-to-shoot in shrubs	0.40	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*" (Seção 11 – p.21)
CF: Carbon Fraction of dry matter	0.47	(IPCC, 2003, 2006) e AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*"
44/12: Conversion factor from carbon to carbon dioxide (C to CO_2)	44/12	(IPCC, 2003) e AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*"

*These equations will be used until approximately 12 years of planting age or until the diameters and heights found in the sample plot measurements are within the range of Rasera's (2019) study.

**These equations will be used when the equations of Rasera (2019) are no longer applicable to plantations.

It is important to note that if an allometric equation specific to the Project Zone or Semideciduous Seasonal Forest (or even one with better quality of fit) is developed over the project period for biomass estimation in forest restoration areas, it can be used.

It is also important to mention that, if exotic species are implemented in the project area, specific equations or literature reference for the chosen species will be used, respecting the same rules of equations appropriateness established in the tools AR-TOOL17 (*version* 1.0) "*Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass*" and/or AR-TOOL18 (*version* 1.0.1) "*Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass*" and validation process, which will follow new instances validation.

3.3. Monitoring

3.3.1. Data and Parameters Available at Validation

Data / Parameter	A_{i_BSL}
Data unit	Hectare (ha)
Description	Project Area in each baseline stratum *i*;
Source of data	Results from R Software and Geoprocessing Software (after stratification analysis)
Value applied	Stratum "herbaceous": 1539.0 ha Stratum "irregular-herbaceous": 296.5 ha Stratum "irregular-arboreal": 19.8 ha
Justification of choice of data or description of measurement methods and procedures applied	First, the limits of the properties and the areas to carry out the ARR activities within the property were received. After the eligibility analysis, the Random Forest algorithm was applied to evaluate and measure which types of vegetation strata were present in the baseline of the project areas. and to reduce supervised classification efforts. The procedures can be divided into six steps: 1- identification of vegetation strata classes in areas eligible for the implementation of ARR activities; 2- one hectare polygon mesh establishment; 3- crossing the polygon mesh with satellite image; 4- application of the Random Forest Algorithm; 5- application of accuracy index; and 6- baseline strata area calculation. The description of each of the steps is presented in Section 3.2.1.1.
Purpose of data	• Calculation of baseline emissions
Comments	-

Data / Parameter	$B_{TREE\_BSL,i}$
Data unit	t. ha^{-1}
Description	Baseline tree biomass in stratum *i*;
Source of data	Calculations on spreadsheets and/or R program, utilizando a equação de Brown et al (1989): AGB_{TREE} = exp (-2,4090 + 0,9522 x ln (DAP^2 x H x ρ))
Value applied	Stratum "herbaceous": 0,25 t. ha^{-1} Stratum "irregular-herbaceous": 4,16 t. ha^{-1} Stratum "irregular-arboreal": 19,67 t. ha^{-1}
Justification of choice of data or description of measurement methods and procedures applied	The calculations were performed as established in the AR-TOOL14 tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities (version 4.2)" and AR-TOOL17, "Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities (version 1.0)"

Purpose of data	• Calculation of baseline emissions
Comments	-

Data / Parameter	$B_{SHRUB\_BSL,i}$
Data unit	t. ha^{-1}
Description	Baseline biomass of shrub in stratum *i*;
Source of data	Calculations on spreadsheets and/or R program, using the equation $b_{SHRUB,t} = BDR_{SF} \times b_{FOREST} \times CC_{SHRUB,t}$
Value applied	Stratum "herbaceous": 0,001 t. ha^{-1} Stratum "irregular-herbaceous": 0,012 t. ha^{-1} Stratum "irregular-arboreal": 0,007 t. ha^{-1}
Justification of choice of data or description of measurement methods and procedures applied	The calculations were performed as established in the AR-TOOL14 tools, version 4.2 "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities".
Purpose of data	Calculation of baseline emissions
Comments	Details of the equation are explained in section 3.2.1.1.2 (Estimation of carbon stock in shrubs)

Data / Parameter	Basic Wood Density
Data unit	g.cm^3
Description	Basic wood density of tree and shrub specie
Source of data	Global wood density (ZANNE et al., 2009)
Value applied	Diverse: species- and/or genus-specific density
Justification of choice of data or description of measurement methods and procedures applied	For both the baseline calculations as well as the proposed equations for ex-post calculations, we used the average wood density value of the species obtained from Zanne et al. (2009). This global dataset is composed of species-specific wood density values of several literature sources in the tropical ecological. This source of default data is in accordance with section 2 of the "*Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks*".
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions
Comments	Zanne, A. E., Lopez-Gonzalez, G., Coomes, D.A., Ilic, J., Jansen, S., Lewis, S.L., Miller, R.B., Swenson, N.G., Wiemann, M.C., and Chave, J. 2009. Global wood density database. Dryad. Identifier: http://hdl.handle.net/10255/dryad.235.

Data / Parameter	R_T

Data unit	dimensionless
Description	Root-shoot ratio for trees
Source of data	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*"
Value applied	$R_T = e^{(-1,085 + 0,9256 \times \ln(b))}/b$
Justification of choice of data or description of measurement methods and procedures applied	As indicated in AR-TOOL14 (p.20), "he value of R is estimated as $R = e^{(-1,085 + 0,9256 \times \ln(b))}/b$, where b is the above-ground tree biomass per hectare (in t d.m. ha^{-1}), unless transparent and verifiable information can be provided to justify a different value.
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions
Comments	This parameter was used in the calculation of the baseline estimates and is planned to be used in the calculation of the ex-post estimates when the Brown et al (1989) equation for estimating aboveground biomass is used.

Data / Parameter	R_S
Data unit	Dimensionless
Description	Root-shoot ratio for shrubs
Source of data	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*"
Value applied	0.40
Justification of choice of data or description of measurement methods and procedures applied	As indicated in AR-TOOL14 (p.20), "the default value of 0.40 is used unless transparent and verifiable information can be provided to justify a different value".
Purpose of data	• Calculation of baseline emissions • Calculation of project emissions
Comments	-

Data / Parameter	$CF_{TREE;SHRUB}$
Data unit	t C $(t.d.m.)^{-1}$
Description	Carbon Fraction of dry matter in trees and shrubs. Carbon fraction is the amount of carbon in biomass components
Source of data	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*" e 2006 IPCC Guidelines for National Greenhouse Gas Inventories - Volume 4: Agriculture, Forestry and Other Land Use, Chapter 4: Forest Land

Value applied	0.47
Justification of choice of data or description of measurement methods and procedures applied	As indicated in AR-TOOL14, "a default value of 0.47 is used unless transparent and verifiable information can be provided to justify a different value". This value is also found in IPCC (2006), in Table 4.3.
Purpose of data	• *Calculation of baseline emissions* • *Calculation of project emissions*
Comments	-

Data / Parameter	44/12
Data unit	dimensionless
Description	Conversion factor from carbon to carbon dioxide (C to CO_2)
Source of data	IPCC (2003) *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry* and AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*"
Value applied	44/12
Justification of choice of data or description of measurement methods and procedures applied	Value established by IPCC and contained in equations 3, 10, 12, 21 and 26 of the AR-TOOL14 tool (version 4.2).
Purpose of data	• *Calculation of baseline emissions* • *Calculation of project emissions*
Comments	-

Data / Parameter	CC_{SHRUB}
Data unit	Dimensionless
Description	Crown cover of shrubs
Source of data	Field measurements
Value applied	See spreadsheet with field data
Justification of choice of data or description of measurement methods and procedures applied	The canopy cover of the shrub species was given by the projection of the canopy of these species on the ground, along a linear transect. The methodology followed the established in Portaria CBRN 01/2015, where the shrub cover is given through the sum of the measures of the stretches of the central sampling line covered by shrub vegetation (in meters) in relation to the length of the line.
Purpose of data	• *Calculation of baseline emissions* • *Calculation of project emissions*

Comments	Details of the field methodology is contained in the baseline inventory field report, called " relatorio-metodologico-biofilica-linha-de-base-2022.pdf", made available to the VVB. SÃO PAULO. Portaria CBRN nº 01/2015, de 17 de Janeiro de 2015. Estabelece o Protocolo de Monitoramento de Projetos de Restauração Ecológica. Diário Oficial do Estado de São Paulo. São Paulo – SP, 123 (11), Seção I, p.45-46.

Data / Parameter	BDR_{SF}
Data unit	dimensionless
Description	Ratio of shrub biomass per hectare in land having a shrub crown cover of 1.0 (i.e. 100 per cent)
Source of data	AR-TOOL14, version 4.2: "*Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM activities*"
Value applied	0.10
Justification of choice of data or description of measurement methods and procedures applied	As indicated in AR-TOOL14, "a default value of 0.10 should be used unless transparent and verifiable information can be provided to justify a different value".
Purpose of data	• *Calculation of baseline emissions* • *Calculation of project emissions*
Comments	-

Data / Parameter	Above ground tree biomass equation ($AGB_{TREE\_PROJ.i}$)
Data unit	t/ha
Description	Equation for *ex-post* estimation of above ground tree biomass, to be applied in each stratum *i*
Source of data	Rasera (2019)
Value applied	$\ln AGB_{TREE}$ = -1,69421 + 2,10406 (ln DAP) + 0,57656 (ln H) + 1,59492 (ln ρ)
Justification of choice of data or description of measurement methods and procedures applied	This is the most specific and appropriate equation to be used in our project, since the allometric model was developed in an area under ecological restoration process of Semideciduous Seasonal Forest, the main phytophysiognomy found in the Project Zone. Furthermore, the equation meets the selection criteria for allometric equations established in AR-TOOL17 "*Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass* (versão 1.0)"
Purpose of data	• *Calculation of project emissions*
Comments	This equation was developed when the forest restoration planting was 12 years old. Thus, this equation will be used as long as the

	average diameter at breast height range found in the Grouped Project inventories is within the range of DBHs found in Rasera's (2019) study.

Data / Parameter	Below ground tree biomass equation ($BGB_{TREE\_PROJ.i}$)
Data unit	t/ha
Description	Equation for ex-post estimation of below ground tree biomass, to be applied in each stratum *i*
Source of data	Rasera (2019)
Value applied	$\ln BGB_{TREE} = -1{,}905 + 0{,}5389\ (\ln AGB_{TREE}) + 0{,}9992\ (\ln DAP)$
Justification of choice of data or description of measurement methods and procedures applied	This is the most specific and appropriate equation to be used in our project, since the allometric model was developed in an area under ecological restoration process of Semideciduous Seasonal Forest, the main phytophysiognomy found in the Project Zone. Furthermore, the equation meets the selection criteria for allometric equations established in AR-TOOL17 "*Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass* (versão 1.0)"
Purpose of data	Calculation of project emissions
Comments	This equation was developed when the forest restoration planting was 12 years old. Thus, this equation will be used as long as the average diameter at breast height range found in the Grouped Project inventories is within the range of DBHs found in Rasera's (2019) study.

Data / Parameter	Above ground tree biomass equation ($AGB_{TREE\_PROJ.i}$)
Data unit	t/ha
Description	Equation for *ex-post* estimation of above ground tree biomass, to be applied in each stratum *i*
Source of data	Brown et al (1989)
Value applied	$AGB_{TREE} = \exp(-2{,}4090 + 0{,}9522 \times \ln(DAP^2 \times H \times \rho))$
Justification of choice of data or description of measurement methods and procedures applied	This is a recognized equation and widely used in studies of forest biomass. Moreover, it meets the selection criteria for allometric equations established in the AR-TOOL17 "*Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass* (version 1.0)"
Purpose of data	• Calculation of project emissions
Comments	This equation will be used when the Rasera (2019) equation is no longer applicable to the project.

Data / Parameter	DF_{LI}
Data unit	%
Description	*Default factor for the relationship between carbon stock in litter and carbon stock in living trees*
Source of data	AR-TOOL12 "Estimation of carbon stocks and change in carbon stocks in dead wood and litter (versão 3.1)"
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	Default factor value for tropical biome, <2,000m elevation and precipitation between 1000 and 1600mm/yr, as established in AR-TOOL12 (version 3.1)
Purpose of data	• *Calculation of project emissions*
Comments	

Data / Parameter	DF_{DW}
Data unit	%
Description	*Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass*
Source of data	AR-TOOL12 "Estimation of carbon stocks and change in carbon stocks in dead wood and litter (versão 3.1)"
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	Default factor value for tropical biome, <2,000m elevation and precipitation between 1000 and 1600mm/yr, as established in AR-TOOL12 (version 3.1)
Purpose of data	• *Calculation of project emissions*
Comments	

Data / Parameter	$COMF_i$
Data unit	dimensionless
Description	*Combustion factor for stratum i (per vegetation type)*
Source of data	AR-TOOL08 "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity (version 4.0)"

<table>
<tr><td>Value applied</td><td>Default value (0.46 to 0.32), depending on the restoration age range:<table><tr><th>Forest type</th><th>Mean age</th><th>Default value</th></tr><tr><td rowspan="4">Tropical Forest</td><td>3-5</td><td>0.46</td></tr><tr><td>6-10</td><td>0.67</td></tr><tr><td>11-17</td><td>0.50</td></tr><tr><td>18 and above</td><td>0.32</td></tr></table></td></tr>
<tr><td>Justification of choice of data or description of measurement methods and procedures applied</td><td>Default factor value for tropical forest, according to average age, as established in AR-TOOL08 (version 4.0)</td></tr>
<tr><td>Purpose of data</td><td>• Calculation of project emissions</td></tr>
<tr><td>Comments</td><td>Other data sources may also be selected, in order of preference, as established in AR-TOOL08 (version 4.0): (a) Project-specific calculation, regional/national inventories; (b) Inventory of neighboring countries with similar conditions and (c) Globally available data applicable to the project site or to the region/country where the site is located.</td></tr>
</table>

Data / Parameter	EF_{CH4}
Data unit	g kg^{-1} dry matter burnt
Description	*Emission factor for CH4 in stratum i*
Source of data	AR-TOOL08 "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity (version 4.0)"
Value applied	6.8
Justification of choice of data or description of measurement methods and procedures applied	Default factor value for tropical forest, as established in AR-TOOL08 (version 4.0)
Purpose of data	• *Calculation of project emissions*
Comments	Other data sources may also be selected, in order of preference, as established in AR-TOOL08 (version 4.0), such as: (a) Regional/national inventories; (b) Inventory of neighboring countries with similar conditions and (c) Globally available data applicable to the project site or the region/country where the site is located.

Data / Parameter	EF_{N2O}

Data unit	g kg^{-1} dry matter burnt
Description	*Emission factor for N2O in stratum i*
Source of data	AR-TOOL08 "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity (version 4.0)"
Value applied	0.20
Justification of choice of data or description of measurement methods and procedures applied	Default factor value for tropical forest, as established in AR-TOOL08 (version 4.0)
Purpose of data	• Calculation of project emissions
Comments	Other data sources may also be selected, in order of preference, as established in AR-TOOL08 (version 4.0), such as: (a) Regional/national inventories; (b) Inventory of neighboring countries with similar conditions and (c) Globally available data applicable to the project site or the region/country where the site is located.

3.3.2. Data and Parameters Monitored

Data / Parameter	A_{i_BSL}
Data unit	Hectare (ha)
Description	Project Area in each baseline stratum *i*;
Source of data	Results from R Software and Geoprocessing Software (after stratification analysis)
Description of measurement methods and procedures to be applied	First, the limits of the properties and the areas to carry out the ARR activities within the property are received. After the eligibility analysis, the Random Forest algorithm is applied to evaluate and measure which types of vegetation strata are present in the baseline of the project areas. This activity is indicated to increase the accuracy of the baseline biomass estimate and to reduce supervised classification efforts.
Frequency of monitoring/recording	The stratification analysis of each new area to compose the project will be carried out once, in the pre-planting period, and reported at each verification event.
Value applied	The value will be reported in each verification event, for each stratum.

Monitoring equipment	The equipment and materials used to evaluate and validate the data consist of geospatial analysis software and materials, namely: - Satellite imagery, such as Sentinel-2 or Sentinel 10 - Geoprocessing software, such as QGIS 3.22.8 - Software R
QA/QC procedures to be applied	To calibrate the results of the stratification analysis, standardization procedures and accuracy indices are applied
Purpose of data	• *Calculation of baseline emissions*
Calculation method	The description of the bands and spectral indices are described in Section 3.2.1.1. Below is the equation of the NDVI index, used to classify the strata. The equation is calculated from the Near Infrared (IVP) and Red (V) spectral bands: $$\text{NDVI} = \frac{\text{IVP} - \text{V}}{\text{IVP} + \text{V}}$$
Comments	Random Forest classification can be performed using a 1ha grid and R software support (as performed in baseline stratification) or directly in geoprocessing software such as QGIS.

Data / Parameter	$A_{ARR,i}$
Data unit	Hectare (ha)
Description	Project area implemented with ARR activities in each baseline stratum i
Source of data	Results from Geoprocessing Software analysis
Description of measurement methods and procedures to be applied	Crossing of information between the area in which ARR activities will be implemented (planting of seedlings and/or facilitating the conduction of regeneration) and the corresponding stratum of this area in the baseline.
Frequency of monitoring/recording	The analysis will be carried out once, in the pre-planting period, and reported at each verification event.
Value applied	The value will be reported in each verification event, for each stratum.
Monitoring equipment	Geoprocessing software, such as QGIS
QA/QC procedures to be applied	The IPÊ team defines together with the rural owner where the forest restoration activities will be implemented and sends the

	agreed limits to the Biofílica team, which prepares the corresponding map (to be inserted in the contract between the parties). In this way, all parties confer and contractually validate where the ARR activities will be carried out. The ATER team, in turn, is responsible for monitoring field restoration activities and ensuring that agreed areas are being restored.
Purpose of data	• *Calculation of project emissions*
Calculation method	The description of the bands and spectral indices are described in Section 3.2.1.1. Below is the equation of the NDVI index, used to classify the strata. The equation is calculated from the Near Infrared (IVP) and Red (V) spectral bands: $$\text{NDVI} = \frac{\text{IVP} - \text{V}}{\text{IVP} + \text{V}}$$
Comments	Random Forest classification can be performed using a 1ha grid and R software support (as performed in baseline stratification) or directly in geoprocessing software such as QGIS.

Data / Parameter	n_i
Data unit	dimensionless
Description	Number of sample plots in each stratum i of the project
Source of data	Spreadsheet calculations and/or Software R
Description of measurement methods and procedures to be applied	The AR-TOOL03 tool "Calculation of the number of sample plots for measurements (version 2.1)" establishes the sample sufficiency procedures and calculations, which will be followed. The definition of the area of each stratum will be given by the stratification analysis, explained in Section 3.2.1.1., Section 3.2.2.1 and Section 3.3.3.2.2.
Frequency of monitoring/recording	The calculation will be carried out at each verification event.
Value applied	The value will be reported in each verification event, for each stratum.
Monitoring equipment	- Geoprocessing software, such as QGIS - Software R and/or Excel
QA/QC procedures to be applied	The AR-TOOL03 "Calculation of the number of sample plots for measurements (version 2.1)" does not specifically establish QA/QC procedures to be applied.

Purpose of data	• *Calculation of baseline emissions* • *Calculation of project emissions*
Calculation method	The calculations will be carried out by applying the equations established in the AR-TOOL03 tool "Calculation of the number of sample plots for measurements (version 2.1)".
Comments	-

Data / Parameter	DBH
Data unit	Centimeter (cm)
Description	Diameter at breast height (130 cm) for each tree with DBH equal to or greater than 5 cm in each plot measured
Source of data	Spreadsheets with field data
Description of measurement methods and procedures to be applied	All existing trees within the sample plot with diameters at breast height (DBH) equal to or greater than 5cm have their diameters measured.
Frequency of monitoring/recording	Sample plots are inventoried at each verification event (for ex-post estimation), and, depending on sample sufficiency, before carrying out ARR activities in the project area (for baseline estimation).
Value applied	Values can be found in spreadsheets containing field data
Monitoring equipment	Measuring tape or "suta"
QA/QC procedures to be applied	Data collection in the field must follow the field protocols for forest inventories widely disseminated in the forest sector. Therefore, only companies with knowledge in field measurement are hired to carry out these activities.
Purpose of data	• *Calculation of baseline emissions* • *Calculation of project emissions*
Calculation method	-
Comments	-

Data / Parameter	H
Data unit	Meters (m)

Description	Tree height for each tree with DBH equal to or greater than 5 cm in each sample plot measured
Source of data	Spreadsheets with field data
Description of measurement methods and procedures to be applied	All existing trees within the sample plot with diameters at breast height (DBH) equal to or greater than 5cm have their heights measured.
Frequency of monitoring/recording	Sample plots are inventoried at each verification event (for ex-post estimation), and, depending on sample sufficiency, before carrying out ARR activities in the project area (for baseline estimation).
Value applied	Values can be found in spreadsheets containing field data
Monitoring equipment	Height measuring equipment such as hypsometers, clinometers and even graduated bars or bamboo poles
QA/QC procedures to be applied	Data collection in the field must follow the field protocols for forest inventories widely disseminated in the forest sector. Therefore, only companies with knowledge in field measurement are hired to carry out these activities.
Purpose of data	• *Calculation of baseline emissions* • *Calculation of project emissions*
Calculation method	-
Comments	-

Data / Parameter	$A_{BURN,i,t}$
Data unit	Hectare (ha)
Description	Area burnt in stratum *i* in year *t*;
Source of data	Results from Geoprocessing Software analysis and fire reports by the IPÊ team
Description of measurement methods and procedures to be applied	The polygons of burned areas will be mapped through supervised classification with the support of satellite images. The direction for carrying out this activity will come from the IPÊ team, responsible for supervising field activities in the project areas.
Frequency of monitoring/recording	The analysis will be carried on each occurrence of forest fire in the project area.
Value applied	The value will be reported in each verification event, for each stratum.

Monitoring equipment	Geoprocessing software, such as QGIS, and satellite images
QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the *IPCC GPG LULUCF 2003*, may be applied
Purpose of data	• *Calculation of project emissions*
Calculation method	The calculations will be carried out by applying the equations established in the AR-TOOL08 "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity" (version 4.0).
Comments	As the project will not use fire to clear the land of harvest residue prior to replanting of the land, this parameter table was adapted from the AR-TOOL08, version 4.0 (Section III, Data and Parameters used in the tool: Data and parameters obtained from measurements") to include monitoring and reporting of the burned area after planting, if it occurs.

Data / Parameter	$GHG_{FF,t}$
Data unit	tCO_2
Description	Emission of non-CO_2 GHGs resulting from fire in year *t*;
Source of data	Results from Geoprocessing Software analysis and fire reports by the IPÊ team
Description of measurement methods and procedures to be applied	The polygons of burned areas will be mapped through supervised classification with the support of satellite images. The direction for carrying out this activity will come from the IPÊ team, responsible for supervising field activities in the project areas. If the project area where the fire occurred is at least 1 hectare and represents more than 5% of the project area, the other specific assumptions established in AR-TOOL08 (version 4.0) will be analyzed to apply the estimated non-CO_2 GHG emissions resulting from the burning of above ground woody biomass calculation.
Frequency of monitoring/recording	The analysis will be carried on each occurrence of forest fire in the project area, considering the criteria to apply the calculation, explained above and in Section 3.1.2.
Value applied	The value will be reported in each verification event, for each year t
Monitoring equipment	Geoprocessing software, such as QGIS, and satellite images

QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the *IPCC GPG LULUCF 2003*, may be applied
Purpose of data	• *Calculation of project emissions*
Calculation method	The calculations will be carried out by applying the equations established in the AR-TOOL08 "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity" (version 4.0).
Comments	

3.3.3. Monitoring Plan

Monitoring plan establishes procedures for monitoring and verification of the implementation of project activities, the removal of GHG associated with the implementation and development of areas under forest restoration process and the consequent change in carbon stock in different carbon pools throughout the project period.

In this sense, the monitoring plan addresses two main parts:

i) Monitoring of the key procedures for inclusion of new planting areas

ii) Monitoring the changes in carbon stocks, GHG emissions and removals from the project

3.3.3.1. Monitoring of the key procedures for inclusion of new planting area

There are two main steps for inclusion of a new area to the Grouped Project:

Step 1: Legal-foundary analysis and contract signing

Step 2: Eligibility analysis

3.3.3.1.1. Legal and land tenure analysis and contract signing

As described in section 2.5 (Legal Status and Property Rights), the Corridors for Life ARR Grouped Project operates only on private rural properties and uses legal contracts to formalize partnerships with their respective owners, which recommend free consent between the parties. For a property to be able to participate in the project and, therefore, transfer the right to operate and own the carbon credits to the project proponents, which is the main objective of the contractual formalization, the property must go through a legal and land tenure diligence. This process is very important, not only to certify the rights of the carbon project, but also to anticipate and mitigate risks that may arise regarding the investment made by the project through ARR activities in the property under analysis. Legal and land tenure diligence analyses an extensive list of documents and real estate, socio-environmental, and judicial processes.

In order to guarantee a complete diligence, which analyzes all the points that may pose a risk to the project and, at the same time, does not make the process unnecessarily time-consuming and bureaucratic, the preparation of this official list of documents and processes went through an extensive

process of review and improvement based on lessons learned in other diligences. In addition, this entire process was prepared by a legal team specialized in environmental law and with experience in the project region, which is also responsible for assisting rural property owners in issuing official documents and carrying out due diligence.

Thus, only after verifying the real estate regularity and the inexistence of judicial risks that the project proponents formalize a contract and start the project operation in the area to be reforested in the property.

3.3.3.1.2. Elegibility analysis

Technical description of monitoring tasks

i) Exclusion of deforested or degraded areas for at least 10 years from the project start date

The assessment is carried out in areas delimited for restoration (environmental liabilities) sent together with the property boundary, in KMZ or shapefile format, by the IPÊ team to the Biofílica Ambipar Environment team. These areas are stored in the project areas database, which contains farms that have ARR activities in progress or under negotiation.

Five scenes of Landsat 5 satellite images with spatial resolution of 30 meters that totally cover the Project Zone (30 municipalities of Pontal do Paranapanema) are analyzed with the composition of the R,G,B bands (red, green and blue).

Then, the analysis is performed by comparing the Landsat 5 images from 2006 with Sentinel-2 images from the years when the property (and the polygon to be restored) entered the project. In the case of the Corridors for Life ARR Grouped Project, started in 2021, the assessment of the occurrence of deforestation in the first properties was carried out between the years 2006 and 2021, while properties that entered in 2022 had the assessment made between the years 2006 and 2022. Sentinel-2 images have composition of R.G.B bands (red, green and blue) and spatial resolution of 10 meters.

The individual scenes (along with metadata) and a single file mosaic of the scenes are stored in the project's geospatial file directory.

ii) Exclusion of wetlands areas

During the eligibility analysis and preparation of maps of areas for the implementation of forest restoration activities, sites that exhibit characteristics of wetlands, as well as periodic flooding and anaerobic conditions, are promptly excluded from the boundary of the project area.

From the initial delimitation of the restoration polygons, the overlap analysis with wetlands areas must be performed, considering both the areas near rivers that are permanently flooded and areas that are periodically flooded during the rainy season in the region of the Project Zone, in order to ensure that the seasonal dynamics of water bodies and courses do not affect the planting area.

The procedure for defining these areas involves an initial stage of evaluation using Geoprocessing software, carried out by the Biofílica Ambipar Environment team, and a stage of complementing and validating the information obtained through the geoprocessing analysis, carried out in the field by the IPÊ team, if they believe that some area was not correctly identified by the software.

Geoprocessing analysis is performed by the Biofílica Ambipar Environment team through overlapping the shapefiles of the farms and areas for restoration with the wetlands areas from Mapbiomas and with the hydrography shapefile from IBGE, to identify the rivers close to the restoration areas. In addition to Mapbiomas, analysis by photointerpretation is also performed, both to include areas not detected by Mapbiomas as to exclude areas that were mistakenly identified as wetlands.

For verification and validation, the shapefiles of the wetlands areas are sent to the IPÊ team. If there are technical doubts about the overlapping, Biofílica Ambipar Environment sends the shapefile of the wetlands areas together with the geographic coordinates, so that the ATER team can provide more information about the area.

Conferences of the areas detected by the geoprocessing analysis are also carried out by the IPÊ team during the stages of area preparation and implementation of planting activities, since the IPÊ team does not plant seedlings in floodplain areas.

After validation, the polygons of floodable areas are corrected and crossed with restoration areas that have not been deforested for at least 10 years and with areas already classified as closed forest (arboreal stratum indicated in Section 3.2.2.1), which results in the determination of the area (ha) eligible for development of restoration activities on the property.

The guide for analysis of eligibility in restoration areas (internal document of Biofílica Ambipar), which includes the entire procedure for identifying wetland areas (geoprocessing stage and, if necessary, field stage), was made available to VVB.

iii) Exclusion of closed forest areas

As pointed out in Section 3.2.2.1, areas with a predominance of arboreal vegetation and little presence of clearings and herbaceous vegetation (canopy cover occupying more than 60% of the area) are not considered for the implementation of ARR activities by the project. In this way, polygons identified in the baseline stratification as arboreal stratum are excluded from the calculation of the area to be restored (that is, this stratum is not included in the project area).

Quality control and quality assurance procedures and organization and responsibilities

As previously mentioned, the project carries out legal and land tenure diligence on all properties that may become part of the Grouped Project, analyzing an extensive list of real estate, socio-environmental and judicial documents and processes. In this way, only after verifying the real estate regularity and the absence of legal risks that the project proponents formalize a contract with the owner and start activities in the area to be reforested on the property. This due diligence process was built by partner lawyers who have a history of working in land and environmental regularization in the region. In this sense, it is pointed out that the project has a qualified legal team to carry out and/or monitor the legal and land tenure due diligence.

As for the location of the areas, the IPÊ team defines together with the rural owner where the forest restoration activities will be implemented and sends the agreed limits to the Biofílica Ambipar Environment team, which builds the corresponding map, to be inserted in the contract between the parties. In this way, all parties confer and contractually validate where the ARR activities will be carried out.

For verification and validation, the shapefiles of the eligible areas (considering both non-deforestation in the last 10 years, wetlands and closed forest areas) are sent to the IPÊ team. In case of technical doubts about the overlap, mainly referring to wetland areas, Biofílica Ambipar sends the shapefile of the wetland areas together with the geographic coordinates, so that the ATER team can provide more information about the area.

Conferences of the areas detected by the geoprocessing analysis are also carried out by the IPÊ team during the stages of area preparation and implementation of planting activities, since the IPÊ team does not plant seedlings in floodplain areas.

From these detailed analyzes on technical and legal eligibility, it is ensured that ARR activities are not implemented in wetland areas, with recent deforestation or degradation, nor with legal obstacles.

Data storage

Biofílica Ambipar Environment will store all data, maps, legal documents and reports of the Corridors for Life ARR Grouped Project in digital files during the entire duration of the Project. All documents related to Project monitoring will be made available to auditors at each verification event.

3.3.3.2. Monitoring the changes in carbon stocks, GHG emissions and removals from the project

Technical description of monitoring tasks

3.3.3.2.1. GHG emissions

As pointed out in Section 3.2.2, no project emissions are foreseen. Specifically regarding the emission of non-CO_2 GHGs resulting from burning of biomass and forest fires within the project boundary, these are not foreseen because the use of fire is not part of the activities of the Corridors for Life ARR Grouped Project (also already pointed out in sections 3.1.2 and 3.1.3).

However, in an event of fire occur within the geographic limits of the Project during the life of the Project, affecting a minimum area of 1 hectare and representing more than 5% of the project, the emission calculation presented in Section 3.2.2 will be performed (if the criteria already set out in Table 14 of Section 3.1.2 are met). The assumptions for non-CO_2 emission calculation for above ground biomass of living trees, also shown in Table 14, should also be considered to assess the significance and necessity of performing the calculations.

The emission of non-CO_2 GHGs resulting from fire ($GHG_{FF,t}$) is calculated by the emission of non-CO_2 resulting from the loss of aboveground biomass of trees ($GHG_{FF\_TREE,t}$) and the loss of dead organic matter due to forest fire ($GHG_{FF\_DOM,t}$) (Equation 6 of AR-TOOL08):

i) Emission of non-CO2 resulting from the loss of aboveground biomass of trees due to forest fire

Emission of non-CO_2 GHGs resulting from the loss of aboveground tree biomass due to fire is calculated using the above ground biomass in trees of relevant strata in last verification and a combustion factor, in addition to the total area of the project that was affected by the fire (Equation 7 of AR-TOOL08).

In addition to the combustion factors that have their values punctuated in the description of the equation 7, the conversion factors presented in Section 3.3.1 and the variable $b_{TREE,i,tL}$ (which will be obtained in the calculations and/or monitoring report of the last verification before the occurrence of fire), one other variable needs to be monitored in case of a fire event, which is precisely the area affected by fire in each of the strata ($A_{BURN,i,t}$).

ii) Emission of non-CO_2 resulting from the loss of dead organic matter due to forest fire

Emission of non-CO_2 GHGs resulting from the loss of dead organic matter due to fire shall be calculated using the dead organic matter stock at the last verification, in addition to the total area of the project that was affected by the fire (Equation 8 of AR-TOOL08).

Therefore, in addition to the variables $C_{DW,I,tL}$ and $C_{LI,I,tL}$ (obtained in the calculations and/or monitoring report of the last verification before the occurrence of fire), in the event of a fire event, the area affected by fire in each of the strata ($A_{BURN,i,t}$) must be monitored, reported and used in calculations.

Forest fire analyses - Methodology to be applied

The initial phase of the fire analysis will include the reporting of fire occurrences in the project areas by the IPÊ field team (since they are the local team working on the project) to the Biofílica Ambipar team. This report will inform the name of the property affected, the polygon(s) affected, the date of occurrence of this fire and the impact forecast (if high, medium or low), in addition to additional information about the firefighting operation and the probable cause of the fire.

Then, the IPÊ field team (ATER team) will monitor the impact of the fire on the site, assessing whether the fire reached the canopy and the size of the area affected by the fire. Photographs with geographic coordinates will serve as input for the geoprocessing analysis. When possible, the perimeter of the polygon affected will be covered using GPS.

The Biofílica Ambipar team, in turn, will calculate the area affected by the fire via geoprocessing software and will use satellite images as support (as well as the shapefiles of the property and the polygon(s) that make up the project area). The process prior to the calculation can involve both the insertion of the polygon traversed using the GPS and the insertion of points from the photographs with coordinates, followed by the delimitation of the polygon.

If the area affected by fire represents 5% or more of the project area, the calculation of non-CO2 GHGs emissions resulting from fire may be necessary[28].

In this case, the variable $A_{BURN,i,t}$, included in Section 3.3.2 (Data and Parameters Monitored) must be reported and used in the calculations, mainly in equations 7 and 8 of AR-TOOL08 (version 4.0).

Note that to refine the value of the area affected by fire, satellite images from different months and analysis of vegetation parameters (such as NDVI) can be used. The comparison between images from different periods will allow measuring the area (ha) affected in case of fire, and the comparison between the NDVI values before and after the fire will allow measuring the effect of fire on the biomass of the burned area, also allowing the monitoring and follow-up of biomass recovery in the area.

Table 23 – Parameters to be considered when applying equations 7 and 8 of AR-TOOL08 (version 4.0), for calculating non-CO_2 GHG emissions resulting from forest fire

Parameter/Variable	Data unit	Value	Source of data
$A_{BURN,i,t}$: Area burnt in stratum *i* in year *t*	Hectare (ha)	To be calculated	Results from Geoprocessing Software analysis and fire reports/data provided by field assessment
$b_{TREE,i,tL}$: Mean aboveground tree biomass per hectare in	d.m. ha^{-1}	To be calculated	Calculations and/or monitoring report of the last verification before

[28] As described in Section 3.1.2 (Table 14), the AR-TOOL08 (version 4.0) applies the following assumptions:
(a) Aboveground biomass of living trees shall be considered not to result in significant non-CO_2 GHG emission in case of fire, when
i) A forest fire burns through the understory but does not climb into the tree canopy; or
ii) A forest fire singes trees but does not cause mortality such that leaf regeneration can be observed within six months (this may be demonstrated in remote sensing imagery);
(b) 60% of the dead organic matter is entirely burnt in all fires

stratum *i* in year t_L which is the year in which last verification was carried out before occurrence of the fire;			the occurrence of the fire. The calculation will follow the equations and procedures for estimating mean aboveground tree biomass (Section 3.2.1.2, Section 3.2.4.5 - Table 22 -, Section 3.3.1 and Section 3.3.3.2).
$COMF_i$: Combustion factor for stratum i;	dimensionless	Default value (0.46 to 0.32)	AR-TOOL08, version 4.0, page 6 – Data and parameters obtained from existing sources. The default value is dependent on the restoration age range, as described in Section 3.3.1
$EF_{CH4,i}$: Emission factor for CH_4 in stratum *i*;	g CH_4 (kg dry matter burnt)$^{-1}$	6.8 or other*	AR-TOOL08, version 4.0, page 6 – Data and parameters obtained from existing sources
GWP_{CH4}: Global warming potential for CH_4	dimensionless	Default value of 21 is used	Equation 7 – AR-TOOL08
$EF_{N2O,i}$: Emission factor for N_2O in stratum *i*;	g N_2O (kg dry matter burnt)$^{-1}$	0.20 or other*	AR-TOOL08, version 4.0, page 6 – Data and parameters obtained from existing sources
GWP_{N2O}: Global warming potential for N_2O	dimensionless	Default value of 310 is used	Equation 7 – AR-TOOL08
$C_{DW,i,tL}$: Carbon stock in dead wood in stratum *i* in year t_L which is the year in which last verification was carried out before occurrence of the fire	t CO_2-e	To be calculated	Calculations and/or monitoring report of the last verification before the occurrence of the fire. The calculation will follow the procedures for estimating carbon stock in dead wood (Section 3.2.2.2, Section 3.3.1 and Section 3.3.3.2.2).
$C_{LI,i,tL}$: Carbon stock in litter in stratum *i* in year t_L which is the year in which last verification was carried out before occurrence of the fire	t CO_2-e	To be calculated	Calculations and/or monitoring report of the last verification before the occurrence of the fire. The calculation will follow the procedures for estimating carbon stock in litter (Section 3.2.2.2, Section 3.3.1 and Section 3.3.3.2.2).

** Other data sources may also be selected, in order of preference, as established in AR-TOOL08 (version 4.0), such as: (a) Regional/national inventories; (b) Inventory of neighboring countries with similar conditions and (c) Globally available data applicable to the project site or the region/country where the site is located.*

With the parameters presented in Table 23, therefore, it is possible to calculate the emission of non-CO_2 resulting from the loss of aboveground biomass of trees ($GHG_{FF\_TREE,t}$) and from the loss of dead organic matter due to forest fire ($GHG_{FF\_DOM,t}$). Through the sum of these two parameters, the emission of non-CO_2 GHGs resulting from fire ($GHG_{FF,t}$) value is obtained.

3.3.3.2.2. Change in carbon stocks of trees and shrubs

To determine the change in carbon stock, trees and shrubs within the sample plots will be measured. As there is a baseline inventory, also via sample plots, all individuals, even those who were in the area before the implementation of ARR activities, can be measured and considered in the calculations for estimating biomass and carbon stock.

Sample plots will be randomly distributed in the different strata existing in the verification period and the sampling intensity will be given by the specific calculation of sample sufficiency contained in the tool "*Calculation of the number of sample plots for measurement (AR-TOOL03, version 2.1)*".

i) Stratification

As pointed out in AR-ACM0003 methodology, "if biomass distribution over the project area is not homogeneous, stratification should be carried out to improve the precision of biomass estimation".

It is also pointed out that "for baseline net GHG removals by sinks, it is usually sufficient to stratify the area according to major vegetation types and their crown cover and/or land use types."

In the case of the Corridors for Life ARR Grouped Project (as already pointed out in Section 3.1.4 - Baseline Scenario), the project considered 3 different strata for implementation of ARR activities: (i) "herbaceous; (ii) irregular-herbaceous; and iii) irregular-arboreal.

Also according to AR-ACM0003 methodology, "for actual net GHG removals by carbon pools, the stratification for ex-ante estimates is based on the project planting/management plan and the stratification for ex-post estimates is based on the actual implementation of the project planting/management plan".

Additionally, if natural or anthropogenic impacts (e.g., local fires) or other factors (such as soil type) significantly alter the pattern of biomass distribution in the project area, then the stratification for ex post estimation should be readjusted.

As the objective of the Project is to perform the restoration plantings and the facilitation of natural regeneration over 20 years, it is previously understood that the distribution of biomass in the project will vary according to the planting year (Table 7) and the restoration method applied. Stratification for ex-post estimation will take into consideration the execution of the planting plan and the development of the restoration areas, using geoprocessing technologies and tools as support in the determination of the strata.

The forest restoration activities are expected to be implemented in the first 20 years of the project, which implies carrying out baseline stratification in the project areas until the entire implementation schedule is fulfilled. Likewise, the areas under restoration process will be monitored throughout the forest period by estimating forest biomass and respective carbon stock and, therefore, will be recurrently stratified (according to forest growth).

Another possible stratum to be considered in monitoring and calculating the Project's GHG removals refers to plantations of exotic species, intended to be used only in specific cases, in low quantities and at the request of the rural owner, as pointed out in Sections 5.2.5, 5.2.7 and 3.2.4.2. When planting of exotic species is planned, the calculation and monitoring of these species specifications will be validated along new instances validation.

Methodology to be applied

The stratification analysis planned to be carried out by the project consists of applying the Random Forest algorithm to evaluate and measure which types of vegetation strata are present in the areas eligible for the development of ARR activities within properties. This activity is indicated to increase the accuracy of the baseline biomass estimate and reduce supervised classification efforts. T

he Random Forest classification can be carried out in the same way as for the stratification of the baseline of the first instance (via geoprocessing software, satellite images and R software) or directly in QGIS, with the support of satellite imagery.

In the case of the introduction of exotic species such as “live fencing for planting, windbreaks and hedges in reforestation areas, following roads or boundaries of rural properties”, the area referring to these plantings can be determined individually (not via Random Forest classification as explained above) as differentiated strata. When planting of exotic species is planned, the stratification of these species will be validated along new instances validation.

Sample plots and field measurement

From the stratification (be it baseline or for ex-post estimation) sample plots are randomly allocated in the field, which are installed to measure the existing biomass within these plots and consequent average estimation of the biomass in each stratum. The random distribution of plots in the different strata is carried out through the geoprocessing software itself.

It is important to point out that the distribution is based on the number of sample plots needed to be measured in each stratum, and this number of plots is given by the sample sufficiency calculations described in the tool AR-TOOL03 “Calculation of the number of sample plots for measurements (version 2.1)”.

Size and field allocation of sample plots

Permanent sample plots of 30x30m (900m2) will be installed to monitor the change in growth and allocation of biomass in trees and shrubs over the years.

The location of the plots, randomly distributed in the strata likely to receive ARR activities, are sent to the measurement team through a gpx file, which contains the coordinates of a point in the plot. In this way, with the use of a GPS it is possible to locate the plot area.

The point must be used as the initial vertex of the plot, from which the plot is installed. In order to avoid a trend in the sampling, it was decided to standardize the direction of travel in the installation of the plots. Thus, the path starts from the initial point, then follows in the east direction, then to the north direction, to the west and, to close the polygon, to the south. The distance between the vertices is 30 meters and is measured using a measuring tape.

A 60 cm long copper rod is inserted at each vertex, in order to physically and permanently define the vertices of the plots. These rods are inserted diagonally to facilitate their location in the future. The geographic coordinates of each vertex are also collected with GPS and recorded in a field worksheet.

It is important to mention that, depending on the planting arrangement that may be used for the introduction of exotic species (preferably in double row and interspersing trees - zigzag model -, as pointed out in Section 5.2.5), different sample plots may be used, but this is expected to be at least 5x60 ($300m^2$)[29]. These plots will also be randomly distributed by the corresponding stratum and the

[29] This plot size is due to the expected planting arrangement, with preferably double rows and with a maximum spacing of 4 meters between rows and, in order to have a greater distribution between the plots, these will have a length of 60 meters.

sample sufficiency will also be calculated following AR-TOOL03 - *Calculation of the number of sample plots for measurements* (version 2.1).

Tree measurement

All tree individuals with DBH≥5 cm (or CAP≥15.7 cm)[30] existing within the 900m^2 plot are measured, and height, DBH or CAP measurements are collected, in addition to performing the botanical identification at the lowest possible taxonomic level. Botanical samples can be collected in cases of non-identification of the species in the field.

In addition, all measured individuals are identified with a numbered metallic plate, nailed to the tree trunk. This measure allows following the development of these individuals in future measurements and recognizing which individuals existed in the area before the implementation of ARR activities.

Shrub measurement

The measurement of individuals of shrub species is carried out by measuring the crown cover projected on the ground along a straight transect. To do so, the transect is allocated in the plot diagonally, walking from the initial vertex to the opposite vertex (third vertex).

After placing the tape in the plot, measurements of the projections of the shrubs on the tape are collected. The crown cover survey with shrub species followed the guidelines of Portaria CBRN 01/2015. In this, shrub cover is obtained by summing the measurements of the sample line sections that are covered by shrub vegetation (in meters) in relation to the length of the line.

For data collection, therefore, the sections covered by native vegetation must be measured with a measuring tape and the sum of the sections in relation to the total length of the transect (in the case of the project, established at 30 meters) must be used to calculate the percentage (%) of coverage in the installment, according to the formula below:

$$CC_{SHRUB,k,i} = \frac{(section\ 1 + section\ 2 + \cdots + section\ n)}{30}$$

Where:

$CC_{SHRUB,k,i}$: crown cover of shrubs in plot *k*, in stratum *i; %*

[30] As much as the measurement of individuals with at least 10 cm of DBH is recommended in the inventory of forests in the state of São Paulo (Durigan and Garrido, 1992), it was decided to reduce this limit to 5 cm, as it is commonly used in several forest surveys (van Breugel *et al.*, 2013; Farah *et al.*, 2014; César *et al.*, 2018; Pinto *et al.*, 2021) and the lowest limit required for measuring trees (below 5cm, it can be defined as "lower DBH") (Batista, Couto and Silva Filho, 2014).

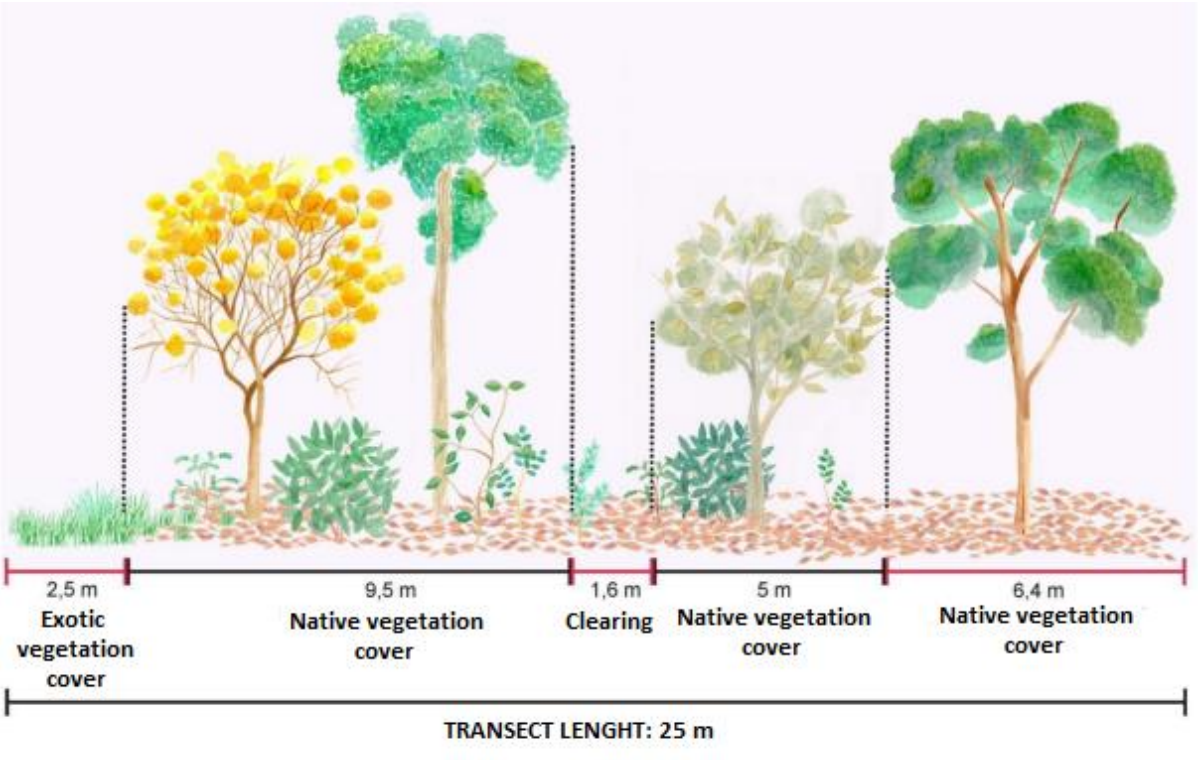

Figure 40 - Example of canopy cover assessment in a 25m transect of Semideciduous Seasonal Forest. Soil cover is the area of soil covered by the canopy of native species. (Extracted from: Portaria CBRN 01/2015 - SP)

Note that this methodology of Portaria CBRN 01/2015 is used to measure the crown cover of trees and shrubs. In the case of the project, however, the crown cover was measured only for shrub individuals. Additionally, the Portaria establishes the length of the transect at 25 meters, but it was decided to consider 30 meters to increase the size of the plot (represented by the transect).

ii) Estimate calculations

With data collected in the field, the estimate of carbon stocks in trees and shrubs will be given by the specific equations established in the tool AR-TOOL14 "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (version 4.2) and already presented in Section 3.2.1.2 (Estimating carbon stock in trees and shrubs).

The allometric models and other parameters used in estimating calculations are presented in Section 3.2.4.1 (Estimated baseline removals) and Section 3.2.4.5 (Ex-post estimated project removals), as well as in Section 3.3.1.

3.3.3.2.3. Change in litter and deadwood carbon stocks

As pointed out in Section 3.2.4.2., the determination of carbon stock in litter and deadwood will be given by the default value established in the AR-TOOL12 tool, version 3.1: *"Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*".

Therefore, it is not necessary to monitor any specific parameter related to these pools, which depend only on estimates of changes in the carbon stock in trees.

3.3.3.2.4. Change in soil organic carbon stocks

As already described in Section 3.2.2.4, the carbon stock in the soil will be given by applying the calculations contained in the AR-TOOL16 tool, version 1.1: "*Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*". In this way, as the values will be obtained directly from the application of the specific tools, there will be no data collection and/or sampling activities in the field to determine the change in carbon stocks in these reservoirs.

However, as determined by the AR-TOOL16 tool, some assumptions for stratification need to be considered.

First, the areas need to be classified into cropland or grassland. The classification of current land use (in the baseline) into pasture and agricultural crops will be carried out by geoprocessing analysis, using data from Mapbiomas, which is a nationally recognized database.

After classifying the current land use, the areas need to be stratified into:

(a) Climatic region and soil types indicated in Table 3 of the AR-TOOL16 tool

The soil type of each instance to be inserted in the project will be checked. This assessment will be given by crossing the boundaries of the area to receive the ARR activities within the property with the soil map, specifically classified into: LAC (soils with low activity clay), HAC (soils with high activity clay), sandy soils, spodic soils and volcanic soils.

(b) Pre-project management activities in cropland, indicated in Tables 4 and 5 of the AR-TOOL16 tool

Although we did not consider this stratum in the final calculations, as presented in Section 3.2.4.2, a previous classification and calculation (associated with this classification) were carried out to understand which soil carbon values would be obtained in this stratum. This conservative classification assumed the following items:

- Land Use (f_{LU}): "Short-term cultivated (< 20 yrs) or set aside (< 5 years);
- Management (f_{MG}): "Reduced tillage"
- Input (f_{IN}): "Medium"

However, the project intends to establish procedures for analysis and verification of other categories for each of these assumptions. The methodology to be created will be reported in the first project monitoring report, along with the specific estimates associated with determining these assumptions.

(c) Pre-project grassland management activities, indicated in Table 6 of the AR-TOOL16 tool

Also conservatively, the following assumptions were assumed for the *ex-ant* calculations:

- Management (f_{MG}): "Moderately degraded grassland"
- Input (f_{IN}): "Low/Medium"

In the same way as presented in item (b) for croplands, it is intended to perform the stratification of these categories, especially classifying grasslands into "severely degraded", "moderately degraded" and "non-degraded".

Quality control and quality assurance procedures and organization and responsibilities

Regarding the monitoring of the change in carbon stock in trees and shrubs, data collection in the field must follow the field protocols of forest inventories widely disseminated in the forestry sector. To this end, only companies with solid knowledge in field measurement are hired to develop these activities.

Besides the existing knowledge within the contracted company's own technical team, it is common for them to hire “mateiros” from the region to support logistics and even recognition of local species.

The data collected in the field, as well as the methodological report, are sent to the Biofílica Ambipar and IPÊ teams, who carry out data analysis and calculations to estimate the change in the carbon stock. During data analysis, data checking is also performed (such as via a scatterplot). When any discrepant data is found, the hired field team is contacted, in order to understand whether it was a typing error or in fact an "outlier".

Furthermore, it is common for member(s) of the IPÊ and/or Biofílica Ambipar technical team to accompany the measurement activities in the field for some periods.

It is also noted that the project usually works with “double checking of data” and “calculation of estimates in a team”, since both member(s) of the technical team of IPÊ and of the technical team of Biofílica Ambipar analyze the data sent individually at first and then meet to discuss their analyzes and carry out the estimation calculations together.

Geoprocessing analyzes (such as land use classification) are performed by the Biofílica Ambipar geoprocessing team, which aligns the objectives and results with other members of the Biofílica Ambipar team and often with members of the IPÊ team.

Joint analysis and checking, in addition to the presence of qualified technical staff (both in carrying out work in the field and in data analysis and calculation of estimates) are essential forms of quality assurance and control.

Data storage

Biofílica Ambipar Environment will store all data, maps, legal documents and reports of the Corridors for Life ARR Grouped Project in digital files during the entire duration of the Project. All documents related to Project monitoring will be made available to auditors at each verification event.

3.3.4. Dissemination of Monitoring Plan and Results (CL4.2)

Monitoring Plan of Climate activities and all its results will be publicly disclosed on the official website of Biofilica Ambipar Environmental Investments, in the tab specially dedicated to the Corridors for Life ARR Grouped Project. All relevant information, the summary of the monitoring plan and its conclusions, will be made available to the community, partners and other stakeholders through meetings and lectures, with emphasis on the monthly meeting "Friday with Science", as well as made available in physical form at the locations established in Section 2.3.

3.4. Optional Criterion: Climate Change Adaptation Benefits

3.4.1. Regional Climate Change Scenarios (GL1.1)

Not applicable.

3.4.2. Climate Change Impacts (GL1.2)

Not applicable.

3.4.3. Measures Needed and Designed for Adaptation (GL1.3)

Not applicable.

4. COMMUNITY

4.1. Without-Project Community Scenario

4.1.1. Descriptions of Communities at Project Start (CM1.1)

As presented above, specifically in the topic 2.1.6 (Social Parameters), until the beginning of the 20th century the far west of the state of São Paulo was covered by extensive forest areas, which were gradually replaced by pastures and agricultural crops in large rural properties occupied by squatters with no documentation (Fernandes; Ramalho, 2001). As from 1990, with the pressure for land redistribution from the Landless Rural Workers Movement (MST) and other groups, many of these properties were occupied by thousands of families (Fernandes; Ramalho, 2001). This popular pressure ended up with the expropriation of several occupied properties, allocating them to public land reform settlements in INCRA and ITESP processes (Fernandes; Ramalho, 2001). During this process there were several confrontations between landowners and settled families, making the Pontal do Paranapanema one of the regions with the highest number of conflicts over land in Brazil (Fernandes; Ramalho, 2001). After the settlement of many landless families, the pace of land redistribution slowed down, and the currently adopted policies seek to consolidate the existing settlements.

In large properties the predominant economic activity is sugar cane and cattle ranching on severely degraded pastures. In the rural settlements, the predominant activity is dairy herding and subsistence crop cultivation (cassava, maize, beans, etc.). As highlighted by ITESP (2001), the fragility of the soils and the absence of conservation measures have quickly exhausted the productive potential of the lands in this region. The Institute points out that the soil characteristics, the concentration of rainfall in a short period of the year, and exposed hillsides without ground cover, led the region to be known as one of the most degraded in the State of São Paulo.

This history of land occupation was fundamental for the origin of a characteristic cultural identity of the local communities in the Project Zone, especially with regard to social movements fighting for land. The rural context of the Pontal do Paranapanema region, of permanence and survival, solidified on the customs related to the ways of life of peasants, family farmers, farmers, settlers, and the “caipira” culture, which are closely associated with the centrality of the family in the organization of the way of life and work with the land (De Oliveira; Barone; Ferrante, 2016; Rabello, 2018). In this sense, rural neighborhoods and agrarian reform settlements, made up of families from different origins and trajectories, are places of reproduction and maintenance of traditional rural culture.

In association, the traditional festivals (for example, "quermesses" and June festivals) are symbolic manifestations that encourage fraternization and socialization in rural areas, as well as the preservation of traditions in the Project Zone, through celebrations with music, food and typical drinks (De Oliveira; Barone; Ferrante, 2016). Together, the Paranapanema and Paraná rivers are leisure and recreation preferences for the local community, who use these spaces for sport fishing, bathing and boat trips.

About land degradation, Pimenta (2019) points out that rural settlements are located in regions where the soil and relief characteristics promote erosive processes. These processes cause great difficulty for subsistence farming in the rural settlements, since very sandy soil retains little water and nutrients and is very susceptible to erosion, especially when deprived of its forest cover (Ross and Moroz, 2011; Rossi, 2017).

Thus, the land reform policy in Brazil has come to recognize the need to reconcile productive activities in rural settlements with biodiversity conservation and sustainable use of natural resources. Such reconciliation is part of the II National Plan for Land Reform (INCRA, 2004), which seeks to consolidate

the settlements that hold the greatest promise of social/environmental sustainability, rather than primarily meeting the redistribution demands of the landless. This goal determines that in the State of São Paulo, the State Land Institute (ITESP) works closely with the Forest Institute (IF), responsible for the administration of protected areas.

In this context, since the beginning of the land reform process, ITESP has sought to integrate environmental actions in rural settlements through the Pontal Verde program (ITESP, 2001). According to the guidelines of this program, actions were taken in environmental education, implementation of soil conservation systems, liming, construction of fences and firebreaks in legal reserve and permanent protection areas. There was also the supply and planting of seedlings of native and exotic forest species to meet the demand for timber and reduce the pressure on the native forest remnants (ITESP, 2001). These actions aim to make the social/economic development of the settled families compatible with the recovery, conservation and environmental preservation of the legal reserve and permanent preservation areas. Furthermore, the management of agroforestry systems such as agroforestry and silvopastoral systems has also been encouraged (ITESP, 2001).

To make the restoration of the Permanent Preservation Areas and the legal reserve feasible, the "Pontal Verde" program sought the involvement of the settled community in a participative way. This involvement was achieved by training Environmental Agents, who were empowered to teach concepts about the importance and role of forests, biodiversity in sustainable agriculture, preservation of natural resources and environmental legislation (ITESP, 2001). This program has also encouraged the deployment of community forest nurseries, making possible a new source of income for the community involved.

Coupled with this effort by the state government, universities and civil society organizations have also contributed to the social/environmental development of Pontal do Paranapanema region. It is worth stressing the work of the Institute for Ecological Research (IPÊ), which has been working in the region training environmental agents, encouraging the implementation of agroforestry and silvopastoral systems, creating forest nurseries and training workers to implement forest restoration systems since 1998 (Chazdon et al., 2020).

In the late 1990s, the Institute for Ecological Research initiated a training program to implement agroforestry and forest restoration in APPs and RLs within the settlements.

The purpose of this program was to demonstrate the benefits obtained from the environmental services provided by agroforestry, which can be economic, through the trading of alternative agricultural products, or environmental, such as reduction of soil erosion, wind barriers etc.

The significant adherence to agroforestry and restoration projects increased the demand for native seedlings, which were brought from other cities, because there was no local production. To meet this demand, in 2000 IPÊ started to encourage the creation of forest nurseries in the Ribeirão Bonito and Tucano settlements, training those interested in the identification and demarcation of producing trees, in the collection of viable seeds, and in seedling production. In 2004 there were 14 community nurseries, involving 102 families, with a production capacity of 157,000 seedlings. These nurseries helped initiate agroforestry productions in the region, stimulating the participation of other settlements (Cullen Jr; Alger; Rambaldi, 2005; Rodrigues et al., 2004).

The production agreements with the associations and families involved in the nursery operations generated approximately USD 367,000 in local income between 2016 and 2019. In this process 115 people and 23 families were involved, from the collection of seeds to the production of seedlings. Thus, this production provided a monthly income of R$1,650 (USD 450.00) per family, which corresponded to 2 minimum wages in 2016 (Chazdon et al., 2020).

Against this backdrop, rural workers in the region were originally unfamiliar with the economic use of forests, and the use of agricultural practices that protect the soil. However, due to the efforts of

governmental and civil society actions, today there are small businesses of workers with experience in the implementation of agroforestry systems, forest restoration, and native forest nurseries.

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These numbers reflect the importance of the ARR Corridors for Life Grouped Project for local economic and social development, as well as corroborate the capital invested in the region's economy over the last few years of the Project's existence. Especially for this area, approximately R$ 700,000 (USD 130,000) was invested in the production of native forest seedlings by community nurserymen, while R$ 2,200,000 (USD 420,000) was spent in signed contracts for the implementation and maintenance of field restorations by service providers. Hence, this case was responsible for moving approximately 2.9 million Brazilian Reais in local economy.

In 2022, the Instituto de Pesquisas Ecológicas was responsible for the implantation of 700 hectares of new forests in Pontal do Paranapanema, which are part of the institution's objective of connecting the remaining native vegetation of the landscape in the region (SOUZA, 2022). Motivated by this large-scale action, the dissertation developed by Souza (2022), whose purpose was to characterize the demographic profile of the community members who work in the reforestation chain in the Project Zone and who benefit from the implementation and maintenance of ecological corridors in the region, identified the main social and economic aspects linked to the actors in the Project Zone.

According to the author's survey, both community nurseries and companies of service providers in the reforestation chain are concentrated between the municipalities of Teodoro Sampaio (SP) and Mirante do Paranapanema (SP).

In that year, IPÊ was responsible for the acquisition of more than one million seedlings from its partner community nurseries. This number reflected in the direct benefit of 33 families, moving the local economy by approximately 1,200,000 reais (USD 229,095), which are divided into 8 nurseries. On average, each nursery has 4 workers, 60% of which are women and almost 6% are young people. With regard to companies and service providers in the restoration chain, the implementation and maintenance of reforestation activities are carried out mostly by men (89%) and adults (71%). These field initiatives directly benefit 54 families, moving around 6,900,000 reais (USD 1,317,297).

In addition to the numbers presented above, the author showed in her study that the two fronts of forest restoration, when analyzed together, directly benefit 93 people and indirectly 277 people. That is, the reforestation activity in Pontal do Paranapanema has the potential to develop socially and economically the region through the offer of jobs in equity for for women and young people, increase in income for the local population, territorial identification and provision of quality of life and social well-being.

4.1.2. Interactions between Communities and Community Groups (CM1.1)

Taking into account the communities identified in the Project Zone and described in detail in Section 2.1.9, as well as the historical performance of the Instituto de Pesquisas Ecológicas in the region, the

nurseries of native forest seedlings and companies of service providers in the reforestation chain interact actively with the Technical Assistance and Rural Extension team. These specialists, local residents, rural settlers and IPÊ associates guide the professionals about good practices for implementing and maintaining forest restoration areas and producing quality seedlings, as well as engaging the community and disseminating information about the importance of the activities promoted by the project for the environmental, social and economic development of the region. In parallel, nursery operators and service providers also interact mutually, because for the implantation of forests to take place in the field by reforestation companies the seedlings need to be available and at acceptable quality levels. It is worth mentioning that, as shown in Section 2.3.8, the Project's other stakeholders are also informed and communicated periodically in interactive spaces about the initiatives developed and the results generated by the aforementioned carbon project, enabling the active participation of these social actors in issues of its interest.

4.1.3. High Conservation Values (CM1.2)

Originally, the concept of high conservation value attributes was developed by the FSC for the certification of forest ecosystems. However, currently, it has been expanded and applied to other ecosystems, including the guidelines set by the High Conservation Values Network and Resources. In this sense, with regard to communities and according to the CCB Standard, attributes of high conservation value refer to those of particular importance to the well-being of communities. In short, these areas are critical to the cultural identity and way of life of communities, related to territorial occupation, obtaining and using natural resources for cultural, social, religious, ancestral, economic and subsistence reproduction. High Conservation Value Areas (HCVAs) are areas of extreme or critical importance due to some characteristic such as significant concentration of biodiversity, seasonal concentration of species, threatened and rare ecosystems, presence of endangered species, provision of essential ecosystem services, social, historical and cultural values, among others. Within this context, as defined by the HCV Resource Network, there may be six types of high conservation values.

Within the social/economic contextualization of the Corridors for Life ARR Grouped Project, some ecological and economic aspects that are relevant for the surrounding communities are discussed, and may characterize High Conservation Value Areas, which should be identified and managed so as to ensure their maintenance and improvement (Brown et al., 2013). From the six criteria listed by the FSC, one of them is directly related to the communities involved:

HCVA 6: Areas of special cultural, archaeological or historical significance, both nationally and globally, and/or of cultural, ecological, economic or religious/sacred importance for local communities.

In the project's coverage area, seed collection areas were identified in several forest fragments, which are imperative for the continuity and economic development of the forest nurseries in the region. IPÊs own seed bank areas were also identified, which are essential for the biodiversity conservation (HCVA 6). Both areas are identified in the map below (Figure 41).

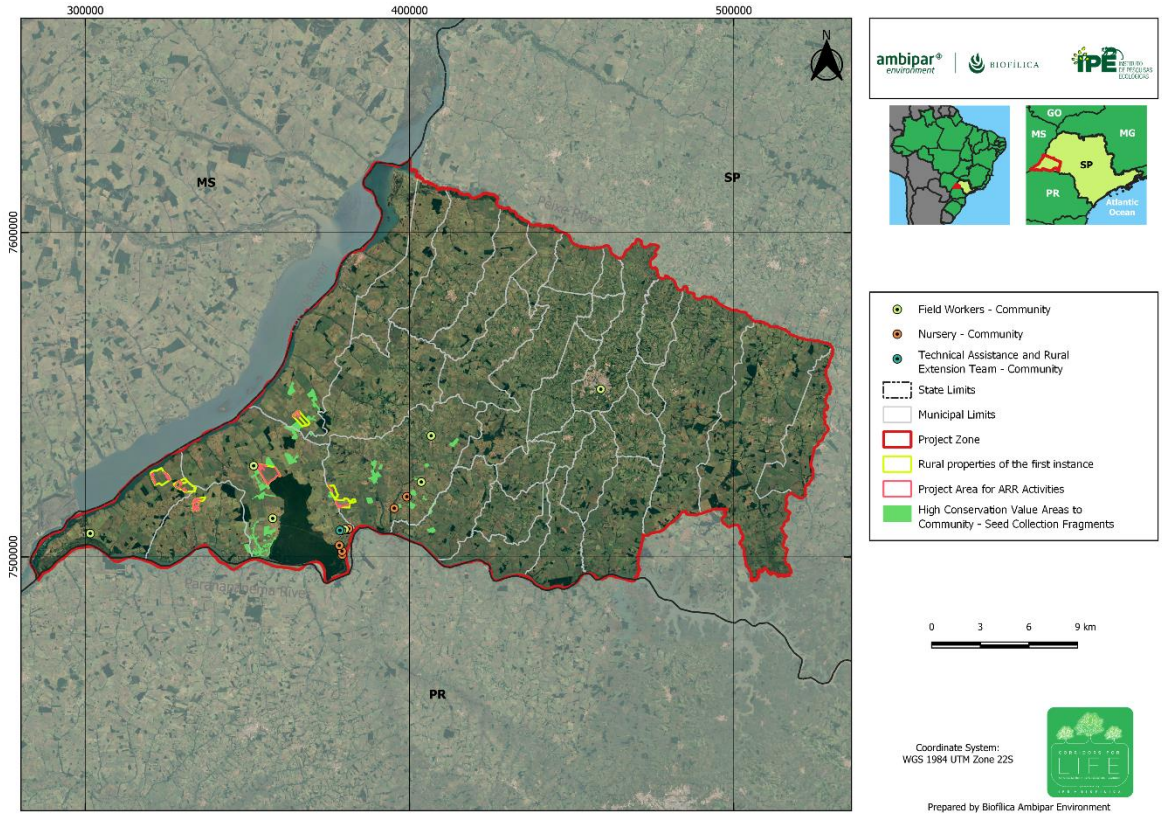


Figure 41 - Areas with High Conservation Values identified and from the point of view of the Corridors for Life ARR Grouped Project communities.

The failure to preserve the forest resources can culminate in the degradation of fragments and seed collection sites, also causing risk to germplasm banks due to the depletion of these natural resources These sites are extremely important for the extraction of forest products, for the income of the communities and especially for the local biodiversity conservation. So, the HVCA identified in the Project area will be continuously monitored.

High Conservation Value	Areas in the Project Zone are critical to the surrounding communities (HVCA 6)
Qualifying Attribute	Areas used by community groups for seed collecting, as well as seed bank areas, essential for biodiversity conservation.
Focal Area	Areas used by the communities within the project need to be monitored and actions taken so that a sustainable management of the resources is carried out in such a way to not deplete them. Technical training on seed collection and environmental education along with the monitoring of these areas assist in the development of connectivity as a result of forest restoration. The ARR Project aims to enhance these activities to ensure the HVCA continuity.

4.1.4. Without-Project Scenario: Community (CM1.3)

As described in Section 4.1.1, IPÊ was a key institution in the setting up of local restoration service companies and community nurseries. The support for structuring the businesses, coupled with trainings and demand for services and seedlings, caused IPÊ to be the main requesting institution. Among the project communities, this dependence relationship is greater in the case of community nurseries (Table 24).

Table 24 - Percentage of seedlings supplied by the nursery to IPÊ.

Nursery	Municipality	Supply to IPÊ
Alvorada	Teodoro Sampaio (SP)	80%
Campos Alvora	Teodoro Sampaio (SP)	90%
Forest	Teodoro Sampaio (SP)	90%
Sol Nascente	Mirante do Paranapanema	80%
Quarteto Florestal	Mirante do Paranapanema	80%
Mata Nativa	Teodoro Sampaio (SP)	75%
Viva o Verde	Teodoro Sampaio (SP)	95%
Manaaim	Teodoro Sampaio (SP)	50%

Thus, given the example presented and the conditions of the Communities presented in Section 4.1.1, the non-occurrence of the Corridors for Life ARR Grouped Project would result in the aggravation of social/economic problems for the people who would be positively impacted by the project activities, such as:

- Without the project there would not be the need to acquire a progressive number of seedlings, supplies, and labor for the development of the initiatives to implement and maintain the restorations. Thus, the project would not encourage the expansion of community nurseries, the emergence of new organizations of technical assistance and rural extension and the origination of new companies specialized in forest restoration;
- Reduction in the generation of jobs for youngsters and women from local communities;
- Lack of training for communities in the restoration and environmental awareness chain, reducing the capacity of these people to develop their businesses and, consequently, harming the strengthening of the local economy, the generation of employment and the improvement of the quality of life of local populations;
- Lack of scientific work, studies, and research focused on the proposed climate, community, and biodiversity strategies, and consequently reducing the improvement of seedling production and restoration techniques that are key to ensure the continued well-being of the communities;
- Communities with little access to public policies and public services.

Such a condition presented in this scenario could also have as a consequence the rural exodus, i.e., the movement of residents to the cities, where there is the possibility of marginalization risk due to the low conditions for absorbing labor in the region.

On the other hand, in the scenario with the presence of the Corridors for Life ARR Grouped Project, the communities are envisioned to have increased levels of social/economic conditions, where the growing demand for restoration services and seedlings combined with training activities will generate sustainable businesses capable of providing employment and income directly to at least 600, people per year.

Recent studies show that environmental recovery, including restoration, creates an average of 33 jobs per million dollars invested, higher than the American oil and natural gas industry, which creates 5.3 jobs per million invested. Forest restoration creates approximately 200 direct jobs (through seed collection, seedling production, planting and maintenance) for every 1,000 hectares in restoration with human intervention (Benini; Brancalion; Rodrigues, 2017).

4.2. Net Positive Community Impacts

4.2.1. Expected Community Impacts (CM2.1)

The Corridors for Life ARR Grouped Project considered the three decades of IPÊ's work in the Project Zone to define the expected impacts on communities from the development of this carbon project. Initially, the developers relied on the final product resulting from the Workshop with the active participation of communities and other local actors to define possible connectivity scenarios between Conservation Units and other protected areas in Western São Paulo, which was held in March 2019 under the leadership of IPÊ's team. This event, which counted on the cooperation of all stakeholders that are part of the Corridors for Life ARR Grouped Project, aimed to discuss, exchange information, identify threats and opportunities for the territory. Based on the results of the diagnosis and the participants' contributions, it was possible to base actions aimed at the expansion and creation of other specially protected areas in the region and regional sustainable development. It is worth mentioning that this episode was one of the institution's main exercises in the interaction, engagement and participation of local actors on a large scale in the initiatives aimed at the landscape.

After the division into thematic groups, the participants were able to build a F.O.F.A. matrix (Strengths, Opportunities, Weaknesses, and Threats) (Appendix 2) to identify relevant points regarding the Conservation Units, Biotic and Social/ Landing Environment. In summary, the main positive points raised related to reforestation activity were: strengthening of action, integration and institutional coordination; construction of knowledge and generation of database; biodiversity conservation; preservation of natural resources (e.g. water resources); environmental education; encouragement of community nurseries and other restoration services; fostering of opportunities for Payments for Environmental Services; and adequacy of Permanent Preservation Areas and Legal Reserves. On the other hand, negative aspects associated with the panorama were also pointed out, such as: uncertainties and vagueness of the current environmental legislation; failures in enforcement; fragmentation process; anthropic pressure; lack of long-term public policies; knowledge gaps; low effective human and financial resources; and legal insecurity.

It is worth mentioning that these observations converged with the results of the dynamics conducted during the ECOnsulta with the communities and other stakeholders of the carbon project, as detailed in section 2.3.7 of this document. In general, the moderator, after the explanatory phase of the event, conducted a dynamic in specific groups that allowed collecting expectations, concerns, doubts and suggestions from the groups present about the development of the Project.

All notes, historical and current, were of paramount importance for the design and rationale of the Corridors for Life ARR Grouped Project, according to the perspectives of the social actors involved.

Community Group	Service providers

Impact(s)	- Access to training and technical capabilities about sustainable practices in the use of natural resources; - Valuation and awareness of forest resources; - Family permanency in rural areas; - Integration with new markets; - Income generation and diversification; - Community engagement; - Promotion of gender equity and opportunity for youngsters;
Type of Benefit/Cost/Risk	Anticipated benefits: - Direct impact under the community; - Cost related to courses and training; - Net positive benefits;
Change in Well-being	- Territorial Belonging; - Qualification to access professional opportunities; - Improvement in economic practices.

Community Group	Forest Nurseries
Impact(s)	- Access to training and technical capabilities for seedling production; - Development of seed collection techniques; - Environmental awareness and stay of families on their land; - Integration with new markets; - Income generation and diversification; - Promotion of gender equity and opportunity for youngsters;
Type of Benefit/Cost/Risk	Expected Benefits: - Direct impact under the community; - Cost related to courses and training; - Net positive benefits.
Change in Well-being	- Territorial Belonging; - Improved income; - Qualification to access professional opportunities; - Improvement in economic practices.

Community Group	Technical Assistance and Rural Extension Team
Impact(s)	- Access to training and technical capabilities; - Development of skills in activities on the forest maintenance and production chain; - Integration with new markets; - Job generation and income diversification; - Promotion of gender equity and opportunity for youngsters;
Type of Benefit/Cost/Risk	Expected Benefits: - Direct impact under the community; - Cost related to courses and training; - Net positive benefits.

Change in Well-being	- Territorial Belonging; - Improved income; - Qualification to access professional opportunities; - Improvement in economic practices.

4.2.2. Negative Community Impact Mitigation (CM2.2)

As mentioned in the topic above (4.2.1) the Corridors for Life ARR Grouped Project does not provide negative impacts on the well-being of local communities. Some potential risks are pointed out such as lack of interest from other stakeholders, decrease in population numbers due to rural exodus and no engagement of communities.

In order to mitigate these risks, some measures can be taken such as the consolidation of the involvement of all the parties involved in the decision-making processes of the Project activities, mainly in meetings, besides improving the already existing communication tools. In order to mitigate the rural exodus, a mitigation measure is to involve the community in the negotiations and decisions about the Project activities, besides the involvement in the proposed training and capabilities, providing an improved well-being for the population. As described in Section 2.3 Stakeholder Engagement, the project will consult the communities about the project activities every verification event (expected to occur every three years, as noted in section 2.1.15), following the "ECOnsulta" model.

For maintenance and improvement of the High Conservation Value Area (HCVA), activities related to the protection of the forest fragments and their seed collecting sites and seed bank have been proposed. These activities are focused on preventing forest fires and on promoting and training in sustainable seed collection practices, helping maintain the forest cover and avoiding the excessive collection of fruits that can reduce the forest ability to regenerate.

4.2.3. Net Positive Community Well-Being (CM2.3, GL1.4)

The Corridors for Life ARR Grouped Project proposes activities aimed at the social/economic and sustainable development of communities, improving their well-being and quality of life, by means of training and improvement of techniques aimed at the forest restoration chain.

In the without Project scenario, as described in Section 4.1.4, the low income context causes the families belonging to the communities to seek alternatives to increase their income from economic and subsistence activities performed in an unsustainable and unplanned way.

Thus, the Project expects to create opportunities for the communities causing the following net positive impacts:

- Promote the empowerment of local communities by expanding existing community nurseries, technical assistance companies, rural extension, forest planting and maintenance companies.
- Increase the engagement of communities from their participation in the Project's activities, as well as the strengthening of skills, knowledge and human capacities related to economic activities;
- Promote an efficient communication aimed at strengthening partnerships and integration with markets.

- Increase the levels of knowledge about sustainable practices, improving the population's perception as to the importance of forests and the opportunities brought about by restoration activities;
- Improve job and income opportunities for local communities through involvement in the restoration activities;
- Promote the emergence of new enterprises focused on the need to meet the Project such as, for example, nurseries and forest restoration companies.

The main problems that will be faced in this context are:

- Low access to public policies related to goods and services;
- Unsustainable economic activities, with low diversification and productivity;
- Difficulty of mobility and access.

As a project, the intention is to influence the social issues and the living conditions of communities within the Project Zone in such a way to reduce social vulnerability and rural exodus. The intention is also to provide families with an improved quality of life and a greater income stability that will enable them to obtain goods and services that promote economic and social well-being.

4.2.4. High Conservation Values Protected (CM2.4)

During the assessment conducted, no negative impacts on the high conservation value attributes related to social issues were identified (HCVA 6 - Section 4.1.3). However, should these be identified at some point in the future, measures should be taken to ensure that there are no net negative impacts on the attributes.

To ensure that no HCVA related to the community well-being are negatively affected, the proposed activities of the Corridors for Life ARR Grouped Project incorporate measures to protect and preserve the public and private forest areas used by the communities.

The activities developed by the project throughout its duration will allow positive impacts to be generated on areas of high conservation value, because they include measures for the maintenance of community-related attributes, such as the promotion of sustainable practices, technical capability and environmental education related to seed collection activities and the importance of seed banks. In addition, forest restoration of the landscape that will connect these fragments is also a key activity for sustainability and maintenance of these areas.

4.3. Other Stakeholder Impacts

4.3.1. Impacts on Other Stakeholders (CM3.1)

For the Corridors for Life ARR Grouped Project, negative impacts on other project stakeholders are not anticipated or are unlikely. On the other hand, it is possible to observe positive impacts of the Project on or in alignment with the goals of these players. Positive impacts anticipated for each stakeholder are shown below.

<u>Rural Landowners:</u>

- Environmental regularization and legal compliances of the rural property;

- Savings of resources with environmental regularization;
- Valuation of rural property;
- Access to markets that require environmental compliance;
- Environmental benefits due to the increase of native forest cover in the area;
- Improved reputation with the State and civil society.

Institutions of Technical Assistance and Rural Extension and Land and Environmental Regularization:

- Contribute to meeting the goals of the environmental agendas and commitments;
- Strengthen the legal certainty of the production chains.

Private Sector:

- Promote the environmental and productive adequacy of rural properties and promote the conservation and maintenance of natural resources.

NGOs and Other Social Movements:

- Contribute to meeting the goals of the environmental agendas and commitments;
- Encourage the development of public policies;
- Expand the acting and improve local governance;
- Encourage the production and dissemination of knowledge;
- Encourage participation, representativeness, active voice and political articulation for the valuation of rural settlements and family agriculture as a whole.

Other public institutions:

- Contribute to meeting the goals of the environmental agendas;
- Promote an increased job generation;
- Expand the acting and improve local governance;
- Disseminate environment knowledge intended for mitigating the environmental risks.

Research and Extension Institutions:

- Promote the development of researches to contribute to the professional training, scientific advancement, biodiversity conservation and social/economic development.

We can emphasize that all local communities, as well as other players living in the project region, whether or not participating in the project activities, will benefit from all the positive impacts related to forest cover restoration and biodiversity protection. All communities and other players will benefit from the sustainable development and opportunities generated by the Project activities, improving their quality of life and well-being.

As indicated above, negative impacts of these activities are unlikely and may be:

- No engagement of communities and other players in Project activities and other articulations;
- Failure in reporting on the Project actions and the occurrence of possible conflicts arising from the implementation and conduction of the activities.

4.3.2. Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

As mentioned above, the occurrence of negative impacts on other Players is not expected in this Project. Mitigating measures include the implementation of participatory strategies in the design of the activity and the decision-making regarding the most appropriate timing and structure of interaction among them.

4.3.3. Net Impacts on Other Stakeholders (CM3.3)

As described and detailed in Section 4.3.2, other negative impacts on the well-being of other local player groups are not anticipated, as the Project does not limit access to natural resources for any agent originally dependent on these resources. The Project goals aim only at impacts that promote inclusion and well-being for communities and other stakeholders.

4.4. Community Impact Monitoring

4.4.1. Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

Indicators associated with human well-being, social harmony, economic development, and governance help elucidate the progress of a carbon project (Le et al., 2012). The social function is monitored by indicators related to local community perception and social and economic development, such as technical capability and income generation (Rigueira et al., 2013). Therefore, choosing the social indicators that cause the success of restoring forests makes up a solid foundation for the development of successful long-term projects that are beneficial to man and the planet (Chazdon et al., 2013).

a) Technical description of monitoring tasks:

The monitoring of benefits to communities aims to access the effectiveness of the activities listed in the theory of change: i) Capability of local communities in the restoration chain and environmental awareness; ii) Research, development, innovation of project activities; iii) Acquisition of native forest seedlings and contracting of forest restoration and maintenance services from local communities.

At the same time, it is worth noting that the monitoring of HCVs for the community (forest fragments, areas undergoing restoration and germplasm banks) will be carried out through monitoring the forest cover of these areas and technical training and capacity building with the community nursery team in methods and adequate amounts of seed extraction.

The HCVs Morro do Diabo State Park (PEMD), Mico Leão Preto Ecological Station (ESEC), and Rio do Peixe State Park (RBMA), despite being forest fragments with native trees, are fully protected conservation units, not occupied by communities, and whose resources - including seeds - cannot be used by the surrounding community. Government policing agencies patrol these areas to prevent the removal of natural resources or settlement of people. In this way, the monitoring indicators for these HCVs refer only to the monitoring of the Biodiversity component, which will be carried out by monitoring the biodiversity of fauna and flora (Table 36).

b) Data to be collected:

Theme	Activity (Theory of Change)	Indicator	Unit	Frequency	Method Description
Community	Training of local communities in the chain of environmental restoration and awareness / Research, development and innovation of the project activities.	Number of events performed.	Number of events	1 year	Record of the number of courses, events and workshops with Community
Community	Training of local communities in the chain of environmental restoration and awareness / Research, development and innovation of the project activities.	Number of participants	Number of people	1 year	Record of the number of people from the Community participating in courses, events and workshops through a list of attendance and other records.
Community	Training of local communities in the chain of environmental restoration and awareness / Research, development and innovation of the project activities	Number of women and young people participating.	Number of people	1 year	Record of the number of women and young people from the Community who participate in courses, events and workshops through a list of attendance and other records.
Community	Training of local communities in the chain of environmental restoration and awareness / Research, development and innovation of the project activities	Number of trained people who are employed in extension and rural assistance	Number of people	2 years	Accounting for the number of trained people working in the extension and rural assistance project.
Community	Acquisition of native forest seedlings and hiring of forest restoration and maintenance services from local communities.	Number of people employed in the restoration service providing companies.	Number of people	1 year	Accounting of the number of people who work in restoration service providing companies who acted in the project.
Community	Acquisition of native forest seedlings and hiring of forest restoration and maintenance services from local communities.	Number of women and young people employed in the restoration service providing companies.	Number of people	1 year	Accounting of the number of women and young people who work in restoration service providing companies who acted in the project.

Community	Acquisition of native forest seedlings and hiring of forest restoration and maintenance services from local communities.	Number of people employed in the forest nurseries.	Number of people	1 year	Accounting of the number of people who work in forest nurseries which supply seedlings for the project.
Community	Acquisition of native forest seedlings and hiring of forest restoration and maintenance services from local communities.	Number of women and young people employed in the forest nurseries.	Number of people	1 year	Accounting of the number of women and young people who work in forest nurseries which supply seedlings for the project.

Table 25 - Community Indicators.

It should be noted that the monitoring plan (Table 25) will also support the monitoring and reporting of the project's contributions to the sustainable development objectives, as explained in section 2.1.12.

In association, with regard to HCVs for communities, the following parameters will be evaluated in monitoring:

Forest cover monitoring: using digital platforms such as Mapbiomas, it will be possible to monitor the forest cover of HCVs for the community to oversee the continued existence of these areas for the communities. More details on the 'Habitat conservation' indicator in table 36.

Community training: using the already consolidated local knowledge of the community and the other techniques for collecting seeds from the literature, continuous training of communities will be carried out regarding the time of collection, method of collection, adequate amount of collection and breaking of seed dormancy seeds of native species produced in nurseries, in order not to harm the dynamics of the forests. Part of this training will be carried out in partnership with Redário.org (Native Seed Network Management System). Redário is an ecosystem formed by the union of Networks and groups of seed collectors from all Brazilian biomes as a space to ensure greater efficiency in the provision of native seeds in a socially fair, transparent and sustainable way, facing competition in the market. These activities are included in the theory of change activity 'Training of local communities in the chain of environmental restoration and awareness.'

4.4.2. Monitoring Plan Dissemination (CM4.3)

The Community Monitoring Plan and all its results will be publicly disclosed on the official website of Biofília Ambipar Environment, in the tab especially dedicated to the Corridors for Life ARR Grouped Project. All relevant information, the summary of the monitoring plan and its conclusions will be made available to the community, proponents, partners and other stakeholders by means of meetings and talks, with an emphasis on the monthly meeting, "Friday with Science", devised by IPÊ, historically implemented by the organization and oriented to the communities and other stakeholders in the Project Zone. Also, physically at the premises of the Institute of Ecological Researches office, in Teodoro Sampaio (SP), at the Alvorada Nursery and the PCL Law firm in Presidente Prudente (SP).

4.5. Optional Criterion: Exceptional Community Benefits

Not applicable.

4.5.1. Exceptional Community Criteria (GL2.1)

Not applicable.

4.5.2. Short-term and Long-term Community Benefits (GL2.2)

Not applicable.

4.5.3. Community Participation Risks (GL2.3)

Not applicable.

4.5.4. Marginalized and/or Vulnerable Community Groups (GL2.4)

Not applicable.

4.5.5. Net Impacts on Women (GL2.5).

Not applicable.

4.5.6. Benefit Sharing Mechanisms (GL2.6)

Not applicable.

4.5.7. Benefits, Costs, and Risks Communication (GL2.7)

Not applicable.

4.5.8. Governance and Implementation Structures (GL2.8)

Not applicable.

4.5.9. Smallholders/Community Members Capacity Development (GL2.9).

Not applicable.

5. BIODIVERSITY

5.1. Without-Project Biodiversity Scenario

5.1.1. Existing Conditions (B1.1)

The Atlantic Forest biome, in Brazil, occurs along the Atlantic Ocean coast from the northeast region, in the State of Rio Grande do Norte, to the south region, in the State of Rio Grande do Sul, including most of the State of São Paulo. This biome presents a unique diversity of forest types, covers an area of approximately 15% of the total Brazilian territory, and occurs from a stretch along the Atlantic coast to the interior of the mainland in some Brazilian states, and also in Paraguay and Argentina. As presented in Figure 42, the Project Area is inserted in the Atlantic Forest Biome, specifically in the ecoregion called Interior Atlantic Forest, and also presents a transition area with the Cerrado Biome.

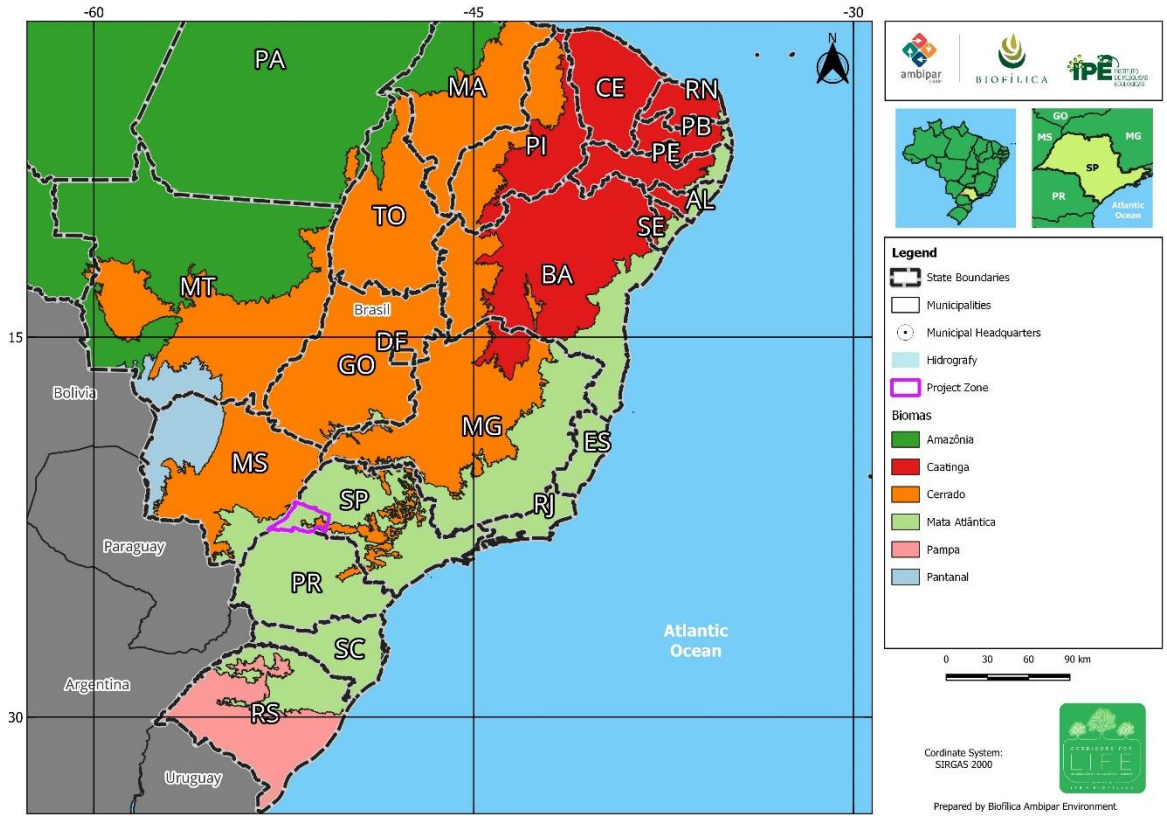


Figure 42 – Location of the project area in the Atlantic Forest biome.

The Atlantic Forest biome is considered one of the most threatened biodiversity hotspots as highlighted by Laurence (2009). The term biodiversity hotspot was defined by Myers and collaborators (2000) to designate places where at least 1,500 endemic vascular plant species occur and which have already lost at least 70% of their original area. This Biome enjoys national recognition according to § 4, Article 225 of the Brazilian Constitution[31], where the Atlantic Forest is considered a national heritage site, and its use will occur, within conditions that ensure the environment preservation, including the use of natural resources. It also enjoys international recognition as an Atlantic Forest Biosphere Reserve - RBMA[32], recognized by UNESCO, in seven successive phases between 1991 and 2019.

[31] Constituição da República Federativa do Brasil de 1988.
[32] Reserva da Biosfera da Mata Atlântica

According to the annual report of the NGO SOS Mata Atlântica (2021), only 12.4% of the original forest remains currently and, from these remnants, 80% are in private areas. Although these fragments are legally protected, they are actually endangered due to the edge effect of neighboring agricultural uses (fire, grazing, poaching, etc.). In this context, the main conservation option is to increase the feasibility of the remaining forest fragments and integrate forest species with farming land and pastures across the landscape.

The State of São Paulo Forest Institute (IF) prepares the State Forest Inventory following the methodology defined by the Brazilian Institute of Geography and Statistics (IBGE, 2012)According to the data presented in the 2020 inventory, the largest forest fragments in the state are concentrated on the coast, while in the Project Area the fragment protected by the Morro do Diabo State Park stands out as one of the largest in the region, isolated in the west of the state and distant from the large fragments mapped on the São Paulo State coast. With regard to the Project Zone, as presented in Section 2.1.7, the remaining native forest cover of the Corridors for Life ARR Grouped Project amounts to approximately 140,000 hectares.

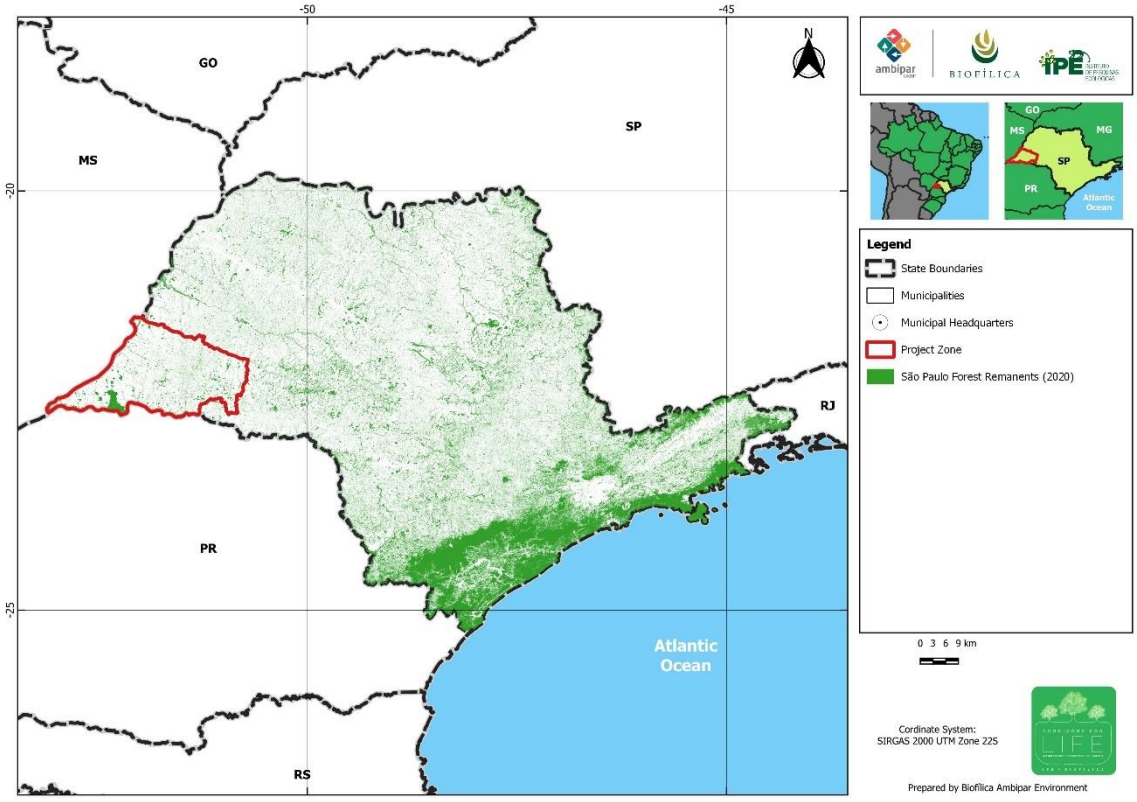


Figure 43 - Forest fragments from the 2020 inventory.

The predominant forest formation in the region is the Seasonal Semideciduous Forest, interspersed with some patches of cerrado (IF, 2020). Generally speaking, this forest formation reaches 20 meters in height, is poor in epiphytes when compared to the Dense Ombrophylous Forest, and has a thin understory. The predominant tree species belong to the Leguminosae, Meliaceae, Euphorbiaceae, Myriaceae, Lauraceae, Apocynaceae, and Rubiaceae families, with several species of economic value such as the peroba (*Aspidosperma* spp.), the jatoba (*Hymenaea courbaril* L.), jequitibás (*Cariniana* spp), aroeira (*Astronium urundeuva* (M.Allemão) Engl.), angicos (*Piptadenia* spp), ipês (*Tabebuia* spp), and pau d'alho (*Gallesia integrifolia* (Spreng.) Harms). Currently, only 1.8% of the original cover of the Semidecidual Seasonal Forest remains.

In addition to the Seasonal Semideciduous Forest, the following physiognomies also occur in smaller proportions in the Project Area: Pioneer Formation with River Influence, Wooded Savanna and Forested Savanna. These physiognomies mapped by the Forestry Institute (IF, 2020) are spatialized in Figure 44. In the Project Area, only 8% of the original forest cover remains, a figure well below the 30% needed to maintain specialist forest species as pointed out by Banks-Leite and collaborators (2014).

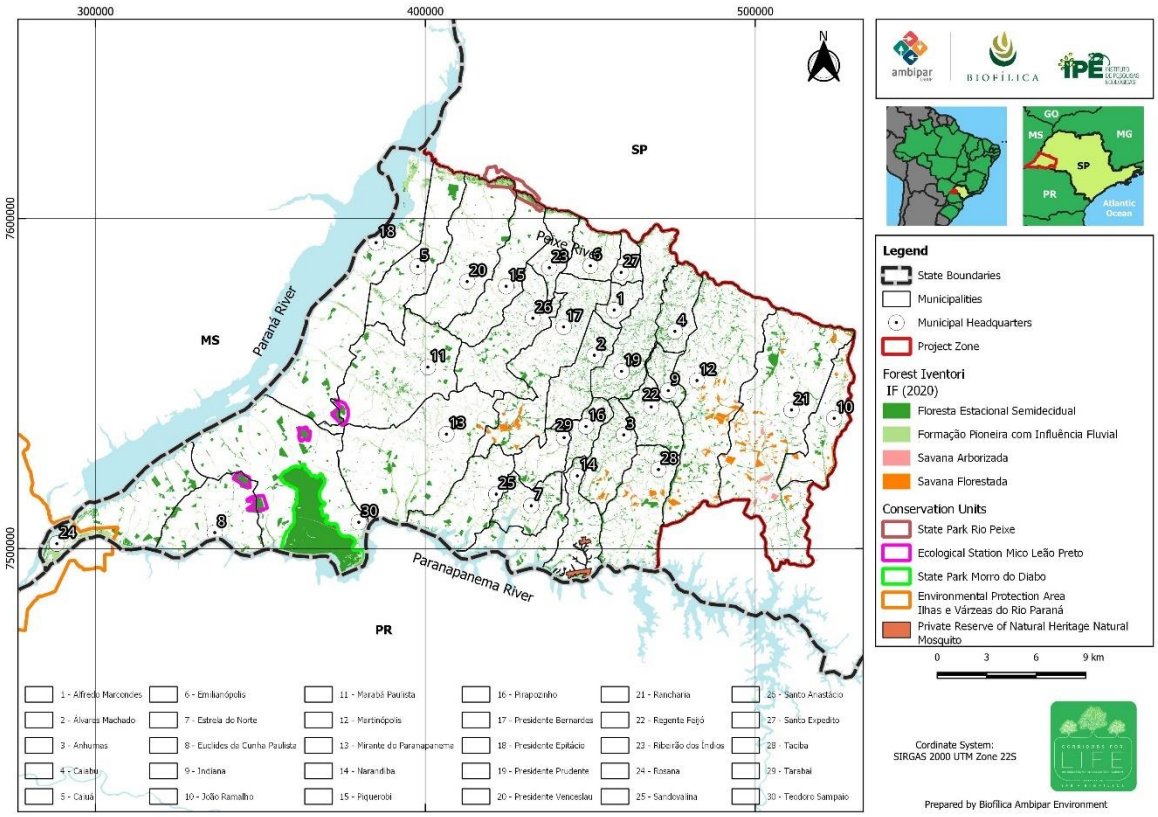


Figure 44 - Phytophysiognomies Mapped by the 2020 Forest Inventory | Source: 2020.

The Morro do Diabo State Park, with an area of approximately 34 thousand hectares, keeps a representative sample of the region's original vegetation and is the second largest forest remnant of the Atlantic Forest Phytophysiognomy Semidecidual Seasonal Forest (Uezu, Beyer and Metzger, 2008) (Figure 45). Also noteworthy are the forest fragments protected by the Mico-Leão-Preto Ecological Station and a significant extension of forest protected by the Rio do Peixe State Park which, although it has a low diversity of tree species, gains importance by its association with aquatic and transition environments. These are the largest fragments in the region and are isolated and pressured by the agriculture and ranching areas.

Figure 45 - The fragment protected by the Morro do Diabo State Park.

When analyzing the phytophysiognomy of two forest fragments near Morro do Diabo State Park, called Estrela fragment and Água Sumida fragment, Durigan and colleagues (2002) found mean diversity values equivalent to other Semidecidual Forest areas in the state, and slightly lower than those of Morro do Diabo State Park (Durigan, Santos and Gandara, 2002). The most abundant species in the two fragments studied by Durigan and collaborators (2002) was *Plinia rivularis* (Cambess.) Rotman, while Ditt (2000) identified Eugenia repanda O.Berg as the most abundant in twelve fragments from western São Paulo. In general, the tree flora of the Estrela and Água Sumida fragments is quite similar to that of Morro do Diabo State Park forest (Durigan, Santos, and Gandara, 2002). The Table 26, based on data raised by Durigan and collaborators (2002), shows the species identified in each fragment in descending order of Importance Value Index (IVI).

Table 26 – Species in descending order of IVI.

Água Sumida Fragment	Estrela Fragment
Plinia rivularis (Cambess.) Rotman	*Plinia rivularis* (Cambess.) Rotman
Chrysophyllum gonocarpum (Mart. & Eichler ex Miq.) Engl.	*Croton floribundus* Spreng.
Croton floribundus Spreng.	*Ficus insipida* Willd.
Garcinia gardneriana (Planch. & Triana) Zappi	*Duguetia lanceolata* A.St.-Hil.
Astronium graveolens Jacq.	*Astronium graveolens* Jacq.
Ficus guaranitica Chodat	*Helietta apiculata* Benth.
Aspidosperma polyneuron Müll.Arg.	*Eugenia psidiiflora* O.Berg
Duguetia lanceolata A.St.-Hil.	*Cecropia pachystachya* Trécul
Acacia polyphylla DC.	*Ocotea indecora* (Schott) Mez
Peltophorum dubium (Spreng.) Taub.	*Nectandra cuspidata* Nees

Upon the study completion, Durigan and collaborators (2002) draw attention to the occurrence of species heavily exploited by selective logging, for example, *Maclura tinctoria* (L.) D.Don ex Steud., *Colubrina glandulosa* Perkins, *Cedrela fissilis* Vell., *Sweetia fruticosa* Spreng. and *Hymenaea courbaril*

L. Besides these, no adult individual of Cabreúva (*Myroxylon peruiferum* L.) was sampled, although being common in the region. For these species, there is a great commitment to maintain the structure and genetic diversity in the forest fragments of the project region, because they suffer an intense exploitation for their highly valued wood for both furniture construction and for finishing in civil construction, as well as for building fences and tool handles (São Paulo, 2006).

The list of threatened species of the International Union for Conservation of Nature (IUCN[33]) includes species that are likely to become extinct according to existing information on their population trends. In the project region there are five species in the threatened species list, as presented in Table 27.

Table 27 - List of Threatened Flora Species.

Family	Popular Name	Scientific Name	Classification (IUCN)
Apocynaceae	Peroba-rosa	*Aspidosperma polyneuron* Müll.Arg.	Endangered (EN)
Bignoniaceae	Ipê-felpudo	*Zeyheria tuberculosa* (Vell.) Bureau ex Verl	Vulnerable (VU)
Lecythidaceae	Jequitibá-rosa	*Cariniana legalis* (Mart.) Kuntze	Vulnerable (VU)
Meliaceae	Cedro-rosa	*Cedrela fissilis* Vell.	Vulnerable (VU)
Rutaceae	Pau-marfim	*Balfourodendron riedelianum* (Engl.) Engl.	Threatened (EN)

The Pontal do Paranapanema forest fragments are the last natural refuges not only for these flora species, but also for several species of fauna. The work by Jenkins and collaborators (2015) estimates that above 100 species of mammals, 439 species of birds, and 30 species of amphibians occur in the project region. Table 28 presents some endangered species occurring in the project area, as well as their classification according to the IUCN List of Threatened Species.

Table 28 - IUCN List of Threatened Species.

Class	Family	Popular Name	Scientific Name	Classification (IUCN)
Mammalia	Callitrichidae	Black lion tamarin	*Leontopithecus chrysopygus*	Endangered (EN)
Mammalia	Atelidae	Howler monkey	*Alouatta guariba*	Vulnerable (VU)
Mammalia	Felidae	Jaguar	*Panthera onca*	Near Threatened (NT)
Mammalia	Felidae	Ocelot	*Leopardus pardalis*	Least Concern (LC)
Mammalia	Felidae	Puma	*Concolor cougar*	Least Concern (LC)
Mammalia	Felidae	Macarajá cat	*Leopardus wiedii*	Near Threatened (NT)
Mammalia	Felidae	Bobcat	*Leopardus tigrinus*	Vulnerable (VU)
Mammalia	Mustelidae	Gian otter	*Pteronura brasiliensis*	Endangered (EN)
Mammalia	Myrmecophagidae	Giant anteater	*Myrmecophaga tridactyla*	Vulnerable (VU)
Mammalia	Chlamyphoridae	Giant armadillo	*Priodontes maximus*	Vulnerable (VU)
Mammalia	Tapiridae	Tapir	*Tapirus terrestris*	Vulnerable (VU)
Mammalia	Tayassuidae	Peccary	*Tayassu pecari*	Vulnerable (VU)
Reptilia	Alligatoridae	Yellow-bellied cayman	*Caiman latirostris*	Least Concern (LC)
Reptilia	Boidae	Boa	*Boa constrictor*	Least Concern (LC)
Reptilia	Boidae	Anaconda	*Eunectes murinus*	Least Concern (LC)
Birds	Tinamidae	Macuco	*Tinamus solitarius*	Near Threatened (NT)

[33] https://www.iucnredlist.org/

Birds	Tinamidae	Shouthern jaó	*Crypturellus noctivagus*	Near Threatened (NT)
Birds	Accipitridae	Pigeon hawk	*Pseudastur polionotus*	Near Threatened (NT)
Birds	Accipitridae	Duck hawk	*Spizastur melanoleucus*	Least Concern (LC)
Birds	Accipitridae	Black-collared hawk	*Spizaetus tyrannus*	Least Concern (LC)
Birds	Psittacidae	Purple-bellied parrot	*Amazona vinacea*	Endangered (EN)
Birds	Psittacidae	Red macaw	*Ara chloroptera*	Least Concern (LC)
Birds	Psittacidae	Hyacinth macaw	*Ara ararauna*	Least Concern (LC)
Birds	Cathartidae	King vulture	*Sarcoramphus papa*	Least Concern (LC)

From the species described above the presence of Jaguar is noteworthy for being the largest feline in the Americas and because its occurrence in the Atlantic Forest biome is in a steady decline (Galetti et al., 2013) (Figure 46). The work of Beisiegel and collaborators (2012) draws attention to an estimation of less than 250 mature specimens alive in this biome, who are distributed in eight isolated populations, one of them occurring in the Pontal do Paranapanema region. The most serious threats, according to these authors, are the loss, fragmentation and degradation of their natural habitat, the reduced population of their preys, as well as hunting (Beisiegel, Sana and Moraes, 2012). In the project region the authors estimate that these threats have led to a reduction of at least 50% of the population over the past 15 years, currently remaining 52 adult individuals. Cullen et al. (2016), suggests that jaguar populations in the upper Paraná River basin have much lower persistence in the next 100 years when population viability models included no dispersal, indicating that the persistence of these populations are dependent to a large extent on dispersal from other populations. The constant trend of decline in this population could lead this species to extinction in the Atlantic Forest in 88 years (Beisiegel, Sana, and Moraes, 2012). These big predators control the populations of herbivores and small predators, and their extinction would bring great harm to the ecosystem.

Figure 46 - Jaguar, present in the remnants of native forests in the Project Zone.

Among the Jaguar's potential preys that occur in the project region, the Tapir (*Tapirus terrestris*) stands out as a large mammal occurring in low density populations and has a low reproduction rate (Medici and Desbiez, 2012). In addition, it is very susceptible to anthropic pressures that cause from population decline to local extinction. When studying this species in the project region, Medici and Desbiez (2012) report the occurrence of approximately 126 individuals of this species inside Morro do Diabo State Park, and in 7 forest fragments in its surroundings. The authors also report that road kill is the main threat to this group in this region, and point to the creation of forest corridors connecting the fragments as essential for this population to remain in the project region (Medici and Desbiez, 2012).

Another extremely endangered species that occurs in the region is the Black Lion Tamarin (*Leontopithecus chrysopygus*), one of the rarest primates of the New World and endemic to the State of São Paulo (Figure 47). This species was considered extinct until it was rediscovered in Morro do Diabo State Park by Coimbra-Filho research (1970). In the work of Valladares-Pádua and Cullen Jr. (1994), a population of 821 individuals was estimated in the Morro do Diabo State Park fragment, and 42 individuals in other fragments of the region. The survival of this species in the natural environment depends on the migration of individuals between these populations.

Figure 47 - Black lion tamarin, endemic and endangered specie present in the remnants of native forests in the Project Zone.

In the fragmented landscape of the project region, metapopulations of endangered species, as described above, are still feasible due to the existence of Morro do Diabo Park, and the larger fragments that still contain part of the original fauna and flora. Metapopulations are defined by Robinson and Fleischner (2004) as a network of totally or partially isolated populations, but with some level of regular or intermittent migration and gene flow between them. Individual populations, in this context, can become extinct as well as be recolonized from individuals of other populations. Thus, the connection between forest fragments, either by forest corridors or forest stepping stones, is the main goal that should be sought to maintain these metapopulations feasible (Valladares-Padua; Cullen Jr., 1994).

5.1.2. High Conservation Values (B1.2)

Originally, the concept of high conservation value attributes was developed by the FSC for the certification of forest ecosystems. However, currently, it has been expanded and applied to other ecosystems; including guidelines approved by the High Conservation Values Network and Resources. In this sense, with regard to biodiversity, according to the CCB Standard, attributes of high conservation value refer to those of particular importance for the conservation of biodiversity at all levels. In short, these areas are essential for the conservation of endemic and endangered species, as well as the conservation of areas of significant size that support large concentrations of species. High Conservation Value Areas (HCVA) have unique characteristics, such as significant concentration of biodiversity, seasonal concentration of species, threatened and rare ecosystems, presence of endangered species, provision of essential ecosystem services, social, historical, and cultural values, among others. In this context, as defined by the HCV Resource Network[34], HCVAs are categorized into six types, described in Table 29.

[34] http://hcvnetwork.org/

Table 29 - Categories of HCVAs, according to HCV Resource Network.

ID	Category	Description
1	Species diversity	Concentration of biological diversity, including endemic species, and rare, threatened or endangered species on a global, regional or national level.
2	Large landscape-level ecosystems, ecosystem mosaics and intact forest landscapes (IFL)	Large landscape-level ecosystems, ecosystem mosaics and Intact Forest Landscapes (IFLs), which are significant on a global, regional or national levels, and containing viable populations of the great majority of naturally occurring species.
3	Ecosystems and Habitats	Rare, threatened or endangered ecosystems, habitats or shelters
4	Ecosystem Services	Basic ecosystem services in critical situations, including protection of water sources and erosion control of vulnerable soils and slopes
5	Community Needs	Areas and resources which are key to meeting the basic needs of local communities or indigenous peoples (for livelihoods, health, nutrition, water, etc.), identified through engagement with these communities or indigenous peoples.
6	Cultural Values	Areas, resources, habitats or landscapes of cultural, archaeological, economic, or religious/sacred significance which are critical to the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples.

For the HCVAs in the Project Area, the guidelines for identification, management and monitoring of high values were considered, as established by Watson and collaborators (2020) and CCB (2017). As presented in the previous topics the project region is located mostly in the Atlantic Forest Biome, with some transition areas to the Cerrado Biome. In addition, endemic and endangered species of fauna and flora occur in this area. In this context, the project region identified HCVAs categorized as 1 and 3 in the in the Table 29 above. These areas will be described below.

To identify the forest fragments most important for landscape connectivity in the project region, the Conefor Software was used[35]. Conefor is a software that allows quantifying the importance of forest fragments for maintaining or improving the landscape connectivity (Saura and Torné, 2009). To model this scenario, Conefor works with graph structures, where the fragments classed by area (ha) are understood as graphs, and the possible distances between these fragments are represented by vectors of lines – simulating the possible flow of flora and fauna species between the fragments (Saura and Torné, 2009). The graph structure enables the identification of fragments that are important for habitat connectivity and, consequently, for long-term population persistence (Minor and Urban, 2007).

Two criteria were used to estimate the importance for connectivity of the forest fragments, the area of the fragments and the distances between them. To represent the importance of these fragments we used the Integral Index of Connectivity (IIC), whose value ranges from 0 to 1, with 0 being of little relevance for connectivity and 1 of extreme relevance (Pascual-Hortal and Saura, 2006). In a scenario in which a forest fragment has a small area and is geographically isolated, the IIC value tends to 0. In a scenario where a fragment presents a large area and is close to other fragments, the IIC value tends to be 1.

The Figure 48 shows the IIC value calculated for each forest fragment using the Conefor software.

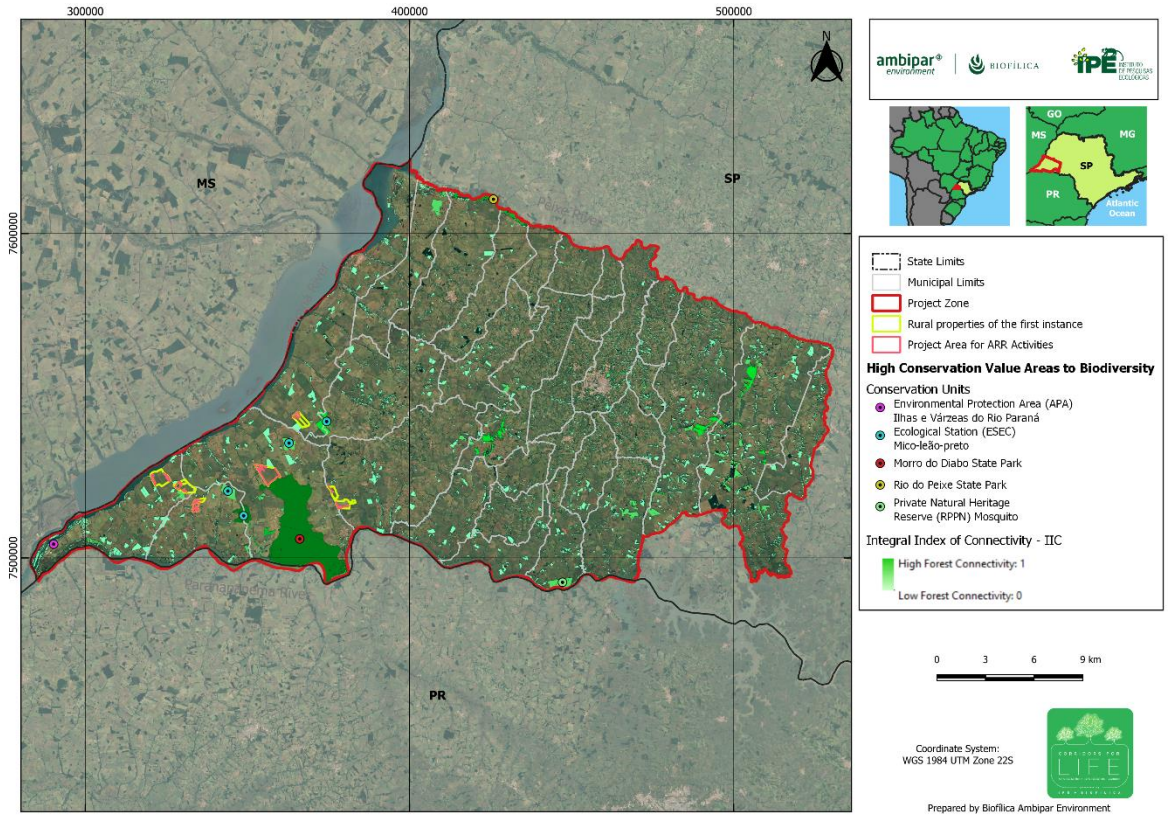


Figure 48 - IIC Value calculated for each forest fragment.

Based on the criteria and analysis described above, HCVAs of types 1 and 3 have been identified in the project region. These areas will be described below.

[35] http://www.conefor.org/

Table 30 - Identification of Areas of High Conservation Value in the Area of the Corridors for Life ARR Grouped Project.

High Conservation Value	Atlantic Forest Biome
Qualifying Attribute	The Atlantic Forest biome is regarded as one of the most threatened biodiversity hotspots as highlighted by Laurence (2009) and Mayers (2000). This ecosystem contains approximately 20,000 plant species, over 1,400 terrestrial vertebrate species and thousands of invertebrate species, many of which are regionally or locally endemic.
Focal Area	Atlantic Forest Biome Area in the Project Region.

High Conservation Value	Integral Protection Conservation Units within the Project Zone
Qualifying Attribute	The fragment protected by the Morro do Diabo State Park stands out as the largest sample of the State's Tropical Seasonal Semideciduous Forest. It is also one of the only four protected areas with more than 10,000 ha containing this type of vegetation in the country. Endemic and threatened populations of fauna and flora occur in this fragment. The Mico-Leão-Preto Ecological Station (ESEC MLP) is a federal unit, created by a Decree on July 16, 2002, and had its boundaries changed in 2004. The Unit contains 6,677 ha, divided into four plots, Santa Maria, Água Sumida, Ponte Branca and Tucano, distributed in the municipalities of Teodoro Sampaio, Euclides da Cunha Paulista, Marabá Paulista and Presidente Epitácio, in the State of São Paulo. Its purpose, as stipulated in its creation decree, is to protect remnants of the Semideciduous Seasonal Forest, also known as the Interior Atlantic Forest. It also intended, as the name indicates, for protecting the populations of the black lion tamarin (*Leontopithecus chrysopygus*), one of the most endangered primate species in the world. The Rio do Peixe State Park is considered a core area of the Atlantic Forest Biosphere Reserve (RBMA) due to the existence of the Semideciduous Seasonal Forest Formation and typical floodplain vegetation with a rich

	aquatic avifauna and endangered species in the State of São Paulo western region.
Focal Area	Remnants of Forest Fragments in the Morro do Diabo State Park, Mico-Leão-Preto Ecological Station and Rio do Peixe State Park. It is worth mentioning that, as presented in Section 2.1.7 of this document, in addition to the Conservation Units, the Project Zone has approximately 140,000 hectares of native forest remnants.

High Conservation Value	Threatened species of flora and fauna
Qualifying Attribute	Threatened species occur in the project region, including 4 species of flora, 12 of mammals, 3 of reptiles and 9 of birds. Protecting forest remnants and increasing connectivity through corridors and stepping stones is essential for the feasibility of these populations.
Focal Area	Remnants of Forest Fragments

5.1.3. Without-project Scenario: Biodiversity (B1.3)

According to Landscape Ecology concepts, the matrix is the element of a landscape that takes the largest area, has the most extensive connectivity or exerts the greatest influence on patches, which are the elements inserted in the matrix (Kupfer et al., 2006). The project region represents a fragmented natural landscape, as the patches of native vegetation are separated by a heterogeneous and anthropized agricultural matrix. This agricultural matrix hinders and prevents the movement of organisms between the native forest patches (Uezu, Beyer, and Metzger, 2008).

Considering the historical changes and trends in land use and occupation mapped by MapBiomas[36] (Souza at. al., 2020), and presented in section 2.1.6., the pasture areas for beef cattle are the predominant land use in the region. According to Dias-Filho (2011), the management practice of these pastures intensifies their degradation, reducing the production potential of these areas and intensifying erosive processes (Municipality of Rosana, 2016).

Although still predominant, these pasture areas have been gradually replaced by intensive cultivation of sugarcane and soybeans in the large properties with soil suitable for such crops. Intensive monocultures require the use of agrochemicals, which long-term impact on fauna and flora is still unknown. In some cases sugarcane is still managed with fire, affecting the surroundings and the interior of the forest fragments.

The traditional way of cattle raising, in the region causes compaction, erosion, contamination and loss of biological activity in the soil, which results in highly degraded pastures (Dias-Filho, 2011). Furthermore, without proper fencing, cattle access the interior of the existing small forest fragments, changing their structure and composition, and compacting the soil around rivers and water springs. Over time, this process reduces the water balance, increases organic and chemical pollution, and the

[36] https://mapbiomas.org/en/o-projeto?cama_set_language=en

water eutrophication. Other threats to forest fragments are fires, the spread of invasive grasses, and the use of pesticides (Cullen-Jr. et al., 2001).

In rural settlements, the practice of extracting wood from nearby forest fragments for fences and small constructions still occurs. When studying the phytophysiognomy of forest fragments in the region, Durigan and collaborators (2002) emphasize the small number of forest species that are heavily exploited by selective logging. For the authors, the maintenance of the structure and genetic diversity of these species is compromised (Durigan, Santos, and Gandara, 2002).

As the predominant land use matrix is monoculture of agricultural production, both the large fragment of Morro do Diabo State Park and the other smaller fragments are isolated, especially the remnants of native forest present on private rural properties. This matrix is not much permeable for the region's endemic flora and fauna, putting at risk the long-term maintenance of threatened species in the region (Uezu, Beyer and Metzger, 2008; Baum et. al., 2004).

The Black Lion Tamarin is an example of a species threatened with extinction due to the low number of individuals in isolated populations in forest fragments within the project region (Valladares-Padua; Padua; Martins, 2001). This species presents a continued decline and the main threat factors, currently, are related to demographic problems due to habitat loss, fragmentation, and disconnection from habitat (ICMBIO, 2018).

The Brazilian Tapir has been listed as Vulnerable to Extinction based on past reductions of more than 30% in population abundances, as well as on declines higher than 30% in the occupation area, range of occurrence and the habitat quality, particularly in the Atlantic Forest and Cerrado biomes (ICMBIO, 2018). Considering that the reduction in the Atlantic Forest population could reach at least 50% in the next three generations or 33 years (ICMBIO, 2018).

The constant reduction and isolation of forest fragments also affects the Jaguar, which needs large remnants for their population feasibility (Cullen et al, 2016; ICMBIO, 2018). In addition, the species is actively persecuted for cultural reasons and also for slaughtering domestic livestock (ICMBIO, 2018).

In this context, the increased connectivity of forest fragments through forest corridors and agroforestry systems, acting as dispersal routes favor a greater richness of generalist species, and are more interesting for conservation than monoculture systems (Uezu, Beyer and Metzger, 2008). Despite the actions of NGOs and the State in forest restoration and encouragement of agroforestry and silvopastoral crops, these actions are concentrated on the surroundings of Morro do Diabo State Park. Without the expansion and encouragement for the entire Project Zone, rural properties will not comply with the current Environmental Law, and the remaining forest fragments will remain highly isolated.

5.2. Net Positive Biodiversity Impacts

5.2.1. Expected Biodiversity Changes (B2.1)

The changes for biodiversity resulting from the Project activities are based on the Theory of Change (Section 2.1.11). From the Theory of Change analysis, it was possible to envisage the cause and effect relationship between the initiatives proposed by the project, the actions involved, their expected results and impacts in the short, medium and long term.

Thus, all the activities for biodiversity were planned with a focus on promoting an increase in native vegetation cover through restoration and facilitation of natural regeneration of 75,000 hectares in the Project Zone, in addition to preserving the approximately 140,000 remaining hectares of native forests in the scope of the carbon project, providing changes in the future expectations of the region. . It is worth mentioning that, eventually, according to the demand and interest of the rural owner, exotic species adapted and non-invasive to the Project Zone may be implanted in the Project Area in order to promote climatic and environmental benefits to the rural properties and the Project. As detailed in topics

5.2.5 and 5.2.7 of this document, individuals of exotic species will be used in specific cases (especially windbreaks and hedges in reforestation areas), and in small quantities.

For biodiversity, the main changes compared to the Project scenario are related to habitat generation and increased connectivity between forest fragments, providing conservation of fauna and flora species; especially those threatened with extinction, whose populations tend to decline if the current land use and occupation in the region is maintained, without the intervention of a carbon project AR (Arroyo-Rodríguez et al., 2020).

In short, the expected changes for the Project biodiversity are:

- Increased native forest cover and habitat for fauna;

- Increased matrix quality;

- Increased connectivity between forest remnants;

- In situ conservation of native tree species;

- Preservation of a high number of forest parches;

- Contribution to the conservation of endangered species;

- Long-term population feasibility of endangered species;

- Reduction of threat levels according to the IUCN Red List.

The Table 31 shows details of the expected changes in biodiversity in the Project Zone during the Project lifetime.

Table 31 – Expected changes to biodiversity from the activities contemplated by the Corridors for Life ARR Grouped Project.

Biodiversity Element	Native forest cover
Estimated Change	Positive
Justification of Change	Restoration and natural regeneration activities increase the native vegetation cover in areas with irregular land use and occupation under Brazilian environmental legislation. When properly implemented at the field, these activities help to increase native forest vegetation in areas previously occupied by other land uses. The forest areas favors the recruitment and establishment of flora species of different successional groups, the in situ conservation of native tree species, the formation of habitat and transit sites for fauna, and the protection of soil and water resources. In addition, auxiliary management practices, such as removal of degradation filters (control of leaf-cutting ants, exotic lianas, and undergrowth competition) and selection of potential species, accelerate the structural reconstruction of reforestations (Ferez et al., 2015). Finally, the encouragement of research, development, and innovation activities within the restoration theme helps to improve initiatives at the field, adaptive management recommendations, and to ensure the achievement of the intended goals; enabling a continuous improvement of actions and the promotion of public policies (Belloto et al., 2009).

Biodiversity Element	Landscape Connectivity
Estimated Change	Positive
Justification of Change	Reforestation activities contribute to the formation of ecological corridors between remaining forest fragments and areas in the process of recovery; helping to ensure that an extensive forest continuum promotes fauna and flora dispersal, favoring the gene flow and the maintenance of native species (Martensen, Pimentel and Metzger, 2008; Alzate and Onstein, 2022). In general, ecological corridors help reduce the negative effects of fragmentation of ecosystems, especially associated with the vulnerability and permissiveness of habitats that can lead to changes in population growth rate, decreased length and diversity of the trophic chain and modification of species interactions, thus promoting the displacement and exchange of fauna, seed dispersal and colonization, and reduced risk of species extinction (Seoane et al., 2010). Forest restoration of APPs and RLs on private rural properties, when appropriate techniques are deployed in the field, more than doubles the habitat connectivity in agricultural landscapes with low native vegetation cover (Rother et al., 2018). Considering the small forest cover in the Project Zone and the low permeability of the main land uses (sugarcane and pasture), the project's restoration activities help increase landscape connectivity and benefit biodiversity.

Figure 49 - Ecological corridor implemented through forest restoration in the Project Zone.

Biodiversity Element	Fauna and Flora
Estimated Change	Positive
Justification of Change	In association with the positive change in the increase of native forest cover and the increase of landscape connectivity, the restoration activity through the planting of native tree species and the facilitation of natural regeneration will also provide direct and indirect net gains for species of fauna and flora; especially those that are endemic, vulnerable, and endangered. In addition to structural gains, the forest continuum formed by restoration areas and forest remnants allows for the in situ conservation of a large number of native flora species, the generation of a diverse seed bank of native species from different ecological groups, the promotion of gene flow, the maintenance of biological diversity, the formation of an extensive and safe habitat for fauna existing in the Project Zone, and the conservation and improvement of populations of endangered species (Uezu, Metzger and Vielliard, 2005; Pivello et al., 2006). Thus, ensuring ecological and functional gains to the Project Zone biodiversity. The native tree planting activity involves the introduction of region's native species. The high species richness at the time of planting allows these forests to maintain high richness throughout their development (Garcia et al., 2016; César et al. 2018). Thus,

	this activity is a powerful tool for in situ conservation of native Atlantic Forest tree species, especially vulnerable species that are also produced in nurseries, such as Peroba-rosa (*Aspidosperma polyneuron*), Pau-marfim (*Balfourodendron riedelianum*), Cedro-rosa (Cedrela fissilis) and Jequitibá-rosa (*Cariniana legalis*). In parallel, the importance of raising the population's awareness about the relevance of the standing forest and the direct and indirect resources also helps enhance the conservation of fauna and flora species by stimulating a critical sense and sharing knowledge. Finally, the encouragement of research related to monitoring the ecology and behavior of species assists in understanding their population feasibility; helping the formation of a robust and comparable database in the long term for more robust and informed decision making in the conservation of endemic, vulnerable, and threatened species, both for the adaptive management of the project and for the promotion of public policies (Belloto et al., 2009). The monitoring and research performance of the restoration activities will also generate knowledge to increase the chances of a successful restoration and survival of planted trees, increasing the benefits of restoration for biodiversity. The project envisages the aforementioned actions, all as tools to enable environmental and biodiversity benefits; especially for fauna and flora species in a quality landscape.

Biodiversity Element	Hunting facilitation
Estimated Change	Negative
Justification of Change	With the increase in native vegetation cover and the increment in connectivity and displacement of fauna through the ecological corridors between remaining, reforested, and regenerated forests; a large habitat is expected to be created for certain species of fauna, promoting broad shelter and displacement corridors for these animals. Despite the aforementioned benefits to biodiversity in the project zone, these corridors may attract poachers, especially of mammals of commercial interest. In this sense, the mitigation measures outlined to prevent this illegal action in the restorations and other forest fragments, within the Project Zone, are exposed and explained in the following section (Section 5.2.2)

Biodiversity Element	Shelter and facilitation of potential exotic fauna species
Estimated Change	Negative
Justification of Change	With increased native vegetation cover and increased connectivity between remaining forests, a large habitat is

	expected to be created for certain fauna species, providing a broad corridor for shelter and displacement for these animals. In addition to supporting native species, these forest continuums may also facilitate access, transit and action by exotic fauna species, such as the wild boar (*Sus scrofa*), damaging the dynamics of the local food chain and compromising biodiversity outside the project area, mainly through competition for resources with native animals. Thus, the mitigation measures planned to curb the negative effects of the entry, displacement and acting of these exotic fauna animals in the restorations and other forest fragments within the Project Zone are presented and explained in the following section (Section 5.2.2)

5.2.2. Mitigation Measures (B2.3).

The Corridors for Life ARR Grouped Project provides for the implementation of restoration activity by means of scientific methods accepted and disseminated for decades, using local native tree species (Rodrigues et al., 2009). In this sense, the development of this project will not negatively impact the Project Zone biodiversity. On the contrary, the activities contemplated by the Project were specifically planned to boost the protection of biological diversity, as well as to promote the increase in native forest cover, landscape connectivity, favoring the gene flow between ecological corridors, serving as refuge and protection for threatened species and ecosystems.

In this sense, seeking to convert the soil in the Project Area to native forests, according to the applicable environmental legislation, as well as to conserve and make viable the populations of species threatened with extinction in the long term, all Project activities contemplated in the Theory of Change (Section 2.1.11) – in particular "Reforestation through seedling planting and facilitation of natural regeneration" and "Research and management of endangered fauna species" – were designed and structured to act as mitigating measures against the main threats to biodiversity, in addition to mitigating against negative adverse factors in the conservation and maintenance of HCVAs.

With respect to the potential negative effects on biodiversity arising from the planned and anticipated activities of the ARR Project, identified and described in the previous section (Section 5.2.1), related especially to "Hunting facilitation" and "Shelter and facilitation of potential exotic fauna species", these are occasional and unlikely to occur within the Project Zone. Nevertheless, in order to ensure proper project development and net benefits to local biodiversity, the proponents of the Corridors for Life ARR Grouped Project have outlined mitigating measures, which are presented and clarified in the following Table 32:

Table 32 – Mitigating measures envisaged by the Corridors for Life ARR Grouped Project for potential negative impacts to biodiversity arising from their activities.

Negative Impact	Hunting facilitation
Mitigation Measures	The mitigating measures outlined to prevent this illegal action in reforestations and other forest fragments within the Project Zone consist of environmental education initiatives, monitoring and political articulation. In general, lectures, workshops and training will be offered and delivered to the communities, other stakeholders and interested parties on the importance of biodiversity conservation, especially of fauna species pressed by poaching, and the preservation of the standing forest. In addition,

	continuous communication with regulatory agencies, such as the park rangers, will be encouraged so that complaints of poaching can be investigated and appropriate measures taken by the relevant institutions. Also, in order to produce information for strategic decision-making, the project will conduct sampling campaigns to measure the number of animals under pressure from poaching, using camera traps as a support tool; in partnership with research institutions.

Negative Impact	Shelter and facilitation of potential exotic fauna species
Mitigation Measures	The mitigating measures planned to curb the negative effects of the entrance, displacement and acting of these exotic fauna animals in reforestations and other forest fragments within the Project Zone are based on environmental education, monitoring, and political articulation actions. In short, lectures, workshops and training will be offered and delivered to the communities, other stakeholders and interested parties on the recognition of these animals in the field and the potential damage caused by invasive exotic species on biodiversity conservation and its associated ecological and environmental aspects. The purpose is that the understandings and experiences gained in the environmental education initiatives be shared among the population living outside the project zone, in order to favor and solidify a sustainable and conservationist consciousness (Section 2.1.11). Jointly, continuous communication will be encouraged with regulatory agencies, such as the park rangers so that complaints and reports of sightings of individuals and/or groups of exotic fauna species can be verified and appropriate measures taken by the relevant institutions. In order to provide information for strategic decision-making by regulatory agencies, the project will also concurrently monitor the presence of these animals in the forest areas; as well as carry out punctual sampling campaigns to measure the number of individuals of these species, using camera traps as a support tool; in partnership with research institutions.

5.2.3. Net Positive Biodiversity Impacts (B2.2, GL1.4)

Reforestation of natural ecosystems by planting native tree species and facilitating natural regeneration is a crucial tool to mitigate the current biodiversity and climate crises (Strassburg et al., 2020). These actions generate greater benefits for biodiversity and connectivity in landscapes with low forest cover such as the Project Zone (Tambosi et al., 2013). The project seeks to plant over one hundred of native tree species to establish habitat and improve landscape connectivity, benefiting threatened fauna species and exercising in situ conservation of dozens of fauna and flora species. Worth mentioning that, eventually exotic species adapted and non-invasive to the Project Zone (which do not exceed 25% of the project's carbon stock) may be implemented in the Project Area in order to promote climatic and environmental benefits to rural properties and the Project. On the other hand, in the without-project scenario, land use and occupation in the Project Area will remain as a highly fragmented rural landscape with areas of pasture and intensive sugarcane plantations, with a deficit of native vegetation in areas of

permanent protection and legal reserves under current legislation, compromising the region's biodiversity and maintaining the isolated forest remnants.

In this regard, the main benefits provided to biodiversity by the project activities, especially restoration of 75,000 hectares and preservation of approximately 140,000 hectares of fragments of native vegetation in the Project Zone , are associated with gaining habitat and connectivity between forest remnants, favoring in situ conservation and gene flow of flora and fauna in the landscape, including endangered species. In parallel, social activities were also designed to enhance biodiversity benefits in the Project Zone. Environmental awareness of the communities and other stakeholders will contribute to improving the perception of the population in the Project Zone about the importance of forests and the opportunities provided by restoration activities.

Quantification and qualification of the positive benefits to biodiversity in the Project Zone will be carried out periodically, through a robust Monitoring Plan suitable for the local conditions Section 5.4.1). From these surveys, a robust database will allow comparison and control of biodiversity conditions at consecutive assessment periods during implementation and maintenance of the outlined activities, relative to the without-project scenario. This Monitoring Plan as well as its frequent assessment will encourage the project to have its effectiveness guaranteed, promoting the intended net positive benefits for biodiversity.

Finally, it is worth mentioning that the Project, through the Theory of Change, has outlined the activity "Research, development and innovation of project activities", this activity will allow the Project to implement an interactive and continuous process for maintaining relationships with its stakeholders and biodiversity components, increasing the effectiveness of activities and mitigating any potential risks to biodiversity, keeping the net positive impacts of the project over time.

5.2.4. High Conservation Values Protected (B2.4)

Project activities do not take place directly in HCVAs and, similarly, the project area does not overlap an HCVA. Thus, no negative effects related to biodiversity are expected arising from the project's proposed activities on the High Conservation Value Areas.

On the contrary, the activities developed by the project throughout its term will allow positive impacts to be caused on the areas of high conservation value, since they include measures to maintain the attributes related to biodiversity, such as connectivity of the forest landscape and conservation of fauna and flora species, including those threatened with extinction.

5.2.5. Species Used (B2.5)

Table 33 shows the native tree species that will potentially be used in the restoration activity by planting seedlings in the project area, according to their functional classification and dispersal syndrome, as classed in the list developed by the State of São Paulo Bureau of Infrastructure and Environment (Barbosa et al., 2017). It is worth pointing out that a minimum of 60 native species from those listed below will be deployed at the field, in keeping with the guidelines, directives and criteria of the applicable environmental legislation on ecological restoration in the State of São Paulo (SMA Resolution No. 32, of April 3, 2014). The determination of the native species to be allocated in the restoration areas will depend, above all, on the availability of seedlings in the supplying nurseries, according to the production volume at a certain time of year.

Table 33 - Native tree species contemplated in the restoration activity of the Life Corridors ARR Grouped Project.

Family	Species	Functional group	Dispersion syndrome
Anacardiaceae	*Astronium graveolens* Jacq.	Diversity	Anemocory

Anacardiaceae	*Lithraea molleoides* (Vell.) Engl.	Diversity	Zoocory
Anacardiaceae	*Myracrodruon urundeuva* M. Allemão	Diversity	Autocory
Anacardiaceae	*Schinus terebinthifolius* Raddi	Fulfillment	Zoocory
Anacardiaceae	*Tapirira guianensis* Aubl.	Diversity	Zoocory
Annonaceae	*Annona cacans* Warm.	Diversity	Zoocory
Annonaceae	*Annona sylvatica* A.St.-Hil.	Diversity	Zoocory
Annonaceae	*Xylopia aromatica* (Lam.) Mart.	Diversity	Zoocory
Apocynaceae	*Aspidosperma cylindrocarpon* Müll.Arg.	Diversity	Anemocory
Apocynaceae	*Aspidosperma parvifolium* A.DC.	Diversity	Anemocory
Apocynaceae	*Aspidosperma polyneuron* Müll.Arg.	Diversity	Anemocory
Apocynaceae	*Tabernaemontana hystrix* Steud.	Diversity	Zoocory
Arecaceae	*Acrocomia aculeata* (Jacq.) Lodd. ex Mart.	Diversity	Zoocory
Arecaceae	*Syagrus romanzoffiana* (Cham.) Glassman	Diversity	Zoocory
Asteraceae	*Gochnatia polymorpha* (Less.) Cabrera	Fulfillment	Anemocory
Asteraceae	*Moquiniastrum polymorphum* (Less.) G. Sancho	Fulfillment	Anemocory
Bignoniaceae	*Cybistax antisyphilitica* (Mart.) Mart.	Diversity	Anemocory
Bignoniaceae	*Handroanthus chrysotrichus* (Mart. ex DC.) Mattos	Diversity	Anemocory
Bignoniaceae	*Handroanthus heptaphyllus* (Vell.) Mattos	Diversity	Anemocory
Bignoniaceae	*Handroanthus impetiginosus* (Mart. ex DC.) Mattos	Diversity	Anemocory
Bignoniaceae	*Handroanthus umbellatus* (Sond.) Mattos	Diversity	Anemocory
Bignoniaceae	*Handroanthus vellosoi* (Toledo) Mattos	Diversity	Anemocory
Bignoniaceae	*Jacaranda cuspidifolia* Mart.	Diversity	Anemocory
Bignoniaceae	*Sparattosperma leucanthum* (Vell.) K.Schum.	Diversity	Anemocory
Bignoniaceae	*Tabebuia aurea* (Silva Manso) Benth. & Hook.f. ex S.Moore	Diversity	Anemocory
Bignoniaceae	*Tabebuia insignis* (Miq.) Sandwith	Diversity	Anemocory
Bignoniaceae	*Tabebuia roseoalba* (Ridl.) Sandwith	Diversity	Anemocory
Bignoniaceae	*Zeyheria tuberculosa* (Vell.) Bureau ex Verl.	Diversity	Anemocory
Boraginaceae	*Cordia americana* (L.) Gottschling & J.S.Mill.	Diversity	Anemocory
Boraginaceae	*Cordia superba* Cham.	Fulfillment	Zoocory
Boraginaceae	*Cordia trichotoma* (Vell.) Arráb. ex Steud.	Diversity	Anemocory
Cannabaceae	*Trema micrantha* (L.) Blume	Fulfillment	Zoocory
Caricaceae	*Jacaratia spinosa* (Aubl.) A.DC.	Diversity	Zoocory
Combretaceae	*Buchenavia tetraphylla* (Aubl.) R.A.Howard	Diversity	Zoocory
Combretaceae	*Terminalia argentea* Mart. & Zucc.	Diversity	Anemocory

Combretaceae	*Terminalia brasiliensis* (Cambess.) Eichler	Diversity	Anemocory
Euphorbiaceae	*Alchornea glandulosa* Poepp. & Endl.	Fulfillment	Zoocory
Euphorbiaceae	*Croton floribundus* Spreng.	Fulfillment	Autocory
Euphorbiaceae	*Croton urucurana* Baill.	Fulfillment	Autocory
Euphorbiaceae	*Mabea fistulifera* Mart.	Fulfillment	Autocory
Fabaceae	*Acacia polyphylla* DC.	Fulfillment	Autocory
Fabaceae	*Albizia niopoides* (Spruce ex Benth.) Burkart	Diversity	Autocory
Fabaceae	*Anadenanthera colubrina* (Vell.) Brenan	Diversity	Autocory
Fabaceae	*Anadenanthera falcata* (Benth.) Speg.	Diversity	Autocory
Fabaceae	*Anadenanthera macrocarpa* (Benth.) Brenan	Fulfillment	Autocory
Fabaceae	*Apuleia leiocarpa* (Vogel) J.F.Macbr.	Diversity	Autocory
Fabaceae	*Bauhinia forficata* Link	Fulfillment	Autocory
Fabaceae	*Copaifera langsdorffii* Desf.	Diversity	Zoocory
Fabaceae	*Dahlstedtia muehlbergiana* (Hassl.) M.J.Silva & A.M.G.Azevedo	Diversity	Autocory
Fabaceae	*Dalbergia miscolobium* Benth.	Diversity	Anemocory
Fabaceae	*Enterolobium contortisiliquum* (Vell.) Morong	Fulfillment	Autocory
Fabaceae	*Enterolobium maximum* Ducke	Diversity	Zoocory
Fabaceae	*Erythrina verna* Vell.	Diversity	Autocory
Fabaceae	*Hymenaea courbaril* L.	Diversity	Zoocory
Fabaceae	*Inga edulis* Mart.	Fulfillment	Zoocory
Fabaceae	*Inga laurina* (Sw.) Willd.	Fulfillment	Zoocory
Fabaceae	*Inga marginata* Willd.	Fulfillment	Zoocory
Fabaceae	*Inga striata* Benth.	Fulfillment	Zoocory
Fabaceae	*Inga uruguensis* Hook. & Arn.	Fulfillment	Zoocory
Fabaceae	*Inga vera* Willd.	Fulfillment	Zoocory
Fabaceae	*Lonchocarpus cultratus* (Vell.) A.M.G.Azevedo & H.C.Lima	Diversity	Anemocory
Fabaceae	*Machaerium hirtum* (Vell.) Stellfeld	Diversity	Anemocory
Fabaceae	*Machaerium nyctitans* (Vell.) Benth.	Diversity	Anemocory
Fabaceae	*Machaerium stipitatum* Vogel	Diversity	Anemocory
Fabaceae	*Mimosa bimucronata* (DC.) Kuntze	Fulfillment	Autocory
Fabaceae	*Myrocarpus frondosus* Allemão	Diversity	Anemocory
Fabaceae	*Myroxylon peruiferum* L.f.	Diversity	Anemocory
Fabaceae	*Parapiptadenia rigida* (Benth.) Brenan	Diversity	Autocory
Fabaceae	*Peltophorum dubium* (Spreng.) Taub.	Diversity	Autocory
Fabaceae	*Platypodium elegans* Vogel	Diversity	Anemocory
Fabaceae	*Poecilanthe parviflora* Benth.	Diversity	Autocory
Fabaceae	*Pterodon emarginatus* Vogel	Diversity	Autocory
Fabaceae	*Pterogyne nitens* Tul.	Diversity	Anemocory
Fabaceae	*Senegalia lowei* (L.Rico) Seigler & Ebinger	Diversity	Autocory
Fabaceae	*Senna alata* (L.) Roxb.	Fulfillment	Autocory

Fabaceae	*Senna macranthera* (DC. ex Collad.) H.S.Irwin & Barneby	Fulfillment	Autocory
Fabaceae	*Senna multijuga* (Rich.) H.S.Irwin & Barneby	Fulfillment	Zoocory
Lameaceae	*Vitex polygama* Cham.	Diversity	Zoocory
Lauraceae	*Nectandra megapotamica* (Spreng.) Mez	Diversity	Zoocory
Lauraceae	*Ocotea odorifera* (Vell.) Rohwer	Diversity	Zoocory
Lauraceae	*Ocotea puberula* (Rich.) Nees	Diversity	Zoocory
Lecythidaceae	*Cariniana estrellensis* (Raddi) Kuntze	Diversity	Anemocory
Lecythidaceae	*Cariniana legalis* (Mart.) Kuntze	Diversity	Anemocory
Lythraceae	*Lafoensia glyptocarpa* Koehne	Diversity	Anemocory
Lythraceae	*Lafoensia pacari* A.St.-Hil.	Diversity	Anemocory
Malvaceae	*Apeiba tibourbou* Aubl.	Diversity	Zoocory
Malvaceae	*Ceiba speciosa* (A.St.-Hil.) Ravenna	Fulfillment	Anemocory
Malvaceae	*Guazuma ulmifolia* Lam.	Fulfillment	Zoocory
Malvaceae	*Heliocarpus americanus* L.	Fulfillment	Anemocory
Malvaceae	*Heliocarpus popayanensis* Kunth	Fulfillment	Anemocory
Malvaceae	*Luehea candicans* Mart.	Fulfillment	Anemocory
Malvaceae	*Luehea divaricata* Mart.	Fulfillment	Anemocory
Malvaceae	*Luehea grandiflora* Mart.	Fulfillment	Anemocory
Meliaceae	*Cedrela fissilis* Vell.	Diversity	Anemocory
Meliaceae	*Cedrela odorata* L.	Diversity	Anemocory
Meliaceae	*Guarea guidonia* (L.) Sleumer	Diversity	Zoocory
Meliaceae	*Guarea macrophylla* Vahl	Diversity	Zoocory
Moraceae	*Ficus dendrocida* Kunth	Diversity	Zoocory
Moraceae	*Ficus guaranitica* Chodat	Diversity	Zoocory
Moraceae	*Ficus mexiae* Standl. LC	Diversity	Zoocory
Moraceae	*Maclura tinctoria* (L.) D.Don ex Steud.	Diversity	Zoocory
Myrtaceae	*Campomanesia pubescens* (Mart. ex DC.) O.Berg	Diversity	Zoocory
Myrtaceae	*Campomanesia xanthocarpa* (Mart.) O.Berg	Diversity	Zoocory
Myrtaceae	*Eugenia brasiliensis* Lam.	Diversity	Zoocory
Myrtaceae	*Eugenia florida* DC.	Diversity	Zoocory
Myrtaceae	*Eugenia pyriformis* Cambess.	Diversity	Zoocory
Myrtaceae	*Eugenia sulcata* Spring ex Mart.	Diversity	Zoocory
Myrtaceae	*Eugenia uniflora* L.	Diversity	Zoocory
Myrtaceae	*Plinia peruviana* (Poir.) Govaerts	Diversity	Zoocory
Myrtaceae	*Psidium cattleianum* Sabine	Diversity	Zoocory
Myrtaceae	*Psidium guineense* Sw.	Diversity	Zoocory
Myrtaceae	*Psidium longipetiolatum* D.Legrand	Diversity	Zoocory
Myrtaceae	*Psidium myrtoides* O.Berg	Diversity	Zoocory
Phytolaccaceae	*Gallesia integrifolia* (Spreng.) Harms	Diversity	Anemocory
Phytolaccaceae	*Phytolacca dioica* L.	Fulfillment	Autocory
Polygonaceae	*Ruprechtia laxiflora* Meisn.	Diversity	Anemocory
Polygonaceae	*Triplaris americana* L.	Diversity	Anemocory
Primulaceae	*Myrsine coriacea* (Sw.) R.Br. ex Roem. & Schult.	Diversity	Zoocory
Primulaceae	*Myrsine guianensis* (Aubl.) Kuntze	Fulfillment	Zoocory

Primulaceae	*Myrsine umbellata* Mart.	Diversity	Zoocory
Rhamnaceae	*Colubrina glandulosa* Perkins	Fulfillment	Zoocory
Rhamnaceae	*Rhamnidium elaeocarpum* Reissek	Diversity	Zoocory
Rosaceae	*Prunus brasiliensis* (Cham. & Schltdl.) D.Dietr.	Diversity	Zoocory
Rosaceae	*Prunus myrtifolia* (L.) Urb.	Diversity	Zoocory
Rubiaceae	*Genipa americana* L.	Diversity	Zoocory
Rutaceae	*Dictyoloma vandellianum* A.Juss.	Diversity	Anemocory
Rutaceae	*Helietta apiculata* Benth.	Diversity	Anemocory
Salicaceae	*Casearia gossypiosperma* Briq.	Fulfillment	Zoocory
Salicaceae	*Casearia lasiophylla* Eichler	Diversity	Zoocory
Salicaceae	*Casearia sylvestris* Sw.	Diversity	Zoocory
Sapindaceae	*Allophylus edulis* (A.St.-Hil. et al.) Hieron. ex Niederl.	Diversity	Zoocory
Sapindaceae	*Dilodendron bipinnatum* Radlk.	Diversity	Zoocory
Sapindaceae	*Sapindus saponaria* L.	Diversity	Zoocory
Sapindaceae	*Talisia esculenta* (Cambess.) Radlk.	Diversity	Zoocory
Sapotaceae	*Pouteria torta* (Mart.) Radlk.	Diversity	Zoocory
Solanaceae	*Acnistus arborescens* (L.) Schltdl.	Fulfillment	Zoocory
Solanaceae	*Solanum lycocarpum* A.St.-Hil.	Fulfillment	Zoocory
Solanaceae	*Solanum mauritianum* Scop.	Diversity	Zoocory
Solanaceae	*Solanum paniculatum* L.	Fulfillment	Zoocory
Solanaceae	*Solanum pseudoquina* A.St.-Hil.	Fulfillment	Zoocory
Solanaceae	*Solanum variabile* Mart.	Diversity	Zoocory
Urticaceae	*Cecropia glaziovii* Snethl.	Diversity	Zoocory
Urticaceae	*Cecropia hololeuca* Miq.	Diversity	Zoocory
Urticaceae	*Cecropia pachystachya* Trécul	Diversity	Zoocory
Verbenaceae	*Aloysia virgata* (Ruiz & Pav.) Juss.	Diversity	Zoocory
Verbenaceae	*Citharexylum myrianthum* Cham.	Diversity	Zoocory
Winteraceae	*Drimys brasiliensis* Miers	Diversity	Zoocory

It is worth pointing out that, from the species suggested for planting, only *Psidium guajava* L. is categorized as naturalized by the Herbário Virtual REFLORA. This species is widely used in restoration projects in the State of São Paulo because of its adaptive success in tropical regions, high seed production, attraction of frugivorous birds and rapid development to cover areas in process of recovery (Pascarella et al., 2000; Berens et al., 2007). Technical manuals about ecological restoration developed and known in the industry, such as the Laboratory of Forest Restoration and Ecology of the University of São Paulo (Rodrigues et al., 2007), include and recommend Psidium guajava as an overlay species in their lists.

In addition to the previously listed native species, the reforestation project also contemplates the use of noninvasive exotic species, adapted to tropical regions. It is worth noting that, when planted, they will be in a smaller number than the native ones, representing less than 25% of the project areas biomass, as indicated in the VCS AFOLU Non-Permanence Risk Report, and will not be removed nor will have an economic use of their products and by-products. This strategy is focused on "carbon booster" species, whose individuals are carbon boosters in reforestation areas, especially in Legal Reserves, as permitted by the applicable environmental legislation. With potentiating carbon storage by exotic trees, this plan aims to mitigate the risks of not reaching the accumulation curve.

In addition, the individuals of non-native species will be used as live fencing for planting, windbreaks and hedges in reforestation areas, following roads or boundaries of rural properties. Hence, the project does not intend to enable the wood cutting and management of these trees, as the purposes of their functionality have already been outlined and detailed. For this purpose, the planting arrangement in double row will be implemented, interspersing trees (zigzag model).

It is worth pointing out that the inclusion of these species will not necessarily occur in all the restoration polygons pertaining to the project. In the initial instances, these species were not included in their respective delineations.

In short, commercially widespread clones of species of Eucalyptus (*Eucalyptus* spp.), Teak (*Tectona grandis*), African Mahogany (*Khaya* spp.) and Rubber Tree (*Hevea brasiliensis*) may be used, if in the interest of the owner and project proponents. More detailed information on these species, as well as the justifications for their use and potential impacts, can be found in section 5.2.7 hereunder.

5.2.6. Invasive Species (B2.5)

The project does not contemplate the introduction of any potentially invasive species in the restoration activity. Additionally, the technical field team is trained to identify and carry out periodic control and removal of any invasive species that may occur. In general, when small clumps of invasive species are identified in the restoration areas, these plants are cut down or ringed in order to avoid competition with the native species planted and regenerated.

5.2.7. Impacts of Non-native Species (B2.6)

As mentioned in the item 5.2.5, reforestation activities contemplate the use of clones of exotic species, introduced, spread and adapted to tropical regions. In summary, the individuals of these species will be planted at the field in a considerably smaller number than the native ones, according to the demand and interest of the rural landowner, to be defined during the project implementation. The use of these species in the project area aims to promote climatic and environmental benefits associated with boosting biomass storage and the implementation of improvements in the areas in process of restoration (for example, hedges, windbreaks and borders in the restoration areas). Therefore, it is further stressed that the use of exotic species in the reforestation project activity is not aimed at the removal of individuals or economic gains from products and by-products of planted trees.

In Table 34, the justification for use and the potential adverse effects associated with the exotic species that the project expects to plant in the restoration activity are presented.

Table 34 – Exotic species planned in the restoration activity of the Corridors for Life ARR Grouped Project, their respective justifications for use, and potential adverse effects.

Species	*Eucalyptus spp.* (Eucalypt)
Justification of Use	*Eucalyptus spp.* has a secular trajectory of selection and adaptation to the Brazilian climatic and soil conditions. The industry and academia have a high level of knowledge about the physiology and silviculture of this exotic species, and its use in reforestation is allowed by the environmental legislation in effect in the Country. It is characterized as a pioneer species that allows the reforestation area to be quickly covered, catalizing natural regeneration of native species and helping to control weeds by overlapping the canopies and the formation of a leaf litter by the leaflets. For presenting a low germination in the field and

	intolerance to shade, this species does not proliferate spontaneously in reforesting areas (César et al., 2018). The benefits of *Eucalyptus spp*. in consortium with native species for restoration include increased matrix permeability for connectivity of forest fragments, source of shelter and food for fauna, maintenance of the local microclimate, pest and disease control, nutrient cycling in the soil, perches for dispersing birds, windbreaks, fire/firebreaks, containment, and improvement/hedges for rural properties (Lacerda, 2009; (Brockerhoff et al., 2013; Brancalion et al., 2019).
Potential Adverse Effect	No adverse effects are anticipated for the project area and its surroundings. The project will commit to using registered clones adapted to the region's environmental and soil conditions. Also, It will follow the technical and operating guidelines recommended by manuals, scientific researches and studies on the climatic, edaphic, silvicultural, phytosanitary, and physiological conditions of the exotic species referred to.

Species	*Tectona grandis* (Teca)
Justification of Use	*Tectona grandis* is widely used for restorations in tropical regions, and is adapted and favorable to the country's local and environmental conditions. Studies and research on the physiology and silviculture of this exotic species are gaining visibility in the timber sector and among the scientific community. Mainly because of the possibility of a consortium with native species in Legal Reserves, in compliance with the applicable environmental legislation. Teak is categorized as a pioneer species, of rapid growth under full sun, and this characteristic allows the trees to store biomass in the short term, thus contributing to the sequestration of atmospheric carbon (Figueiredo and Sá, 2015). In parallel, the quick shading of the canopies provides an effective control of competing grasses in the forest understory; ensuring the establishment and proper development of native tree species. The high density of its wood also allows the species to be used as hedges, firebreaks and borders in rural areas, favoring the environment and the landscape ecology.
Potential Adverse Effect	No adverse effects are anticipated for the project area and its surroundings. The project will commit to using registered clones adapted to the region's environmental and soil conditions. Also, It will follow the technical and operating guidelines recommended by manuals, scientific researches and studies on the climatic, edaphic, silvicultural, phytosanitary, and physiological conditions of the exotic species referred to.

Species	*Khaya spp.* (African Mahogany)
Justification of Use	*Khaya spp.* has been widely used in tropical restoration in recent years, both in combination with native tree species and in

	monocultures, and is adapted to the local and environmental conditions of Brazil. Studies and researches on technical information regarding the physiology and silviculture of exotic species clones are being encouraged by the industry and academia in order to produce knowledge about the behavior of African Mahogany under Brazilian conditions. It is known that the *Khaya spp*. is categorized as a pioneer species, of vigorous growth under full sun, whose short-term diametric increase contributes to the storage of biomass and, consequently, mitigation of climate changes. Such characteristic of the species also provides other ecological benefits, such as shading and control of competing grass, favoring the survival of seedlings and seed bank expression, and improving soil nutrient cycling (Santos, 2019). Concurrently, the high density of its wood allows the tree individuals to be used as hedges, borders and windbreaks in order to prevent negative effects of fire and wind on rural properties; benefiting the environment and landscape ecology (Reis et al., 2019).
Potential Adverse Effect	No adverse effects are anticipated for the project area and its surroundings. The project will commit to using registered clones adapted to the region's environmental and soil conditions. Also, It will follow the technical and operating guidelines recommended by manuals, scientific researches and studies on the climatic, edaphic, silvicultural, phytosanitary, and physiological conditions of the exotic species referred to.

Species	*Hevea brasiliensis* (Rubber tree)
Justification of Use	*Hevea brasiliensis* is widely used in restoration projects in the State of São Paulo to recompose Legal Reserves, especially at drier climate locations. It is a species native to the Amazon domain, adapted to and widely spread in the State. Because of its commercial capacity for latex production and versatility of uses, the knowledge about the physiology and silvicultural management of the species is widespread in the industry and in the academia. The rubber tree is categorized as a covering species, whose rapid short-term development allows for the sequestration of atmospheric carbon and, consequently, the incorporation of biomass (Gonçalves, 2010). In restoration with native species the rubber tree helps the survival of native tree species, suppression of competing grass, water maintenance, improvement of the soil physical and chemical properties and climate regulation, improvement of generalist species acting as perches. Also, its flexibility of use allows the execution of hedges, firebreaks and windbreaks in rural properties, fighting potential intercurrences of wind, fire and extreme lighting (Venturin et al., 2004; Carmo, Manzatto and Alvarenga, 2007).
Potential Adverse Effect	No adverse effects are anticipated for the project area and its surroundings. The project will commit to using registered clones adapted to the region's environmental and soil conditions. Also, It

	will follow the technical and operating guidelines recommended by manuals, scientific researches and studies on the climatic, edaphic, silvicultural, phytosanitary, and physiological conditions of the exotic species referred to.

5.2.8. GMO Exclusion (B2.7)

The project does not anticipate the use of any Genetically Modified Organism (GMO) in the restoration activities.

5.2.9. Inputs Justification (B2.8)

All products used are registered and regulated by the relevant agencies in Brazil, including the National Health Surveillance Agency (ANVISA) and the Ministry of Agriculture, Livestock and Supply (MAPA). Together with its service providers, IPÊ pays attention to the strict compliance with the manufacturers' guidelines and recommendations.

Additionally, if any adverse effects of the inputs are identified, they will be reported in the monitoring reports and appropriate measures will be outlined and implemented, ensuring the environmental benefits of the project.

Table 35 – Inputs used in the restoration activity of the ARR Life Corridor Grouped Project, their respective justifications for use and potential adverse effects.

Name	Formicide (bait, powder and soluble)
Justification of Use	The leaf-cutting ants of the most diverse species (for example, *Atta sexdens, Atta laevigata* and *Acromyrmex spp*.) harm the establishment and development of restorations in tropical regions by defoliating seedlings and natural regenerants, delaying the development and mortality of planted trees. In this regard, it is essential to control leaf-cutting ants in restorations to ensure the effectiveness of the actions taken. It is worth pointing out that the use of baits and powdered formicides as insecticides against leaf-cutting ants in restoration are the most widely used in Brazil, precisely because of the ease of application, high operating yield and high efficiency. Baits based on sulfluramid are slow-acting, and its active ingredient is the only one with the most effective and safe control of leaf-cutting ants among those registered in Brazil (Forti et al., 2007). Fipronil baits are fast acting baits. In fact, studies show that fipronil is a low persistence active principle in the environment (Harris; Rees;Toft, 2002). When applied in the indicated dosages, these inputs protect restorations from the harmful action of leaf-cutting ants. The leaf-cutting ants are monitored daily in the first two years after planting the seedlings (genus *Atta* sp. and *Acromyrmex* sp.), so that are controlled using only suitable products and following leaflet recommendations. As an example, Mirex's recommendations are: deposit 10 grams of the product for each square meter of land around the anthill entrance. Mirex is commonly used to control leaf-cutting ants in Brazil and the

	project follows all the product manufacturer's application recommendations. It is worth mentioning that the fight against leaf-cutting ants is carried out beforehand, as a means of diagnosis and prevention; through the same method previously described, and after the implantation of the forest.
Potential Adverse Effect	No adverse effects are anticipated for the project area and its surroundings. The project is committed to using products approved by the competent registration agencies in Brazil. It also follows all manufacturers' recommendations regarding dosages, storage, transportation and disposal of these inputs. It also pays attention, periodically, to the positions and decisions of the regulatory agencies about the impacts of the inputs used in the restoration activity on the environment and natural resources. It also ensures that the service providers use the required Personal Protection Equipment.

Name	Pre-emergent and post-emergent herbicides (selective and non-selective)
Justification of Use	Invasive exotic species, in short, grasses such as guinea grass (*Panicum maximum*), brachiaria (*Urochloa decumbens* and *Melinis minutiflora*), are considered one of the main filters in the restoration establishment and development in tropical regions. In addition to favoring the occurrence of fires, invasive exotic plants also compete with established seedlings and natural regenerants for resources, lighting, and space in forest restoration areas. Among the most diverse damages, this competition can cause the mortality of native trees, allowing for the spread and dominance of the competing grass. Thus, it is essential to periodically control invasive exotic species in restoration – especially in the first years after planting – to avoid compromising the regional biodiversity. Chemical control is recommended by using herbicides to efficiently suppress invasive exotic species. The use of herbicides as a technique for the control of invasive exotic species in restoration areas is widespread in Brazil; it is even a management practice recommended in technical manuals and scientific researches of great prestige in the country. Non-selective, post-emergent herbicides, based on glyphosate, have a high operating yield, high efficiency and high effectiveness in controlling a wide spectrum of invasive species (Weidlich et al., 2020). According to Flórido (2022), the characteristics of tropical soils, highly weathered, together with the physical-chemical properties of the active ingredient, make the contamination of the product in the environment unfeasible, with the possibility of leaching into the water table being very, very low, with a quick microbial degradation of the herbicide when in solution. Pre-emergent herbicides, whose active ingredient is indaziflam, have a broad spectrum of action and long-lasting efficacy, even at low doses, as well as being considered a herbicide with moderate leaching potential, showing a positive correlation with sorption and organic

	matter content (Guerra et al., 2013). Thus, these inputs, when applied at the indicated dosages, protect reforestations from the harmful action of competing exotic plants and provide better conditions for the expression of natural regeneration.
Potential Adverse Effect	No adverse effects are anticipated for the project area and its surroundings. The project is committed to using products approved by the competent registration agencies in Brazil. It also follows all manufacturers' recommendations regarding dosages, storage, transportation and disposal of these inputs. It also pays attention, periodically, to the positions and decisions of the regulatory agencies about the impacts of the inputs used in the restoration activity on the environment and natural resources. It also ensures that the service providers use the required Personal Protection Equipment.

Name	Planting Fertilizer (Monoammonium Phosphate - MAP)
Justification of Use	In order to guarantee the appropriate establishment and development of the implanted tree individuals and the natural regenerants in the restorations, preventing degradation factors from acting and compromising the plantations, the project contemplates the fertilization of Monoammonium Phosphate (MAP) in the rock rose seedlings used in the restoration activity. In short, this practice aims at the proper vegetation and root growth of the planted native tree species and the supply of chemical energy to the seedlings for their proper development. The appropriate tree growth speeds up the canopy closure and the setting up of conditions that suppress shade-intolerant invasive grasses and favor natural regeneration. Several technical manuals and instructional guides widely disseminated in Brazil recommend and advise this initiative in restorations in the country. MAP is a mineral fertilizer used as a source of phosphorus and nitrogen, of high concentration and quick release, highly soluble in water, which ensures the survival of the seedling implanted in the short term.
Potential Adverse Effect	No adverse effects are anticipated for the project area and its surroundings. The project is committed to using products approved by the competent registration agencies in Brazil. It also follows all manufacturers' recommendations regarding dosages, storage, transportation and disposal of these inputs. It also pays attention, periodically, to the positions and decisions of the regulatory agencies about the impacts of the inputs used in the restoration activity on the environment and natural resources. It also ensures that the service providers use the required Personal Protection Equipment.

Name	Planting and irrigation gel

Justification of Use	Additional actions to favor the survival and growth of seedlings planted in restorations are widely recommended and disseminated in technical manuals and scientific researches approaching the subject. The use of hydrogels, organic hydro-retentive polymers, and polyacrylamide when planting native arboreal individuals increases the chances of survival, especially during Indian summers (*veranicos*), acting as conditions for soil moisture, reducing the number of irrigations and nutrient losses. One should take into account the type of soil and the period of restoration implementation, using it preferably in dry seasons, favoring the product best performance (Barbosa, Rodrigues and Couto, 2013). From the environmental point of view, several studies are found in the literature demonstrating the benefits of hydrogels with respect to increased water retention in the soil, reduced nutrient leaching, and improved cation exchange capacity.
Potential Adverse Effect	No adverse effects are anticipated for the project area and its surroundings. The project is committed to using products approved by the competent registration agencies in Brazil. It also follows all manufacturers' recommendations regarding dosages, storage, transportation and disposal of these inputs. It also pays attention, periodically, to the positions and decisions of the regulatory agencies about the impacts of the inputs used in the restoration activity on the environment and natural resources. It also ensures that the service providers use the required Personal Protection Equipment.

It is worth noting that non-native invasive forage grasses severely impair the development of native trees in restoration initiatives (Hooper et al., 2005). In order to reduce the number of interventions and effectively control invasive grasses in reforestation areas, glyphosate-based herbicides are the most commonly used worldwide (Weidlich et al., 2020) and are also used for the implementation and maintenance of reforestation areas in Corridors for Life ARR Grouped Project, since scientific research has shown that: glyphosate is not toxic to birds, rats, fish and other groups of vertebrates (Moore et al., 2012; Howe et al., 2004); given that it binds to soil particles, glyphosate runoff is unlikely and only occurs in extreme rainfall events after application (Florido et al., 2022); and the use of glyphosate to control invasive grasses doubles seedling height growth and increases the basal area by five times when compared to cutting, this impact is critical for the accumulation of carbon stocks in reforestation activities (Florido et al., 2022). In addition to these works, more information on the composition and use of glyphosate in restoration can be readily found in the available literature, for example, "Parecer Técnico-Científico - Uso do herbicida glifosate no panorama de restauração florestal" (Florido and Brancalion, 2014).

While the application of glyphosate-based herbicides is safe and is the most common method of controlling invasive grasses in restoration worldwide, the Corridors for Life ARR Grouped Project is transitioning to using Scout, a glyphosate-based herbicide specifically for use in reforestation areas with native trees, aiming to further reduce the environmental impact of controlling invasive grasses in the project. It is worth mentioning that the focus of the transition is not on a specific herbicide (for example, Scout). The Project seeks to monitor and contribute scientifically to the development and use of more sustainable inputs, both for the environment and for human health, which can increase the efficiency of controlling invasive exotic grass in reforestation and the longevity of areas.

5.2.10. Waste Products (B2.9)

The service providers of the IPÊ - Ecological Research Institute, responsible for technical and operational initiatives at the field (e.g. restoration implementation and maintenance), are subject to the obligation of complying with the guidelines and duties of the Regulatory Standards required by the Brazilian Labor Laws associated with the process of identification, classification and management of all residual products resulting from the project activities. This obligation to ensure a safe and healthy work is agreed between IPÊ and its service providers by means of a legal contract, reinforcing the importance of mutual commitment to the fulfillment of labor requirements of health and safety concerning the waste management, use of personal protection equipment, and reverse logistics.

It is worth pointing out that IPÊ works continuously for the ongoing improvement of this process, drawing up a Solid Waste Management Plan, paying attention to the environmental and labor legislations in effect.

Generally speaking, the organization is supported by the following documents and procedures associated with occupational safety and medicine, which all service providers that carry out restoration activities in the field are subject to: NR 07 (P.C.M.S.O - Program Occupational Health Medical Control); SEPRT Min. Directive 8.873 of 07/23/2021 (provides for the Management of Occupational Risks and Management of Occupational Risks); Decree no. 3048 - INSS (L.T.C.A.T - Technical Report on Occupational Environmental Conditions); Decree no. 3.048, of May 6, 1999 (provides for the Social Security Regulations); NR 31 (P.G.R.T.R - Risk Management Program in Rural Work); SEPRT Min. Directive No. 22.677 of 10/22/2020 (provides for the Labor Safety and Health in Agriculture, Livestock, Forestry, Forest Exploitation and Aquaculture); and NR 01 (OS - Service Order). It also prepares and frequently updates procedures, programs, and internal manuals on Preliminary Risk Analysis (APR), Safe Work Procedure, and PPE Matrix. Additionally, it offers and delivers training courses in keeping with the regulatory rules for internal workers and service providers, in particular: Safety Integration (NR 01); Use, Upkeep and Conservation of PPEs (NR 06); First Aids (NR 07); Operation of Machinery and Equipment (NR 12); Manual Weight Lifting and Transportation (NR 17); Safety in the Operation of Chainsaws and Brush Cutters (NR 31); Safety in the Operation of Farming Machinery - Tractor (NR 31); and Prevention of Accidents with Pesticides (NR 31).

In order to reinforce the commitment to ensure that the guidelines and duties of occupational health and safety, with a focus on waste management, are fulfilled by service providers in restoration activities at the field, the Occupational Safety Technician together with IPÊ pays monthly technical visits to all areas where the initiatives are taking place; preparing a photographic record report, issuing technical opinions on the environmental working conditions, applying technical guidance to workers and service providers on Occupational Health and Safety (S. S.T), performs the Daily Safety Dialogue (D.D.S) and other relevant activities of the professional's competence. It should be noted that the monthly inspections are done by the Occupational Safety Technician, while the IPÊ's Forest Restoration team prioritizes weekly and daily visits.

5.3. Offsite Biodiversity Impacts

5.3.1. Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2)

No potential negative effects outside the Project Zone are anticipated from the activities planned by the Corridors for Life ARR Grouped Project. Should they occur, the proponents will mobilize with the community and other stakeholders to mitigate any potential negative impacts by collectively articulating adaptive management measures by means of external partnerships with public organizations, private sector, civil society, and research institutions.

5.3.2. Net Offsite Biodiversity Benefits (B3.3)

Generally speaking, net impacts on biodiversity in the Project Zone will be positive compared to the without-project scenario (Section 5.1.). Should negative effects on biodiversity occur outside the Project Zone, mitigating measures have been outlined and planned by the proponents, taking into account the engagement with communities, other stakeholders and interested parties; promoting adaptive management and ensuring the project intended biodiversity benefits (Section 5.2.).

Activities proposed by the project are expected to foster more favorable conditions for biodiversity than agricultural activities. In view of this, the restoration plantings and areas undergoing natural regeneration will promote increased native forest cover, in situ conservation, landscape connectivity, favoring the gene flow between ecological corridors, serving as shelter and protection for threatened species and ecosystems, which outweighs the potential negative effects of project activities outside the Project Zone.

5.4. Biodiversity Impact Monitoring

5.4.1. Biodiversity Monitoring Plan (B4.1, B4.2, GL1.4, GL3.4)

For Engel and Parrotta (2003), the key principle in assessing the reforestations is sustainability, meaning that sites in the process of reforestation are self-sustaining in the long term, without the need for external anthropic interventions.

For this, the choice of efficient indicators is imperative for the success of the monitoring plan in projects that seek benefits for the climate and biodiversity (Andreasen et al., 2001). Generally speaking, the parameters focus on ecological factors such as species richness of fauna and flora, structure (increase in native vegetation cover and density of natural regeneration) and functionality (seed dispersal, connectivity between fragments and presence of functional groups of fauna and flora) (Moraes et al., 2006).

a) Description of monitoring activities:

The biodiversity monitoring plan for the Corridors for Life ARR Grouped Project will be in full association with community and climate elements, in order to endorse a better understanding of the dynamics of biological diversity vis-a-vis the other scopes.

For the parameters associated with the ecology and functioning of the reforestations, mainly regarding the diversity of natural regenerants recruited and established in the areas under recovery, the monitoring protocol of the State Bureau of Environment of São Paulo (SMA Resolution No. 32, April 3, 2014) will be used and applied at the field for all polygons belonging to the Project Area, according to the advices, guidelines and criteria of the applicable environmental legislation. The diversity of species planted will also be determined, according to the lists provided by the nurseries responsible for providing seedlings for the development of the activity, throughout the Project Area. As to the indicators associated with the structure and physiognomy of the reforestations, especially the connectivity of the landscape by forest fragments, both in the process of recovery and remaining native vegetation, they will be determined and analyzed on a landscape basis by using accurate remote sensing tools widespread by the scientific community. In parallel, focusing on the biological diversity of fauna species, seasonal field expeditions will be carried out in the polygons implemented to assess and analyze the diversity of these animals that use the reforestations in the Project Area. The data collection and ascertainment of information will be carried out in partnership with researchers from IPÊ and their partners who have historically led studies on the subject in Pontal do Paranapanema. For this, evidences of the presence and movement of animals (e.g. footprints and droppings) will be observed, and camera traps records will be used to obtain robust results on these parameters; especially on endemic, vulnerable, and endangered species in the region.

In these field expeditions, as well as in the analysis of information from the nurseries that supply seedlings for the implementation of native species planting activities, and in the survey of natural regenerants, a special emphasis will be placed on relevant species, whether endemic, threatened, and rare flora and fauna. An exceptional focus will be given to the species Cedro-rosa *(Cedrela fissilis),* Ipê-felpudo *(Zeyheria tuberculosa)* and Jequitibá-rosa *(Cariniana legalis)* considered "Vulnerable"" by the IUCN Red List, as well as for the Tapir *(Tapirus terrestris*) and the Giant anteater (*Myrmecophaga tridactyla*), also categorized by the same list, and the Black Lion Tamarin (*Leontopithecus chrysopygus*), Peroba-rosa (*Aspidosperma polyneuron*) and Pau-marfim (*Balfourodendron riedelianum*) indicated as "Endangered".

With this, a vigorous framework of data, information and results will be generated on the structural and ecological viability of native species plantations and areas undergoing a natural regeneration, as well as the on-site conservation status of fauna and flora species in the Project Area, with a more accurate estimate of the abundance and population trends of the identified species. In addition to this database allowing for time comparisons, including the without-project scenario, it will also support various studies, researches and works to bring about understanding, disseminate knowledge and better manage the project in terms of its adaptive management, allowing for relevant adjustments and repairs in search of the desired goals.

Finally, this Plan will also seek to protect the High Conservation Value Areas (HCVAs), with sampling of fauna and flora biodiversity in these areas, encouraging, enhancing and supplementing the knowledge about local biodiversity through this long-term monitoring, given the effort and interest of researchers on the landscape, fauna and flora in the Project Zone region.

At the landscape scale, the Integral Connectivity Index (IIC) and the maintenance of forest cover in forest remnants, HCV areas and project reforestation areas in the Project Zone will also be measured (table 36). These monitoring indicators encompass HCVs related to globally, regionally or nationally significant biodiversity present in the project zone. HCV areas of ecological corridors established by reforestation will also be monitored periodically as described in detail in table 36 below. Fauna data collected in HCVs adjust the targets of the project's monitoring indicators for reforestation areas.

b) Data to be collected:

Table 36 - Biodiversity Indicators.

Theme	Activity (Theory of Change)	Indicator	Unit	Frequency	Method Description
Biodiversity	Restoration through seedling planting and facilitation of natural regeneration	Number of species planted in the restoration	Number of species	First year of restoration	Measurement of the number of species that are planted at the field in the Project Area, considering its full scale, from the survey of species lists made available by the nurseries in charge of supplying seedlings for implementation of the restoration activity planned by the ARR project.
Biodiversity	Restoration through seedling planting and facilitation of natural regeneration	Number of seedlings of endangered species planted	Number of seedlings	First year of restoration	Measurement of the number of species considered "vulnerable", "endangered" and "critically endangered", according to the IUCN Red List, that are planted at the field in the Project Area,

					considering its total scale, from the survey of species lists made available by the nurseries in charge of supplying seedlings for implementation of the restoration activity planned by the ARR project.
Biodiversity	Restoration through seedling planting and facilitation of natural regeneration	Restoration canopy cover	%	6 months, 3 years, 5 years, 10 years, 15 years, 20 years, and 30 years	Measurement of the ground cover with native vegetation according to the guideline and criteria of the applicable legislation of the State of São Paulo on ecological restoration (SMA Resolution No. 32, April 3, 2014), sample plots of 4x25 m (100 m²) will be installed diagonally to the planting lines and areas conducting natural regeneration at the sites with implementation of the restoration activity. The sum of the stretches covered by native trees relative to the total length of the plot (25 m) will be used to calculate the cover percentage in the plot. Non-native species will not be counted when measuring tree ground cover.
Biodiversity	Restoration through seedling planting and facilitation of natural regeneration	Tree density in natural regeneration	Number of trees	6 months, 3 years, 5 years, 10 years, 15 years, 20 years, and 30 years	Measurement of the number of regenerating native tree individuals according to the guidelines and criteria of the applicable legislation of the State of São Paulo on ecological restoration (SMA Resolution No. 32 of April 3, 2014), sampling plots of 4x25 m (100 m^2) will be installed diagonally to the planting lines and areas conducting natural regeneration at sites with implementation of the restoration activity planned by the ARR project for counting planted tree individuals and in spontaneous regeneration with height>0.5 m and CAP<15 cm in the areas under restoration process in the Project Area.
Biodiversity	Restoration through seedling planting and facilitation of	Species diversity in natural regeneration	Number of species	6 months, 3 years, 5 years, 10 years, 15 years, 20	Measurement of the number of regenerating native tree species according to the guideline and criteria of the applicable legislation of the

	natural regeneration			years, and 30 years	State of São Paulo on ecological restoration (SMA Resolution No. 32, April 3, 2014), sampling plots of 4x25 m (100 m^2) will be installed diagonally to the planting lines and areas in facilitation of natural regeneration at sites with implementation of restoration activity planned by the ARR project for counting and classification of morphospecies planted and in spontaneous regeneration with a height>0.5m and CAP<15 cm in the areas under restoration process in the Project Area. Non-native species will not be counted for morphospecies richness. The total number of plots will be equal to the number of hectares in restoration plus four, up to a maximum of 50 plots.
Biodiversity	Restoration through seedling planting and facilitation of natural regeneration	Relative increase in the integral connectivity index of the landscape	%	Annual	Measurement of landscape connectivity between forest remnants and restoration implemented and conducted by the ARR project by means of a comparative analysis of the Integral Connectivity Indexes for the current monitoring year with the previous period through Geographic Information Systems. The current Project Zone index in relation to the IIC at the landscape scale will be used when all the project target areas are restored.
Biodiversity	Research and management of endangered fauna species	Number of fauna species (birds and medium and large mammals)	Number of species	2 years	Measurement of the number of fauna species recorded by camera traps (for medium and large mammals, installed for a 30-day period in each monitoring area) and audio recorders (for birds, installed for a 15-day period in each assessment site) that use and move around the restorations and areas undergoing regeneration implemented by the ARR project. Evidences of the animals in these locations (e.g., footprints and droppings) will also be verified. Periodic expeditions will take place to collect

					information that can subsidize different taxons per monitoring event.
Biodiversity	Research and management of endangered fauna species	Number of fauna species threatened with extinction	Number of species	2 years	Measurement of the number of fauna species considered "vulnerable", "endangered" and "critically endangered" according to the IUCN Red List; recorded by camera traps (for medium and large mammals, installed for 30 days in each monitoring area) and audio recorders (for birds, installed for 15 days at each assessment site) that use and move around the restorations and areas undergoing regeneration implemented by the ARR project. Evidences of the animals in these locations (e.g., footprints and droppings) will also be verified. Periodic expeditions will take place to collect information that can subsidize different taxons per monitoring event.
Biodiversity	Research and management of endangered fauna species	Number of scientific publications	Number of publications	Annual	Measurement of the number of studies, papers, researches and scientific publications in journals, TCCs/ dissertations/ theses and events on the biological diversity of fauna and flora that are based on the restorations and areas undergoing natural regeneration in the ARR Project Zone, that directly affects activities in the Project Area.
Biodiversity	Research and managemnt of endangered fauna species	Number of wildlife species in HCVs	Number of species	5 years	The number of fauna species considered "vulnerable", "endangered" and "critically endangered" according to the IUCN Red List will be measured by camera traps that capture and record images (for medium and large mammals, installed for 30 days in each monitoring area) and audio recorders (for birds, installed for 15 days at each assessment site) that will be deployed in the project area and HCV biodiversity areas. Evidences of the animals in these locations

					(e.g., footprints and droppings) will also be verified. Periodic expeditions will take place to collect information that can subsidize different taxons per monitoring event. At this moment of the grouped project, the RBMA HCV will be monitored once project instances occur near this HCV.
Biodiversity	Research and management of endangered fauna species	Landscape Connectivity for wildlife	Integral Connectivity Index (IIC)	Annual	Applied in the whole grouped Project Zone, the IIC provides two metrics related to connectivity in the landscape: 1) the overall connectivity of the Project Zone, 2) the importance of each forest remnant and reforestation for connectivity in the project zone. This information will measure the benefits of project activities to wildlife connectivity in HCVs and areas under reforestation throughout the project duration. Since it can be calculated using land-use maps of the project zone, it can be calculated annually for the whole Project Zone.
Biodiversity	Research and management of endangered fauna species	Habitat conservation	Forest cover in the landscape	Annual	By overlapping annual land-use maps of the Project Zone throughout the duration of the project, the remnant forest cover in the project zone can be mapped and deforestation events can be identified in HCVs for Community and Biodiversity. Additionally, enforcement agencies in the project zone can also report on forest degradation and deforestation in the Project Zone.

It should be noted that the monitoring plan (Table 36) will also support the monitoring and reporting of the project's contributions to the sustainable development objectives, as explained in section 2.1.12.

5.4.2. Biodiversity Monitoring Plan Dissemination (B4.3)

The Biodiversity Monitoring Plan and all its results will be publicly released on the official website of the Biofilia Ambipar Environment, in the tab especially dedicated to the Corridors for Life ARR Grouped Project. All relevant information, the summary of the monitoring plan and its conclusions will be made available to the community, proponents, partners and other stakeholders through meetings and talks, with an emphasis on the monthly meeting, "Friday with Science", devised by IPÊ, historically implemented by the organization and aimed at the communities and other stakeholders in the Project

Zone. Also, physically, at the premises of the Ecological Research Institute office, in Teodoro Sampaio (SP), at the Alvorada Nursery and the PCL Lawyers office in Presidente Prudente (SP).

5.5. Optional Criterion: Exceptional Biodiversity Benefits

5.5.1. High Biodiversity Conservation Priority Status (GL3.1)

As described in detail in Sections 5.1.1 and 5.1.2, the Project Zone can be considered a high priority area for biodiversity conservation, both locally and nationally, with attributes characteristic of high conservation value areas such as significant concentration of biodiversity; seasonal concentration of species; threatened and rare ecosystems; presence of endangered species and provision of essential ecosystem services. In this regard, the Corridors for Life ARR Grouped Project Area is home to a high rate of biological diversity, with many of the fauna and flora species found in the Project Zone being categorized with some degree of threat, according to IUCN listing.

The presence of forest remnants, especially the Morro do Diabo State Park and the Black Lion Tamarin Ecological Station, together with the restoration areas in Permanent Preservation Areas and Legal Reserves restored by this ARR project, implement ecological corridors in the Project Zone landscape that justify the high biodiversity found in the region.

Thus, the presence of threatened species of fauna and flora found in the without-Project scenario were verified in keeping with the IUCN Red List of Threatened Species, following the vulnerability criteria required in the CCB Standards [37]and Program Rules[38]:

Fauna:

- Endangered (EN): *Leontopithecus chrysopygus* (Black Lion Tamarin) and *Amazona vinacea* (Purple-breasted Parrot).

- Vulnerable (VU): *Alouatta guariba* (Howler Monkey); *Myrmecophaga tridactyla* (Giant anteater); *Priodontes maximus* (Giant armadillo); *Tapirus terrestris* (Tapir) and *Tayassu pecari* (Peccari).

- Near Threatened (NT): *Crypturellus noctivagus* (Undulated tinamou); *Leopardus wiedii* (Maracajá cat); *Panthera onca* (jaguar); *Pseudastur polionotus* (Pidgeon hawk) and *Tinamus solitarius* (Macuco).

- Safe or Low Concern (LC): *Ara ararauna* (hyacinth macaw); *Ara chloroptera* (Red macaw); *Boa constrictor* (Constrictor); *Caiman latirostris* (Yellow-bellied cayman); *Eunectes murinus* (Anaconda); *Leopardus pardalis* (Ocelot); *Puma concolor* (Puma); *Sarcoramphus papa* (King vulture); *Spizaetus tyrannus* (Black-collared Hawk) and *Spizastur melanoleucus* (Duck-billed hawk).

Flora:

- Endangered (EN): *Aspidosperma polyneuron* (Peroba-rosa) e *Balfourodendron riedelianum* (Pau-marfim).

- Vulnerable (VU): *Cariniana legalis* (Jequitibá-rosa); *Cedrela fissilis* (Cedro-rosa), *Zeyheria tuberculosa* (Ipê-felpudo).

[37] https://verra.org/wp-content/uploads/2017/12/CCB-Standards-v3.1_ENG.pdf
[38] https://verra.org/wp-content/uploads/2017/06/CCB-Program-Rules-v3.1.pdf

5.5.2. Trigger Species Population Trends (GL3.2, GL3.3)

In order to deepen and narrow the selection of key species, the Official National Lists of Flora and Fauna Species Threatened with Extinction, developed by the Chico Mendes Institute for Biodiversity Conservation (Brasil, 2022), and subsidized by the IUCN guidelines, and that assess the national risk of fauna and flora extinction, were also consulted for a more careful and realistic definition of these species in their local context. It is worth mentioning that all the elected species, except for the Ipê-felpudo (*Zeyheria tuberculosa*), the Pau-marfim (*Balfourodendron riedelianum*) and the Peroba-rosa (*Aspidosperma polyneuron*), which were not found in the national list, have extinction rates equal to or more critical than those in the international list. The two species out of the national list, which were restricted only to international categorization, were also selected as key by this project due to comments from nurserymen in the stakeholder consultation about the difficulty of access and seed collection in the Project Zone.

The key species were defined according to the proposed activities and the developed Monitoring Plan of this project, being in line, especially, with the initiative "Research and management of endangered fauna species" and the monitoring assessment parameters "Number of seedlings of endangered species planted" and "Number of fauna species threatened with extinction".

In addition, based on the available literature, the key species were also carefully chosen from their ecology and behavior in the restoration areas, such as demand, occupation, traffic and use of forest restorations. Also, they were determined according to scientific researches being developed by the IPÊ team, and the project is in direct contact with the researchers responsible for them.

Table 37 - Identification and description of key species and trend of populations to the without and with Corridors for Life ARR Grouped Project scenarios.

Trigger Species	Black lion tamarin (*Leontopithecus chrysopygus*)
Population Trend at Start of Project	The species is considered Endangered (EN) by the IUCN and is categorized as endemic to the Atlantic Forest Semideciduous Forest from the western São Paulo state, being limited to the Paranapanema and Tietê Rivers. Currently, only the subpopulation of Morro do Diabo State Park can be considered demographically and genetically viable in the long term (Rezende, 2013). In general, its population has a declining trend, especially due to habitat fragmentation and reduction events, advance of agriculture and cattle ranching, and forest fires.
Without-project Scenario	In a without-Project scenario, it is expected that environmental degradation and forest fragmentation will remain in the Project Zone. The continued isolation of the black lion tamarins would lead to inbreeding and population decline in degraded forest fragments in process of degradation with a support capacity below the number indicated for viable populations of the species, due to the difficulty of translocation and genetic dispersal (Ayala-Burbano et al., 2017). Currently, considering that only the subpopulation of Morro do Diabo State Park can be marked as demographically and genetically viable in the long term, the other subpopulations existing in the interior of São Paulo are regarded as unfeasible in the medium and long term, and may become extinct even in this century (Paranhos, 2006). In parallel, in certain scenarios, climate changes, resulting from environmental degradation, may also pose a future threat to the population

	viability of the black lion tamarin, especially by affecting the extent and quality of habitat available to the species (Meyer, Pie and Passos, 2014).
With-project Scenario	With the purpose of creating ecological corridors through the implementation and facilitation of restorations, the Corridors for ARR Life Grouped Project tends to promote the maintenance of viability and the increase of *L. chrysopygus* populations in the Project Zone. In this regard, the efforts of this carbon project are focused on the expansion and creation of continuous forest areas for the occupation and translocation of the species; the stimulation of studies and scientific research on management strategies for the meta population to ensure their survival and population viability; and the promotion of environmental education on sustainable development for local communities and other stakeholders. In this regard, the Corridors for Life ARR Grouped Project, in partnership with the Black Lion Tamarin Conservation Program, a research and management initiative led by IPÊ scientists at Pontal do Paranapanema for decades, will foster a continuous monitoring and genetic and demographic management of the population of this species in the ecological corridors for the long-term conservation of the biological diversity of the black lion tamarin in the Project Zone. Furthermore, the in-depth knowledge about the biology and ecology of the species; the consistent habitat restoration and preservation of existing forest remnants; the facilitation of gene flow and the reduction of the possibility of inbreeding; the periodic assessment of the results obtained in studies and researches; and the environmental awareness of local communities about sustainable development and the importance of preserving the species promoted by the Corridors for Life ARR Grouped Project will be positive compared to the without-project scenario for *L. chrysopygus*, leading to improvements in the population trend of such species.

Trigger Species	Tapir (*Tapirus terrestris*)
Population Trend at Start of Project	Regarded as Vulnerable (VU) to extinction by IUCN. The Project Zone, especially in Morro do Diabo State Park and its immediate surroundings, has approximately 150 individuals of this species (Medici, 2010). In general, their population have a decreasing trend, especially due to habitat fragmentation and reduction events, advance of agriculture and cattle ranching, hunting pressure and road kill.
Without-project Scenario	Environmental degradation and forest fragmentation are expected to remain in the Project Zone. Taking into account that the tapir is a species strongly dependent on the forest for its survival, the loss of habitat for *T. terrestris* would lead to a population decline, especially due to depletion and loss of genetic variability, as well as the difficulty in accessing resources (mainly

	food and water) (Flesher and Medici, 2022). It is well-known that, in anthropized landscapes, tapirs can tolerate radical large-scale habitat changes, as they persist in commercially produced grain plantations (e.g. soybean), pervading the remaining forest fragments (Rossi, Panachão and Arasaki, 2009). However, this fact exposes the animal to a differentiated diet, subject to a wide range of agrochemicals, as well as making them more susceptible to poaching events and road kill (Medici and Desbiez, 2012; Gonzales, 2022). In parallel, the species reproduction is characterized as slow, making it difficult to recover viable numbers of their population in the long term (Pukazhenthi et al. 2013).
With-project Scenario	With the purpose of creating ecological corridors through the implementation and facilitation of restorations, the Corridors for ARR Life Grouped Project tends to promote the maintenance of viability and the increase of *T. terrestris* populations in the Project Area. Thus, the efforts of this project are aimed at the expansion and formation of continuous forest areas for shelter and facilitation of tapir movement between the forest restoration areas and the remaining forest fragments. Many of the trees planted in the restoration activities are consumed by the tapir, also known as "forest gardener", due to their high capacity to disperse seeds of native flora species. It also seeks to stimulate academic studies and researches on the biology, ecology and management of the tapir for the development of priority conservation actions for the species and its habitat. In parallel, environmental education strategies and awareness campaigns will also be components of the initiatives concerning this carbon project for the conservation and improvement of tapir population viability in the landscape, making the local population aware of the negative effects of hunting and killing animals the region's roads.

Trigger Species	Giant anteater (*Myrmecophaga tridactyla*)
Population Trend at Start of Project	Is regarded as Vulnerable (VU) to extinction by the IUCN and, at Pontal do Paranapanema, especially in Morro do Diabo State Park, between years 2020 and 2021, 18 individuals of this species were recorded by researchers of Fundação Florestal (Fonseca, 2022). Generally speaking, their population has a decreasing trend, especially due to habitat fragmentation and reduction events, advance of agriculture and cattle ranching, hunting pressure, being run over by cars on roads and fires.
Without-project Scenario	Environmental degradation and forest fragmentation is expected to persist in the Project Zone. Considering that the giant anteater requires extensive areas, including native forests, for their survival and that the species has a low reproductive potential; presenting prolonged parental care, long gestational periods and only one calf per year; the process of maintaining current land use and occupation in the Project Zone would be harmful to the free-

	living populations of *M. tridactyla* in the region; compromising the entire food chain of the local ecosystem (Knott et al., 2013). In parallel, this biological characteristic associated with the solitary habit makes the species vulnerable to poaching action, road kills local roads and episodes of fires in crops and pastures (Fischer, 1997; Peres, 2000). Finally, in certain scenarios of climate changes, resulting from environmental degradation, extreme temperature events may contribute to the future rarefaction of species, which is physiologically fragile, mainly by compromising the extent and quality of habitat available to the giant anteater (Camilo-Alves and Mourão, 2005).
With-project Scenario	The Corridors for Life ARR Grouped Project, with the purpose of creating ecological corridors by the implementation and facilitation of restorations, seeks to promote the maintenance of viability and population growth of *M. tridactyla* in the Project Area. To this end, the efforts of this carbon project are aimed at the expansion and formation of continuous forest areas for the facilitation of shelter and transit of the giant anteater between the forest restoration areas and the remaining forest fragments, providing suitable environmental conditions for the survival and reproduction of this species. At the same time, the project also seeks to encourage studies and scientific research on the biology and ecology of *M. tridactyla*, in ecological corridors in the region, to understand the population viability and to recommend management strategies for the conservation of the *in situ* species. It will also promote environmental awareness activities so that the local population can acquire and disseminate information about the importance of sustainable development for the conservation of the giant anteaters in the Project Zone, minimizing the effects of hunting, fires and road kills. Thus, the initiatives proposed by the Corridors for Life ARR Grouped Project will ensure positive benefits to the giant anteater population in relation to the without carbon project scenario.

Trigger Species	Peroba-rosa (*Aspidosperma polyneuron*), Pau-marfim (*Balfourodendron riedelianum*), Cedro-rosa (*Cedrela fissilis*), Ipê-felpudo (*Zeyheria tuberculosa*), Jequitibá-rosa (*Cariniana legalis*).
Population Trend at Start of Project	Peroba-rosa (*Aspidosperma polyneuron*): The species is regarded as Endangered (EN) by the IUCN, in Pontal do Paranapanema, specifically in two fragments (Água Sumida - 555 ha and Estrela - 1207.62 ha), 16 individuals of that species were sampled (Durigan, Santos and Gandara, 2002) Pau-marfim (*Balfourodendron riedelianum*): The species is regarded as Endangered (EN) by the IUCN and, in Pontal do Paranapanema, especially in the Mico-Leão-Preto Ecological Station, the presence of the said species was recorded in all plots making up the UC (Corte and Valladares-Pádua, 2007).

	Cedro-rosa (*Cedrela fissilis*): The species is regarded as Vulnerable (VU) to extinction by the IUCN and, in Pontal do Paranapanema, especially in the Nova Esperança settlement (Euclides da Cunha -SP), an average density of 3.1 individuals per hectare was recorded (Rodrigues, Monteiro and Cullen Jr., 2010). Ipê-felpudo (*Zeyheria tuberculosa*): The species is regarded as Vulnerable (VU) to extinction by the IUCN and, in Pontal do Paranapanema, specifically in two fragments (Água Sumida - 555 ha and Estrela - 1207.62 ha), 3 individuals of that species were sampled (Durigan, Santos and Gandara, 2002). Jequitibá-rosa (*Cariniana legalis*): The species is regarded as Vulnerable (VU) to extinction by the IUCN, and was recorded in field expeditions by researchers in Morro do Diabo State Park, located in Pontal do Paranapanema and deployed in restoration projects conducted by IPÊ, because of its regional importance and occurrence (Paula et al., 2011; Almeida, 2019). Generally speaking, the populations of the referred species have a verified and/or projected decline trend, especially due to illegal logging events because of their high commercial values.
Without-project Scenario	In a scenario without Project, environmental degradation and forest fragmentation is expected to continue in the Project Zone. Peroba-rosa (*Aspidosperma polyneuron*): Considering that seed production by *A. polyneuron* occurs naturally in the period of 2 to 4 years, and disperses over short distances, the maintenance of land use and occupation by crops and pastures to the prejudice of native forests would be detrimental to the maintenance, dispersal and establishment of the rosewood in the Project Zone, especially due to the isolation of individuals (Carvalho, 2004). In other words, habitat reduction negatively affects the species viable population maintenance dynamics, especially with regard to recruitment, establishment, growth, reproduction, and genetic variability of tree individuals (Fisher and Lindenmayer, 2007). This species also has wood with high density, resulting in great commercial interest and high pressure for irregular extraction in its natural environment (Martinelli and Moraes, 2013). Pau-marfim (*Balfourodendron riedelianum*): The maintenance of land use and occupation entails drastic effects for the population of *B. riedelianum*, because it reduces the species habitat in small isolated fragments and compromises the process of viable population maintenance of the species, especially with regard to recruitment, establishment, growth, reproduction and genetic variability of tree individuals (Aguiar, 2018). Besides this fact,

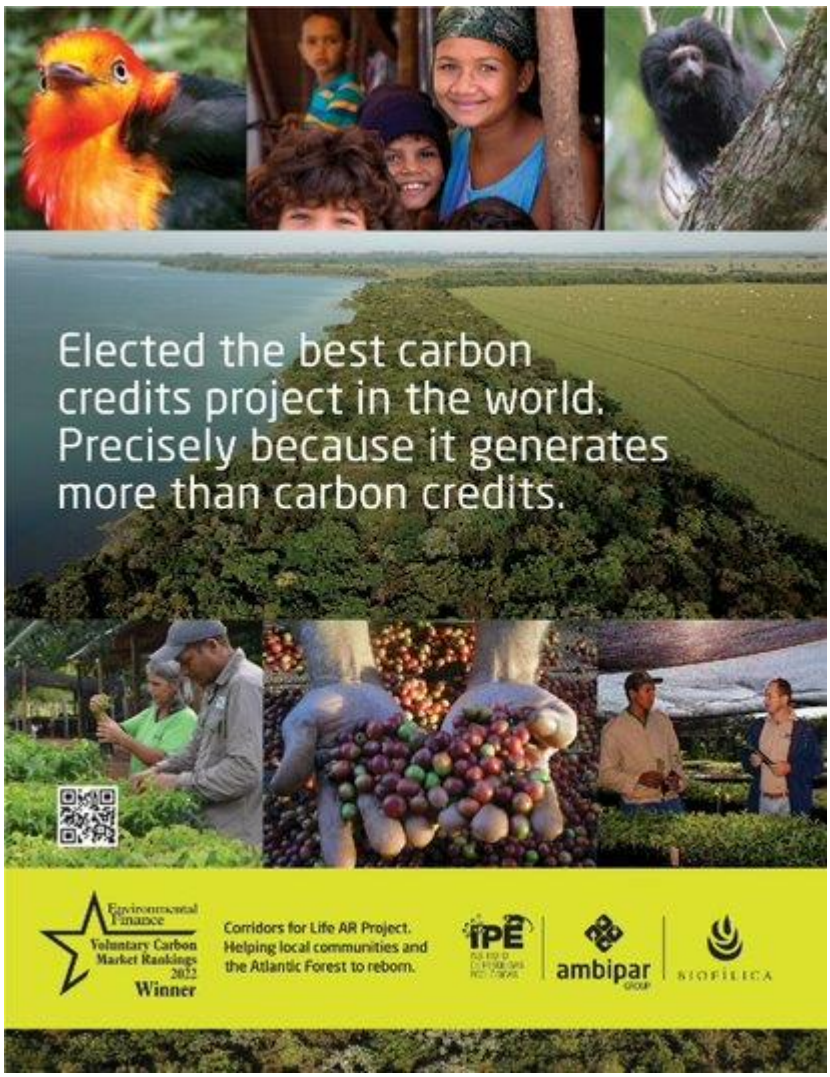
	although the biological, physiological, and ecological characteristics of Pau-marfim identify it for its ease of dispersal and natural regeneration, it is a species largely dependent on conservation measures due to overexploitation of wood because of its high economic value in the market (Martinelli and Moraes, 2013). Cedro-rosa (*Cedrela fissilis*): The maintenance of land use and occupation causes harmful effects to the population of *C. fissilis,* as it reduces the species habitat in small, isolated fragments and compromises the process of viable population maintenance of the species, especially with regard to recruitment, establishment, growth, reproduction, and genetic variability of tree individuals (Fisher and Lindenmayer, 2007). Added to this, it is well-known that the Cedro-rosa is a species largely dependent on forests, because it develops in clearings of primary forests or secondary forest shrub clearing (Carvalho, 2003). This characteristic prevents the species from forming dense populations. In addition, *Cedrela fissilis* is largely dependent on conservation measures due to overexploitation of timber because of its high economic value in the market, as well as its survival is directly affected by the action of the "Broca-do-credo" (borer) (Martinelli and Moraes, 2013). Ipê-felpudo (*Zeyheria tuberculosa*): *Z. tuberculosa* is characterized by the rusticity of population colonization in pastures and degraded areas. However, the maintenance of land use and occupation has negative effects on the populations of the Ipê-felpudo, because these dynamic compromises the recruitment of individuals, decreases genetic diversity and reduces the reproductive success of this species in its local range because of the physical and genetic isolation, directly affecting the preservation of its viable population (Aguilar et al., 2009). In parallel, *Zeyheria tuberculosa* is highly dependent on conservation measures because of the overexploitation of wood due to its high economic value in the market (Martinelli and Moraes, 2013). Jequitibá-rosa (*Cariniana legalis*): *C. legalis* is characterized as a long-lived, slow-growing species, presenting a generation cycle close to one hundred years (Martinelli and Moraes, 2013). Added to this particularity, it is largely dependent on the forest for its reproduction and growth, and the process of fragmentation of forests into small and isolated remnants, due to the continued use and occupation of land by crops and pastures in areas governed by environmental legislation, is highly detrimental to the maintenance, dispersal and establishment of Jequitibá-rosa in the Project Area, especially due to the physical and genetic isolation of individuals (Carvalho, 2003; Fisher and Lindenmayer, 2007).

	In association, this species has great commercial interest and high pressure for irregular extraction in its natural environment, due to the quality of its wood and the columnar trunk of large dimensions, aggravating the population decline of *Cariana legalis* in areas of natural occurrence (Martinelli and Moraes, 2013).
With-project Scenario	With the purpose of creating ecological corridors through the implementation and facilitation of restorations, the Corridors for Life ARR Grouped Project seeks to promote the maintenance of viability and increase the population of *A. polyneuron, B. riedelianum, C. fissilis, Z. tuberculosa*, and *C. legalis* in the Project Area. To this end, the activities of this carbon project aim to conserve these species *in situ*, as well as to enhance the richness of species in the restorations by encouraging the planting of seedlings in the field and training in the collection and production of several native tree species, including those categorized as endangered. In this way, the continuous forest areas will act as a shelter and a source of seed dispersal for the proper recruitment, establishment, development, and reproduction of the Peroba-rosa, Pau-marfim, Cedro-rosa, Ipê-felpudo, and Jequitibá-rosa. At the same time, the project will also encourage academic studies and researches on the richness of native tree species, especially endangered species, in the restorations of the Project Area to understand the population viability and for strategic management recommendations for *in situ* species conservation. It will also promote environmental awareness activities so that the local population can acquire and share knowledge about restoration activities and their importance for the conservation of these species in the Project Area. Finally, these activities suggested by the Corridors for Life ARR Grouped Project, especially with regard to the commitment to deploy the species seedling and the continuous monitoring of same in the restoration polygons, will ensure positive benefits to the populations of *Aspidosperma polyneuron, Balfourodendron riedelianum, Cedrela fissilis, Zeyheria tuberculosa,* and *Cariniana legalis* to the prejudice of the scenario without the carbon project.

6. APPENDICES

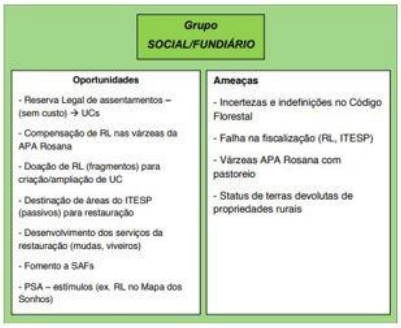
6.1. Appendix 1: Additional Information

Figure 50. Publicity art for the Best Individual Offseting Project of 2022 award by Environmental Finance



6.2. Appendix 2: Additional Information

F.O.F.A. matrix (corresponding to topic 4.2.1)



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