



**Verified Carbon
Standard**

MIXED AFFORESTATION WITH NATIVE AND NON-NATIVE SPECIES IN ARGENTINA-I PROJECT



Cambium

Project title	Mixed afforestation with native and non-native species in Argentina-I
Project ID	4763
Monitoring period	01-September-2022 to 16-November-2023
Crediting period	01-September-2022 to 31-August-2062
Original date of issue	01-December-2023
Most recent date of issue	31-Oct-2025
Version	v. 1.4
VCS Standard Version	4.7 VCS Standard Version
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1 PROJECT DETAILS

1.1 Summary Description of the Project

This *Mixed afforestation with native and non-native species in Argentina-I Project* (hereinafter “the Project”) consists of the afforestation of 973.14 hectares with different types of pine species (67.59% of the area) and eucalyptus species (29.50% of the area), and a 2.91% of the area with a mix of native species. The project activity will be carried out in two locations owned by Garruchos S.A and managed by Cambium, in the departments of Ituzaingó and Santo Tomé, within the province of Corrientes, Argentina. No harvesting activity will be done, to maximize the CO₂ removals from the atmosphere.

The project activity has converted an area, where mainly extensive livestock activity was historically carried out, into an afforestation project activity with no harvest. The total project area has been planted between the end of year 2022 and second quarter of year 2023, after soil preparation activities took place (September 1st, 2022). Carbon removal is the goal, so pruning activities are not planned for. In addition, the afforestation will contribute to minimizing soil erosion, protecting, and restoring areas degraded by continuous cattle raising. Moreover, a native species domestication program has been implemented together with Misiones National University, aiming to further study native species’ growth demands and conditions.

This afforestation project will be carried out considering the existing guidelines of Good Forest Practices suggested by authorities as a basic tool for the implementation of environmentally sustainable forestry. In addition, it will have the FCS certificate, which ensures that the design, planting and maintenance of the forest are carried out through a sustainable forest management program avoiding negative impacts on biodiversity, local communities and water quality.

The removals of GHGs will occur through the carbon reservoirs that will be generated through the planting of trees. These include the measured pools aboveground biomass and belowground biomass, as well as others not measured in this project (dead wood, litter and soil organic carbon). The project is estimated to remove a total amount of 1,090.185 tCO₂ over a 40-year period, which works out at an average reduction of 27,255 tCO₂ per year. During this first monitoring period (01/09/2022 - 16/11/2023) the net GHG emissions removals equals 904tCO₂.

1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation/verification	01-September-2022 - 16-November-2023	VCS	AENOR	1.2 years

1.3 Sectoral Scope and Project Type

Sectoral scope	14, Agriculture, Forestry and Other land Uses
AFOLU project category	Afforestation, Reforestation, Revegetation (ARR)
Project activity type	-

1.4 Project Eligibility

1.4.1 General eligibility

The project is eligible under the scope of the VCS Program as the project includes AFOLU activities (project category ARR) which are supported by a CDM methodology approved under the VCS Program, CDM methodology AR-ACM0003 “Afforestation and reforestation of lands except wetlands” (version 02.0). As the project is expected to remove more than 16,000 tCO₂e/year it is considered a large-scale project thus meets the condition of the mentioned methodology.

The project meets the pipeline listing deadline for AFOLU projects of 3 years since start date. Moreover, the validation deadline is expected to be met, within 8 years from start date. In relation to the methodology’s grace period deadline, the project has been registered as ‘under validation’ before December 28th, 2023.

1.4.2 AFOLU project eligibility

The standard establishes a set of specific requirements for Afforestation, Reforestation and Revegetation (ARR) projects eligibility. The project is eligible under the ARR category, as it seeks to increase carbon removals by establishing vegetative cover through the planting of native and non-native woody vegetation. **Although permitted by project activity eligibility conditions, the project does not include timber harvesting in their management plan.**

Regarding the non-displacement of native non-degraded ecosystems, no natural ecosystems have been converted, cleared, drained or degraded to generate GHG credits within 10 years of the project start date. The areas have remnants of native species but having been used for cattle breeding for more than 50 years they are highly modified and moderately degraded. Pereira et al. (2023) assessed the degradation of the ecoregion where the project is located: The “Malezales” in the western part of Santo Tomé department. They concluded that the “Malezales” were degraded. To assess the degree of degradation of the project area we carried out the same analysis using vegetation cover (VC) and the pasture degradation index (IDP) as a proxy for environmental degradation. VC was calculated as a spectral index that estimates vegetation cover using NDVI, and IDP is an index that determines the level of degradation of a given area based on VC. As a conclusion, a strong and extreme degradation class of grasslands has been identified also with minor areas with slight and moderate degradation (*APPENDIX 4 – IDENTIFICATION OF DEGRADED LANDS -DATA REQUIRMENTS UNDER AR-ACM0003*).

The previous project land use was extensive continuous cattle breeding, leading to grassland degradation over time. Culturally, cattle breeding activities include grasslands burning in Corrientes to control weeds¹, modifying natural ecosystems. Moreover, there are registries of grassland implementation in 73.52% of the project area in Puerto Valle with more palatable species. This was done only on one occasion in different plots between years 2004 and 2012². For this reason, it cannot be considered as an improved grassland, it is still a moderately degraded land.

Moreover, in the case of Garruchos’ property, the type of vegetation presents 10 years prior to the project start date is the result of many years of forest and grassland disturbances due to cattle breeding: slash-and-burn, forest plantations, roads, and other activities in the property. Through satellite images it is possible to identify an area of the farm which was planted with non-native species by the previous owner. This area of 16 hectares (1.64% of project area) had been planted around 2002 and later harvested (2010); thus, no native ecosystem has been replaced by the project. Later, prior to project start date, with the aim of improving cattle feeding, pastures were planted in part of the area, further altering the land. See further information in section 2.4.3.

Moreover, the area was not cleared of forests. This can be evidenced with satellite images for 10 years prior to project start date. The following images are from December 2010 from Puerto Valle (Figure 1) and February 2010 for Garruchos properties (Figure 2). In green, the plot of land where the project trees will be planted are shown. It is possible to see that the land within the planned

¹ Fernández, J. A., Schroeder, M. A., Goldfarb, M. C., & Bernardis, A. C. (2011). Efecto de la frecuencia de quema prescrita sobre la composición mineral de los pastizales en el nordeste argentino. *Ecología Aplicada*, 10(1), 23-29. Available at: http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S1726-22162011000100003

² Evidence on cattle paddocks implemented within project area available in shared folder “*Environmental health>Grassland implementation paddocks*”

project boundary has not been cleared of forest within the 10-year period to the project start date.

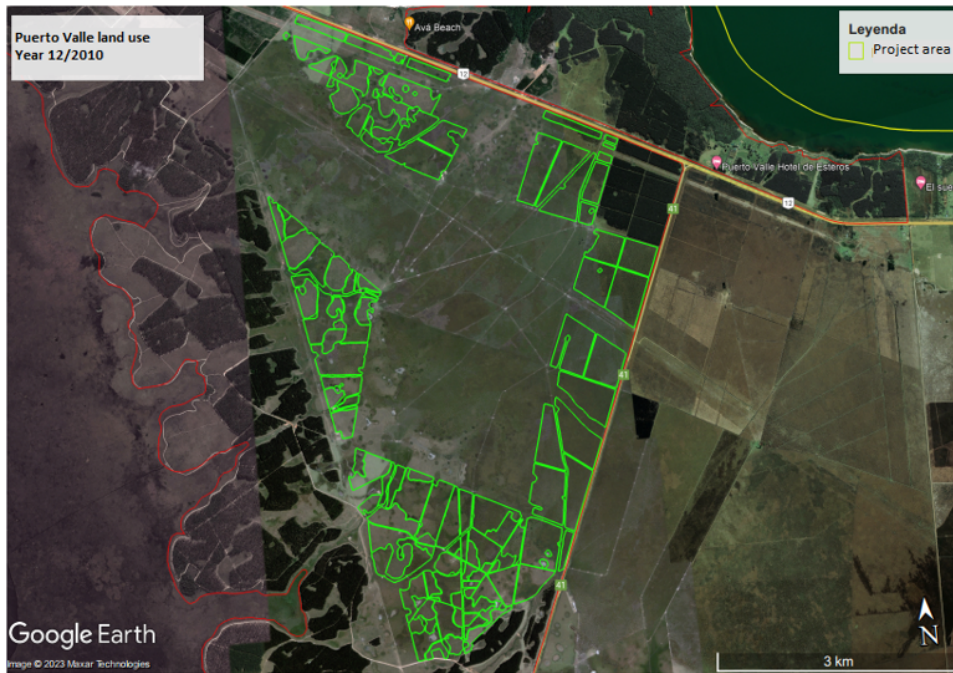


Figure 1 Puerto Valle property – plot of lands for the proposed ARR project activity are indicated in green. Date 2010



Figure 2 Garruchos farm – plot of lands for the proposed ARR project activity are indicated in green. Date 2010

Regarding the wetland condition, it is evidenced from the National Wetland Inventory (MAyDS, 2017) in the figures below (Figure 3 & Figure 4), that the two properties are not wetlands.

Although the area near to the project presents wetland conditions, the project area is not. This is particularly the case as, as part of the company's policy and FSC's certification, HCV areas were identified by third party experts in the property, including wetland areas. These areas were excluded from the project area and no plantation took place as part of the project nor the company's commercial plantations (Figure 5). Moreover, the chosen species are not adapted to waterlogged conditions and would not survive those conditions. Garruchos S.A with many years in the forestry sector designed the project accordingly to avoid those lowlands.

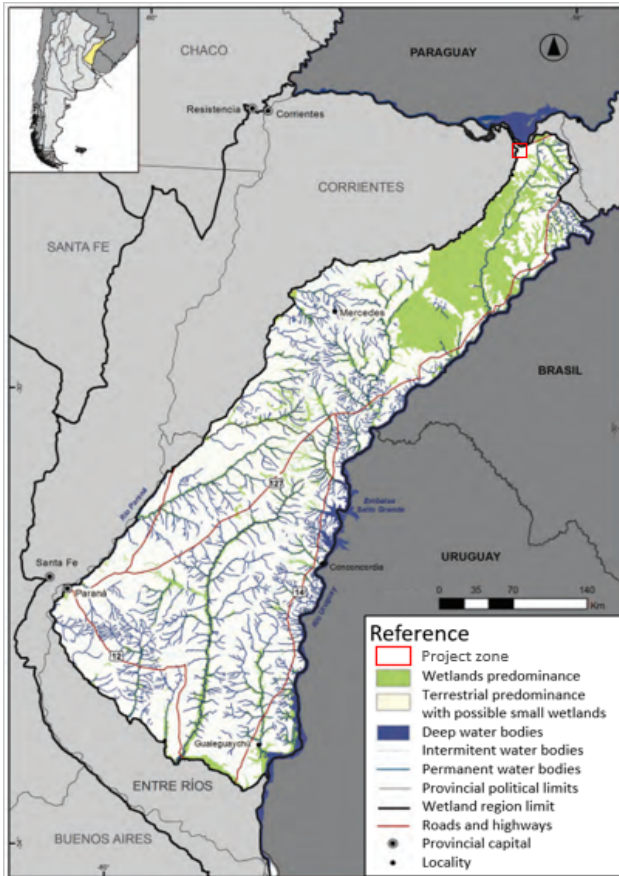


Figure 3 National Wetlands inventory for subregion in *Wetlands of the Chaco-Mesopotamian River Corridor Region* showing the area of Puerto Valle property. Adapted from MAyDS (2017)³

³ Benzaquen, L., D.E. Blanco, R. Bo, P. Kandus, G. Lingua, P. Minotti y R. Quintana. (editores). 2017. *Regiones de Humedales de la Argentina*. Ministerio de Ambiente y Desarrollo Sustentable, Fundación Humedales/Wetlands International, Universidad Nacional de San Martín y Universidad de Buenos Aires

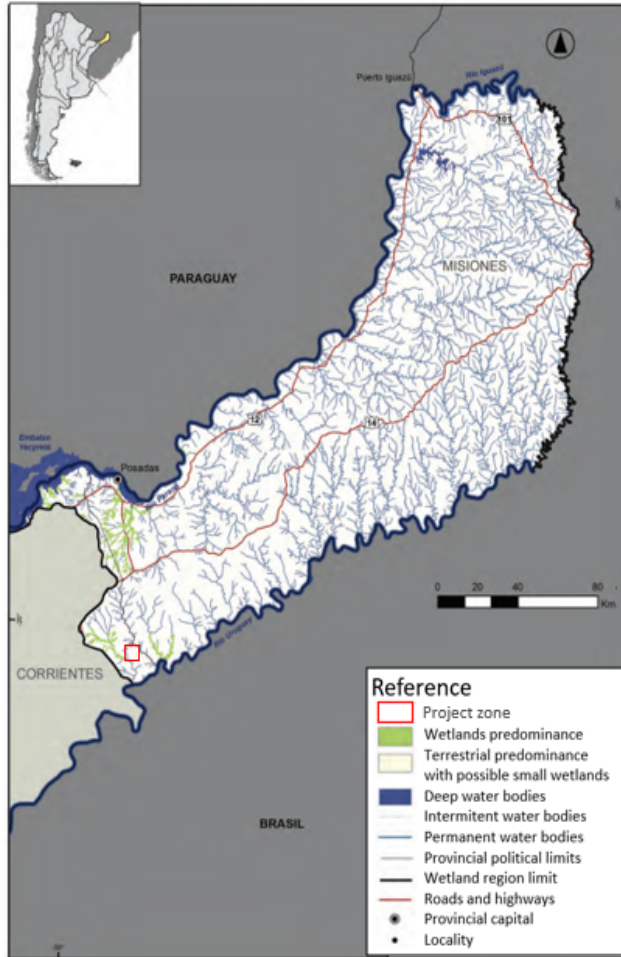


Figure 4 National Wetlands inventory for *Misioneros wetland Region* showing the area of Garruchos property. Adapted from MAyDS (2017) ⁴

⁴ Benzaquen, L., D.E. Blanco, R. Bo, P. Kandus, G. Lingua, P. Minotti y R. Quintana. (editores). 2017. Regiones de Humedales de la Argentina. Ministerio de Ambiente y Desarrollo Sustentable, Fundación Humedales/Wetlands International, Universidad Nacional de San Martín y Universidad de Buenos Aires

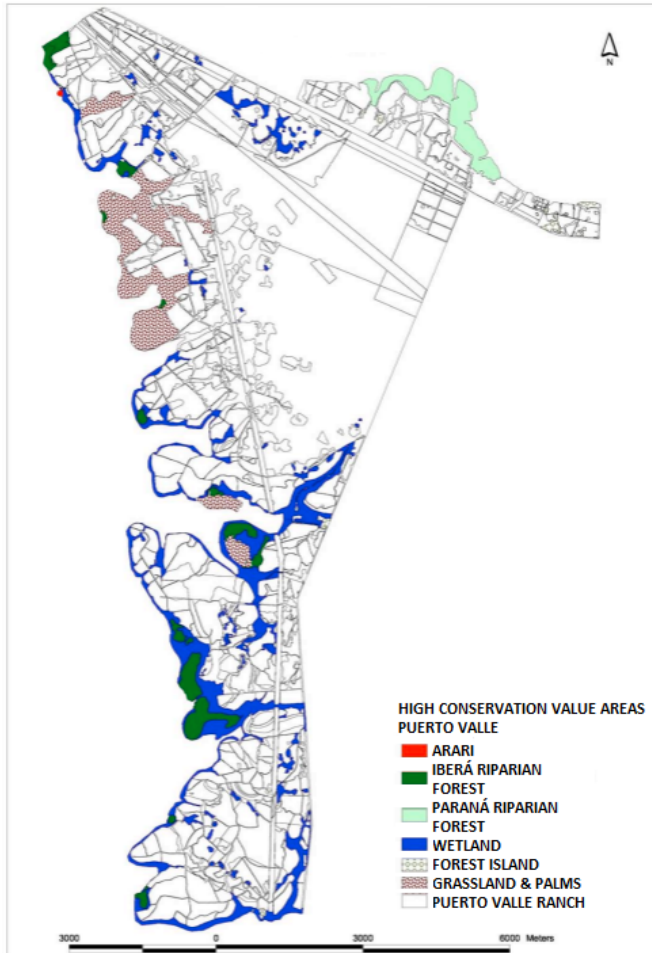


Figure 5 . HCV areas within Puerto Valle, identified as wetlands and excluded from the project area. Garruchos S.A’s Environmental Monitoring Report 2022.

1.4.3 Transfer project eligibility

Not applicable for the project

1.5 Project Design

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

Grouped Project Design

Not applicable

1.6 Project Proponent

Organization name	Cambium Earth S.L. (Cambium)
Contact person	Juan Murillo
Title	Director
Address	c/Recaredo 3, 28002-Madrid (Spain)
Telephone	+34 608 350 706
Email	juan.murillo@cambium.earth

1.7 Other Entities Involved in the Project

Organization name	Garruchos S.A.
Role in the project	Implementing partner - land owner and forest manager
Contact person	Gumerciendo Irala
Title	Forestry Manager Pomera Maderas (Garruchos S.A)
Address	Ruta Nac 12 Rotonda Km 1339/40
Telephone	+54 9 376 4695385
Email	gira@PomeraMaderas.com

Organization name	ProSustentia
Role in the project	VCS-CCB Certification Consultant
Contact person	Federico Moyano
Title	Director
Address	Lavalle 465, piso 7, Buenos Aires, Argentina
Telephone	+54911-36338195
Email	fmoyano@prosustentia.com

1.8 Ownership

Cambium (hereafter “the Project proponent”) has the legal right for the project activity. The project is operated and administered by the project proponent on private property owned by Garruchos S.A⁵ the implementing partner, in charge of management, and monitoring of the project, over the project crediting period. The ownership for the project is evidenced by the commercial agreement⁶ signed between Cambium S.L. and Garruchos S.A. where Cambium appears as project developer with complete authority over the carbon credits to be generated, and Garruchos SA acts both as landowner and forest manager.

It’s important to mention that Garruchos S.A. is the legal name of the company and that the fantasy name (brand name) is POMERA MADERAS. As POMERA MADERAS brand is well known, the official web page⁷ is under this name. Despite that, throughout this document the legal name Garruchos S.A. will be used as implementation partner and Cambium as project proponent.

The contract describes Cambium as the developer and project proponent and included a language in which Garruchos S.A. formally transfers project ownership and carbon credit rights to Cambium for the entire crediting period, including retroactive coverage before the contract was signed.

1.9 Project Start Date

Project start date	01-September-2022
Justification	It is the date when the activities that lead to the generation of GHG emission removals (soil preparation) ⁸ were first implemented.

1.10 Project Crediting Period

Crediting period	<input type="checkbox"/> Seven years, twice renewable <input type="checkbox"/> Ten years, fixed <input checked="" type="checkbox"/> Other. ARR project with a 40-year crediting period
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⁵ Documentation available at validation and verification in shared folder “Ownership”

⁶ Documentation available at validation and verification in shared folder “Ownership”

⁷ Pomera’s web page available at: <https://pomeramaderas.com/corporativo/>

⁸ Evidence of soil preparation with invoice and work order available in shared folder “Project start date”

Start and end date of first or fixed crediting period	01-September-2022 to 31-August-2062
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1.11 Project Scale and Estimated GHG Emission Reductions or Removals

- < 300,000 tCO₂e/year (project)
- ≥ 300,000 tCO₂e/year (large project)

Being conservative with the carbon capture estimations, the following figures have been rounded down to the nearest unit.

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO ₂ e)
01-September-2022 to 31-December-2022	-36
01-January-2023 to 31-December-2023	1,111.00
01-January-2024 to 31-December-2024	13,504.00
01-January-2025 to 31-December-2025	27,955.00
01-January-2026 to 31-December-2026	38,545.00
01-January-2027 to 31-December-2027	47,199.00
01-January-2028 to 31-December-2028	52,865.00
01-January-2029 to 31-December-2029	55,378.00
01-January-2030 to 31-December-2030	55,479.00
01-January-2031 to 31-December-2031	53,946.00
01-January-2032 to 31-December-2032	51,551.00
01-January-2033 to 31-December-2033	48,749.00
01-January-2034 to 31-December-2034	45,741.00

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO _{2e})
01-January-2035 to 31-December-2035	42,798.00
01-January-2036 to 31-December-2036	39,944.00
01-January-2037 to 31-December-2037	37,321.00
01-January-2038 to 31-December-2038	34,901.00
01-January-2039 to 31-December-2039	32,513.00
01-January-2040 to 31-December-2040	30,422.00
01-January-2041 to 31-December-2041	28,493.00
01-January-2042 to 31-December-2042	26,706.00
01-January-2043 to 31-December-2043	25,216.00
01-January-2044 to 31-December-2044	23,764.00
01-January-2045 to 31-December-2045	22,414.00
01-January-2046 to 31-December-2046	21,245.00
01-January-2047 to 31-December-2047	20,125.00
01-January-2048 to 31-December-2048	19,126.00
01-January-2049 to 31-December-2049	18,203.00
01-January-2050 to 31-December-2050	17,290.00
01-January-2051 to 31-December-2051	16,481.00
01-January-2052 to 31-December-2052	15,759.00

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO ₂ e)
01-January-2053 to 31-December-2053	15,062.00
01-January-2054 to 31-December-2054	14,446.00
01-January-2055 to 31-December-2055	13,819.00
01-January-2056 to 31-December-2056	13,257.00
01-January-2057 to 31-December-2057	12,730.00
01-January-2058 to 31-December-2058	12,2
01-January-2059 to 31-December-2059	11,734.00
01-January-2060 to 31-December-2060	11,239.00
01-January-2061 to 31-December-2061	10,785.00
01-January-2062 to 31-August-2062	10,385.00
Total estimated ERRs during the first or fixed crediting period	1,090,185.00
Total number of years	40
Average annual ERRs	27,255

1.12 Description of the Project Activity

This *Mixed afforestation with native and non-native species in Argentina-I Project* (hereinafter “the Project”) consists of the afforestation of 973.14 hectares with different types of pine and eucalyptus species and a 3% of the area with a mix of native species (see appendix 6 for species description sheet). The project activity will be carried out in two locations owned by Garruchos S.A and managed by Cambium, in the departments of Ituzaingó and Santo Tomé, within the province of Corrientes, Argentina. No harvesting activity will be done, to maximize the CO₂ removal from the atmosphere.

The total project area was planted between 2022 and 2023: 479.89 hectares were planted in the last quarter of 2022 and 493.25 hectares of Pinus were planted in the first quarter of 2023. The project includes both native and non-native woody species: 287.08 hectares of *Eucalyptus grandis*, 596.91 hectares of *Pinus hybrid (elliottii x caribaea)*, 60.82 hectares of *Pinus tadea* and 28.33 hectares of a mix of diverse native species (see complete list in section 2.4.2). There will be no harvesting activity in this ARR project. The sole objective is to mitigate climate change by capturing CO₂ from the atmosphere, contributing toward carbon neutrality.

It's important to point out that Garruchos S.A silvicultural activities have been certified under the Forest Stewardship Council (FSC) since 2006, which shows the long-term commitment towards responsible forest management⁹. The design, planting and maintenance of the forest will be carried out by means of a sustainable forest management program as well. The program seeks to avoid any negative impact over the biodiversity, local communities, and hydro balance of the basins or on the landscape.

Furthermore, the project will also be carried out considering the guidelines on good forestry management suggested as a basic tool for implementation of sustainable environmental forestry by the National Department of Agriculture, Fishing, Livestock and Food (SAGPyA)¹⁰, the Guideline of Good Practices for the province of Corrientes¹¹, as well as Principles and Criteria for Forest Stewardship of the FSC.

At the same time, research activities will take place together with Misiones National University and INTA to generate further information on native species growth needs. In this sense, it must be noted that in native species plots, Eucalyptus species have been planted to provide a shelter service to native species during the first 2 years. These exotic individuals will be then thinned and extracted; for this reason, they will not be monitored or included within the project's carbon removals estimations.

Moreover, the plantations are expected to contribute to minimising further soil erosion and compaction by providing tree cover to the areas thereby protecting and restoring the degraded areas. The project activities also provide additional co-benefits, through the creation of

⁹ Certification evidence available to VVB during validation/verification Available at: <https://app.powerbi.com/view?r=eyJrIjojN2U3NGMyNWZlZTAxNS00MzVhLWExNmMtOTlhZjdiYjQ4MWNkIiwidCI6IjE5NGU2OWRiLWVmNjUtNDk2Yi05NmE5LTVkNTZiZWxWMxZDI5MSIsImMiOjI9>

¹⁰ SAGPyA Manual on Good Forestry Practice. Available at: https://www.magyp.gob.ar/sitio/areas/desarrollo-foresto-industrial/buenas_practicas/

¹¹ Manual of Good Practices of the Province of Corrientes. Available at: https://www.magyp.gob.ar/sitio/areas/desarrollo-foresto-industrial/buenas_practicas/_archivos//000001_Provincia%20de%20Corrientes.pdf

employment opportunities for local stakeholders, restoration of lands with native species, as well as others.

Site preparation

Soil preparation creates optimal conditions for the establishment of the plantation, with adequate levels of aeration, humidity and temperature. Efficient contact between the seedling roots and the soil is sought to achieve a good establishment rate. Soil protection is the main consideration, considering rainfall, soil texture, slope and drainage. Soil is subsoiled and harrowed. Subsoiling is done only on the planting line to minimise movement and disturbance, and perpendicular to the slope to prevent erosion. Harrowing reduces the size of clods and improves the contact of soil particles with the roots. The harrow passes over the subsoil. Weed control is then carried out.

Puerto Valle:

Pine areas: A first pass was made with a heavy harrow (Fiat AD14 bulldozer), and finally a ridging machine was used because the soil is low (Figure 6).

Eucalyptus areas: In these areas a heavy harrow (Valtra 190 HP) was used for one pass, followed by a second pass with a light harrow (New Holland 110KP) and finally a subsoiler with 3 tines to decompactify the soil (Valtra 190) (Figure 25).

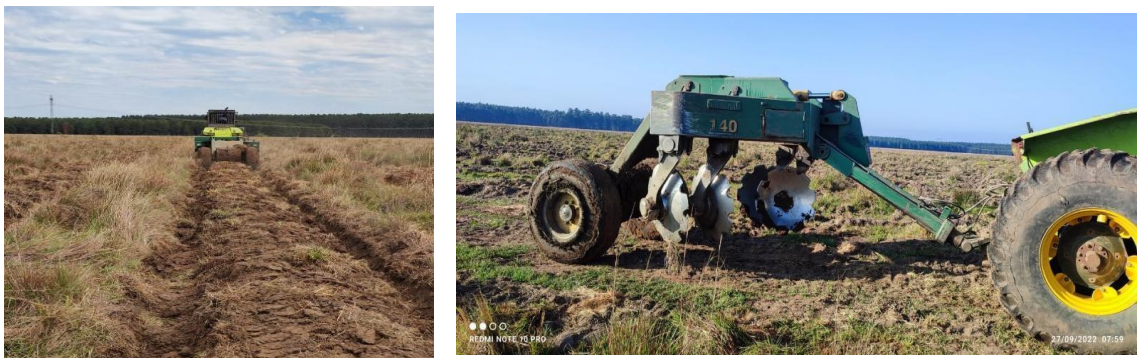


Figure 6. Soil preparation in Puerto Valle (September 2022)



Figure 7 Soil preparation in Puerto Valle for Eucalyptus plantation (November 2022)

Garruchos:

Native areas: On the hectares planted with native species in Garruchos, the first pass was made with a heavy harrow, followed by a light harrow and finally a subsoiler with 3 tines to break up the compaction (Figure 8).



Figure 8 Site preparation in Garruchos Farm for the plantation of native species (September 2022)

Nursery for plantations

The nursery is in Puerto Valle property and has an annual production capacity of approximately 6,000,000 seedlings (Figure 9). It is mainly oriented towards the production of pine and native species from seeds, while eucalyptus is reproduced through vegetative propagation. The production of clonal eucalyptus in plastic tubers was replaced by biodegradable, cellulose based, FSC® certified tubers. This improves seedling quality, reduces the volume of plastic waste, and lowers the risk of potential alteration. All seedlings are of high genetic quality, certified by INASE (National Seed Institute) ¹² and SENASA (National Agri-food Health and Quality Service) ^{13 14}.



Figure 9 Nursery in Puerto Valle

Weed Control

To improve conditions for plant development and ensure plant establishment and survival, weed control is carried out. In this way, competition for water, light and nutrients is reduced. The weed control programs currently applied by Garruchos S.A uses a combination of chemical, manual and/or mechanical control practices. Priority is given to minimizing the use of agrochemicals and reducing the area of application. The handling, storage, application, and final disposal of phytosanitary products is carried out under strict safety standards for the operator and the environment, in accordance with the "Programa de Manejo Responsable de Agroquímicos" ¹⁵

¹² INASE web page available at: <https://www.argentina.gob.ar/inase>

¹³ SENASA web page available at: <https://www.argentina.gob.ar/senasa>

¹⁴ Seedling certification available to VVB in shared folder "Environmental health>Seedlings certificate"

¹⁵ INTA. Instituto Nacional de Tecnología Agropecuaria. Programa de Manejo Responsable de Agroquímicos: <https://inta.gob.ar/sites/default/files/inta-manual-uso-agroquimicos-frutihorticola.pdf>

(Program for the Responsible Management of Agrochemicals) from INTA (Nation Institute for Agriculture Technology).

Pest control

The main pest is the cutter ant, and pre- and post-planting populations that may persist are controlled, as well as other pests if necessary. The control strategy is based on a set of integrated measures to keep damage levels below economically sustainable levels. The measures are intended to have a low impact on the environment and represent a low risk to forest operators and neighbouring local communities. Controls are carried out using permitted phytosanitary products. The handling, storage, application, and final disposal of phytosanitary products are carried out in accordance with the "Programa de Manejo Responsable de Agroquímicos¹⁶" (Responsible Agrochemical Management Program). To reduce the use of phytosanitary products, all controls are directed at the anthill.

In all cases, pre-planting ant control was carried out with Formidor (fipronil¹⁷), which consists of granulated baits. Between 2 and 3 kg per hectare was used. After planting, checks were made to ensure that no ant mounds were reactivated.

Plantation per plot

Planting was done manually with a shovel. In the case of native species planted in Garruchos, the plants were provided with planting gel to avoid water stress. Planting density varies between 625 to 1,250 plants/ha depending on the species and the genetic material used (clones/seeds) (see Table 1 for more details). The destination of the plantation is not commercial, therefore the density that optimizes the highest possible carbon removal is sought, based on the quality of the site, and the species or genetic material. The seedlings come from the company's own nursery in biodegradable tubes. Eucalyptus plantations are fertilized with nitrogen, phosphorus and potassium NPK+ micronutrients in a targeted way to the plant and with granulated products. This procedure only occurs once at the time of the planting of this species. Planting is carried out at two times of the year, spring and autumn, when climatic conditions are favorable for plant development.

¹⁶ <https://inta.gob.ar/sites/default/files/inta-manual-uso-agroquimicos-frutihorticola.pdf>

¹⁷ https://www.casadeinsecticidas.com.ar/imgprod/Formidor_control_hormigas.pdf



Figure 10 Plantation of native species in Garruchos (October-December 2022)

The planting scheme for the project will be as follows:

Table 1. Planting scheme for the project activity

Stratum	Line spacing and trees spacing (meters)	Gender	Species	Tree density	Area (ha)	YOP
1	4x3	<i>Pinus</i>	<i>hybrid (elliottii x caribaea)</i>	833 plants/ha	473.82	Q2 2023
2	4x2	<i>Pinus</i>	<i>hybrid (elliottii x caribaea)</i>	1250 plants/ha	123.09	Q4 2022
3	4x2	<i>Pinus</i>	<i>taeda</i>	1250 plants/ha	41.39	Q4 2022
4	4x3	<i>Pinus</i>	<i>taeda</i>	833 plants/ha	19.43	Q2 2023
5	4x4	<i>Eucalyptus</i>	<i>grandis</i>	625 plants/ha	129.83	Q4 2022
6	4x2	<i>Eucalyptus</i>	<i>grandis</i>	1250 plants/ha	157.25	Q4 2022
7	4x4	Native mix		625 plants/ha	7.37	Q4 2022
8	4x2	Native mix		1250 plants/ha	5.98	Q4 2022
9	4x4	Native mix + Eucalyptus		625 plants/ha	7.76	Q4 2022
10	4x2	Native mix + Eucalyptus		1250 plants/ha	7.22	Q4 2022
Total					973.14	

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

1.13 Project Location

The project consists of 973.14 hectares of native and non-native species planted in two private properties owned by Garruchos S.A. Puerto Valle farm is in the Mesopotamian region, northeastern Argentina (latitude 27° 36' 33.01" S; longitude 56° 26' 11.60" O), on National Route No. 12 Km 1282, in the Department of Ituzaingó, Province of Corrientes. The nearest towns are Santa Tecla (4 km), Ituzaingó (28 km) and Gobernador Virasoro (92 km), and further away is the capital, Corrientes City (246 km). Regarding the province of Misiones, the establishment is located 65 km from the city of Posadas (Figure 11).

Garruchos farm is also located in the Mesopotamian region, northeast of Argentina (Latitude 28° 5' 21.15" S; longitude 55° 44' 50.65" O), on the Provincial Ruta N° 7 km 79 in the Department of Santo Tomé, Province of Corrientes. The nearest towns are Colonia Garabí and Garruchos in the province of Corrientes, and Azara in the Province of Misiones. This property is located 104 km from the city of Posadas and 384 km from Corrientes City (Figure 12).

The location of the planted plots in the respective properties is detailed in shared KML file.

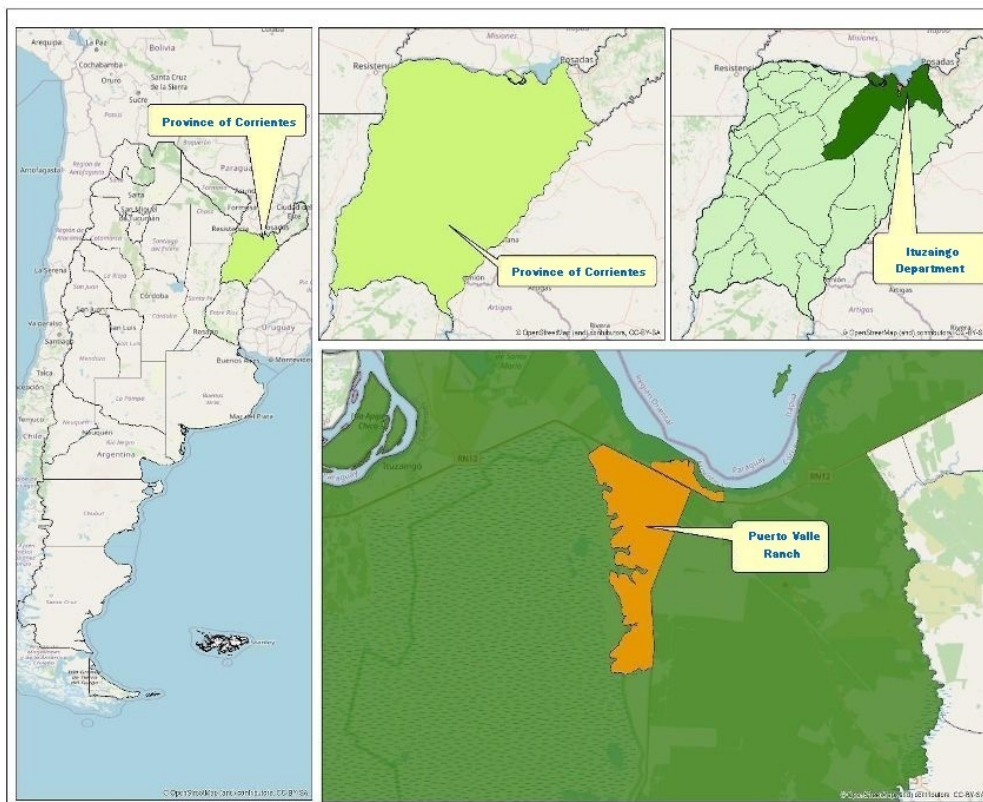


Figure 11 Puerto Valle property Location

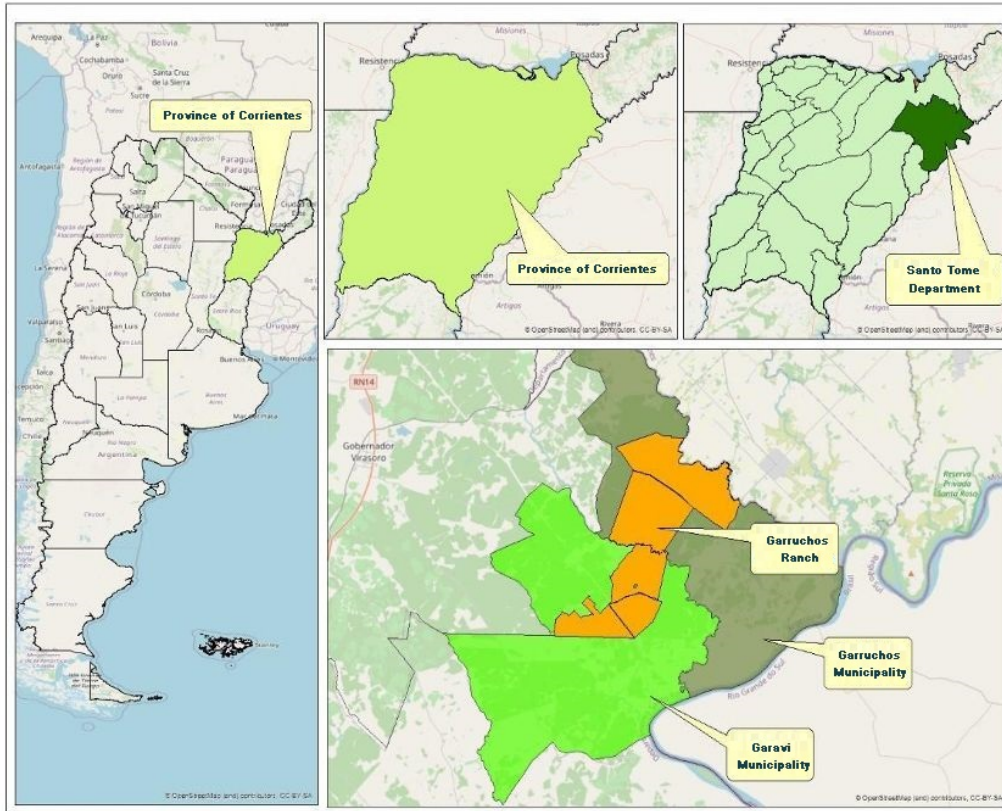


Figure 12 Garruchos property Location

1.14 Conditions Prior to Project Initiation

The conditions existing prior to the project initiation are the same as those described as the baseline scenario in Section 3.4: continuous extensive cattle raising.

The ecosystem of the province of Corrientes is humid subtropical. It is characterized by a warm and humid climate with abundant rainfall throughout the year. The activity in the project area has been continuous extensive cattle ranching for decades, including an area of forest planted around year 2002 (16ha, 1.64% of project area), later harvested around 2010. Cattle raising is the most suitable agricultural activity due to the conditions of the land, an activity widely spread in the region representing almost 40% of the agriculture sector in the province¹⁸.

¹⁸ "Informe Expoagro 2021" in La Nación 14/10/21, available at: https://www.lanacion.com.ar/economia/campo/radiografia-de-la-ganaderia-en-corrientes-como-esta-la-actividad-y-cuales-su-norte-nid14102021/?utm_source=google&utm_medium=cpc_verticales&utm_campaign=campo&utm_content=dsa&gad_source=1&gclid=CiOKCQiAo7KqBhDhARIsAKhZ4uiYC-CiW8JlrXx3D35mpOh0vKYHe7tGPEwyYwWpCkQChuz8Ki8bgaAnpXEALw_wcB

This project activity is implemented within the Argentinean Ecoregions of “Campos y Malezales” and the northeast limit of “Esteros del Iberá”¹⁹. The first is distinguished from the neighboring ecoregions by its plant cover, of vast plain grasslands, barely interrupted by small, wooded patches. The second, mostly known for its wetlands, consists of 3,900,000 hectares of low depth, due to the passage of the Paraná River some 8,000 years ago.

In the higher lands of “Esteros del Iberá” Ecoregion there is usually a predominance of dense herbaceous strata in which palms (*Copernicia alba*) and isolated trees are scattered. The species associations of the herbaceous stratum depend on the soil moisture gradient some of the native species include paja amarilla (*Sorghastrum setosum*), bobo (*Paspalum intermedium*), *Aristida jubata* (*Aristida jubata*) and *Paspalum rufum*.

To the north of “Campos y Malezales” ecoregion, grasslands composed of herbaceous communities prevail, whose specific physiognomy and composition depends on their location on hills, slopes or bottom of hollows. They constitute the formation called “Campos”, which due to its subtropical and humid condition is home to a great wealth of herbaceous species. The grasslands are interrupted by thin strips of river gallery forest and by small islets of native forest (composed of the same species used in the project) locally called “capons” or “mogotes”. Towards the south, almost pure and very uniform grasslands predominate due to the persistence of waterlogging in the soils with limitations due to poor drainage. This sector is known as “Malezales”.

According to Köppen climate classification, Corrientes Province is climatically classified as “Caf” (see figure below) which bears the following features:

- Mild and humid; type “C”
- Temperature in the warmest month over 22 °C; type “a”
- Precipitation throughout the whole year; type “f”

¹⁹ Matteucci, S., Rodriguez, A., Silva, M., & de Haro, C. (2012). Ecorregiones y complejos ecosistémicos argentinos. Buenos Aires, Orientación Gráfica Editora, 309-348.

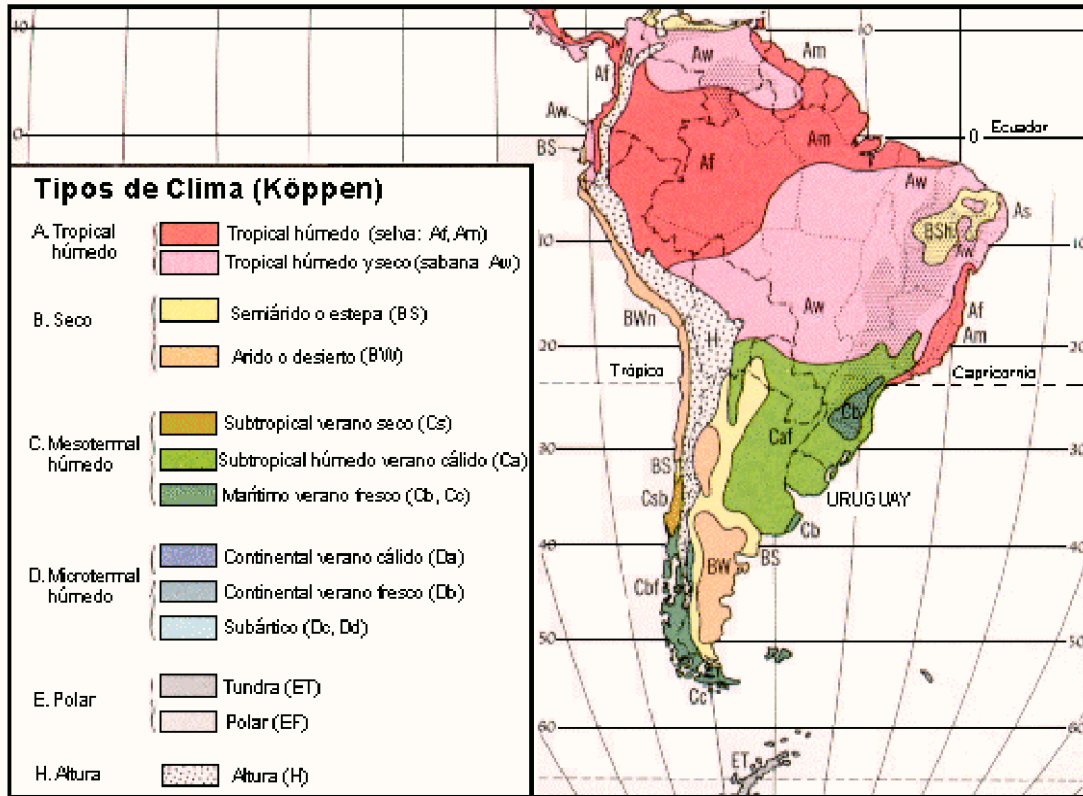


Figure 13 Types of Climates South America Köppen²⁰

The climate is humid subtropical, very warm throughout the summer but with frost in winter, without a dry season; with abundant rainfall decreasing from northeast to southwest. In the area where Puerto Valle and Garruchos property are located, rainfall is frequent and exceeds 1,500 mm per year in the NE, gradually descending to less than 1,000 mm in the SW angle. The maximum precipitations are registered in autumn and spring, periods where water excesses are frequent. In summer moderate deficiencies can be registered and in August the absolute minimum values, with a monthly average for the last 8 years of 53.8mm.

²⁰ <http://campos.caldeyro.com/uruguay-clima.php>

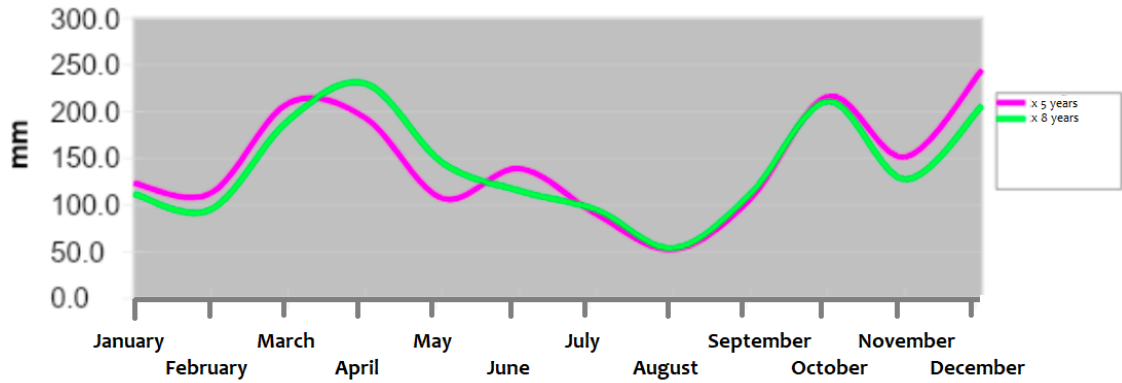


Figure 14 Historical Rainfall –Puerto Valle Farm and Garruchos Farm

In terms of temperatures, there is a decrease in annual averages from north to south, with average values of over 22°C in the north, to 19.5°C in the southern sector. Maximum temperatures can reach 44 °C, while minimum can reach -2 °C.

In order to summarise the characteristic climatic values of the region, the following table is presented. It contains historical average meteorological data on temperatures (maximum, minimum and average), relative humidity, rain, rainy days and hours of sunshine for the region.

Table 2 Meteorological Information INTA Mercedes. Historical Average - Last 40 years²¹

Historic average (last 40 years)							
Month	Temperature (°C)			Relative Humidity	Precipitation (mm)	Days with rain	Sun hours
	Max	Min	Mean				
January	32.1	20.1	26.2	66	145.5	8	274.1
February	31.2	19.7	25.3	68	177.3	7	239.3
March	29.0	17.9	23.2	73	183.9	8	231.4
April	25.4	14.2	19.4	76	170.6	7	223.7
May	22.7	11.8	16.9	80	103.9	8	194.7
June	19.5	9.2	13.8	82	74.5	7	164.8
July	19.6	8.8	13.6	78	60.4	6	179.5
August	20.8	9.4	14.8	74	57.4	7	197.8
September	22.6	11.2	16.6	74	98.0	8	213.2
October	25.1	14.0	19.5	73	140.6	9	241.9
November	28.0	16.3	22.3	67	147.0	7	276.1
December	31.2	18.6	24.9	63	125.8	7	288.8
Average and totals	25.6	14.3	19.7	72.8	1484.9	89	2725.3

²¹ <https://www.argentina.gob.ar/inta/sedes#82-eea-mercedes>

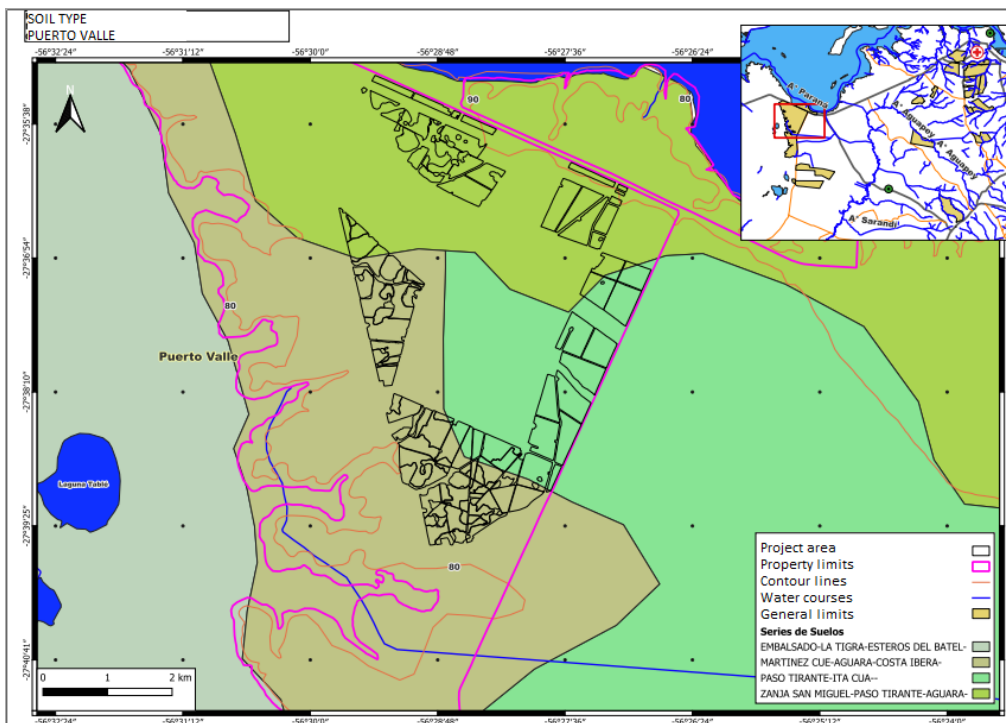
Geology and geomorphology

According to the Soil Map of the Province of Corrientes (INTA, 1996²²), the soils included in Puerto Valle belong to Cartographic Unit No. 51 (Martinez Cué Series, Aguará, Costa Iberá), Cartographic Unit No. 66 (Paso Tirante Series, Ita Cuá) and Cartographic Unit 99 (Zanja San Miguel, Paso Tirante and Aguará Series). Figure 15 shows the topographic map and soil types of Puerto Valle.

Cartographic Unit 51 is an association of fine and thick loam with susceptibility to water erosion, low natural fertility and poor drainage. It corresponds to a landscape of inserted hills in the central part of the Rincón de Santa María, delineating the eastern margin of the Esteros del Iberá, in the form of pseudo-albardones, with grassland vegetation on the planes and meadows on the elevations.

Cartographic Unit 66 contains fine loam, characterised by poor drainage and susceptibility to waterlogging. It corresponds to a landscape of extensive plain and scrubby environment with a plant cover of humid meadows and grasslands.

Cartographic Unit 99 is an association of fine loam, mixed with susceptibility to water erosion, low natural fertility and poor drainage. It corresponds to a gently undulating to undulating plain landscape, in a bulwark position on the coast of the Paraná River, NE sector, from Rincón de Santa María and Rincón de Ombú.



²² INTA (1996) Mapa de suelos de la provincia de Corrientes 1:500.00

Figure 15 Topographic map for Puerto Valle, with project area delimited in black.

Regarding Garruchos property, according to the Soil Map of the Province of Corrientes (1996), the soils included in the project area belong to Cartographic Unit No 38 (Series: Diaz de Vivar, Arroyo Itaembé y Sosa Cué).

Cartographic Unit 38 is an association of very fine clay with susceptibility to water erosion and low fertility. It corresponds to a landscape of dome-shaped hills, with relatively wide valleys, forming a high energy relief, accompanied by a dense dendritic drainage network.

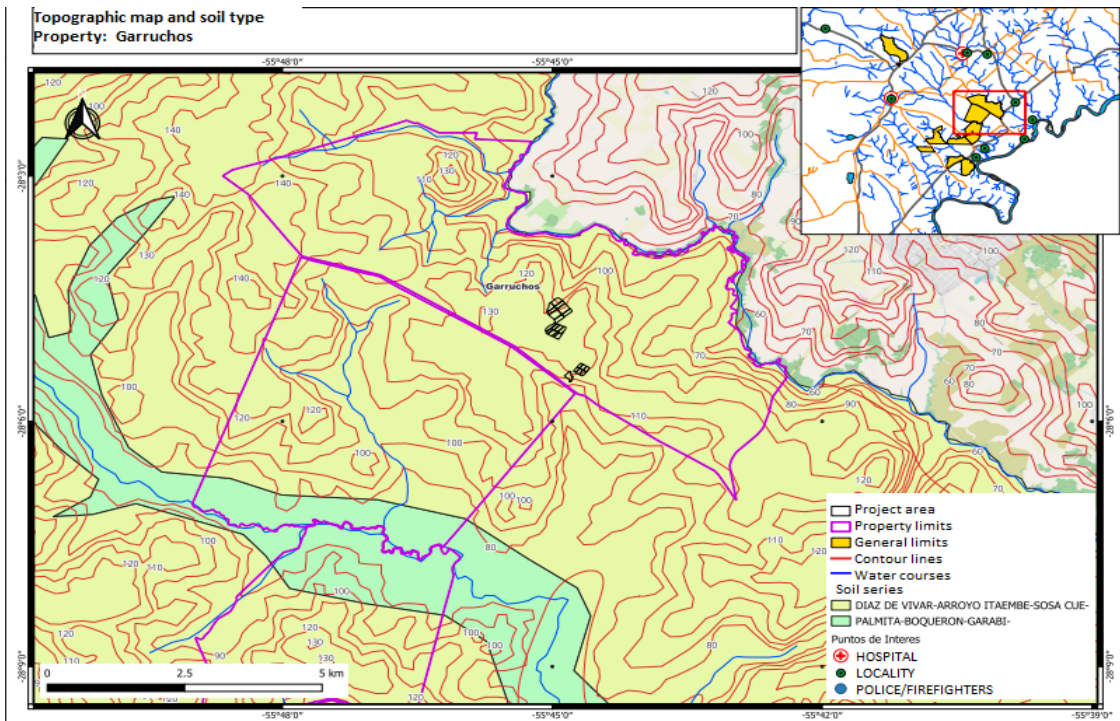


Figure 16 Topographic map for Garruchos´ property, with project area delimited in black.

Hydrology and Hydrogeology

In the territory of Corrientes there are approximately 600 bodies of water made up of rivers, streams, lagoons, estuaries, and wetlands. Most of the Puerto Valle Farm is included within the Central Hydrographic Basin in the Esteros del Iberá Region, basin of the Corrientes River, a tributary of the Paraná River. Inside, the area is depressed to flat, with a very gentle NE-SW general slope, but in relation to the surrounding river valleys, it presents a greater relative height. It's feeding is of pluvial origin. In the middle part of the property there is an artificial ditch, with a permanent flow, which communicates to the east with the Santa Tecla ditch, outside the limits of the property. The property is located within the wetland subregion scrublands, sandbanks and

coastal streams, but the project area is not located on wetland. This can be evidenced in the National Wetland Inventory²³ and the description included in section 1.4.

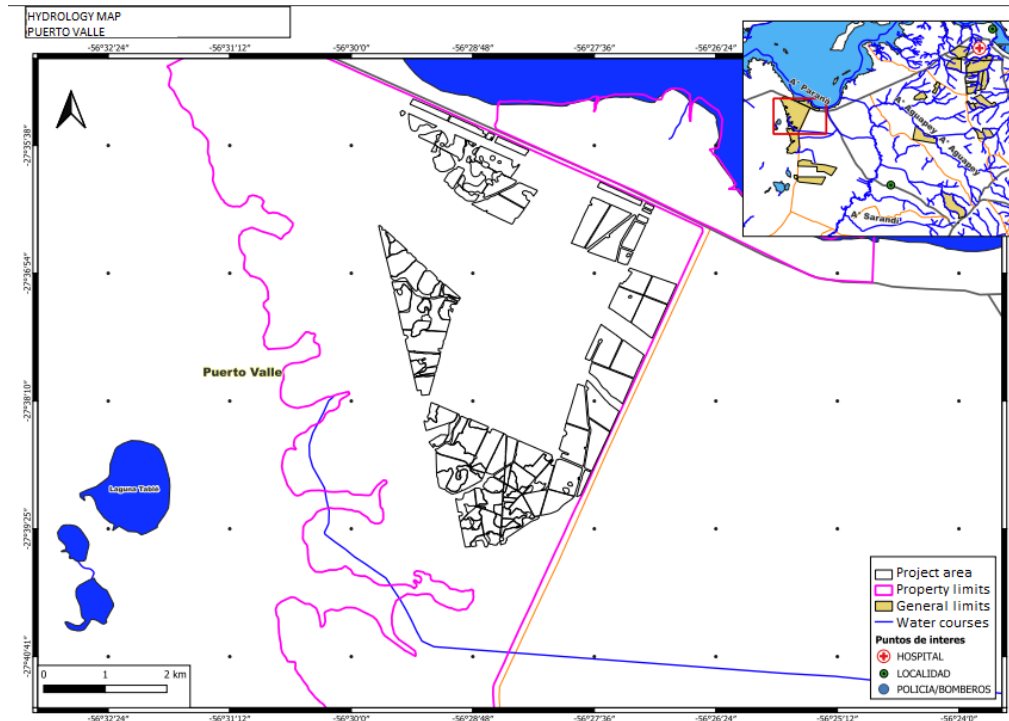


Figure 17 Hydrographic map Puerto Valle Farm. The plots included in the project activity within the property are delimited in black

In the case of Garruchos farm, it is included within the minor basins of the Chimiray creek, Garabí and Ciriaco. The first is the provincial limit, and also constitutes the northern limit of the property for a length of 14.5 km. The Garabí stream crosses the property in a NW – SE direction. The Ciriaco stream marks the southwestern end of the property.

²³ Benzaquen, L. et al. (2017). Regiones de Humedales de la Argentina. Ministerio de Ambiente y Desarrollo Sustentable, Fundación Humedales/Wetlands International, Universidad Nacional de San Martín y Universidad de Buenos Aires. p. 150

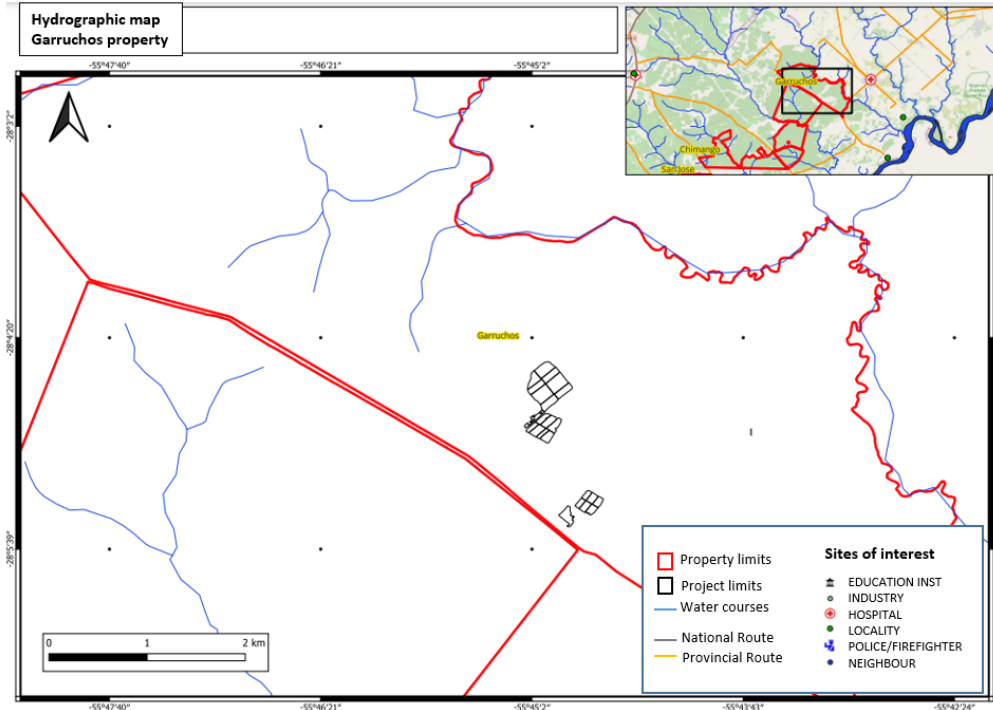


Figure 18 Hydrographic map Garruchos Farm. The project area included in the project activity within the Farm are delimited in black

1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks

Garruchos S.A, the implementing partner, is an industrial forestry company; therefore, afforestation’s activities are part of its bylaws. Furthermore, the project activity is not mandatory for the project proponent in any circumstance. Its activities comply with national law and regulations, since the management plan has been approved by Corrientes´ Water and Environment Institute (ICAA, for its Spanish acronym) ²⁴, as well as the Decree 1440-09 and Law 26,331 on Minimum Budgets for Environmental Protection of Native Forests. The first, regulates development activities under good sustainability practices and within local regulations. The last two limit the type of activities that can be carried out depending on their conservation category.

Evidence of local law compliance can be found in FSC public summary reports²⁵ available during validation.

- Law No 26,331²⁶- Minimum Budget for the Environmental Protection of Native Forest:

²⁴ ICAA and Decree 1440-09 file number and project approval available during validation/verification within shared folder “Authorizations”

²⁵ Reports for the company available in shared folder “FSC certification” to VVB during validation/verification

²⁶ <https://www.argentina.gob.ar/normativa/nacional/ley-26331-136125>

The objective of the Law, defined in Art 3, are the promotion of the conservation by means of the Territorial Organization of Native Forest and the regulation of the expansion of the farming frontier and of any other change of land use"; the regulation and control of a reduction in existing forests, in pursuit of sustainability of the forests; improvement and maintenance of ecologic and cultural processes in native forests; making precautionary and preventive principles prevail in the preservation of native forests, without affecting known or unknown benefits they may provide and the encouragement of activities related to the enrichment, conservation, restoration, improvement and to the sustainable management of native forests.

The law, which delegates the Territorial Organization of Native Forests to the provinces, creates three categories according to conservation value. Whether the transformation is allowed or not depends on conservation.

Category 1 - RED: represents forest sectors with a great conservation value which must not be transformed. The category includes areas which, due to relative position to reserve, connectivity value, presence of outstanding biological values and/or basins that they protect, merit perpetual persistence as forest, including importance to indigenous communities and the subject of a scientific investigation.

Category 2 - YELLOW: forest sectors with a medium conservation value which, although they may be degraded, may (to the jurisdictional authority's discretion) acquire a great conservation value implementing restoration activities. These sectors may be subjected to different uses: sustainable exploitation, tourism, scientific collection and research.

Category 3 - GREEN: forest sectors with a low conservation value which may be partly or wholly transformed.

In the following figures, the Territorial Planning of Native Forests categories can be appreciated, according to the national law and the location of the properties. The project area has no category assigned as it has no native forest.

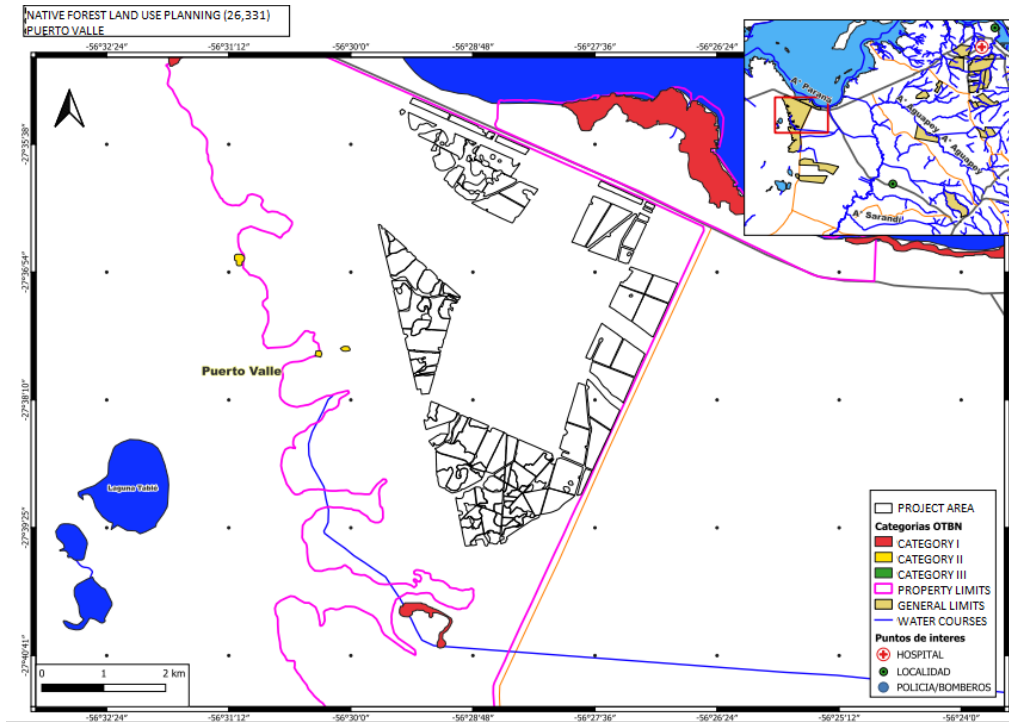


Figure 19 Native Forest Land Use Planning in Puerto Valle property. The project area within the property is delimited in black.

As it can be seen in the figure above, Puerto Valle property contains native forest formations included in Category I (red): sectors of very high conservation value that should not be transformed, located in the gallery forest of the streams; and forests in Category II (yellow): sectors of medium conservation value, which allow sustainable use, tourism, collection and scientific research, located in different sectors of the property. In these areas, the provisions of this regulation are respected.

As for Garruchos property, it can be seen that it contains native forest formations included in Category I (red): sectors of very high conservation value that should not be transformed, located in the gallery forest of the Chimiray and Garabí streams; and forests in Category II (yellow): sectors of medium conservation value, which allows use with sustainable use, tourism, collection and scientific research, located in different sectors of the property.

All categorized areas regulated by Law 26,331 are respected in full. On top of this, there are also more areas containing native forest along the riverbank or in mogotes, which the company intends for protection purposes, although they are not included by the category scales established by Law 26,331, they are included as part of the identified protected areas.

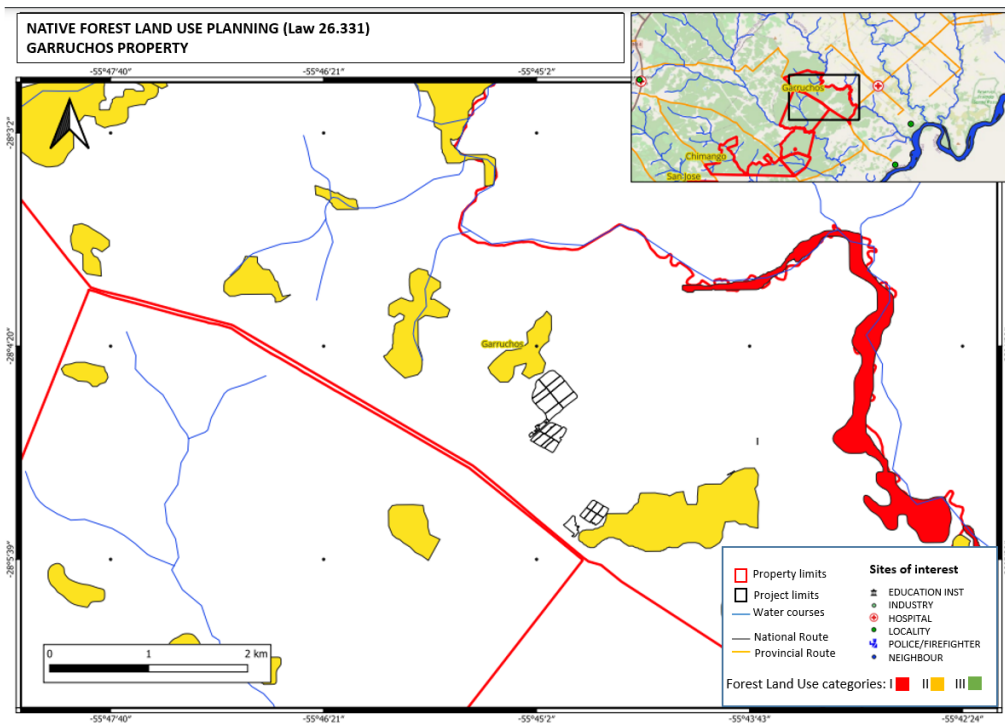


Figure 20 Native Forest Land Use Planning for Garruchos´ property. The project area within the property is delimited in black.

- Law No 27,487²⁷ - Investments in Cultivated Forests: This law is an extension of the law 25,080²⁸ (which is no longer in force). It maintains the main aspects of the law 25,080 but adds some changes like the promotion of forest planting, management, timber management and industrialization of wood when they are part of an integrated forestry enterprise. This law introduces a regime to promote investments *in new forest enterprises and in the expansion of existing forests.*

This law introduces a regime to promote activities related to planting, maintenance, management, irrigation, protection and harvesting of cultivated forests mainly for business and industrial purposes. Benefits include exemptions or tax reductions, tax stability for 30 years, regime of amortization of income tax and a non-refundable financial help: a scaled²⁹ fixed amount per hectare which varies according to zone, species and forest activity, as determined by competent authority. It is also possible to request up to a 70% of the costs of forest treatments (pruning/thinning)) discounted any income received. The regulation indicates that subsidies must

²⁷ <http://servicios.infoleg.gob.ar/infolegInternet/verNorma.do?id=318459>

²⁸ Law 25,080: Investment law for cultivated forests. Available at: <http://servicios.infoleg.gob.ar/infolegInternet/verNorma.do?id=55596>

²⁹ Scales for the region where the Project activity takes place: a) between 1 and 300 hectares (up to an 80% of planting costs) and b) between 301 and 500 hectares (up to 20% of planting costs)

be paid within two years of the plantation certification. This benefit is lower as the surface planted grows. If the surface is over 300 hectares the benefit does not apply.

Garruchos S.A.'s commercial plantations are part of this program. However, due to the lack of adequate budgeting, average payment exceeds by far the 2-year period established by the law³⁰. In addition, due to the high inflation rates (for instance the inflation rate of 2022 was 95%³¹), and the lack of adjustments for inflation these subsidies fail as an incentive. Furthermore, all these benefits only apply when the destination of the harvest wood is for the generation of energy or wood. Carbon credits are not considered by the law thus the proposed project will be exempt from these benefits.

Other laws related to the proposed project include:

- Law No 13,273 - Forest Defence, Improvement and Enlargement³²: This law, known as Defense of Forest Wealth, regulates natural forests and it declares that the protection, improvement and enlargement of forests are of public interest. At provincial level, Law No 1,643 declares adherence to the National Law above by means of Decree No 1501/51.
- Law No 25,675 - National Environmental Policy³³: It's a minimum budget law which's aim is to achieve a sustainable and suitable administration of the environment, the preservation and protection of biological diversity and the implementation of sustainable development. At provincial level, Law No 5,067 -modified by law No 5,517 (Environmental impact assessment Act) constitutes the legislation in force and it defines the enforcing authority.

The proponent of this project has fulfilled this requirement, and the approval of the Environmental Impact Assessment is evidenced³⁴.

- Law No 22,421 (Fauna Conservation Act) ³⁵: approved and promulgated by the Argentine President on March 5, 1981. It regulates care relating to indigenous fauna.
- Law No 19,587 (Hygiene and Safety at Work Act) ³⁶: It establishes the conditions of hygiene and safety at work which will, in the whole country, adjust to the clauses of the current law and of its

³⁰ News from the newspaper La Nación: "Forestry industry complains about non-payment of subsidies". Available at: <https://www.lanacion.com.ar/economia/reclamo-de-la-industria-forestal-por-la-falta-de-pago-de-subsidios-nid712055/>

³¹ INDEC (2023) Índices de precios. Vol. 7, n° 1. Índice de precios al consumidor. Cobertura nacional Diciembre de 2022. Available at: https://www.indec.gob.ar/uploads/informesdeprensa/ipc_01_23891D383E4F.pdf

³² <http://servicios.infoleg.gob.ar/infolegInternet/verNorma.do?id=30713>

³³ <http://servicios.infoleg.gob.ar/infolegInternet/verNorma.do?id=79980>

³⁴ ICAA and Reserve and Parks Direction's authorization available to VVB during validation/verification in shared folder *Authorizations*

³⁵ <http://servicios.infoleg.gob.ar/infolegInternet/verNorma.do?id=38116>

³⁶ <http://servicios.infoleg.gob.ar/infolegInternet/anexos/15000-19999/17612/norma.htm>

regulation. Its provisions apply to all establishments and exploitations with profitable or non-profitable objectives, indistinctly of the economic nature and location of the activity performed, the features of the working canters and jobs and the type of machinery, elements, devices or procedures adopted.

Regarding water resources the province of Corrientes has established the following regulations:

- Decree Law No 191/01 "Code of Waters"³⁷: is among the water resource rules regulating the correct use of waters within provincial jurisdiction.
- Resolution No 250/06³⁸: determines fines and sanctions in case of non-compliance with the Code of Waters.
- Resolution No 282/07³⁹: relating to the Registry of Exploitation and Drillings of Groundwater.
- Provincial Decree No. 1140/09⁴⁰: promotes the adoption of manuals of good practices for the sustainable development of the different productive activities, establishes the requirements for permitted agricultural and forestry activities, and establishes the content of the EIAs of projects to be carried out within the Natural Reserve Iberá.
- Decree 1440/09⁴¹ : Defines the creation of the Natural Reserve Iberá.

Regarding working conditions:

- Law 20.744 of Work Contracts⁴²: This law governs all matters relating to the validity, rights and obligations of the parties in a job contract regardless of their nationality. The program for monitoring compliance with social contributions, training, ART, insurance, S&H, is carried out monthly by means of a documentary control system⁴³.

³⁷ <https://hcdcorrientes.gov.ar/leyes-diputados/Ley191-2001.pdf>

³⁸ <http://www.hcdcorrientes.gov.ar/RECOPIACIONES/Listadodeleyes-23-6251.pdf>

³⁹ <http://www.hcdcorrientes.gov.ar/digesto-ambiental1.html>

⁴⁰ Provincial Decree No. 1140/09

⁴¹ https://www.magyp.gob.ar/sitio/areas/producciones_sostenibles/legislacion/provincial/_archivos/000005-Legislaci%C3%B3n%20Ambiental%20General/000007-Corrientes/144009-Decreto%201440-09.doc

⁴² <https://servicios.infoleg.gob.ar/infolegInternet/anexos/25000-29999/25552/norma.htm>

⁴³ EHS System to be shown during validation/verification to VVB

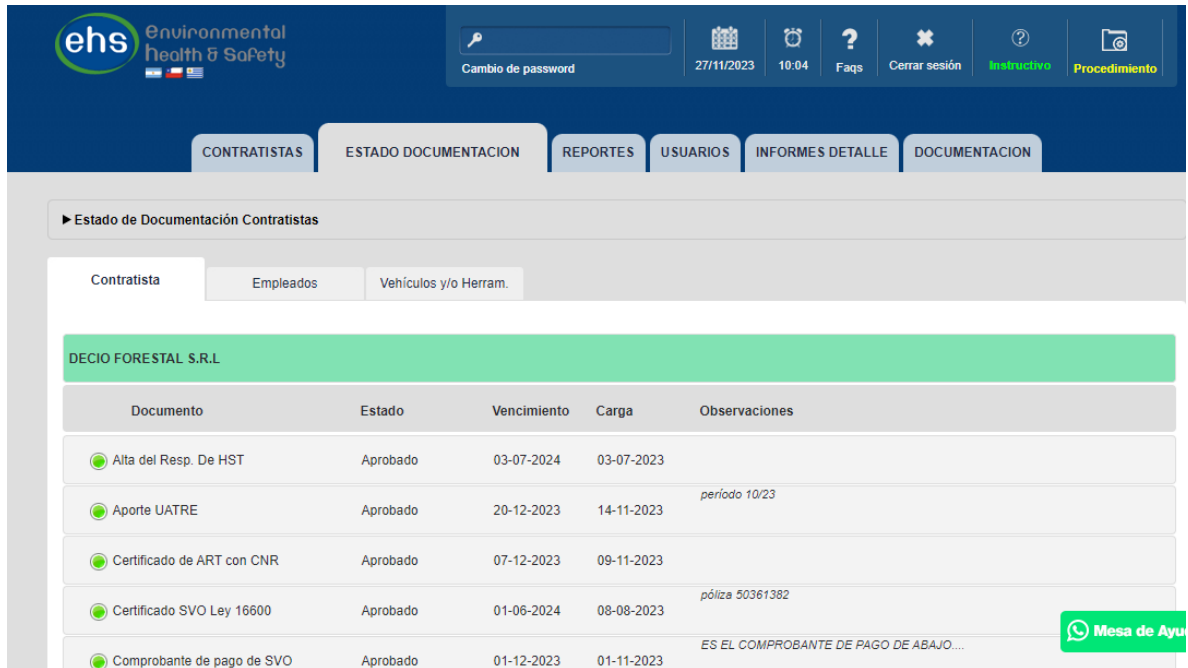


Figure 21 Print screen of EHS, the documentary control system in place for Garruchos SA. contractors and own personnel.

- Law 24,557 on occupational hazards⁴⁴: States the conditions for the prevention of risks and compensation of work-related damages
- Law 26,390⁴⁵: states the minimum age for admission to employment and the corresponding conditions.

The Project proponent will, during all the stages of the Project, comply with all the legislation applicable within the framework of the project activity.

1.16 Double Counting and Participation under Other GHG Programs

1.16.1 No Double Issuance

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

- Yes No

1.16.2 Registration in Other GHG Programs

Is the project registered or seeking registration under any other GHG programs?

- Yes No

⁴⁴ <https://www.argentina.gob.ar/normativa/nacional/27971/actualizacion>

⁴⁵ <https://servicios.infoleg.gob.ar/infolegInternet/anexos/140000-144999/141792/norma.htm>

1.16.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

Yes No

1.17 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

1.17.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the *VCS Program Definitions* for definitions of emissions trading program and binding emission limit.

Yes No

1.17.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the *VCS Program Definitions* for definition of GHG-related environmental credit system.

Yes No

1.17.3 Supply Chain (Scope 3) Emissions

Do the project activities specified in Section 1.12 affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

Yes No

1.18 Sustainable Development Contributions

1.18.1 Sustainable Development Contributions Activity Description

Argentina, along with other 192 countries, adopted the 2030 Agenda for Sustainable Development, including the Sustainable Development Goals (SDGs). Different governmental institutions including the National Council for the Coordination of Social Policies, the National Statistics and Census Institute (INDEC) and the International Relations and Institutional Communication Direction are coordinating efforts at government level to establish and implement monitoring systems for ODS indicators integrated with the national planning and identifying the advances and challenges in relation to them.^{46 47 48}

⁴⁶ <https://www.argentina.gob.ar/politicassociales/ods>

⁴⁷ <https://www.indec.gob.ar/indec/web/Institucional-GacetillaCompleta-177>

⁴⁸ <https://www.argentina.gob.ar/politicassociales/ods/subnacional/provincias/informes/2019>

In this regard, the project contributes to the achievement of the country's adapted goals defined to reach the SDGs⁴⁹. It does so by contributing to the sustainable development of the region and the country and also contribute to generate co-benefits to community and biodiversity in the following ways:

- SDG 4. Quality education: The project participates in a scholarship program, offering the possibility for students to study and graduate from technical level.
- SDG 8. Promote sustained, inclusive and sustainable economic growth. New quality jobs will be created. Most of the new jobs created in afforestation projects tend to be fulfilled by nearby local communities, which is why they have a positive impact on them. Moreover, these jobs are fully in compliance with labor rights providing high quality jobs in the area.
- SDG 13. Implement measures against Climate Change and its effects - GHG emission reductions: Through the reforested areas, native and non-native species of trees remove CO_2 from the atmosphere and increase the resilience of the previously degraded areas.
- SDG 15. Promote the sustainable use of land ecosystems -
 - Conservation of biological diversity: with the plantation of native species and domestication studies, that will generate information necessary for further native commercial plantations.
 - The conservation of areas of particular interest: with the conservation of wetlands and native forests within the project zone (project gross area part of the agreement between parties) that are attached to the crediting period of the project.
 - Degraded ecosystems restoration: the presence of trees also contributes to responsible soil management that reduces further erosion. The plantations manage a good undergrowth forest that protects both the soil and the fauna, maintaining health and forest ecosystem vitality

The project has a Forest Management Plan⁵⁰ in place, where social, economic, and environmental impacts are identified and action to mitigate as well as commitments to the public are stated. Moreover, the monitoring of the contributions is registered in the company's social and general monitoring spreadsheets⁵¹ including indicators such as those reported in the following section.

1.18.2 Sustainable Development Contributions Activity Monitoring

During the first monitoring period, the plantation of the total project area took place with native and non-native species, generating local job and training opportunities as well as first carbon removals. Moreover, the certification under FSC standards of the project took place, while at the same time the company has worked on development projects with communities in the project

⁴⁹ https://www.argentina.gob.ar/sites/default/files/metadata_ods.pdf

⁵⁰ See document in shared folder with VVB during validation/verification "Forest Management Plan>Forest Management Plan POMERA V3.14"

⁵¹ Available in shared folder "SD Contributions" to VVB during validation/verification

area, such as training on climate change adaptation, scholarships for tertiary and university levels, among others. All these activities have resulted in a series of SD contributions listed in the table below, in line with the national SDGs⁵².

The co-benefits of the project, including the listed activities, are monitored and systematized as part of the company's general and social monitoring plan through spreadsheets registering stakeholders involved and activities⁵³. Evidence of the project's SD contributions are provided throughout the document and in the appendix 3 to this report.

⁵² SDG for Argentina available at: <https://www.argentina.gob.ar/politicassociales/ods>

⁵³ Registry available in shared folder to VVB during validation/verification "*SD Contributions*>"General Monitoring spreadsheet_2022" and "*SD Contributions*> Social Monitoring spreadsheet_2022"

Table 3 Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	4.b	4.b.1 Volume of official development assistance flows for scholarships by sector and type of study	Scholarships assigned to increase indicator	1,394 USD ⁵⁴ to finance scholarships to tertiary and university level education	1,394 USD to finance scholarships to tertiary and university level education
2)	8.8	8.8.1 Fatal and non-fatal occupational injuries per 100,000 workers	Training and security equipment implemented to decrease indicator	40 non-fatal occupational injuries per 100,000 workers ⁵⁵ due to 100% of employees trained in security and use of work safety equipment	40 non-fatal occupational injuries per 100,000 workers due to 100% of employees trained in security and use of work safety equipment
3)	8.8	8.8.2 Level of compliance with labor rights	Full compliance with labor rights of job offerings implemented to increase indicator	100% of employees in full compliance with labor rights	100% of employees in full compliance with labor rights
4)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Forest plantation implemented to increase indicator	By planting 973.14 ha of native and exotic species, project has removed 904 tonnes of carbon eq into the atmosphere during the monitoring period	By planting 973.14 ha of native and exotic species, project has removed 1,090.185 tonnes of carbon eq into the atmosphere during the monitoring period

⁵⁴ Based on a USD exchange value of \$137,65 based on August 's (2022) value and only for scholarships as of August 2022.

⁵⁵ Takes into consideration 2022 and 2023 personal accidents at work corrected to 100,000 workers and the proportion of the project area in total Garruchos S.A lands (2,4%)

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
5)	13.3.1	Extent to which education on climate change mitigation, and adaptation are mainstreamed to population ⁵⁶	Talks and presentation within local communities implemented to increase indicator	105 stakeholders within project zone trained in climate change and mitigation	105 stakeholders within project zone trained in climate change and mitigation
6)	15.2	15.2.1 Progress towards sustainable forest management	FSC policies implemented to increase indicator	FSC certification of the 973.14 hectares of the project in process (awaiting report)	FSC certification of the 973.14 hectares of the project in process (awaiting report)
7)	15.5	Progress towards biodiversity conservation	Native species planted to increase indicator	28.3 has of native species planted	28.3 has of native species planted
7)	15.5	Progress towards biodiversity conservation	Protection of wetlands and native forest to increase indicator	40.6 has of wetlands and native forest protected within the gross project area	40.6 has of wetlands and native forest protected within the gross project area
8)	15.3	15.3.1 Proportion of land that is degraded over total land area	Restore degraded land and soil to increase indicator	No monitoring implemented in this period yet	No monitoring implemented in this period yet

⁵⁶ SDC defined by number of students who took part in workshop on “*Más bosques mas futuro, Prevención de dengue Mundo Sano*”

1.19 Additional Information Relevant to the Project

Leakage Management

Where According to AR ACM-003 Methodology and Tool 15 “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” leakage emission due to displacement of agricultural activities should only be considered if this leads to an increase in GHG emissions relative to the GHG emissions attributable to the activity as it exists within the project boundary. In the present project all livestock has been sent to a slaughterhouse (3 receipts for the sale of livestock are included in Appendix 2, but all receipts are available to VVB)⁵⁷. Therefore, no leaks emissions will be considered in line with section 6 of the Tool where in point e) it states that leakage emission attributable to the displacement of grazing activities to a zero-grazing system is considered insignificant and hence accounted as zero.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Further Information

Garruchos has a long-lasting history of working together with the local community as it can be appreciated in the ongoing programs listed below. These and other projects are implemented in the whole project zone for the company but those within the project zone are listed below:

Environmental Education Programs at schools

Programs have been created aimed at primary and secondary educational centres (childhood: environmental education, household waste treatment, forestry as a productive system, rural work safety, FSC principles dissemination), community centres (health: prevention of endemic diseases), neighborhood producers (fire management). Through a documentary mechanism, and to manage our relations with the communities and ensure compliance with the commitments assumed with them, all activities are recorded on monitoring spreadsheets⁵⁸. These are saved and aim to document the progress and achievements accomplished with the community,

Community-oriented education programs:

⁵⁷ All cattle sales available in shared folder with VVB during validation/verification within folder “Leakage”

⁵⁸ Spreadsheets available to VVB during validation in shared folder “SD Contributions>Social monitoring plan results_2022”

Más Bosque Más Futuro (More Forest more Future): More future forests educational program has been implemented since 2010, since then it reached more than 7,000 girls and boys from the neighbouring community of POMERA. This program is intended to raise awareness and promote environmental care in the neighbouring communities, and responsible forest management. More than 35 schools per year take part in this program in the provinces of Corrientes and Misiones. In 2022, the program reached 30 schools (3 within the project zone). More than 1,225 students participated in the program, 105 from the project zone. The main messages are the care and protection of biodiversity, the responsible use of natural resources, responsible consumption, responsible use of fire and proper waste management in line with climate change mitigation. This program was awarded three prizes -Eikon (Argentina), Stevie International Business Award (US) and Communitas Award (US)- in relation to environmental sustainability, communication and Corporate Social Responsibility⁵⁹.



Figure 22 Activities within “Mas Bosque mas futuro” program

Forest Cycle: Technical talks are adapted to rural schools, with basic contents of the forest cycle, nursery, forestry, forest management, environmental care. The general goal is to disseminate information on responsible forest management of plantations.

⁵⁹ Evidence of prizes and recognitions in shared folder “Stakeholders>POMERA prizes and recognitions”

Club de Amigos del Bosque: This program is intended for primary school students. The central theme is the responsible use of fire and controlled burning. The day ends with didactic games created especially for the program on the theme of fire.

Prevention of Dengue and Handwashing: Aimed at primary school students in the Grupo Garruchos area and their families. The campaigns´ main objective is Dengue, Zika and Chikungunya prevention. Also, preventing diseases through hand hygiene. They are carried out in partnership with the Mundo Sano Foundation.

Scholarships: This program provides the opportunity to continue training at the tertiary or university level for those students from schools linked to the rural environment who have good academic performance. It is achieved through agreements with educational institutions such as the Instituto Navajas Centeno.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

2.1.1 Stakeholder Identification

Stakeholder Identification

Being a company with more than 20 years in the area, it has been working with the impacted community for a long time. It has a registry and identification of key stakeholders within the area of influence, who make up the neighboring communities with whom it maintains an ongoing relationship. This registry consists of an updated list of stakeholders, which identifies the interest group, type of relationship, contact information (telephone, email), organization to which it belongs or represents, area of scope of Pomer's operating areas, location (town, place, field). The list has been prepared since 2014 and is updated annually. It is made up of approximately 149 stakeholders (79 for this project area), with the main emphasis on the relationship with local neighbors. There are groups defined that allow the company to manage more effectively the relationship with them. The defined groups are as follows⁶⁰:

- Communities that are immediately adjacent to the company's assets.

⁶⁰ Complete list with detailed information on stakeholders available in shared folder "Public consultation>Stakeholder list".

	<ul style="list-style-type: none"> -Communities that may be affected by the company's main forestry operations. -Communities that have some link to the company's assets. This is due to the presence of sacred sites, ceremonial sites, cemeteries. -Communities with which there are links from the scope of collaboration in productive areas such as local development projects and entrepreneurship; cultural and/or religious; social and/or by the extraction of non-timber forest products (NTFPs), within the company's heritage. -Community leaders of the localities, or neighborhoods, with whom community programs are articulated to promote local development. -Civil organizations both, in which the company is part of or with whom it interacts (Volunteer firefighters, NGOs such as Fundación Mundo Sano and Fundación Rewilding, Fire Management Consortium, Forestry consortium, APEFIC, FSC Argentina, national and regional AFOA). -National, provincial and/or local governmental organizations. -Primary and secondary education community of the areas and neighboring localities to the establishments. -Health and primary care centres (CAPs) of neighboring localities. -University and scientific educational community.
<p>Legal or customary tenure/access rights</p>	<p>There are no disputes over land tenure in the project area. Nevertheless, to describe the general situation of stakeholders, further information is included for the colonies land tenure in the province.</p> <p>The existing colonies in the province of Corrientes were created in different stages -mostly at the end of 1800 and the beginning of 1900- and over the years the inhabitants and families who settled in them obtained the ownership of the lots, which is why at present the main objective of the process of awarding fiscal lands is to regularize the situation of the occupants who for some reason - lack of documentation, discontinuity in the procedures or payments - did not obtain the definitive ownership of the lot or plot.</p> <p>The inhabitants of the Official Colonies seek to regularize the tenancy situation of the lots where they live and some also seek to solve conflicts between neighbors who dispute the tenancy, which are generally resolved in the judicial sphere.</p> <p>In all cases, priority is given to the adjudication of former inhabitants and small producers who develop agricultural or livestock enterprises.</p>

	<p>Due to the age of the Colonies, the availability of new lots is subject to expirations, transfer of rights or resignations; therefore, as the situation of a lot is regularized, it is delivered to the applicants registered in a waiting list.</p> <p>The adjudications of fiscal lands are governed by Provincial Law No. 3,228 of Colonization which establishes the conditions of delivery, these are the signature of the purchase-sale ticket, a payment plan, the obligation to reside in the place, not to sell without authorization or to lease to third parties for agricultural undertakings⁶¹.</p>
<p>Stakeholder diversity and changes over time</p>	<p>The project zone is surrounded by rural communities, with small city departments nearby. The population in both departments has shown an annual increase between 0.2 and 1.4% between the last two census 2001 and 2010⁶². Regarding gender, statistical information shows the same proportion of men and women in the population of project area departments (50.2% and 49.8% respectively).</p> <p>The main economic activities in the area are related to cattle raising, yerba mate production and forestry and the stakeholder groups are created around these economic activities.</p> <p>Regarding ethnic groups, 0.5% of the population in the whole province identify as indigenous (lower than the national level of 2.4%)⁶³; still, within the project zone, no indigenous communities are identified (see Figure 26).</p>
<p>Expected changes in well-being</p>	<p>The project is expected to generate new formal job positions. Moreover, Garruchos has been working with the community on development programs for a long time now, and these projects will continue and grow with the project in place, this includes training opportunities, field visits, among others.</p> <p>Regarding changes in ecosystem services, the planting of native species and the agreements with research institutions is expected to generate needed information regarding native species domestication.</p> <p>Moreover, the project activities are expected to reduce soil erosion and degradation due to cattle raising and cultural practices associated with it⁶⁴, reducing fire risks for the region.</p> <p>Moreover, although there are confirmed existence of indigenous communities surveyed by the Institute of Indigenous Affairs (INAI)⁶⁵ in the province (see Figure 26), it can be confirmed that these communities have no productive or sacred link with the</p>

⁶¹ Provincial information available at: <https://icaa.gov.ar/category/tierras-fiscales>

⁶² INDEC population census for 2022 results are not yet available at department level.

⁶³ INDEC (2015) Censo Nacional de Población, Hogares y Viviendas 2010: Censo del Bicentenario. Pueblos originarios: región Nordeste Argentino. - 1a ed. - Ciudad Autónoma de Buenos Aires

⁶⁴ Publication on cultural practices of grassland burning for cattle raising available at: <https://santafe.conicet.gov.ar/inali-la-quema-de-pastizales-en-humedales-y-sus-efectos-nocivos/>

⁶⁵ Available at: <https://www.argentina.gob.ar/derechoshumanos/inai/mapa>

	<p>properties that have been included in the project. All the plots are owned by Garruchos S.A, and there are no legal conflicts in these areas. There is no indigenous community directly impacted by this project in any forest management unit so it can be said that no negative impacts have been found on any indigenous community by the project.</p>
<p>Location of stakeholders</p>	<p>The area presents a low demography (3.6hab/km²), and the rural population in Corrientes doubles the national average (17% of population is rural, compared to 8% in the country’s total⁶⁶), there are very little surrounding population, and the nearby villages are also very few⁶⁷.</p> <p>Puerto Valle’s nearest towns are Santa Tecla (4 km), Ituzaingó (28 km) and Gobernador Virasoro (92 km), and the city of Posadas (65km) in the neighboring province.</p> <p>Garruchos’ farm nearest towns are Colonia Garabí and Garruchos in the province of Corrientes, and Azara in the Province of Misiones.</p> <p>As previously mentioned, regarding indigenous population, they are present in the province of Corrientes but not in the project area (see Figure 26).</p> <p>The identified stakeholders are in neighboring cities and colonies, as well as others further away, such as Posadas in the case of a university (National Misiones University).</p>
<p>Location of resources</p>	<p>There are no resources which stakeholders own or to which they have customary access within the project area. The property, in which the project area is located, includes other forest plantations and a buffer area of HCV areas adjacent to the Iberá National Park. These areas are conserved and managed in line with the Natural Reserve Iberá’s policies (Decree 1,440/09⁶⁸).</p>

2.1.2 Stakeholder Consultation and Ongoing Communication

<p>Date of stakeholder consultation</p>	<p>14-April-2023</p>
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⁶⁶ INDEC (2010) Población Urbana y Rural por provincia available at:

<https://www.indec.gob.ar/ftp/cuadros/poblacion/n020210.xls>

⁶⁷ Complete list with detailed information on stakeholders location available in shared folder "Public consultation>Stakeholder list"

⁶⁸ Provincial Decree 1,440/09 on Natural Reserve Iberá

Stakeholder engagement process

Since this afforestation project is the first that Cambium Earth as proponent and Garruchos S.A as implementing partner will register to obtain carbon credits, a public consultation was held to explain the details of the project so that stakeholders could have an opportunity to express themselves, share their concerns or benefits that this type of project can bring to the community.

On April 14, 2023, at 11:00 a.m. through the Zoom virtual platform, a public consultation was held for local stakeholders in the community neighbouring the Garruchos and Puerto Valle Farm. The total number of participants was 34, of which 16 were external stakeholders and 18 were internal stakeholders.

The invitations were sent by email and WhatsApp to representatives of governmental organizations, civil associations, academia, educational centers, security forces, health, and private neighbours. The invitation included information on the day, time and form of the meeting. To ensure participation, an invitation reminder was sent the day before with the link to access the virtual platform.

The objective of the public consultation was to make the Cambium Earth and Garruchos S.A. carbon project known among its main stakeholders, raise awareness regarding the context of climate change, mitigation strategies, compensation, and commitments at global, national and local levels and the way this project will contribute to mitigate the effects of climate change.

The objectives, location, surface areas, species, and the process for its implementation in the field, registration and documentary compliance were explained.

A PowerPoint presentation was shared⁶⁹ with those present and Griselda Guarino, head of MASSO (at that moment Corporate Environmental, Safety, and Occupational Health Department) at Pomerá Maderas, and Gumerciendo Irala, the Garruchos's forestry manager, were responsible for the presentation.

The list of guest and attendees by site are listed below:

Table 4 List of participants – External and Internal Stakeholders

⁶⁹ Available to VVB in shared folder "Public consultation>Presentation_April 2023"

Stakeholders Participants	
External Stakeholders	Description
Oriando Urbietta	Neighbor of Garruchos
Enrique Cervián	Occupational Health and Safety
Sergio Greniuk	Rural Workers Union of Gobernador Virasoro
Liliana Franco	Principal of Garruchos Elementary School
Sergio Enriquez	Teacher Colonia Unión
Vilma Salina	Principal of San Alonso Elementary School
Emiliano Fernández	Mayor of Gobernador Virasoro
Francisco Torres	Regional Argentine Forestry Association
Alicia Delgado	Foundation Rewilding
Ditmar Kurt	National Institute of Agricultural Technology
Rafaela Morales	National University of Misiones
Luis Ritter	National University of Misiones
Diego Ybarra	National Institute of Agricultural Technology
Carolina López Ferloni	Mundo Sano Foundation
José Bravo	Gendarmerie of Ituzaingó
Roberto Rojas	Ministry of Production of the Province of Corrientes
Internal Stakeholders	Department
Maria José Cristaldo	Planning
José María Marchessini	RH
Martin Vargas	Industry
Matias Jara	Operations
Pablo Aquino	Operations
Facundo Bernaudo	Sales
José Luis Añasco	Operations
Gustavo Dlutowski	Operations
Silvia Kosinski	Planning
Jorge Souza	Operations
Alan Mallorquín	Planning
Eduardo Acosta	Operations
Germán Andersson	Operations
Tania Dürks	HR
Gumercindo Irala	General Management
Gabriela del Ristoro	Communications
Griselda Guarino	MASSO
Federico Scheffer	Livestock Management

Consultation outcome	
	<p>At the end of the presentation, there were questions and queries related to the presentation and the expected impact on the community. The feedback was very positive, with acceptance of the project and recognition of the company for its initiative. There were no objections or comments about possible detrimental effects on the community. The questions were addressed, and the attendees were thanked, then the meeting was adjourned.</p> <p>The main comments include⁷⁰</p> <ul style="list-style-type: none"> -Interest of the Misiones National University to take part in the project, especially working with the area of native species planted. -School teacher within project zone interested in including Climate Change subject in the school curricula. -School teacher interested in knowing the relation and level of participation of the local authorities

⁷⁰ Complete consultation minute available to VVB during validation/verification in shared folder "Public consultation>Minute_public consultation 04.23"

Ongoing communication

Garruchos S.A has a Social Management Plan⁷¹ which applies to all its projects and therefore also to the present. The main objective is to build and maintain permanent relationships of trust with those interest groups that coexist daily with the forestry activity, seeking to preserve and create social value. As part of their policy, there is a program which includes the invitation to different interested parties to visit the properties or facilities, with the objective that they can learn about the forest management practices in the field and express their opinions.

It is the company's policy to maintain respectful and continuous communication with the neighboring community. Garruchos S.A has had communication mechanisms and strategies with the neighboring community for 20 years. It has a long-lasting history of working together with the local communities, as it can be appreciated in the ongoing programs that are listed in Further information section 1.18.

The relationship with residents of the project zone is carried out through the leaders and representatives of Civil, Government and Non-Governmental Organizations of the neighborhood community, together with the representatives of Garruchos.

It also maintains direct communication with the local community through direct dialogue and visits from those responsible for each forest area. The heads and supervisors of the operational area are responsible for communicating changes in management, news, and invitations to local stakeholders. Community collaboration requests are formalized through notes, which are managed in a way that enables the company to give feedback to them as fast as possible. The company has a communication system through an indicative billboard at the main entrances of the forest establishments. This billboard contains information on the names of the establishments and other regulations, such as prohibited and mandatory activities, which respond to reducing risks to people, property, and the environment.

Garruchos shares an annual report with the neighbourhood community evidencing the results of the productive, social and environmental management that were developed during the year. This report is uploaded to the website and social networks and is sent by mail to all interested parties.

Stakeholder input

All comments were considered, but no updates to the project design were necessary as there were no comments regarding changes to the project. Within the comments that were made, there have been no complaints or negative views about the project. On the other hand, they have received comments on the importance of generating this type of projects in a sustainable way. Moreover, the main comments were seeking information regarding the certification methodology.

⁷¹ Social Management Plan 2023 available to VVB during validation/verification in shared folder "Stakeholders"

	<p>Within the inputs received, it included the University’s interest in helping in the project, especially with the native species area. In this sense, the project proponent is working on formalising the interaction with the stakeholder.</p>
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2.1.3 Free Prior and Informed Consent

<p>Obtaining consent</p>	<p>The project is in private property and as well as all other forest plantations from the company, it was granted authorization by local and provincial authorities. This is done taking into consideration land ownership as well as the specific activity, authorised land use for the area, and with prior presentation of an EIA.</p> <p>Moreover, the project conducted a public consultation with interested stakeholders where the project was presented.</p> <p>There are no ongoing or unresolved conflicts and thus the project does not exacerbate nor influence the outcomes of unresolved conflicts.</p>
<p>Outcome of FPIC</p>	<p>The project has not encroached on land, relocated people without consent, or forced physical or economic displacement as the project is located within a private property owned by Garruchos for more than 10 years.</p>

2.1.4 Grievance Redress Procedure

<p>Development process</p>	<p>The grievance redress procedure was developed in 2011, in line with FSC principles taking into consideration current regulations and the ILO Conventions. It is updated as needed.</p>
<p>Grievance redress procedure</p>	<p>Garruchos S.A considers the opinions and claims that the community may have regarding the projects being carried out to be of vital importance. For this reason, a Community Relations Form as the one shown in figure 24 was created where all the complaints that come from the community are registered.</p>

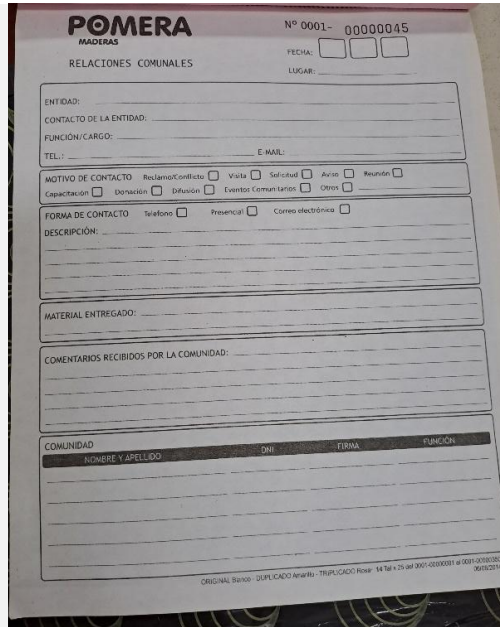


Figure 23 Community relations form to be completed with claims/complaints from stakeholders.

In the event of complaints formulated by stakeholders, they will be registered in the mentioned form, and their response will be resolved within a period to be determined according to the type of consultation. In all cases, an interview will be sought with the Stakeholder who feels affected and the reasons for the complaint and possible points of agreement will be discussed in depth. The meeting will be documented or recorded. During the resolution process, communication will be maintained with the Stakeholder to keep them informed of progress.

Any complaint received from a Stakeholder who feels morally, intellectually, or economically affected by Pomera's Socio-Economic and Environmental Management will be submitted to a mediation process to avoid reaching a Conflict.

If the mediation process is not successful and the complaint or claim leads to a process that interrupts the company's normal operations or involves loss of patrimony or monetary expenditures, negotiations will be carried forward by the Forestry Manager, who will define the actions to be taken.

If forestry operations may compromise the right of tenure or future use of the communities or may be a direct cause of dispute, the suspension or non-commencement of forestry operations will be considered.

In these cases, the country's current regulations and the ILO Conventions appropriate to each situation will be considered.

In summary, the process includes:

	<p>1-Complaint reception, which will be reflected in the Community Relations form and forwarded to the corresponding area manager for the affected area.</p> <p>2- The area manager will have 10 days to communicate with the affected party and arrange a meeting to discuss the reasons for the complaint and possible points of agreement. This meeting will be documented and/or recorded.</p> <p>3- Depending on the type of complaint, the area manager will propose possible solutions to the interested party for conflict resolution and establish deadlines.</p> <p>4- If an agreement is not reached, the area manager must refer the case to the forest management for evaluation and eventual resolution.</p> <p>5- If, after the intervention of the forest management, a resolution favourable to both parties is not obtained, the forest management will arrange for the initiation of mediation. To this end, a neutral third party with experience in the matter in question will be involved as a mediator. The manager will have approximately 30 days to arrange for mediation. If the conflict is resolved, it will be recorded on a follow-up form.</p> <p>6. If the mediation is unsuccessful, the matter will be referred to the Legal Affairs Department, which will keep management regularly informed about the progress of the legal process.</p> <p>These include:</p> <ul style="list-style-type: none"> i) initiate dialogue with the opposing party's legal department (if appropriate/feasible), ii) initiate a pre-trial mediation process (conducted before mediators registered on the judiciary's lists), iii) initiate judicial proceedings (before the competent judicial body of the state), iv) initiate arbitration proceedings before an arbitrator competent in the matter and impartial.
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Grievances received	Resolution and outcome
Since de begging of the project, September 2022, Garruchos S.A has not received any complaints or claims of any kind through the communications channels of the company	NA

2.1.5 Public Comments

The public comment period took place from 9/12/2023 to 10/01/2024 in VERRA´s webpage. No comments were received during that period.

Comments received	Actions taken
No comments received	Not applicable

2.2 Risks to Stakeholders and the Environment

The implementation of programs, plans, operating procedures, and guides to good forest practices allow avoiding and reducing risks to low and acceptable levels while promoting co-benefits for the community and biodiversity. In this project, as mentioned, no harvest or pruning is expected, still, the company has operating procedures available for each of the silvicultural and forest activities, which consider how to implement risk management and mitigation measures in the field. The procedures contemplate the preparation of land and planting, the responsible management of phytosanitary products, pest and weed control, waste management, if generated, the use of planted forests, the transport of personnel, forest roads, forest camps, management of fuels and lubricants, elaboration of poles, medical emergency plans, permanent plots.

	Risks identified	Mitigation or preventative measure taken
Risks to stakeholder participation	No risk identified	As mentioned, the implementing partner has a long-lasting experience working with the stakeholders in the project zone, and the project does not represent a risk to the current programs and activities in place with the communities, but it further enhances them, allowing new interactions for example, with research institutions.
Working conditions	Personal accidents	<p>First, there is a risk assessment in place for the different silvicultural activities to take place. Second, as part of the contingency and prevention plan, there is a training plan for forestry personnel that details the schedule for the year with the topics to be taught, the person in charge and the procedure to be applied⁷². This is mandatory for all workers and collaborators in S&H. Personal security equipment is provided as well.</p> <p>Third, operations are monitored monthly in terms of environmental, S&H, social, and operating procedures through a system of nonconformities and corrective action</p>

⁷² See training records in "Health and safety>General monitoring spreadsheet_2022"

	Risks identified	Mitigation or preventative measure taken
		requests, which allow Garruchos S.A to identify deviations, determine their causes, corrective and preventive actions, and deadlines for their correction. The monitoring and surveillance of inputs, products and services is carried out by means of a system of registration and administrative control during operations.
Safety of women and girls	No risk identified	There are no specific risks to women and girls' safety due to the project implementation. The project is implemented in a current productive private land which access is controlled in a rural area with limited number of neighbours. Moreover, the project includes limited silvicultural activities (no harvest) so less risks are expected. In addition, the group's integrity policy has planned reporting channels for cases that may affect employees.
Safety of minority and marginalized groups, including children	No risk identified	There are no specific risks to minority and marginalized groups, including children due to the project implementation. The project is implemented in a current productive private land. Moreover, the project includes limited silvicultural activities (no harvest) so less risks are expected.
Pollutants (air, noise, discharges to water, generation of waste, release of hazardous materials)	Hazardous substances are used, handled, and stored during the production process, during which time occasional spills could occur. These risks are internal and, depending on their magnitude, may be low to medium risk. Within this group of substances, hydrocarbons are used during all stages of the production process for the movement of vehicles and machinery,	<p>The program implements the recommendations stated in the Responsible Management of Agrochemicals Program⁷³ which establishes the guidelines and safe work standards for the reception, loading, unloading, storage, handling, application and final disposal of phytosanitary products.</p> <p>Some of the measures include storage places for inputs based on dangerous substances such as hydrocarbons and/or agrochemicals, specially conditioned for this purpose, duly signposted, with signage indicative of the place and the risks associated with the stored input.</p>

⁷³ Guidelines provided by public entities available at: <https://bancos.salud.gob.ar/recurso/guia-de-uso-responsable-de-agroquimicos>

	Risks identified	Mitigation or preventative measure taken
	and agrochemicals/ phytosanitary products are used to control weeds and pests, mainly during the first stage of the process. The potential environmental impacts, depending on where the spill occurs, the magnitude of the spill, and the type of substance, would be on the soil, water, and biota associated with these factors. Potential social impacts could be linked to the S&H of personnel and the neighboring community, depending on the case.	<p>Have PPE for handling and elements to act in emergency situations.</p> <p>Restrict access and handling to authorized personnel.</p> <p>Manage the different types of waste in its classification, collection, transfer, treatment and final disposal.</p> <p>Keep phytosanitary storage tanks at safe distances from other facilities, such as houses, populated areas, and watercourses.</p>

2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

Discrimination and sexual harassment	The project proponent or any other entity involved in project design or implementation is not involved in any form of discrimination or sexual harassment. Garruchos S.A is a registered company, compliant with local and national regulations regarding discrimination (National Law 23,592), with the regarding registration certifications as evidence. Moreover, non-discrimination is part of the company's policy, providing same working opportunities without gender, color or religion considerations ⁷⁴ . At the same time, being an FSC certified company, evidence of law compliance is certified ⁷⁵ .
Management experience	Garruchos has a long-lasting history of working together with the local community as it can be appreciated based on the information provided along the document. With more than 20 years as a forestry company in the region, and certified under FSC, it has wide experience in this type of activities as well as engaging with communities. In this line, the team of experts is composed for:

⁷⁴ Evidence for VVB during verification and information on company’s policy in the Forest Management plan in shared folder “Forestry Management Plan”

⁷⁵ FSC certification in shared folder “FSC Certification”

	<p>Forest engineers, Forest technicians, agriculture engineers as well as professionals in health and safety (see organization chart in figure 24 below).</p> <p>For those activities where more expert professional knowledge is needed, Garruchos S.A hires third parties. These activities have included in the past:</p> <ul style="list-style-type: none"> -Forest inventory -Biodiversity and environmental monitoring <p>Moreover, Cambium brings to the group expertise in economic and data analysis, as well as GIS and environmental analysis with professionals in the subject.⁷⁶</p>
<p>Gender equity in labor and work</p>	<p>Non-discrimination is part of the company's policy, providing same working opportunities without gender, color or religion considerations⁷⁷. At the same time, being an FSC certified company, gender equity in labor and work has been worked on and accomplished.</p>
<p>Human trafficking, forced labor, and child labor</p>	<p>As previously mentioned, the project proponent or any other entity involved in project design or implementation is not involved in any form of discrimination or sexual harassment, neither human trafficking, forced labor, and child labor. Garruchos S.A is a registered company, compliant with local and national regulations regarding working conditions (National Law 20,744 and 26,390), with the regarding registration certifications as evidence. At the same time, being an FSC certified company, evidence of law compliance is certified⁷⁸.</p>

⁷⁶ All personnel CV available for VVB during validation/verification in shared folder "*Management team*"

⁷⁷ Evidence for VVB during verification and information on company´s policy in the "*Forestry Management Plan*"

⁷⁸ FSC certification in shared folder "*FSC Certification*"

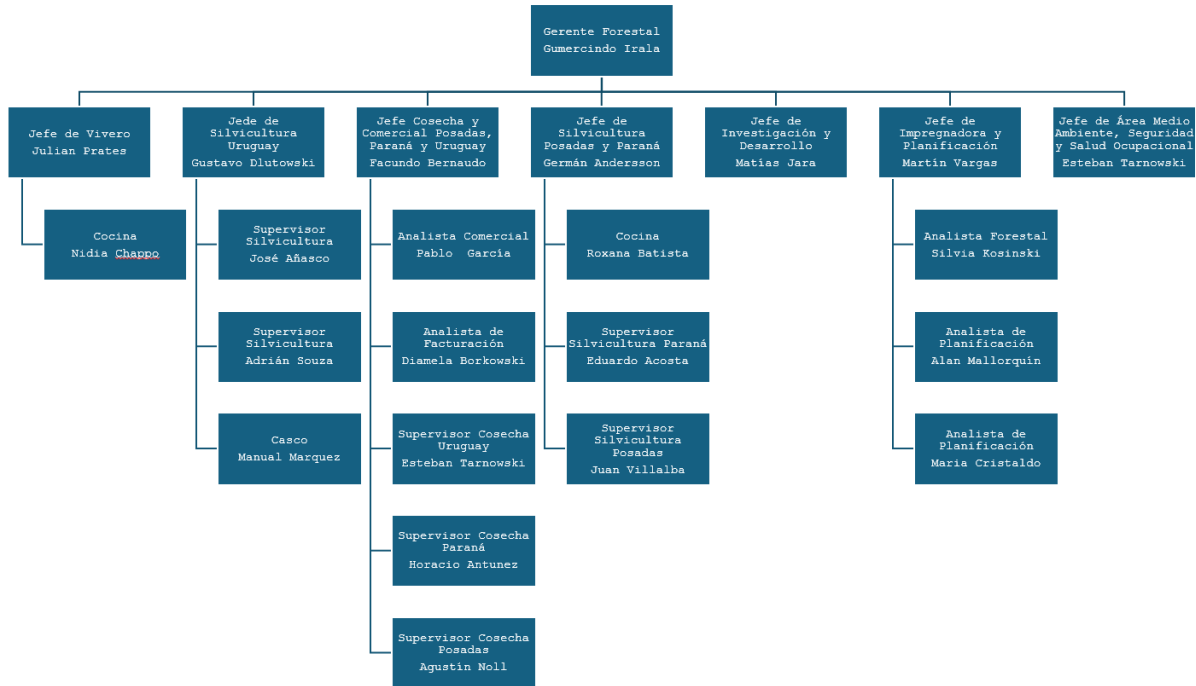


Figure 24. Organizational structure of Garruchos S.A

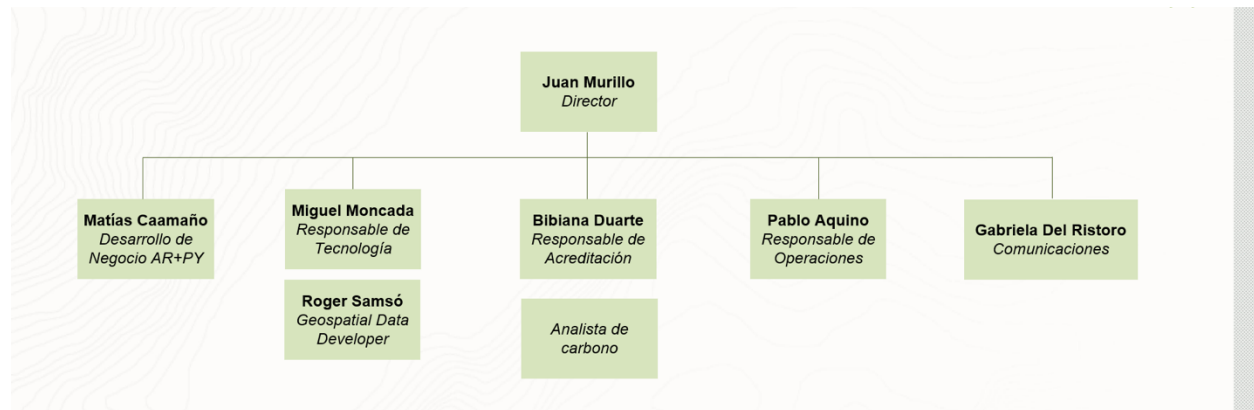


Figure 25 Cambium's organizational structure.

2.3.2 Human Rights

The project recognizes, respects, and promotes the protection of the rights of IPs, LCs, and customary rights holders in line with applicable international human rights law, and the United Nations Declaration on the Rights of Indigenous Peoples and ILO Convention 169 on Indigenous and Tribal Peoples. This can be evidenced as the project complies with all local legislation, which includes land tenure rights as well as all FSC principles. Moreover, as mentioned, there are no identified indigenous people or communities in the project area.

2.3.3 Indigenous Peoples and Cultural Heritage

Although there are confirmed existence of indigenous communities surveyed by the Institute of Indigenous Affairs (INAI)⁷⁹ in the province (see Figure 25), it can be confirmed that these communities have no productive or sacred link with the properties that have been included in the project. All the plots are owned by Garruchos S.A, and there are no legal conflicts in these areas. There is no indigenous community directly impacted by this project so it can be said that no negative impacts have been found on any indigenous community by the project.

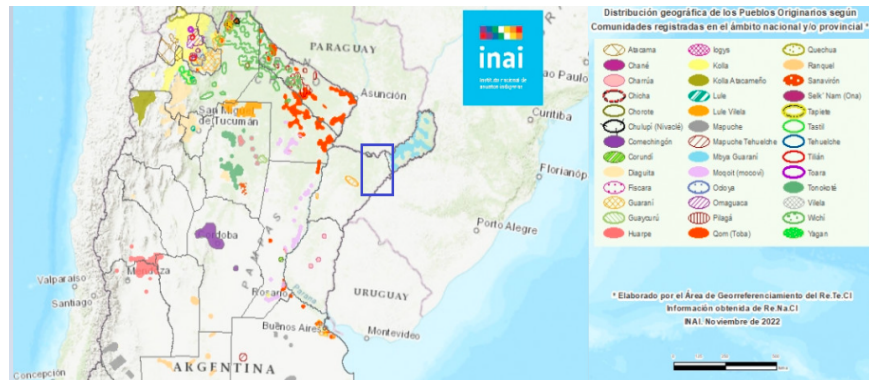


Figure 26. Comparative area of Garruchos´ project zone (blue square) and indigenous communities surveyed by INAI in northern Argentina.

In terms of Cultural Heritage, Garruchos S.A has a policy in place identifying communities that have some link to the company's assets. These can be either due to the presence of sacred sites, ceremonial sites or cemeteries, as well as communities with which have links to the properties in terms of cultural and/or religious; social and/or by the extraction of non-timber forest products (NTFPs). In case this takes place, there are processes in place to respect these relations, by allowing communities into the properties, with the corresponding registry of the activities in place.

2.3.4 Property Rights

Rights to territories and resources	Since these lands are all legal forestry land, the ownership is clear, and there is no dispute over land ownership in the project site. Land tenure evidence is provided through notarial certificates of ownership ⁸⁰ which comply with Argentinean legislation. Moreover, evidence of complying with principle n°2 Rights and Responsibilities of Tenure and Use of FSC certification ⁸¹ are reported in FSC summary reports publicly available.
Respect for property rights	If forestry operations may compromise the right of tenure or future use of the communities or may be a direct cause of

⁷⁹ Available in: <https://www.argentina.gob.ar/derechoshumanos/inai/mapa>

⁸⁰ Land ownership evidence available in shared folder to VVB "Ownership"

⁸¹ Certification evidence in shared folder to VVB "FSC certification"

	<p>dispute, the suspension or non-commencement of forestry operations will be considered.</p> <p>In these cases, the country's current regulations and the ILO Conventions appropriate to each situation will be considered.</p>
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2.3.5 Benefit Sharing

The project does not need benefit-sharing mechanisms since it does not impact property rights.

Process used to design the benefit sharing plan	Not applicable as there is no benefit sharing plan in place as the project does not impact property rights.
Summary of the benefit sharing plan	Not applicable as there is no benefit sharing plan in place as the project does not impact property rights.
Approval and dissemination of benefit sharing plan	Not applicable as there is no benefit sharing plan in place as the project does not impact property rights.
Benefit sharing during the monitoring period	Not applicable as there is no benefit sharing plan in place as the project does not impact property rights.

2.4 Ecosystem Health

The project activity converts an area that was modified and moderately degraded, where extensive continuous livestock activity was carried out, into an ARR project activity that does not harvest and where pruning is not expected. The sole objective is to provide the service to the environment by capturing CO₂ from the atmosphere contributing to carbon neutrality.

According to the EIA⁸², the potential alterations that the project could cause are low and of acceptable levels, due to the implementation of good forestry practices. The project is based on direct planting with low-impact and environmentally friendly techniques and the use of sustainable management practices under FSC certification, which implies that the design, planting and maintenance of the forest are carried out through a sustainable forest management program avoiding negative impacts on biodiversity, local communities, or water bodies. This is accomplished by identifying risks and determining a contingency plan that establishes the actions to be taken, the steps to be followed, and the assignment of roles in each case.

This afforestation project will be carried out considering the Basic Manual on Good Forest Practices suggested by the Secretary of Agriculture, Fisheries, Livestock and Food (SAGPyA)⁸³ of the national government as a basic tool for the implementation of environmentally sustainable

⁸² EIA shared to VVB as document: "EIA_Puerto Valle" and "EIA_Garruchos" in shared folder "Environmental Health>EIA"

⁸³ https://www.magyp.gob.ar/sitio/areas/desarrollo-foresto-industrial/buenas_practicas/_archivos//000000_Manual%20Basico%20de%20referencia%20de%20BPM.pdf

forestry, as well as the Guidance on Good Forest Practices for the province of Corrientes (Resolution N° 875/14, Corrientes)⁸⁴.

The ARR project activity is included in the environmental studies developed for both properties: Puerto Valle and Garruchos. Only a part of the environmental impacts mentioned in the environmental assessment correspond to the project activity as no thinning or harvest is expected. Moreover, there is an environmental and social monitoring program⁸⁵ aimed at ascertaining the health of the ecosystems involved in the properties and the potential impacts of forestry operations, using status indicators that warn of possible risk situations.

The methodology is based on the EcoRap procedure guidelines, developed by TNC (The Natural Conservancy), which is used to assess the health of ecosystems and their attributes of high conservation value, and at the same time detect signs of deterioration due to erosion, contamination, fragmentation, exclusion, landscape affectation or any of its functions, and other processes that could occur as a consequence of area management. Given that forestry operations are in the higher parts of the relief, in addition to the effect of altering the natural landscape, it has an influence on the depressed sectors of the landscape. Therefore, the interpretation of the parameters usually used to know the health of the ecosystems are analysed in the context of the functioning of the basin. The frequency of this monitoring is annual.

Wildlife is monitored periodically during operations through a participatory program of occasional sightings. Operations are monitored monthly in terms of environmental, S&H, social, and operating procedures through a system of nonconformities and corrective action requests, which allow Garruchos S.A to identify deviations, determine their causes, corrective and preventive actions, and deadlines for their correction.

These is summarized in the table below:

	Risks identified	Mitigation or preventative measure taken
Impacts on biodiversity and ecosystems	The EIA has concluded that the degree of affectation of the project to the flora, fauna and landscape is moderate. The project activity is developed in a productive establishment in which transformation of the natural environment has occurred many years ago and the context of the landscape and environments that surround it	Garruchos S.A has an environmental management plan whose scope includes the conservation of natural ecosystems and their biodiversity, the treatment of waste generated during operations, among others. The risks related to the impacts on the ecosystem are regulated by the company in all its properties, from planning and designing the stands in such a way that ages and species alternate, to leaving

⁸⁴ <https://icaa.gov.ar/Normativas/guia-de-buenas-practicas-forestales-resolucion-n-875-14-adhesion-icaa> and guideline available at: https://www.magyp.gob.ar/sitio/areas/desarrollo-forestal-industrial/buenas_practicas/_archivos//000001_Provincia%20de%20Corrientes.pdf

⁸⁵ Document "Social monitoring spreadsheet" shared folder "SD Contributions", to VVB

	Risks identified	Mitigation or preventative measure taken
	<p>present similar characteristics of transformation.</p> <p>The project converts a degraded area, where continuous extensive livestock activity was carried out, into an ARR project activity with no harvesting. The impacts on these factors will be of a variable intensity over time according to the stage of the project.</p> <p>However, the presence of wild species is expected, even those with some degree of threat. Wildlife constitutes the factor of greatest environmental mobility and least predictability due to its variable requirements throughout its life cycle, growth phases, and difficulty of observation. Undoubtedly, its abundance and biodiversity are directly linked to the physical habitat spaces.</p>	<p>conservation areas of the natural ecosystem's representative of the fields, such as native forests, gallery forests, pastures, among others. Connectivity between these conservation areas and with neighboring natural areas is prioritized.</p> <p>Hunting and capture of wild animals is not allowed within the property. The extraction of native plants or their parts (flowers or fruits) in conservation areas is prohibited. Warning and prohibition signs are installed in key places on the properties, establishing a surveillance system.</p>
<p>Soil degradation and soil erosion</p>	<p>EIA⁸⁶ has identified that periods with low vegetation coverage may lead to slight soil erosion. This could take place during land preparation, and road and firebreak maintenance.</p>	<p>Ploughing will be the minimum essential to be able to form the needed canals.</p> <p>Planning of roads and firebreaks, adapting their construction to the existing topography, minimizing the movement of earth and the alteration of water courses. On roads, sinks and sediment traps (indentations) are placed in representative places before the water passes into natural channels, and reduce the erosive energy of runoff waters. Between the planting plots, the drains are conducted towards the interior of the same, favoring the capture of humidity and</p>

⁸⁶ Documentation shared to VVB in folder "Environmental health>EIA"

	Risks identified	Mitigation or preventative measure taken
		<p>reducing the dragging of sediments.</p> <p>The roads are located at a safe distance from bodies of water and protection areas, maintaining a buffer zone.</p>
<p>Water consumption and stress</p>	<p>The EIA has resulted in a moderate degree of affectation of the project to water resources. During the stages of the project, a potential alteration of the resource could occur, modifications in the quality of the surface water, in case of inadequate handling of phytosanitary products during land preparation, and of hydrocarbons during the entire cycle. Inadequate management of waste from forestry operations also represents a risk of altering water quality.</p>	<p>There is an agrochemical responsible management plan⁸⁷ in place that includes general guidance as well as specific guidance for the application of agrochemical for weed and ant controls. Training to agrochemical operators is conducted periodically.</p> <ul style="list-style-type: none"> - When applying agrochemicals, maintain a safety distance of at least 25 meters from watercourses and 20 meters from other natural areas. - Consider weather forecast when applying herbicides Applications will not be carried out in rainy, unstable weather or with excessive environmental humidity. -During the preparation, application, and handling of agrochemical products, precautions must be taken to avoid: <ul style="list-style-type: none"> a) Direct contact with the chemicals b) Contamination of water sources c) Extreme caution in the vicinity of homes d) Leaving product and packaging residue behind

⁸⁷ Documentation shared to VVB in folder "Environmental health>Agrochemical responsible management"

	Risks identified	Mitigation or preventative measure taken
		<ul style="list-style-type: none"> - Train workers in spill control, waste management and safe working practices. - Agrochemicals must be transported in a specially conditioned tank trailer, never with food, drinking water, hydrocarbons, animals, much less people, or in the body of a truck. - The transport unit must also have an environmental kit (shovel, bag, nitrile gloves) to prevent potential spills. - The use of agrochemicals is carried out in a targeted manner and is limited to the establishment stage of the plantations, during the first 2 or 3 years. - The roads are located at a safe distance from bodies of water and protection areas, maintaining a buffer zone.
<p>Usage of fertilizers</p>	<p>There is minimum fertiliser usage in forestry, only during the first stage of growing, with the plantation of individuals. For these reasons, risks are limited.</p>	<p>Fertilizers usage is conducted under the Agrochemical Responsible Procedure⁸⁸. It includes a specific guideline in annex 5, for fertilizers. stating different preventive measures such as:</p> <p>At time of application: they shall not be made in rainy, unstable weather or excessive ambient humidity. The crew foreman will be primarily responsible for enforcing this.</p> <p>Necessary care during the application and handling of fertilizer, precautions must be taken in order to avoid:</p>

⁸⁸ Procedures available to VVB in shared folder: "02. PD-MR References>Environmental health>Agrochemical responsible management V.2.9"

	Risks identified	Mitigation or preventative measure taken
		1. Direct contact with chemicals 2. Contamination of water sources and extreme caution in the vicinity of dwellings. 3. Leaving product residues and containers behind.

2.4.1 Rare, Threatened, and Endangered species

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

Yes

No

<p>Species:</p> <p><i>Myrmecophaga tridactyla</i></p> <p><i>Ara chloropterus</i></p> <p><i>Pecari tajacu</i></p> <p><i>Panthera onca</i></p> <p><i>Pteronura Brasiliensis</i></p> <p><i>Ozotoceros besoarticus</i></p> <p><i>Blastocerus dichotomus</i></p> <p><i>Chrysocyon brachyurus</i></p> <p><i>Lontra longicaudis</i></p> <p>Habitats: wetland, grasslands, riparian forests and palms</p>	<p>The project will take place in modified and moderately degraded lands. It is located within cattle raising and forest plantation properties which have identified, and protect, 1,270.5 hectares of HCV areas, of which 40.6 ha are within the gross area of the project. These protected areas include wetlands as well as other areas of high conservation interest: riparian and native forest, grassland and palms; these form a buffer area with the Iberá National Park (figure 5).</p> <p>As mentioned in the environmental monitoring report 2022⁸⁹, regarding the HCV areas, “none of the areas included in Puerto Valle and Aguaracua can be considered critical for maintaining the integrity of the landscape, which does not imply recognizing their relictual value and adopt the most appropriate management to maintain their stability over time (Burkart, 1994).” In this line, the project’s design respects local legislation conditions regarding distance from water bodies, native forest, etc.</p> <p>Moreover, the project does not include thinning or harvesting activities, limiting silvicultural and transport impacts over biodiversity and ecosystems. Still, an EIA was conducted for the whole area, moreover, the implementation of the Non-native Invasive Species Control Plan is to be implemented in this area and throughout the crediting period.</p> <p>To assess the influence of productive activities on the natural environment, the guideline of the EcoRap procedure, developed by Conservation International, is used. This procedure allows analyzing the ecosystem’s health and their high conservation value attributes, as well</p>
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⁸⁹ Environmental monitoring report 2022 available to VVB in shared folder “Environmental health” including impact assessment monitoring results for the protected areas.

	as to detect signs of deterioration due to erosion, contamination, fragmentation, exclusion and other processes consequence of productive management. Among the variables analysed there are physical, chemical and biological parameters of water quality measured in main water courses and wetlands, which have shown no signs of contamination.
Species and habitat: <i>Ozotoceros bezoarticus and Xanthopsar flavus in wetlands and grasslands</i>	Specifically, to contribute to the conservation of endangered species of fauna Garruchos S.A has a "Conservation Program for the Venado de las Pampas and Tordo Amarillo". Through a letter of cooperation agreement with the NGO Conservation Land Trust, lines of work were agreed upon to promote the recovery of the environment where these two species live, long-term monitoring and follow-up, behavioural studies in forest environments, education and training of the personnel in charge, and recovery of pampas deer in other sectors of the Iberá Reserve through translocation.

2.4.2 Introduction of species

introduced Species	Classification	Justification for use	Adverse effects and mitigation
<i>Pinus taeda</i>	Non-native	Rapid carbon removal with known adaptation to the area and growth level, due to wide commercial use	<p>Although some species of Pinus are considered invasive <i>Pinus taeda</i> is not the case, according to the local list of invasive species⁹⁰.</p> <p>Still, in line with local and FSC requirements, the project implements it's "Non-native Invasive Species Control Plan"⁹¹ which includes preventive and corrective measures. In the first place, with the analysis of the species characteristics and monitoring, while the second corresponds to control measures including</p>

⁹⁰ Access the complete list of invasive non-native species list for Argentina here: https://www.argentina.gob.ar/sites/default/files/lista_oficial_eei_boletin_oficial_con_nombres_comunes_0.pdf

⁹¹ Garruchos has a control plan available to VVB during validation and verification in the shared folder: "PDD-MR reference-> Environmental health-> Plan de Gestión de exóticas invasoras G. Garruchos V4"

introduced Species	Classification	Justification for use	Adverse effects and mitigation
			the extraction of individuals outside the plantation plot. This can be done manually or mechanically depending on the size.
<i>Pinus hybrid (elliottii-caribaea)</i>	Non-native	Rapid carbon removal with known adaptation to the area and growth level, due to wide commercial use	<i>Pinus hybrid (elliottii x caribaea)</i> is not registered in the national invasive species list. Moreover, GloNAF a global list of naturalized species (a step prior to invasion) includes <i>Pinus elliottii</i> in Argentina, but not <i>caribaea</i> nor its <i>elliottii x caribaea</i> hybrid (van Kleunen et al 2018). Last, a list specific for <i>Pinus</i> genus (Perret et al., 2019) mentions <i>Pinus elliottii</i> as a naturalized species in the south of Argentina, but does not include <i>Pinus caribaea</i> nor its hybrid in Argentina. Still, the mentioned “Non-native Invasive Species Control Plan” is applied.
<i>Eucalyptus grandis</i>	Non-native	Rapid carbon removal with known adaptation to the area and growth level, due to wide commercial use	<i>Eucalyptus grandis</i> is not classified as an invasive species by the local list (national). Still, the “Non-native invasive Species Control Plan” is applied to control possible invasiveness outside the plantation plot.
<i>Handroanthus heptaphyllus</i>	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from the region
<i>Parapiptadenia rigida</i>	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from the region
<i>Apuleia leiocarpa</i>	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from

introduced Species	Classification	Justification for use	Adverse effects and mitigation
			the region
<i>Patagonula americana</i> L.	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from the region
<i>Peltophorum dubium</i>	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from the region
<i>Handroanthus albus</i>	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from the region
<i>Campomanesia xanthocarpa</i>	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from the region
<i>Jacaranda mimosifolia</i>	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from the region
<i>Plinia rivularis</i>	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from the region
<i>Albizia niopoides</i>	Native	Carbon removal, native domestication studies & biodiversity benefits	No adverse impacts are expected nor identified, as the species are native from the region

Existing invasive species	Mitigation measures to prevent spread or continued existence of invasive species
There are no existing invasive species.	There is a “Non-native invasive Species Control Plan” in place applied to control possible invasiveness outside the plantation plots, thus the project activity will not allow appearing invasive species to thrive.

2.4.3 Ecosystem conversion

No natural non-degraded ecosystems have been converted, cleared, drained or degraded to generate GHG credits within 10 years of the project start date. Evidence has been gathered in

Section 1.4.2, AFOLU Project Eligibility and further degradation analysis included in Appendix 4. The areas have remnants of native species but having been used for cattle breeding for more than 50 years they are highly modified and moderately degraded.

The figures below show the land conditions in the property with bare soils and modified vegetation (a), compared to natural grasslands in other parts of the same property.



Figure 27. Puerto Valle property images of (a) cattle breeding impacts on soil (b) conserved grassland, which occupies an extensive strip bordering Iberá, in a mid-hill position, within the same property.

Moreover, in the case of Garruchos´ property, the type of vegetation presents 10 years prior to the project start date is the result of many years of forest and grassland disturbances due to cattle breeding: slash-and-burn, forest plantations, roads, and other activities in the property. Through satellite images it is possible to identify an area of the farm which was planted with non-native species by the previous owner. This area of 16 hectares had been planted around 2000 and later harvested (2010), thus, no native ecosystem has been replaced by the project. Later,

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	AR-ACM0003	AR-ACM0003: Afforestation and reforestation of lands except for wetlands	02.0
Tool	AR TOOL 02	Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities	01.0
Tool	AR TOOL 08	Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity	04.0
Tool	AR TOOL 14	Estimation of carbon stocks and change in the carbon stocks of trees and shrubs in A/R CDM project activities	04.2
Tool	AR TOOL 15	Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity	02.0
Tool	AR TOOL 03	Tool for the Calculation of the number of sample plots for measurements within A/R CDM project activities	02.1.0

No burning is expected from project’s activity but in case of fire occurrence (natural or anthropogenic) the tool will be considered to analyze applicability.

3.2 Applicability of Methodology

Methodology ID	Applicability condition	Justification of compliance
AR-ACM0003	<p>The land subject to the project activity does not fall in wetland category</p>	<p>Project activities will not take place in wetlands. This is demonstrated through the land eligibility analysis in which wetlands and water bodies were identified and excluded from project boundaries. See section 1.4.2</p>
	<p>Soil disturbance attributable to the project activity does not cover more than 10 percent of area in each of the following types of land, when these lands are included within the project boundary:</p> <ul style="list-style-type: none"> • Land containing organic soils; • Land which, in the baseline, is subjected to land use and management practices and receives inputs listed in appendices 1 and 2 to the methodology AR ACM003. 	<p>The project activities do not take place in land containing organic soils, nor in land which, in the baseline, is subject to land use and management practices and receives inputs listed in appendices 1 and 2 to the methodology AR-ACM003). Baseline before the project start date was grasslands without any inputs. In the absence of the project activity, the baseline is expected to remain as unmanaged grasslands (without receiving inputs such as listed in appendices 1 and 2 to the methodology AR-ACM003). Such grasslands under tropical conditions have less carbon compared to plantations and forest cover. Therefore, it is expected for soil organic carbon to increase less in the absence of the project activity relative to the baseline.</p>
	<p>A project activity applying this methodology shall also comply with the applicability conditions of the tools contained within the methodology and applied by the project activity.</p>	<p>The project complies with the applicability conditions of the tools contained within the methodology as evidenced in this table</p>

Methodology ID	Applicability condition	Justification of compliance
<p>Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (Version 01).</p>	<p>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.</p>	<p>The AFOLU activities won't lead to the violation of any applicable law as they are currently implemented in the area under legal compliance. Garruchos S.A. activity is framed within the existing legislation and in a context of respect and harmony with the natural and social environment, as it is described in its FSC certification statement.</p>
	<p>This tool is not applicable to small - scale afforestation and reforestation project activities.</p>	<p>The project is considered a large-scale afforestation project</p>
<p>Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity (version 4.0.0)</p>	<p>The tool is applicable to all occurrence of fire within the project boundary</p> <p>Non-CO₂CO₃ 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.</p>	<p>No fire activities are expected as part of the project activity as they are not a silvicultural procedure at Pomera, therefore, this criterion is not applicable. But in the case of fire occurrence within the project boundary, the tool will be used when the area affected is higher than 5% of the project area, taking into consideration the national forest (native) definition is: a tree cover of native species greater than or equal to 20 %; trees reaching a minimum height of 3 metres, and a minimum area equal to or greater than 0.5 hectares, including palm groves.</p>
<p>Estimation of carbon stocks and change in the carbon stocks of trees and shrubs in A/R CDM project activities (Version 04.2).</p>	<p>This tool has no internal applicability conditions</p>	<p>Not Applicable</p>
<p>Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity</p>	<p>This tool is not applicable if the displacement of agricultural activities is expected to cause, directly or</p>	<p>There is no displacement of agriculture activities that will cause drainage of wetlands or peat lands as no leakage is expected with the project</p>

Methodology ID	Applicability condition	Justification of compliance
	indirectly, any drainage of wetlands or peat lands.	implementation as the cattle was sold to slaughterhouses.
Calculation of the number of sample plots for measurements within A/R CDM project activities	This tool has no internal applicability conditions	Not Applicable

3.3 Project Boundary

Source	Gas	Included?	Justification/Explanation	
Baseline	Above and below ground biomass in trees and shrubs	CO ₂	Yes	It is expected that carbon stock in these pools will not increase due to the implementation of the baseline activity. Above and below ground carbon stock in the baseline, present in isolated trees, is accounted as zero. The trees present in the Project Area before the Project were neither harvested, nor cleared, nor removed. These won't suffer mortality because of competition from trees planted in the project, or damage because of implementation of the Project activity and they are not inventoried along with the Project trees in monitoring of carbon stocks throughout the crediting of the project activity, checking the overall condition of trees and mortality.
		CH ₄	No	This is not a requirement of the methodology.
		N ₂ O	No	This is not a requirement of the methodology.
		Other	No	This is not a requirement of the methodology.
Dead wood, litter and Soil	Dead wood, litter and Soil	CO ₂	No	It is expected that carbon stock in these pools will not increase due to the implementation of the baseline activity
		CH ₄	No	This is not a requirement of the methodology.

Source		Gas	Included?	Justification/Explanation
	organic Carbon	N ₂ O	No	This is not a requirement of the methodology.
		Other	No	This is not a requirement of the methodology.
	Burning of woody biomass	CO ₂	No	There will be no burning of woody biomass in the project activity
		CH ₄	No	There will be no burning of woody biomass in the project activity
		N ₂ O	No	There will be no burning of woody biomass in the project activity
		Other	No	There will be no burning of woody biomass in the project activity
Project	Above and below ground biomass in trees and shrubs	CO ₂	Yes	Carbon stocks in tree biomass is the main carbon pool affected by project activity.
		CH ₄	No	This is not a requirement of the methodology.
		N ₂ O	No	This is not a requirement of the methodology.
		Other	No	This is not a requirement of the methodology.
	Dead wood, litter and Soil organic Carbon	CO ₂	No	Optional. Expected to increase due to project activity, since it does not virtually exist in the pre-project situation.
		CH ₄	No	This is not a requirement of the methodology.
		N ₂ O	No	This is not a requirement of the methodology.
		Other	No	This is not a requirement of the methodology.
	Burning of woody biomass	CO ₂	No	There will be no burning of woody biomass in the project activity
		CH ₄	No	There will be no burning of woody biomass in the project activity
		N ₂ O	No	There will be no burning of woody biomass in the project activity
		Other	No	There will be no burning of woody biomass in the project activity

The following afforestation maps show the areas included within the project boundary. They show the plantation which took place in Puerto Valle property and in Garruchos property. The green color represents *Pinus taeda* and *hybrid*, the orange color represents *Eucalyptus grandis* species and the blue color represents native mix of species. The last includes the list of native species in section 2.4.2.

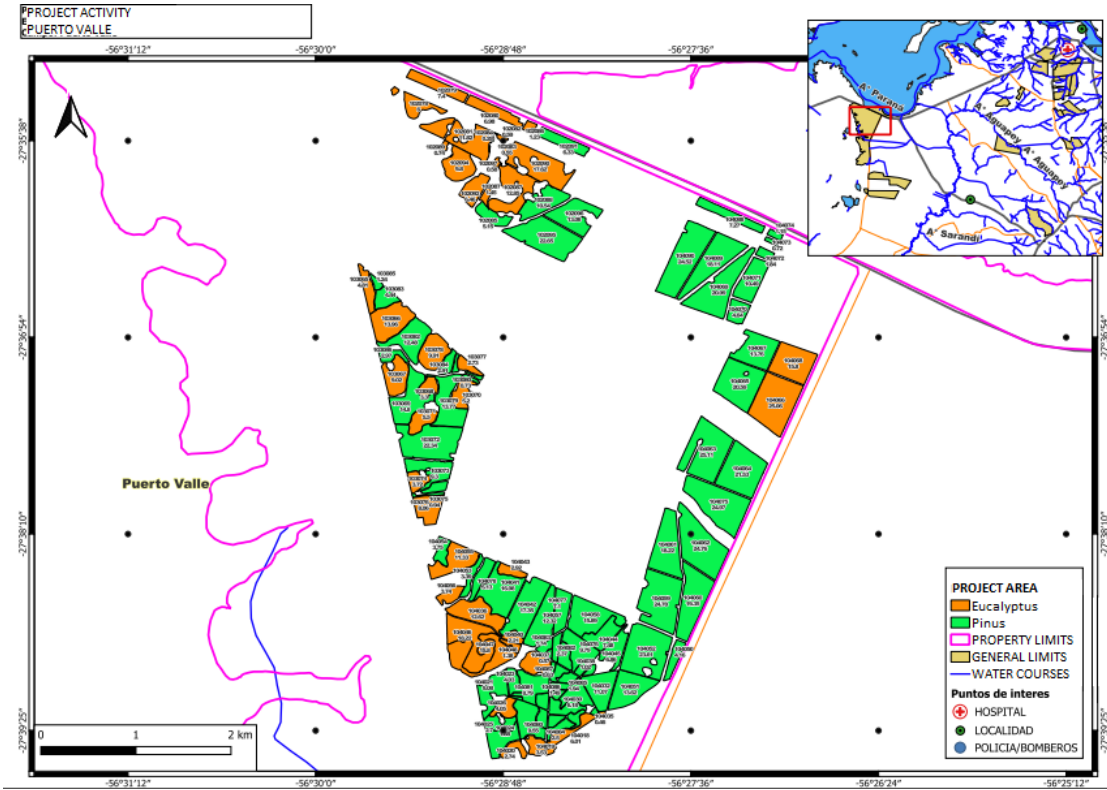


Figure 29 Eucalyptus and Pine plantations in Puerto Valle property equal to 945 hectares

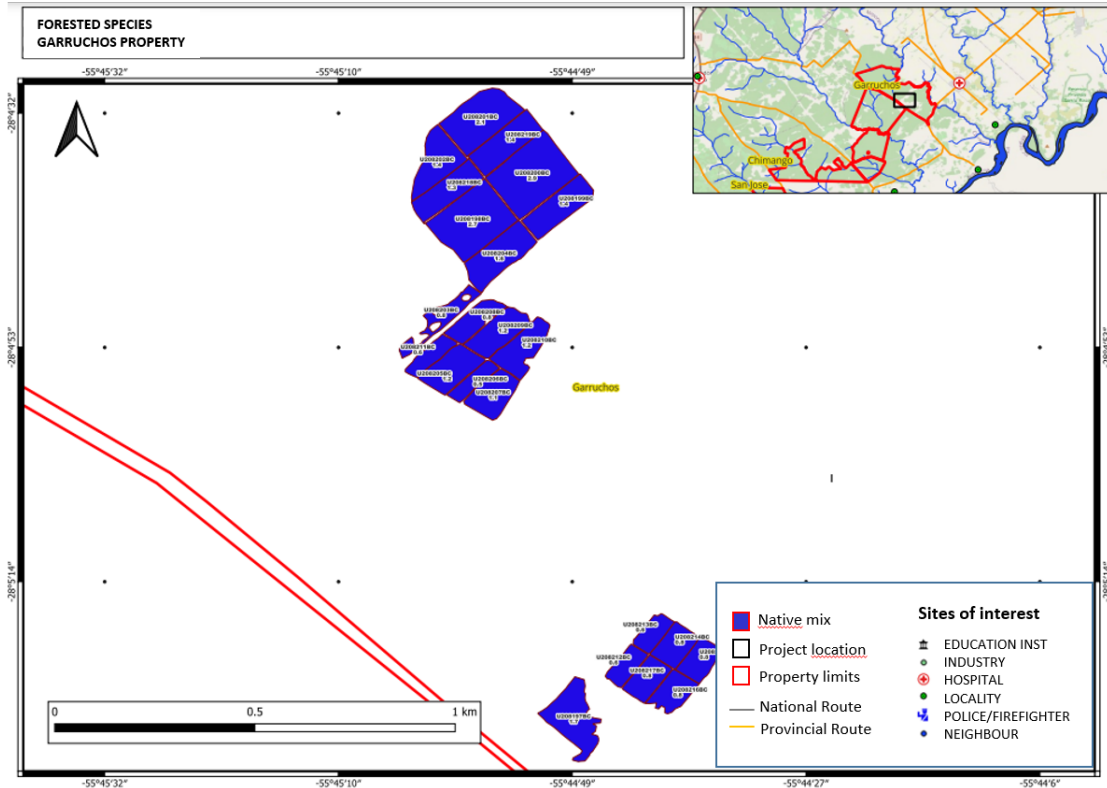


Figure 30 Native species plantations in Garruchos property equal to 28.3 hectares

It is important to clarify that the project considers the carbon pools required by the applied methodology. Those carbon pools that cannot be quantified with high certainty—such as dead wood, litter, and soil organic carbon—and those for which data is unavailable are not considered. Similarly, harvested wood products are not included in carbon pools because the project does not involve harvesting.

3.4 Baseline Scenario

The baseline scenario and demonstration of additionality (see section 3.5), follows the AR-TOOL02 “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (version 01)”. This tool is part of the methodology applied: AR-ACM0003 version 02.0 (see chapter 3.1) which is applicable to large-scale projects (according to CDM scale).

This tool is applicable to the project activity since afforestation of the land within the proposed project boundary does not lead to violation of any applicable law, even when laws might not be enforced. Garruchos S.A. activity is framed within the existing legislation and in a context of respect and harmony with the natural and social environment, as it is described in its FSC´ certification statement. Furthermore, the project activity exceeds what is requested by law in benefit of social and environmental characteristics.

According to the tool, the Project shall apply the following five steps to identify the baseline scenario and demonstrate additionality:

- Step 0. Preliminary screening based on the starting date of the A/R project activity
- Step 1. Identification of alternative scenarios to the proposed project activity
- Step 2. Barrier analysis
- Step 3. Investment analysis (if applicable)
- Step 4. Common practice

The following section presents the description and justification of the procedure followed in relation to these steps. In the section Baseline the step 0 and step 1 will be analyzed. The following steps will be approached in the additionality section.

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

Although the project does have a start date after 31 December 1999, according to section 3.2.4 of VCS Validation and Verification Manual Version 3.2, it clearly states that the CDM's requirement for prior consideration of carbon finance can be disregarded, replaced by VCS retroactive condition for project presentations.

Step 1: Identification of alternative land use scenarios to the proposed project activity

According to "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (version 01)" section 1.9 one of the alternative scenarios that must be analyzed is the proposed project activity undertaken without the incentives from VCS carbon credits. In the following analysis it is presented as scenario two.

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

The alternative scenarios identified that would take place in the absence of the proposed project are:

- Scenario 1: Continuation of the pre-project land use – extensive continuous cattle raising, by grazing.
- Scenario 2: Afforestation with no harvesting activity and without incentives from VCS carbon credits.
- Scenario 3: Afforestation with only exotic species with harvesting activity.
- Scenario 4: Yerba mate production.

All these scenarios are viable, taking into consideration that the primary production sector of the project area is quite diversified, with the main productive activities being bovine cattle, forestry and the cultivation of yerba mate (Table 4) with their respective industrial processing⁹².

⁹² Corrientes, Informe productivo provincial 2018. Secretaría de Política Económica. Subsecretaría de Programación Microeconómica (SSPMicro). Ministerio de Hacienda. Presidencia de la Nación. Available at: https://www.argentina.gob.ar/sites/default/files/sspmicro_informes_productivos_provinciales_corrientes.pdf

Table 5 Implanted surface by type of production. Data in hectares and cattle stocks from campaign 2021/2022. Source: SAGyP⁹³ and SENASA⁹⁴. Own elaboration.

	<i>Land use</i>			
	<i>Livestock</i>	<i>Exotic Implanted Forest</i>	<i>Native Implanted Forest</i>	<i>Yerba Mate</i>
	<i>Cattle stocks</i>	<i>Implanted surface (hectares)</i>		
Argentina	53,416,435	1,206,471	44,058	177,530
<i>Province</i>				
Corrientes	4,493,777	436,880	940	23,085
<i>Project area Departments</i>	431,128	211,971	909	23,085

Scenario 1: Continuation of the pre-project land use – continuous extensive cattle raising

The northeast of Argentina, commonly named as NEA, is the second livestock-producing region in the country⁹⁵ (Figure 31). Emphasizing the project area, Corrientes is the fourth largest province in terms of livestock production⁹⁶.

⁹³ Ministerio de agricultura, ganadería y pesca, Argentina. Available at: <https://datosestimaciones.magyp.gob.ar/reportes.php?reporte=Estimaciones>
<https://www.magyp.gob.ar/sitio/areas/desarrollo-foresto-industrial/inventarios/tablero.php>
<https://www.magyp.gob.ar/sitio/areas/estimaciones/tableros/tablero-cultivos.php?accion=imp>

⁹⁴ Animal statistics (SENASA). Available at: <https://www.argentina.gob.ar/senasa/mercados-y-estadisticas/estadisticas/animal-estadisticas/bovinos/bovinos-y-bubalinos-sector-primario>

⁹⁵ Científico-Tecnológicas, J., & Cibils, O. A. (2013). Situación de la ganadería bovina en Misiones y propuesta para intensificar su producción. Available at: [https://bibliotecadigital.fce.unam.edu.ar/bitstream/handle/bhp/548/Cibils%20O.A. \(2013\). Situación de la ganadería bovina en Misiones y propuesta para intensificar su producción. Available at:](https://bibliotecadigital.fce.unam.edu.ar/bitstream/handle/bhp/548/Cibils%20O.A.%202013%20Situacion%20de%20la%20ganaderia%20bovina%20en%20Misiones%20y%20propuesta%20para%20intensificar%20su%20produccion.pdf?sequence=1&isAllowed=y)

⁹⁶ https://www.argentina.gob.ar/sites/default/files/sspmicro_informes_productivos_provinciales_corrientes.pdf

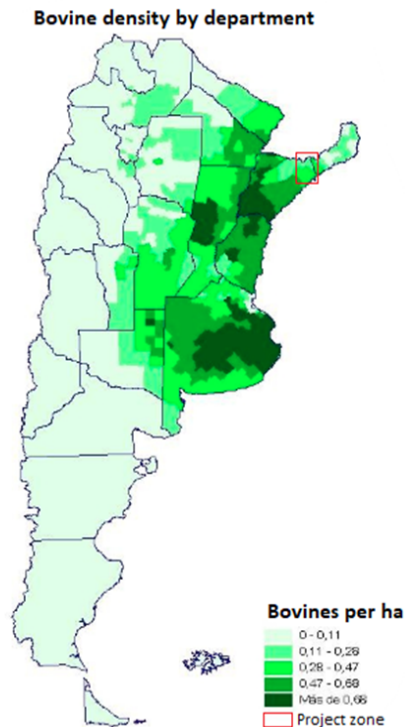


Figure 31. Bovine density by department. Dirección de Control de Gestión y Programas Especiales – Dirección Nacional de Sanidad y Calidad Agroalimentaria (SENASA)⁹⁷

The predominant livestock activity in this province is breeding. This activity is carried out in conjunction with other livestock activities, such as mixed cattle and sheep farming. It is characterized by the extensiveness of its production systems, based on the use of unmanaged pastures of spring-summer growth, with little participation of cultivated pastures and other complementary forage sources. Livestock production with grazing of unmanaged grassland is the existing activity prior to the project implementation and it has been the historical activity performed in the project area and surrounding areas. The soils in farms in this region are poor, and livestock production does not require large investments.

This activity is one of the main economic activities not only of the province of Corrientes but also of Argentina as a whole. Cattle raising in the province of Corrientes participates with 33% of the Gross Geographic Product in the primary sector, average years 1993 to 2017 (being 2017 the latest official data provided by the National Institute of Agricultural Technology⁹⁸). This activity is developed in the entire provincial territory, constituting the most widespread economic activity in

⁹⁷ Dirección de Control de Gestión y Programas Especiales – Dirección Nacional de Sanidad y Calidad Agroalimentaria (SENASA) Available at: https://www.senasa.gob.ar/prensa/DNSA/Control_Gestion_y_Programas_Especiales/Indicadores_ganaderos/1_Indicadores_Ganaderia_Bovina/Densidad_Bovina_por_Hectarea.jpg

⁹⁸ National Institution for Agriculture Technology. Available at: <https://www.todoagro.com.ar/documentos/2019/intaestadisticasganaderasencorrientes.pdf>

the interior of the country, distributed among producers of different sizes (see Figure 32). The cattle raising in the province of Corrientes covers approximately 6.3 million hectares (71.6% of surface)⁹⁹.

It also supplies other provinces such as Santa Fe, Buenos Aires, Córdoba and La Pampa with calves for fattening. Approximately 70% of the calves produced are destined for fattening and slaughter, while the remaining 30% are used to replace breeding stock.

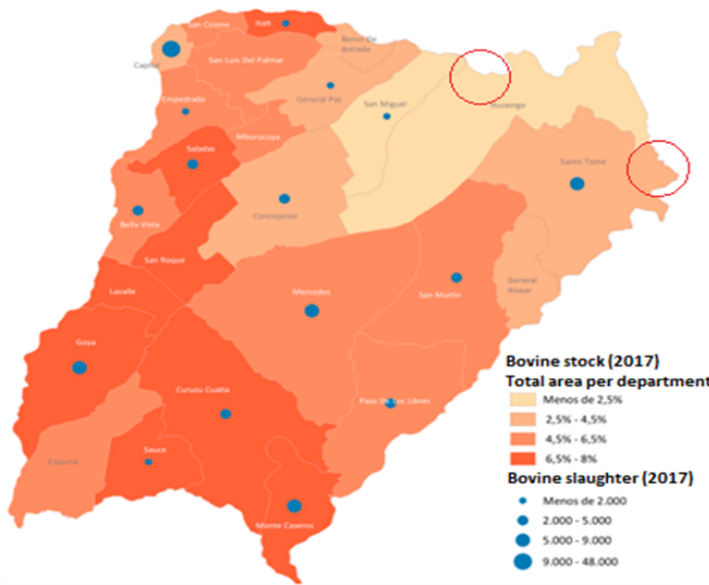


Figure 32. Livestock load (bovine stock/total area of the department) and provincial bovine slaughter of Corrientes. In red, the project zone. Ministerio de Hacienda de la Nación (2018) Productive reports – Corrientes

Scenario 2: Afforestation with no harvesting activity without incentives from VCS carbon credits

This scenario is credible since Garruchos S.A is a forest company with more than 20 years’ experience in the province of Corrientes (where the project is proposed to be placed) and in the province of Misiones. Between both provinces this company has over 23,000 hectares planted. Nevertheless, it’s important to keep in mind that in the province of Corrientes, where the project is located, industrial forest activities with harvesting are not uncommon. Nevertheless, the proposed project will not perform any harvesting activity and will also include native species. There are no records of a similar project in the region.

The proposed project will not perform harvesting activities according to the definition of Verra Program Definitions Version 4.3. The sole purpose for Garruchos S.A is to obtain carbon credits by the removal of CO₂, it’s not feasible to develop this kind of project without the incentives of VCU.

⁹⁹ Ministerio de Hacienda de la Nación (2018) Productive reports – Corrientes. Available at: https://www.argentina.gob.ar/sites/default/files/sspmicro_informes_productivos_provinciales_corrientes.pdf

Scenario 3: Afforestation of only exotic species with harvesting activity

Forestry is one of the most recently developed productive sectors in Corrientes, with pine and eucalyptus plantations, mainly due to government incentives for afforestation¹⁰⁰. In this sense, Corrientes stands out for its potential, both at a provincial and regional level, for the area available for reforestation, as well as for the quality of the wood that can be produced.

Corrientes is the province with the largest area of planted forests and is characterised by the presence of several seed-producing areas and seed orchards, which ensure that quality genetic material is obtained. The most interesting species are *Eucalyptus grandis*, *Eucalyptus saligna*, *Pinus elliottii*, *Pinus taeda* and *Pinus caribaea*. The species *Pinus* accounts for 73% of the forestation, followed by *Eucalyptus* (25.7%) ¹⁰¹. The north-eastern basin, made up of the departments of Santo Tomé, Ituzaingó and General Alvear, has the highest production volumes and is home to the province's largest industries (Figure 33).

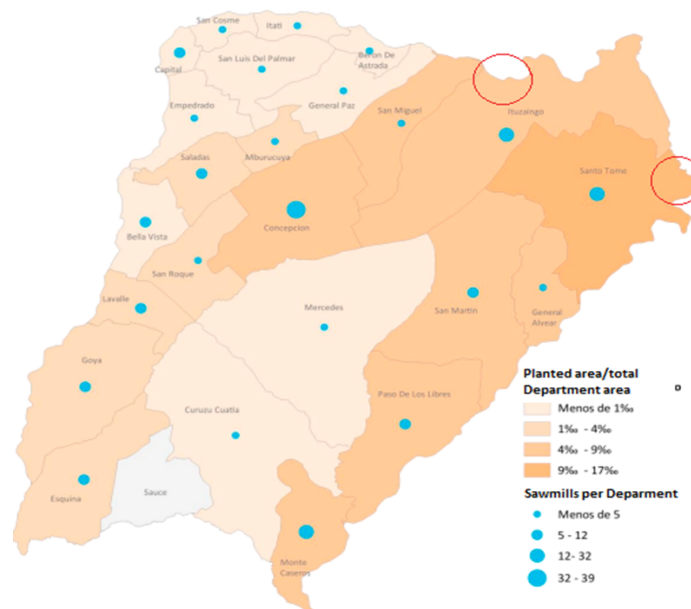


Figure 33. Forestal planted area over total department area and sawmills per department. In red, the project area. Ministerio de Hacienda de la Nación (2018) Productive reports – Corrientes.

Scenario 4. Yerba mate production

In Argentina, yerba mate is cultivated in the provinces of Misiones and Corrientes, with Corrientes representing 10% of the hectares planted in the country. In these provinces there is a "bush" production area corresponding to the north and centre of the territory of Misiones, and a "field" area in the south of this province and the northeast of Corrientes. The first one records greater

¹⁰⁰ Law 25,080: Investment law for cultivated forests. Available at: <http://servicios.infoleg.gob.ar/infolegInternet/verNorma.do?id=55596>

¹⁰¹ Corrientes, Informe productivo provincial 2018. Secretaría de Política Económica. Subsecretaría de Programación Microeconómica (SSPMicro). Ministerio de Hacienda. Presidencia de la Nación.

performances and gives rise to a product with a more accentuated taste¹⁰². Of the total production area of Corrientes, 72% corresponds to the department of Santo Tomé and 28% to Ituzaingó (Figure 33), mainly due to its suitable soil (red soil) and the advantage of being a rural area and not a scrubland. This production represents about 10% of the gross production value of the agricultural sector in Corrientes.

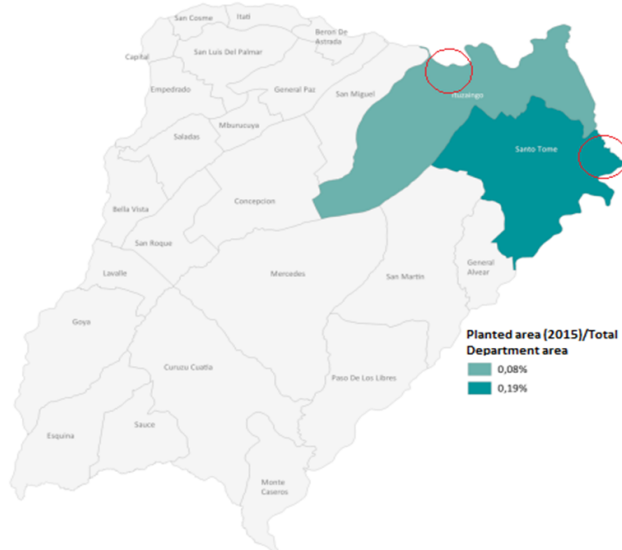


Figure 34. Yerba mate planted area over total department area, in Corrientes. In red, the project zone. Ministerio de Hacienda de la Nación (2018) Productive reports – Corrientes

Outcome of Sub-step 1.a: List of credible alternative land use scenarios that would have occurred on the land within the project boundary of the A/R CDM project activity:

- Scenario 1: Continuation of the pre-project land use – extensive continuous cattle raising, by grazing.
 - Scenario 2: Afforestation with no harvesting activity and without incentives from VCS carbon credits.
 - Scenario 3: Afforestation with only exotic species with harvesting activity.
 - Scenario 4: Yerba mate production.
- **Sub-step 1b: Consistency of credible alternative land use scenarios with enforced mandatory applicable laws and regulations** Scenario 1: Continuation of the pre-project land use – continuous extensive cattle raising

There are no legal restrictions to continue with the activity of raising cattle in this land as stated by the Rural Code of the province of Corrientes. This activity is one of the main activities of the province and is the historical activity performed in the project area.

- Scenario 2: Afforestation with no harvesting activity without incentives from VCS carbon credits and Scenario 3: Afforestation with only exotic species with harvest activity

¹⁰² Misiones, Informe productivo provincial 2018. Secretaría de Política Económica. Subsecretaría de Programación Microeconómica (SSPMicro). Ministerio de Hacienda. Presidencia de la Nación.

The province of Corrientes has adhered to the National Act 25,080 that promotes the plantation of forests for commercial use. This law establishes that the national and provincial enforcement authorities must establish a zoning for the location of the plantations, based on environmental, economic and social sustainable criteria. The zoning will respect the territorial ordering of native forests adopted by provincial law as established in Law 26,331. Plantation projects must obtain the corresponding provincial environmental approvals and be developed using practices framed in environmental, economic and social sustainable criteria. Therefore, this scenario complies with applicable laws and regulations.

The rest of the mandatory laws which would apply to this project were described in section 14.1 of the present document.

- Scenario 4: Yerba mate production

In the case of yerba mate, the region has shown to have an important area planted with yerba mate. In terms of laws and regulations, Law No. 25,564 gives the National Institute of Yerba Mate (INYM, for its acronym in Spanish) the power to fix the price of the raw material every six months. This law, Resolution 170/21, establishes that each producer registered in the Register of Yerba Mate Sector Operators may plant up to five hectares of new yerba mate plantations per year, with the possibility of replanting up to 2% of its area, to avoid a future oversupply crisis. This limits the possibility of new yerba mate production activity in the area.

Outcome of Sub-step 1b: List of plausible alternative land use scenarios to the A/R CDM project activity that are in compliance with mandatory legislation and regulations taking into account the their enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

All land use alternatives identified above are credible and comply with all mandatory regulations in the country and there is no law or regulation that prevents the realization of them; thus, no alternatives are eliminated based on this criterion.

The following steps (step 2 “Barrier analysis” to step 4 “Common practice”) are presented in the section additionality of this document.

3.5 Additionality

3.5.1 Regulatory Surplus

Is the project registered or seeking registration in an UNFCCC Annex 1 or Non-Annex 1 country?

- Annex 1 country Non-Annex 1 country

Are the project activities mandated by any law, statute, or other regulatory framework?

- Yes No

If the project is located inside a Non-Annex 1 country and the project activities are mandated by a law, statute, or other regulatory framework, are such laws, statutes, or regulatory frameworks systematically enforced?

Yes No

Project activities are not mandated by any law. As described previously, there are insufficient economic incentives for commercial plantation, which is not the case of this project with no projected harvest activities.

3.5.2 Additionality Methods

The baseline scenario (see chapter 3.4), and demonstration of additionality follows the AR-TOOL02 “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (version 01)”. This tool is an indispensable part of the methodology applied: AR-ACM0003 version 02.0 (see chapter 3.1) which is applicable to large-scale projects.

In this section the remaining steps of the Tool will be analyzed:

- Step 2. Barrier analysis
- Step 3. Investment analysis
- Step 4. Common practice

Step 2: Barrier analysis

This step is formed by two sub-steps: sub-step 2a. Identification of barriers that would prevent the implementation of at least one alternative land use scenario and sub-step 2b. Elimination of land use scenarios that are prevented by the identified barriers. This step serves to identify barriers and to assess which of the land use scenarios identified in the sub are not prevented by these barriers.

Step 2a: Identification of barriers that would prevent the implementation of at least one alternative land use scenarios

Based on the AR-TOOL02 Version01 the following list describes the barriers that were identified and described in the following analysis:

Investment Barriers:

To develop the investment analysis, it is important to understand the economical context that Argentina is going through.

Argentina’s long running inflation, economical risk, political and economic instability and the devaluation of the national currency makes any long-term investment a high-risk decision. Its long history of defaulting on its debt is reflected in the high spread of its interest rates.

Evolution of the country risk index Argentina. November 2018 -2022

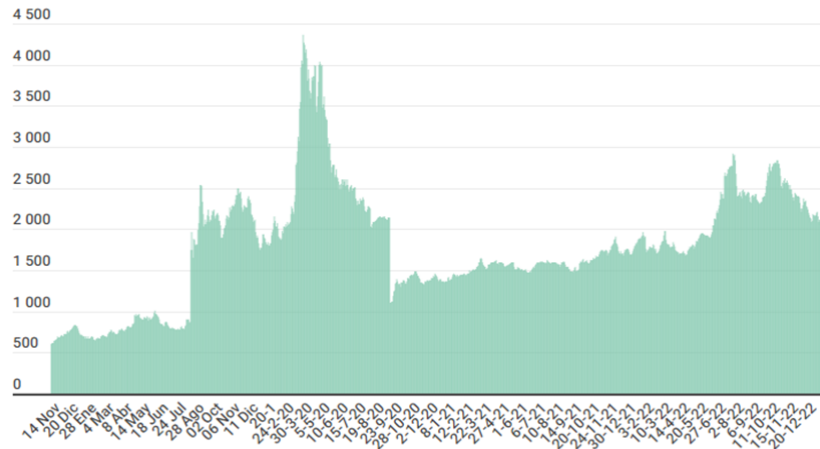


Figure 35. Evolution of Argentina Risk Index period 2018-2022. Source: JP Morgan

The risk index closed at over 2.000 points at the end of 2022 with the inflation on that year reaching almost 100% ³⁷.

The lack of fiscal discipline, a chronic problem in Argentina, and the scarce access to credit result in inflation via monetary issues to face the high level of public spending. Fiscal dominance thus becomes a central factor in uncertainty and economic instability.

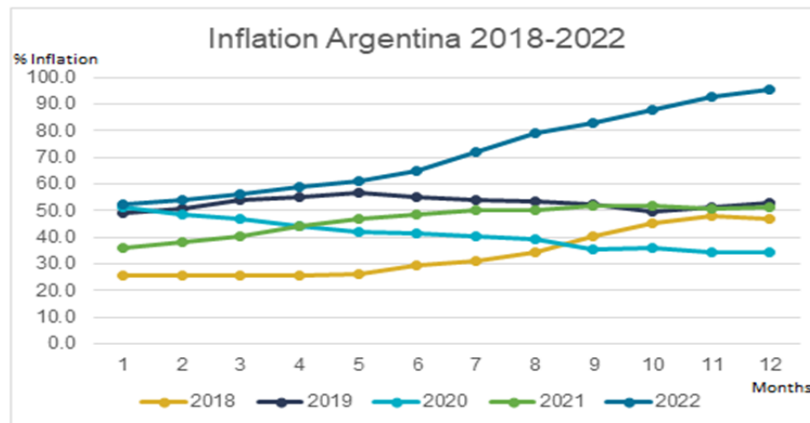


Figure 36. Inflation index Argentina for period 2018-2022. Source: INDEC¹⁰³

The constant loss of value over time suffered by the Argentine local currency (peso) reflects a weak economy. Even though the official nominal exchange rate follows a path of devaluation, the local economic policy is using the exchange rate as a nominal anchor in an economy that accumulates inconsistencies making the official exchange rate less competitive. While in most economies, exchange rate movements help cushion macroeconomic shocks, in Argentina they represent a misused tool which weakens even further the economy and pushes away any long-term investment.

¹⁰³ <https://www.indec.gov.ar/indec/web/Buscador-Buscador-1-inflacion-Todo-Todo-Relevantes>

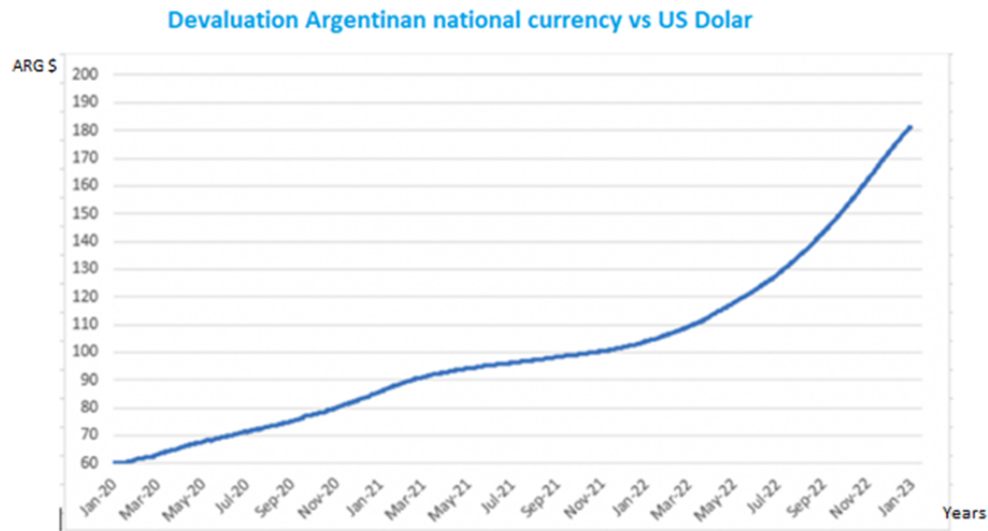


Figure 37 Monthly devaluation Argentinian national currency vs US Dollar for period January 2020 to January 2023. Source: Banco Nacion¹⁰⁴

This level of devaluation makes any long-term investment in Argentina considered as high risk not only for foreign investors but also domestic. The incentive of a carbon credit which is paid in US dollars would be an incentive to develop any production since the US dollar, unlike the peso, is a stable currency on which there is a high degree of certainty of its long-term value.

In addition to macroeconomic instability, the environment for doing business in the country is one of the most hostile that can be found in the world. The recognize survey Doing Business (World Bank¹⁰⁵), which provides objective measures of business regulations and their enforcement across 190 economies and selected cities at the subnational and regional level, every year ranked Argentina at the almost end of the line¹⁰⁶. This survey was replaced recently by a new measure called Business Enabling Environment (BEE) that will be published in the second quarter of 2023. The last survey in 2020 showed Argentina in the 126th place out of 190 countries:

¹⁰⁴ <https://www.bna.com.ar>

¹⁰⁵ <https://www.worldbank.org/en/programs/business-enabling-environment/doing-business-legacy>

¹⁰⁶ <https://www.pwc.com.ar/es/publicaciones/doing-business-in-argentina.html>

Rank	Economy	DB score	Rank	Economy	DB score	Rank	Economy	DB score
1	New Zealand	86.8	65	Puerto Rico (U.S.)	70.1	128	Barbados	57.9
2	Singapore	86.2	66	Brunei Darussalam	70.1	129	Ecuador	57.7
3	Hong Kong SAR, China	85.3	67	Colombia	70.1	130	St. Vincent and the Grenadines	57.1
4	Denmark	85.3	68	Oman	70.0	131	Nigeria	56.9
5	Korea, Rep.	84.0	69	Uzbekistan	69.9	132	Niger	56.8
6	United States	84.0	70	Vietnam	69.8	133	Honduras	56.3
7	Georgia	83.7	71	Jamaica	69.7	134	Guyana	55.5
8	United Kingdom	83.5	72	Luxembourg	69.6	135	Belize	55.5
9	Norway	82.6	73	Indonesia	69.6	136	Solomon Islands	55.3
10	Sweden	82.0	74	Costa Rica	69.2	137	Cabo Verde	55.0
11	Lithuania	81.6	75	Jordan	69.0	138	Mozambique	55.0
12	Malaysia	81.5	76	Peru	68.7	139	St. Kitts and Nevis	54.6
13	Mauritius	81.5	77	Qatar	68.7	140	Zimbabwe	54.5
14	Australia	81.2	78	Tunisia	68.7	141	Tanzania	54.5
15	Taiwan, China	80.9	79	Greece	68.4	142	Nicaragua	54.4
16	United Arab Emirates	80.9	80	Kyrgyz Republic	67.8	143	Lebanon	54.3
17	North Macedonia	80.7	81	Mongolia	67.8	144	Cambodia	53.8
18	Estonia	80.6	82	Albania	67.7	145	Palau	53.7
19	Latvia	80.3	83	Kuwait	67.4	146	Grenada	53.4
20	Finland	80.2	84	South Africa	67.0	147	Maldives	53.3
21	Thailand	80.1	85	Zambia	66.9	148	Mali	52.9
22	Germany	79.7	86	Panama	66.6	149	Benin	52.4
23	Canada	79.6	87	Botswana	66.2	150	Bolivia	51.7
24	Ireland	79.6	88	Malta	66.1	151	Burkina Faso	51.4
25	Kazakhstan	79.6	89	Bhutan	66.0	152	Mauritania	51.1
26	Iceland	79.0	90	Bosnia and Herzegovina	65.4	153	Marshall Islands	50.9
27	Austria	78.7	91	El Salvador	65.3	154	Lao PDR	50.8
28	Russian Federation	78.2	92	San Marino	64.2	155	Gambia, The	50.3
29	Japan	78.0	93	St. Lucia	63.7	156	Guinea	49.4
30	Spain	77.9	94	Nepal	63.2	157	Algeria	48.6
31	China	77.9	95	Philippines	62.8	158	Micronesia, Fed. Sts.	48.1
32	France	76.8	96	Guatemala	62.6	159	Ethiopia	48.0
33	Turkey	76.8	97	Togo	62.3	160	Comoros	47.9
34	Azerbaijan	76.7	98	Samoa	62.1	161	Madagascar	47.7
35	Israel	76.7	99	Sri Lanka	61.8	162	Suriname	47.5
36	Switzerland	76.6	100	Seychelles	61.7	163	Sierra Leone	47.5
37	Slovenia	76.5	101	Uruguay	61.5	164	Kiribati	46.9
38	Rwanda	76.5	102	Fiji	61.5	165	Myanmar	46.8
39	Portugal	76.5	103	Tonga	61.4	166	Burundi	46.8
40	Poland	76.4	104	Namibia	61.4	167	Cameroon	46.7
41	Czech Republic	76.3	105	Trinidad and Tobago	61.3	168	Bangladesh	45.0
42	Netherlands	76.1	106	Tajikistan	61.3	169	Gabon	45.0
43	Bahrain	76.0	107	Vanuatu	61.1	170	São Tomé and Príncipe	45.0
44	Serbia	75.7	108	Pakistan	61.0	171	Sudan	44.8
45	Slovak Republic	75.6	109	Malawi	60.9	172	Iraq	44.7
46	Belgium	75.0	110	Côte d'Ivoire	60.7	173	Afghanistan	44.1
47	Armenia	74.5	111	Dominica	60.5	174	Guinea-Bissau	43.2
48	Moldova	74.4	112	Djibouti	60.5	175	Liberia	43.2
49	Belarus	74.3	113	Antigua and Barbuda	60.3	176	Syrian Arab Republic	42.0
50	Montenegro	73.8	114	Egypt, Arab Rep.	60.1	177	Angola	41.3
51	Croatia	73.6	115	Dominican Republic	60.0	178	Equatorial Guinea	41.1
52	Hungary	73.4	116	Uganda	60.0	179	Haiti	40.7
53	Morocco	73.4	117	West Bank and Gaza	60.0	180	Congo, Rep.	39.5
54	Cyprus	73.4	118	Ghana	60.0	181	Timor-Leste	39.4
55	Romania	73.3	119	Bahamas, The	59.9	182	Chad	36.9
56	Kenya	73.2	120	Papua New Guinea	59.8	183	Congo, Dem. Rep.	36.2
57	Kosovo	73.2	121	Eswatini	59.5	184	Central African Republic	35.6
58	Italy	72.9	122	Lesotho	59.4	185	South Sudan	34.6
59	Chile	72.6	123	Senegal	59.3	186	Libya	32.7
60	Mexico	72.4	124	Brazil	59.1	187	Yemen, Rep.	31.8
61	Bulgaria	72.0	125	Paraguay	59.1	188	Venezuela, RB	30.2
62	Saudi Arabia	71.6	126	Argentina	59.0	189	Eritrea	21.6
63	India	71.0	127	Iran, Islamic Rep.	58.5	190	Somalia	20.0
64	Ukraine	70.2						

Source: Doing Business database.

Note: The rankings are benchmarked to May 1, 2019, and based on the average of each economy's ease of doing business scores for the 10 topics included in the aggregate ranking. For the economies for which the data cover two cities, scores are a population-weighted average for the two cities. Rankings are calculated on the basis of the unrounded scores, while scores with only one digit are displayed in the table.

Figure 38. Ease of doing business ranking for year 2020. Source: World Bank¹⁰⁷

¹⁰⁷ World Bank - Doing Business Database. Available in: <https://databank.worldbank.org/source/doing-business>

Furthermore, there is an additional obstacle which any company which decides to invest in Argentina faces. In May 2020, the Official Communication “a” 7030 of the Central Bank of the Argentina Republic established severe restrictions for companies to access the Free and Single Exchange Market (MULC)¹⁰⁸, thus hindering the possibility of making transfers abroad. If the investment were to be profitable, the current existing legislation, and the problem related to the stocks in the foreign exchange in Argentiniens central bank, makes it extremely difficult to access dollars to transfer abroad as dividends.

- Cattle raising

The economical context explained above has mild repercussions over cattle raising activities. While all the economical index undermines any kind of investment, if Garruchos S.A or other landowner had continued with cattle raising a large investment would not have been necessary because this activity was already being developed in the area.

Access to credit has always been a problem for the private sector in Argentina¹⁰⁹, an issue that has been exacerbated by the economic context of recent years. In this sense, it is important to analyse the access to credit of the livestock sector. According to Argentinian National Bank, in 2022 a total of 628,003,156 US\$ was lent to the agriculture, livestock, hunting and forestry sector which was the sector with the highest amount of loans. The livestock sector obtained 30% of the total amount (186,102,977 US\$)¹¹⁰

In addition, it is important to stress out that an investment in livestock is a short-term investment because the sale of livestock occurs within 2 to 3 years from the beginning of the investment. Corrientes’ main cattle productive scheme is cattle raising, with calf sales for fattening. Therefore, in an economic situation of such instability as the one Argentina is going through, this type of investment is the most convenient. Furthermore, the great beef consumption culture in Argentina always ensures a high demand for this product¹¹¹.

In Argentina there are many agricultural financial instruments, with a vision of a productive chain and policies that give more and better stimulus for farming and livestock activities. These activities have lower perceived risks, proven experience, and a steady cash flow. Furthermore, Corrientes’s ecological conditions allow the supply of grass required for production of cattle raising. Added to the great Argentine tradition of raising cattle, this product has a great demand both domestically and abroad.

Some of the main national and provincial incentive plans for cattle raising are:

- National Decree 133/2015¹¹²: Reduction on export duty rates. For the tariff items corresponding to bovine meat and live cattle, the tariffs are reduced to 0%.

¹⁰⁸ <https://www.bcra.gob.ar/pdfs/comytexord/A7030.pdf>

¹⁰⁹ National Bank statistics report on financial inclusion: <https://www.bcra.gob.ar/PublicacionesEstadisticas/informe-inclusion-financiera-0219.asp>

¹¹⁰ National Bank statistics report on standardised series:

https://www.bcra.gob.ar/PublicacionesEstadisticas/Cuadros_estandarizados_series_estadisticas.asp

¹¹¹ Average meat consumption: <https://www.visualcapitalist.com/cp/mapped-meat-consumption-by-country-and-type/>

¹¹² <https://www.argentina.gob.ar/normativa/nacional/decreto-133-2015-256979>

- Argentine Livestock Campaign^{113 114}. More efficiency, more future: intended for breeding stock. It is a public-private campaign at the initiative of the Undersecretary of Livestock of the Ministry of Agroindustry of the Nation. Good practices are promoted to increase productive efficiency in cattle breeding.
- Federal Plan for the Bicentennial of Livestock and Meat¹¹⁵: one of its objectives is to increase the supply of livestock products and by-products to adequately supply the internal and external market, both in quality and quantity, improving productive efficiency
- Provincial Law 5,552¹¹⁶: Rural Development Fund: its purpose is to assist and finance infrastructure works in rural areas, phytosanitary campaigns and projects that increase the productivity of agricultural activities. constitutes a trust composed mainly of the collection of real estate tax administered by Banco de Corrientes

For these reasons there is no financial barrier to continue with the actual activity of cattle raising.

-Commercial Forestry with harvest activities

In comparison, no local sources of finance were found specifically for forestry^{117 118}. It is necessary to consider the forest sector as atypical compared to the agricultural sector, due to the high initial investment funds needed to develop a project, maturity periods (above 12 years), biological cycles, maintenance requirements, etc. Commercial afforestation in Argentina is supported by incentives and tax benefits given by the government under the Act. 27,487 (modification of Law 25,080¹¹⁹). Garruchos S.A is part of this program for its commercial plantations. However, due to the lack of adequate budgeting, average payment exceeds by far the 2-year period established by the law^{120 121 122}. In addition, due to the high inflation rates, for instance the inflation rate of 2022 was 94,8%^{123 124}, and the lack of adjustments for inflation these subsidies, which are in local currency, fail as an incentive. Furthermore, all this benefit only

¹¹³ <https://magyp.gob.ar/ganar/>

¹¹⁴ https://magyp.gob.ar/sitio/areas/cfa/actividad/2017/_reunion2/_material/ganaderia//000000_SSG-CFA%202017-09-20%20Campa%C3%B1a%20Ganader%C3%ADa.pdf

¹¹⁵ <https://servicios.infoleg.gob.ar/infolegInternet/anexos/165000-169999/166132/norma.htm>

¹¹⁶ <https://hcdcorrientes.gov.ar/wp-content/uploads/2022/04/Ley5552.pdf>

¹¹⁷ Plan estratégico forestal y foresto industrial Argentina 2030. Ministerio de Agricultura, Ganadería y Pesca. Available at: https://www.argentina.gob.ar/sites/default/files/2021/04/plan_estrat%C3%A9gico_foresto_industrial_2030.pdf

¹¹⁸ <https://www.noticiasagropecuarias.com/2021/09/27/destacan-la-importancia-de-invertir-en-forestacion/>
<https://www.ambito.com/informacion-general/medio-ambiente/plantar-arboles-y-recuperar-bosques-mitigar-el-cambio-climatico-n5309212>

¹¹⁹ <https://www.argentina.gob.ar/normativa/nacional/ley-25080-55596#:~:text=Resumen%3A,AMBITO%20DE%20APLICACION%20Y%20ALCANCES>

¹²⁰ News from the newspaper La Nación: "Forestry industry complains about non-payment of subsidies". Available at: <https://www.lanacion.com.ar/economia/reclamo-de-la-industria-forestal-por-la-falta-de-pago-de-subsidios-nid712055/>

¹²¹ Desarrollo Forestal. "AfoA: falta de presupuesto provoca pérdida de miles de hectáreas y puestos de trabajo". Available at: <https://maderamen.com.ar/desarrollo-forestal/2015/09/28/afoa-falta-de-presupuesto-provoca-perdida-de-miles-de-hectareas-y-puestos-de-trabajo/>

¹²² Argentina Forestal. "Ley 25.080. No llegan fondos nacionales de la deuda de planes y preocupa la baja de plantaciones de pino en las cuencas forestales de Misiones". Available at: <https://www.argentinaforestal.com/2023/04/16/ley-25-080-no-llegan-fondos-nacionales/>

¹²³ INDEC (2022) Índices y variaciones porcentuales mensuales e interanuales según principales aperturas de la canasta. Diciembre de 2016-mayo de 2022. Available at: <https://www.indec.gob.ar/indec/web/Nivel4-Tema-3-5-31>

¹²⁴ INDEC in <https://www.cronista.com/economia-politica/el-indec-dio-a-conocer-la-inflacion-de-2022-que-fue-la-mas-alta-en-31-anos/>

applies when the destination of the harvest wood is for the generation of energy or wood. Carbon credits are not considered by the law thus the proposed project is exempt from these benefits.

Regarding the loans to the forestry industrial sector, it only obtained loans for 1,532,886 USD¹²⁵ in the year 2022 which, in comparison to the livestock sector is almost 400 times less. It is important to point out that these loans are only to companies which harvest and sell wood. There is no kind of loan for an afforestation project with no harvesting activity with the sole objective of capturing CO₂ from the atmosphere to obtain carbon credits.

The economical context explained above has a high impact on the forestry scenarios. This situation is a consequence of the low development of the banking system and the capital market, which in turn is explained by the persistent instability of economic activity and the price system, which have encouraged short-termism in the demand and supply of finance¹²⁶. In the same line, the Argentine Chamber of Forestry Industry identifies as negative forces, to the growth of the sector in the last 15 years, the macroeconomic instability, legal insecurity, the conflict with the R.O. of Uruguay over the installation of the ex-Botnia and the passing of the Land Law (Law No. 26,737) which restricts foreign investments in land. While in the region there was a wave of investments of around US\$ 25 billion linked only to pulp mills, during that period, investments in Argentina were almost non-existent¹²⁷.

In short, the information mentioned above provides a strong argument to justify that forestry investment, for this scale and type, faces a concrete barrier related to financial restrictions.

-Forestry without harvest activities:

Considering the above-described scenario for forestry with harvest activities, cash flow analysis for the project (Forestry without harvest) was carried out. The results indicate a negative NPV for the project without carbon credits sales¹²⁸. This means the project represents an economic loss for the company and without the corresponding investment it is not economically viable. Moreover, timber forestry represents the lowest IRR value results.

In this case of no-harvest forest activities, not only these projects must face the risk of a long-term investment but also the non-existing credits to develop an afforestation project. Therefore, it is concluded that this scenario faces a strong investment barrier and that carbon finance would alleviate the financial barrier by providing the necessary income to avoid harvest.

- Yerba mate

For its part, yerba mate production in Corrientes (as well as Misiones) has access to financial assistance by the National Bank in the shape of credits. In 2022, the total amount of the credits to be granted by the Argentinean National Bank is up to \$ 300 million, and the National Ministry of Agroindustry would benefit an additional 6 annual percentage points of interest rate. The

¹²⁵ https://www.bcra.gob.ar/PublicacionesEstadisticas/Cuadros_estandarizados_series_estadisticas.asp

¹²⁶ Clarín (2017) Editorial. La falta de crédito de largo plazo. Febrero 2017. Available at https://www.clarin.com/opinion/falta-credito-largo-plazo_0_r1EzC9RpKe.html

¹²⁷ Argentinean Forestry Industry Chamber available at: <https://forestoindustria.org.ar/plantaciones-forestales/>

¹²⁸ Cashflow analysis for the forestry project and best economic alternatives available to VVB during validation/verification in shared folder "NPRR>Cashflow analysis(...)"

benefit is available to individuals and/or legal entities engaged in production and industrialization activities in the yerba mate production value chain in the provinces of Misiones and Corrientes¹²⁹.

Still, the production is limited by law, with a small margin for the incorporation of new plantation areas. This is evidence by analysing Law 25,564 with its Resolution 170/21 and its limitations in terms of production price and production area¹³⁰. This establishes that each producer registered in the Register of Operators of the Yerba Mate Sector may sew up to five hectares of new yerba mate plantations per year, with the possibility of replanting up to 2% of its surface, to avoid a future crisis of oversupply. Further evidenced with the limited variability (less than 0.8%) in raw material entry to drying plants' evolution for the last 5 years (Figure 39).

In conclusion, financial assistance is accessible for existing producers, and the production area quota represents a strong barrier for new production units.

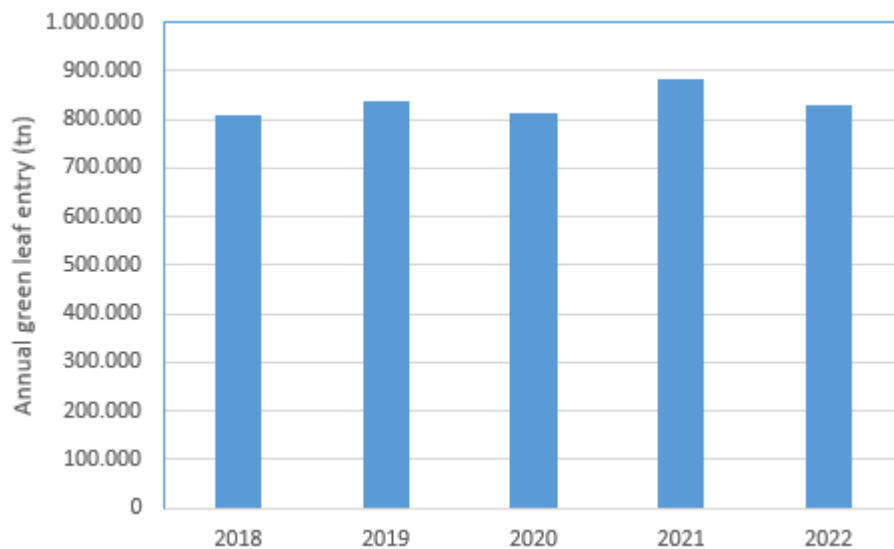


Figure 39. Annual green leaf entry to drying plants for all productive regions of Corrientes and Misiones, for the period 2018 to 2022. National Institution of Yerba Mate¹³¹

Technological barriers:

The scenarios that are being analyzed do not have any kind of technological barrier. On one hand, low cattle raising is being done now and there is no technological barrier that could prevent this activity from continuing in the future. On the other hand, an afforestation project without the incentives of VCS carbon credits is also viable from the technological point of view due to the over 20 years of experience from Garruchos S.A in the industrial forest activity. Garruchos owns all the machinery needed to develop this kind of project in this area despite the difficulty represented by the degradation of the soil.

¹²⁹ National Institution of Yerba Mate. Available in: <https://inym.org.ar/noticias/programas/78276-estan-disponibles-300-millones-para-el-sector-yerbatero.html>

¹³⁰ <https://www.boletinoficial.gob.ar/detalleAviso/primera/245891/20210622>

¹³¹ National Institution for Yerba Mate (2022) Annual report for Yerba Mate sector 2022. Available at: <https://inym.org.ar/descargar.html?archivo=QzJsbzRPaZlYk9lcDN6VUdOTHdkZz09>

In the case of yerba mate production, although the company has no experience, the region has trained personnel and technology at hand so it would not represent a barrier.

Local ecological conditions barriers:

The cattle raising alternative does not present ecological barriers. The soil where this activity is taking place is a low-quality soil, nevertheless the subtropical weather of the province helps to provide grass for the cattle during spring/summer with higher limitations during winter.

On the other hand, afforestation projects do suffer a midst ecological barrier due to the low quality of the soil for commercial plantations. This has prevented Garruchos S.A from developing any kind of commercial forest activity in this area due to the opportunity cost with cattle raising.

The plantation site in Puerto Valle farm corresponds to a flat relief with gentle hills, generally with low to medium natural fertility. Garruchos farm corresponds to a normal relief, in a hilly position, called *lomas coloradas*. Both with historical livestock use, with implanted pastures at some point. The stocking rate is low compared to the average for the province, which indicates the low quality of the site.

Furthermore, Garruchos S.A. is an industrial forest company with more than 20 years' experience in this field. Between the province of Corrientes and Misiones Garruchos S.A has over 23,000 hectares of plantations. However, the plots of land where this project activity will take place have never been an option to develop a commercial forest project since acquiring the land. Garruchos S.A owns Puerto Valle since 2004 and Garruchos farm since 2006. This lack of forest plantation development in this area is due to the soil conditions of the farms, and to the opportunity cost with cattle raising in that area. Growing conditions are heterogeneous due to small uneven plots, access limited thus complicating a commercial plantation.

It can be seen in the oldest satellite imagines, there has not been an attempt to afforest Puerto Valle Farm since at least 1985 (older available image), while in Garruchos farm there has been no attempt to afforest the area, not even reforest the 16 has planted by previous owners around 2000 and harvested in 2010. There is confidence that in these plots of land, except for the 1.64% harvested in Garruchos farm, no type of tree planting took place for an even longer period of time.

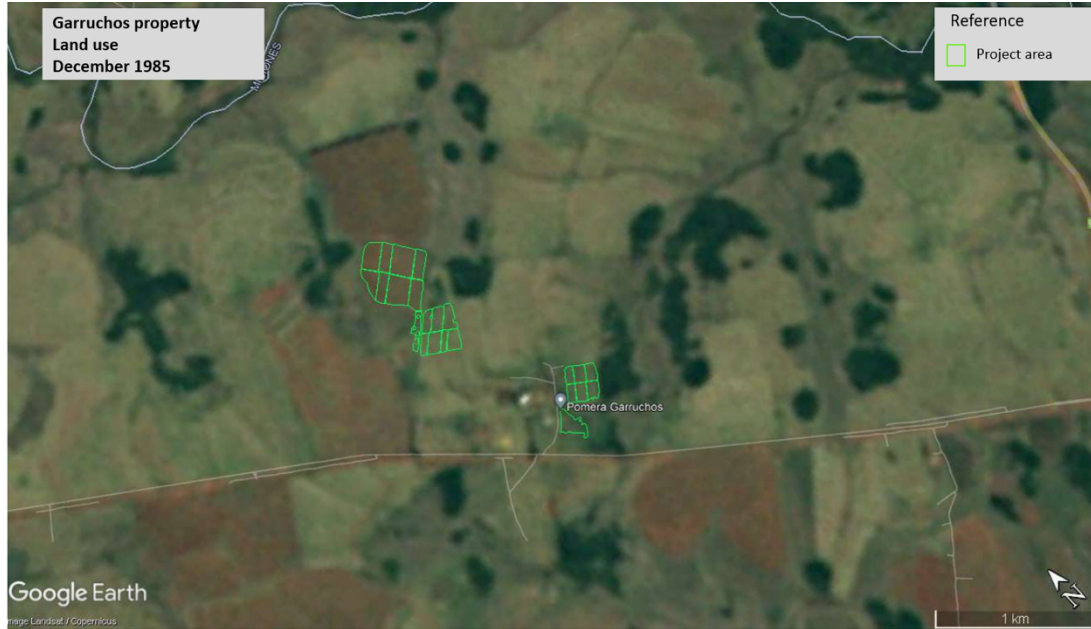


Figure 40. Garruchos farm plots of lands for the proposed ARR project activity are indicated in green. Date 1985

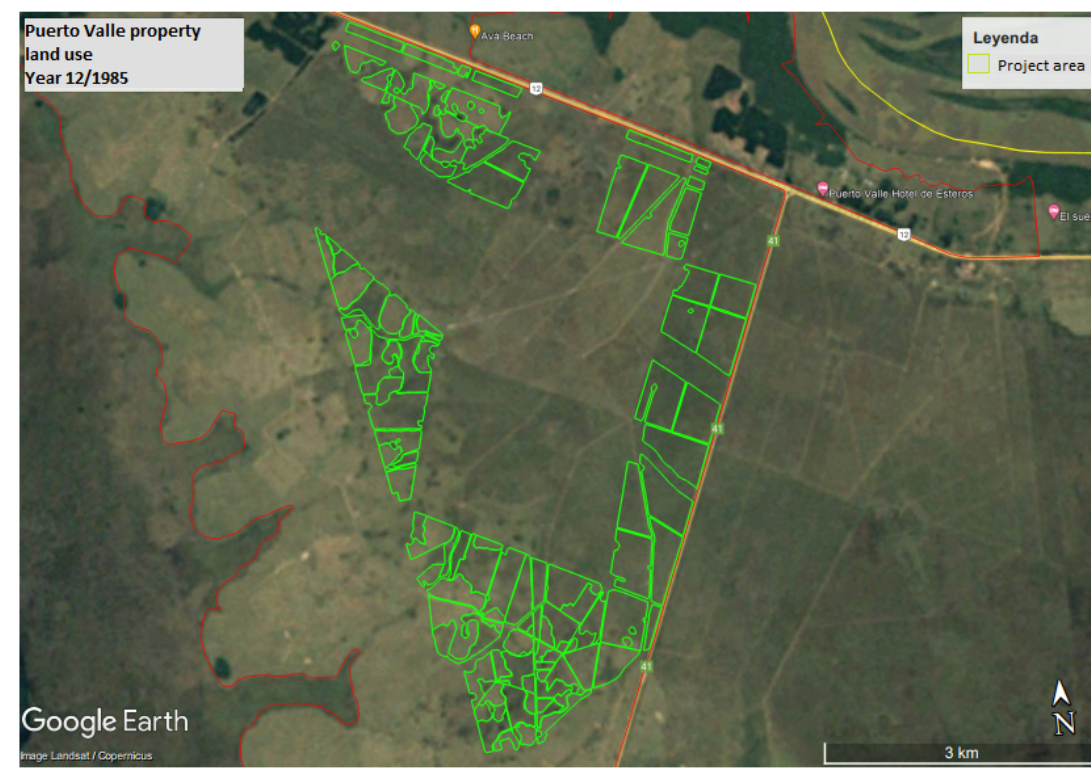
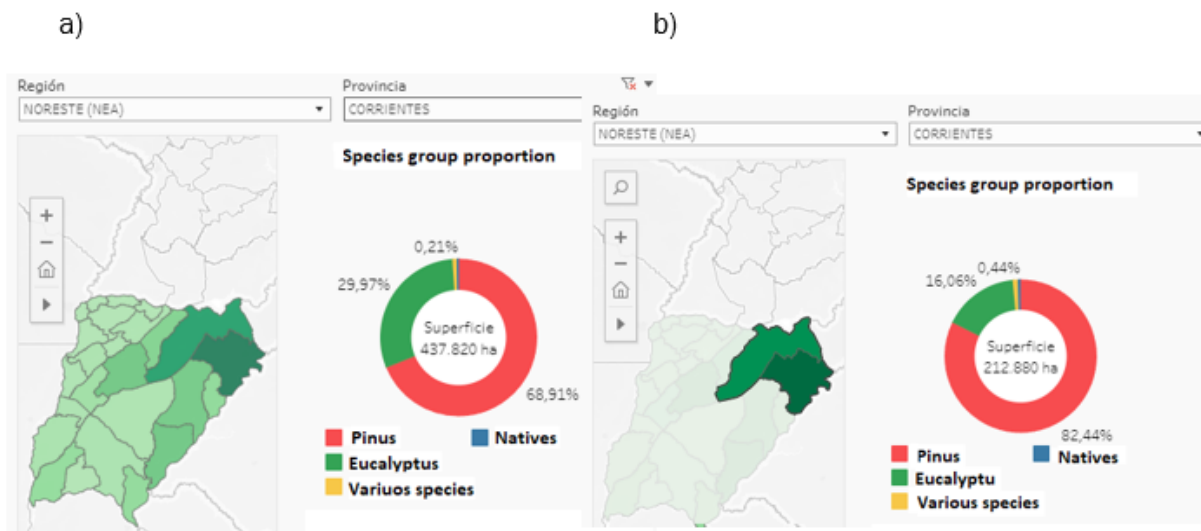


Figure 41 Puerto Valle farm indicated in red. The plot of lands for the proposed ARR project activity is indicated in green. Date 1985

Barriers related to local tradition

The three main economic activities that have historically developed in the project zone are cattle ranching, forest plantations of exotic species and yerba mate. Unlike cattle raising and agricultural production, which have been carried out in the region for centuries, forestry, a relatively new type of production, began its commercial development in the 1990s¹³². Also, forestry with native species is completely new in the area and in the country. However, this incipient activity has strong limitations to obtain an adequate quantity of seedlings and plants together with the knowledge to manage this type of plantation^{133 134}.

Although Corrientes, together with Misiones, is the province with the largest area of planted forest and is characterized by the presence of several seedling nurseries and sawmills, forest plantations with no harvest and with the planting of native species, are not common practice in the region (Figure 41). Therefore, there is a general lack of knowledge about this type of activity along the region: on the one hand, the number of nurseries producing native seedlings is very limited; on the other hand, there are not enough studies on the productivity of the species and it is not known how it is affected by diseases, climate and management, it is a subject that is still at the research stage¹³⁵. In addition, no growth simulators have been developed for native or mixed plantations. Therefore, local knowledge and the technology to implement it are still taking their first steps in the area, creating significant uncertainties. It must be added that no harvest activities are not common practice, and this may present cultural challenges for management.



¹³² Ramírez, D. (2017). Un abordaje histórico de la actividad forestal en Misiones: del frente extractivo al agronegocio forestal. *Folia histórica del nordeste*, (30), 29-51. Available at:

http://www.scielo.org.ar/scielo.php?script=sci_arttext&pid=S0325-82382017000300002

¹³³ El Litoral: “Yacyretá y el Inta crearán un vivero de bosques nativos en Corrientes”. Available at:

<https://www.ellitoral.com.ar/corrientes/2023-2-14-1-0-0-yacyreta-y-el-inta-crearan-un-vivero-de-bosques-nativos-en-corrientes>

¹³⁴ INTA. Catálogo de variedades vegetales INTA. Available at: <https://www.argentina.gob.ar/inta/variedades#4>

¹³⁵ Ensayo de especies leñosas nativas para la producción de biomasa mediante bosques energéticos en la provincia de Misiones. Available at:

https://www.magyp.gob.ar/sitio/areas/proyectos_forestales/transferencia/eldorado/PIA%2010069_BOHREN.pdf

Figure 42. Area of planted forests in (a) Corrientes and (b) project area departments. Native species represent 0.21% and 0.44%, respectively. Ministerio de Agricultura, Ganadería y Pesca¹³⁶

Cattle raising does not have any barriers regarding local tradition cattle raising because it is one of the main economic activities of the Province of Corrientes for more than 50 years. According to official reports produced by the National Forest Directorate, which depends on the Ministry of Environment and Sustainable Development, cattle raising has been the primary activity set up in this area since colonial times (early XIX century).

In conclusion, only for the case of scenario 2 local tradition barriers are identified and carbon finance could alleviate it by providing further income to pay for differentiated job positions, and services needed.

Outcome of Step 2a: List of barriers that may prevent one or more land use scenarios identified in the Step 1b:

As analysed above, the proposed project without the incentive of VCS carbon credits faces several barriers that would prevent its development. On the other hand, current land use, cattle raising doesn't face any of the barriers analysed. Moreover, for afforestation projects with exotic species, investment and ecological barriers have been identified. Last, in the case of yerba mate, investment barriers are identified as summarised in table 5.

Table 6 Barriers per scenario

Barriers	Scenario 1: Continuation of the pre-project land use (cattle raising)	Scenario 2: Afforestation without incentives from VCS carbon credits	Scenario 3: Afforestation with non-native with harvest	Scenario 4: Yerba mate production
Investment/ quote barriers	NO	YES	YES	YES
Technological barriers	NO	NO	NO	NO
Local ecological barriers	NO	YES	YES	NO
Local tradition barriers	NO	YES	NO	NO

¹³⁶ Ministerio de Agricultura, Ganadería y Pesca – Tablero de Plantaciones Forestales. Available at: <https://www.magyp.gob.ar/sitio/areas/desarrollo-foresto-industrial/inventarios/tablero.php>

Step 2b: Elimination of land use scenarios that are prevented by the identified barriers.

Scenarios 2, 3 and 4, all face barriers of different kinds that prevent its development as described above. Therefore, they are eliminated from the alternative scenario list.

Outcome of Sub-step 2b: *List of land use scenarios that are not prevented by any barrier*

Concluding what was analysed in the previous sections, the land-use that is not prevented by any of the barriers is:

Scenario 1: Continuation of the pre-project land use – continuous extensive cattle raising

Sub-step 2c. Determination of baseline scenario (if allowed by the barrier analysis)

This sub-step consists of applying the decision tree from the tool. As demonstrated above, forestation without being registered as an A/R VCS project activity is not included in the list of land use scenarios that are not prevented by any barrier and the list contains only one land use scenario. Therefore, according to the decision tree of sub-step 2c of the combined tool, it is concluded that Scenario 1: Continuation of the current situation: extensive livestock breeding production, is the baseline scenario and Step 4: “Common practice test” is the next step in the analysis.

Step 3: Investment analysis

Given the result of step 2, and specifically Sub-step 2C, where only one scenario presents no barriers, Step 3 is not implemented, in line with the methodology used.

Step 4: Common practice analysis

According to the *Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (v1)*, the previous steps shall be complemented with an analysis of the extent to which forestation activity has already diffused in the geographical area of the proposed AFOLU VCS project activity. This test is a credibility check to demonstrate additionality which complements the barrier analysis (Step 2) above conducted.

The analysis consists in examining to which extent similar activities to the one proposed as the VCS AFOLU project activity have been implemented previously or are currently underway. Furthermore, the tool defines similar forestation activities as those which are of similar scale, take place in a comparable environment, inter alia, with respect to the regulatory framework and are undertaken in the relevant geographical area as defined in Step 1a above.

As defined by the Tool the applicable geographical area should be the entire host country. Given the extension of the country and the expected variability in the plantation’s characteristics. At the country level we can distinguish 6 large geographic regions according to the types of trees that grow in them. The Mesopotamian region is made up of the provinces of Misiones, Corrientes and Entre Ríos. The province of Misiones and NE Corrientes represent the area with the highest concentration of plantations in the country. The predominant species are Eucalyptus and Pine. In the case of Eucalyptus, they have a cutting period in this region of 10 to 12 years, the shortest

in the country. The common practice analysis is then focused on the Mesopotamian region, with similar climatic and production cycles in relation to forest plantations.

Although commercial forestry is a growing activity in Argentina and in the province of Corrientes, the common practice is to develop plantations with only commercial non-native species, with harvest activities. The total forest plantation area in Corrientes, as shown in figure 41 is 437,820ha, reaching 955.000ha in the case of the Mesopotamian region (Figure 42). This area is for commercial plantations of Pinus followed by Eucalyptus. In the case of Corrientes, those plantations are used by local main wood product establishments (with their own plantations) and exported to neighbor provinces¹³⁷.

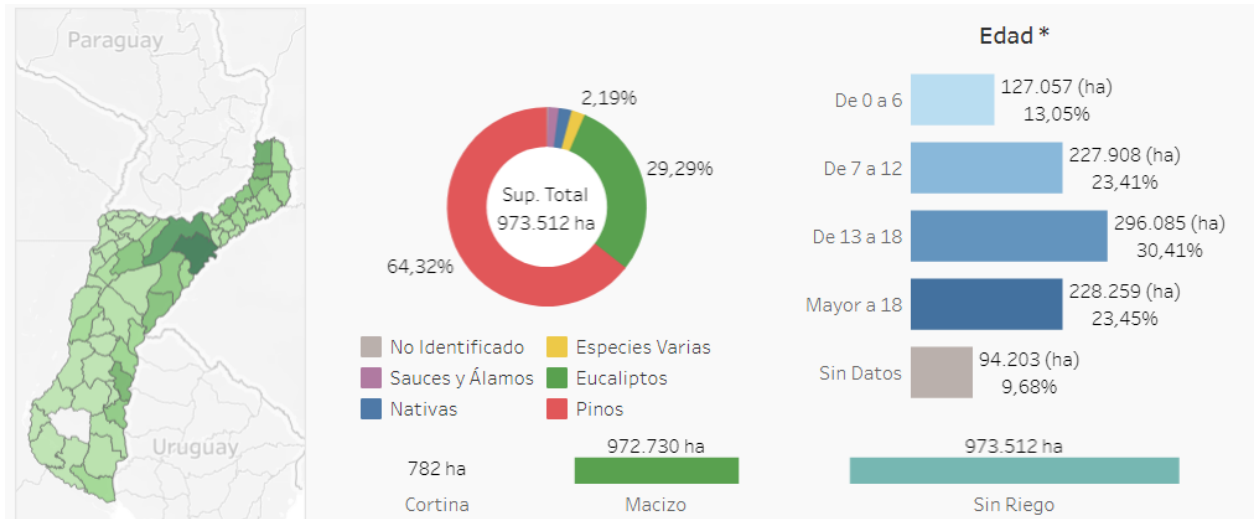


Figure 43. Planted forest characteristics for the Mesopotamian Region. Ministerio de Agricultura, Ganadería y Pesca¹³⁸

There are essential distinctions between the industrial forestry activity that is being developed in the Mesopotamian region and the proposed project. This project does not intend to perform any kind of harvesting activities as defined in the Verra Standard Document version 4.7. In addition, it will also include the plantation of 28.3 hectares of native species (3% of project area). This means the project is not subject to the subsidies to forest promotion as the Law states the subsidies are limited to plantations with commercial or industrial uses¹³⁹.

While it could be considered that the forestry activity with the objective to perform harvesting to sell the wood is a common practice, there is no record of another forestry project with no harvesting activity. According to forest statistics, less than 24% of the region’s plantation area has individuals above 18 years, showing rotational forestation production. The lack of distinction in public reports and stats, between forests planted for harvesting and not, evidence that there are no significant afforestation projects without harvesting, may be said that there are not. Communication with experts in forest activities also confirms this point.

¹³⁷ https://www.argentina.gob.ar/sites/default/files/sspmicro_informes_productivos_provinciales_corrientes.pdf

¹³⁸ Ministerio de Agricultura, Ganadería y Pesca – Tablero de Plantaciones Forestales. Available at: <https://www.magyp.gob.ar/sitio/areas/desarrollo-forestal-inustrial/inventarios/tablero.php>

¹³⁹ Law 26.432 updating previous forest promotion industry Law 25.080

In terms of native species plantations, these only represent less than 2% of the planted (and less than 0,2% in the case of Corrientes province)¹⁴⁰. The 2% is explained by *Araucaria angustifolia* the main native commercial plantations in the region¹⁴¹. On the other hand, projects that combine non-native and non-commercial native species, are primarily projects certified under carbon credit standards which are not designed as no-harvest projects. The list of project certified, or searching for carbon certification, in the Mesopotamian area and which include native species mix, are listed below:

Project	Proponent	Area (ha)	Characteristics	Standard
Reforestation of grazing lands in Santo Domingo	Novartis Pharma AG	2,430	75% native species and 25% exotic species planted in Corrientes	CDM
Afforestation project with native and exotic species on degraded grasslands in Northeast Argentina	Vista Energy Argentina SAU	2,602,000	Grouped project in Corrientes and Misiones	VCS

In conclusion, similar activities with the plantation of native and non-native species and with no harvest and no financial assistance cannot be observed in the project region therefore the proposed project is not a common practice, thus is additional.

3.6 Methodology Deviations

No methodology deviations apply to this period.

4 IMPLEMENTATION STATUS

4.1 Implementation Status of the Project Activity

This monitoring period is the first for the crediting period of the project, thus, the activities which have been implemented during the current period have been detailed in the document. These include:

- Land preparation took place during September, starting September 1st.
- Total project area was planted: 973.14ha of native and non-native species during last and first quarter of year 2022 and 2023, respectively.

¹⁴⁰ Ministerio de Agricultura, Ganadería y Pesca – Tablero de Plantaciones Forestales. Available at: <https://www.magyp.gob.ar/sitio/areas/desarrollo-foresto-industrial/inventarios/tablero.php>

¹⁴¹ Sabattini et al (2020) Producción forestal en la Mesopotamia Argentina: situación actual y potencialidades en el uso de la madera como fuente energética. Cuadernos de la Red Iberomasa

- Public consultation including project description, redress and communication processes, risks and benefits took place on April 14th, 2023.
- Research activities started in the project, together with INTA and National University of Misiones (the native plots were designed together with the University).
- First forest inventory took place between 14 and 16th of November 2023, on those plots with 50% of individuals higher than 1.5m height. This represents an area of 144.57has of *Eucalyptus grandis* plantation.
- Other activities with communities such as training, presentations, among others.

The area has received exceptionally high precipitation volumes caused by El Niño during the last quarter of year 2023 (figure 43), affecting part of the area. These are small plots with limited carbon removal accomplished and were not monitored during this monitoring period, so no net removals were estimated for this area and no loss event should be considered.

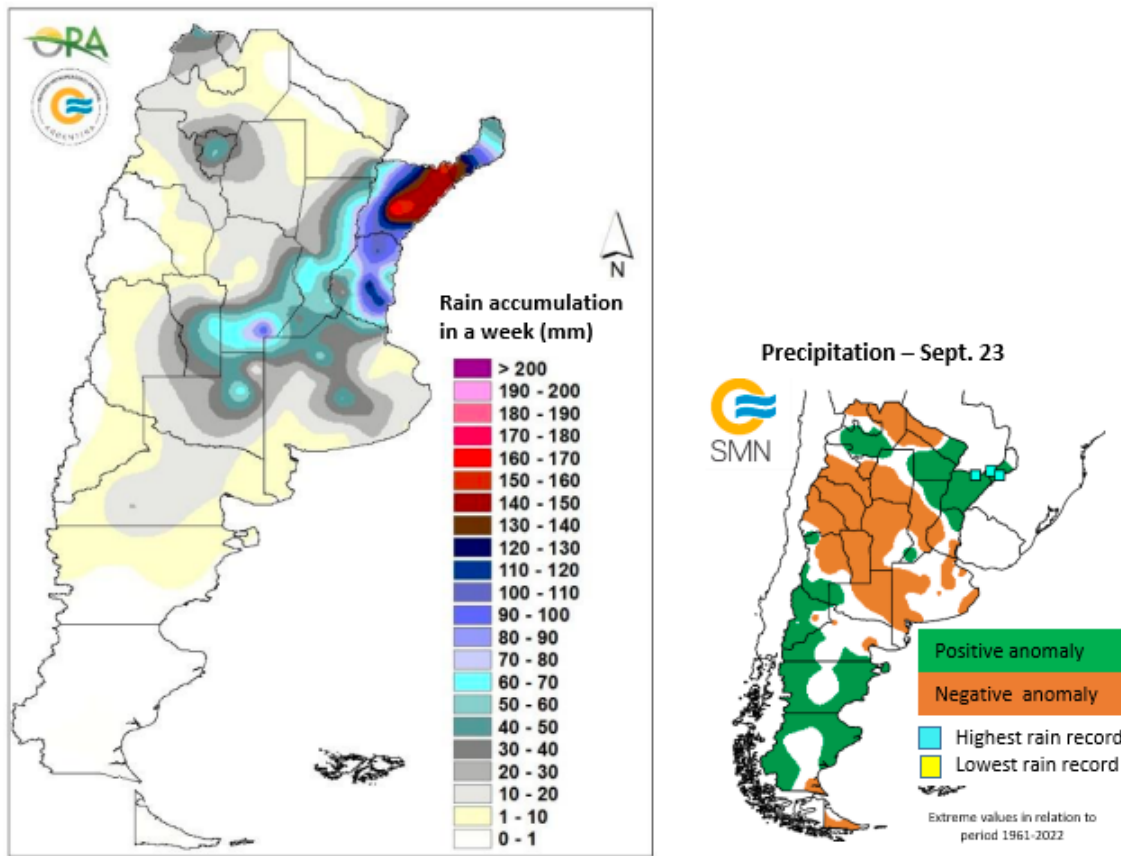


Figure 44 Left figure show accumulated precipitation volumes (mm) for one week in October of 2023 (from 19th to 26th) and the right figure precipitation anomalies for September 2023 in

relation to period 1961-2022. Sources: Ministry of Economics¹⁴² and National Meteorological System (SNM)¹⁴³.

No leakage is expected, as all previous cattle in the area were sold to slaughterhouses. Regarding non-permanence risk factors monitoring and mitigation actions, fire and floodings are the main identified natural risks, however, factors such as storms were also considered.

5 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

All the equations and assumptions applied in this assessment follow the AR-ACM0003 version 2.0 methodology. This methodology, developed under the Clean Development Mechanism (CDM), is widely recognized and adopted for Afforestation, Reforestation, and Revegetation (ARR) projects. As an officially approved CDM methodology, AR-ACM0003 v2.0 adheres to the highest international standards and incorporates best scientific and technical practices for carbon accounting and biomass estimation. Therefore, the equations and assumptions used are consistent with peer-reviewed and validated approaches, ensuring methodological robustness and credibility.

5.1 Baseline Emissions

Baseline net GHG removals by sinks

According to methodology AR-ACM 0003 v.2.0, section 5.4, baseline net GHG removals by sinks are calculated as follows:

$$\Delta C_{BSL,t} = \Delta C_{TREE_BSL,t} + \Delta C_{SHRUB_BSL,t} + \Delta C_{DW_BSL,t} + \Delta C_{LI_BSL,t}$$

Where,

¹⁴² Ministry of Economics - Agriculture, cattle and fishing Secretariat (2023) Agriculture estimates, weekly report. Available at: https://www.magyp.gob.ar/sitio/areas/estimaciones/archivos/estimaciones/230000_2023/231000_Octubre/231026_Informe%20Semanal%20al%2026_10_2023.pdf

¹⁴³ Annual precipitation report for 2023 available at: https://www.smn.gob.ar/sites/default/files/monitoreo_precipitacion_A%C3%B1o2023.pdf

$\Delta C_{BSL,t}$ = Baseline net GHG removals by sinks in year t; tCO₂-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”; tCO₂-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”; tCO₂-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”; tCO₂-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”; tCO₂-e

As it was demonstrated in previous sections, the baseline scenario is the continuation of historic use of land, which consists of extensive continuous cattle grazing. This means that the project area without the project activity would have remained as modified pastureland. Thus, based on IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry (2003), Chapter 3 ¹⁴⁴, given that the activity of the identified baseline scenario has been the same for the last decades, it is assumed that the net GHG removals in the baseline are null.

Change in carbon stock in baseline tree and shrub biomass within the project boundary

¹⁴⁴ In the case of biomass it is mentioned in Section 3.4.1.1.1.2: “(Note: It is important, in deriving estimates of biomass accumulation rates, to recognize that net changes in biomass stocks will occur primarily during the first years (e.g. 20 years) following changes in management. After which time biomass stocks will tend towards a new steady-state level with little or no change in biomass stocks occurring unless further changes in management conditions occur).” For the case of soil C pools, the maintenance of the same land use, management and input practices imply the use of the same default values in table 3.4.5 for equation 3.4.8

As part of the project area-specific geospatial analysis for the estimated rating, it was analyzed that the only existing trees within the project area are scattered individuals. Those scattered trees present in the project area will be neither harvested, nor cleared, nor removed; will not suffer mortality because of competition from trees planted in the project, or damage because of implementation of the project activity, and will not be inventoried along with the project trees in monitoring of carbon stocks. Furthermore, their continued existence, consistent with the baseline scenario, will be monitored throughout the crediting period of the project activity. In summary, taking into consideration the conditions in the AR-TOOL 14 – Section 5 are met, carbon stock in trees in the baseline can be accounted as zero.

Moreover, in terms of baseline emissions, it is important to note the common practices for livestock production. It is estimated that in savannas and wet pastures the fire interval is 1-2 years. Fire is considered a management alternative because of its low cost and simple application, whose main purpose is to remove senescent or dry material rejected by livestock. It stimulates the growth of new, softer, more palatable and better-quality grass used by ruminants, thus achieving better results in animal production (Heringer & Jacques, 2001). In this sense, whenever the shrub generates a significant encroachment, it is recently burned, generating GHG emissions. For this project, a conservative approach has been taken and emissions from burning have not been estimated ¹⁴⁵ ¹⁴⁶. In this line, changes in carbon stocks in shrubs and trees in the baseline may be accounted as zero complying with point f, and g as previously mentioned, of section 5 in the stated Tool.

Change in carbon stock in baseline dead wood and litter biomass within the project boundary

Likewise, it is expected that the dead wood and litter carbon pools will not increase in the baseline in line with the description above. Given it corresponds to an optional pool, and expected to increase in the project scenario, it is considered null in the baseline.

Thus,

$$\Delta C_{BSL,t} = 0$$

5.2 Project Emissions

The actual net GHG removals by sinks shall be calculated as follows:

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

Where,

¹⁴⁵ Heringer, I., & Jacques, A. V. A. (2011). Effect of burning and management alternatives on forage litter composition of a native pasture. Available at: <https://uknowledge.uky.edu/igc/19/9/10/>

¹⁴⁶ Fernández, J. A., Schroeder, M. A., Goldfarb, M. C., & Bernardis, A. C. (2011). Efecto de la frecuencia de quema prescrita sobre la composición mineral de los pastizales en el nordeste argentino. *Ecología Aplicada*, 10(1), 23-29. Available at: http://www.scielo.org.pe/scielo.php?pid=S1726-22162011000100003&script=sci_arttext

$\Delta C_{ACTUAL,t}$ = Actual net GHG removals by sinks, in year t ; tCO₂-e

$\Delta C_{P,t}$ = Change in the carbon stocks in project, occurring in the selected carbon pools, in year t ; tCO₂-e

$GHG_{G,t}$ = Increase in non-CO₂ GHG emissions within the project boundary because 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”; tCO₂-e

According to methodology AR-ACM 0003 v.2.0, section 5.5. 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 zero¹⁴⁷.

Moreover, the use of fire for site preparation and/or to clear the land of harvest residue prior to replanting did not take place during site preparation activities, and will not take place as the project does not include harvesting, thus excluded from the project management; no fire, as part of the project activities, are expected.

Hence, project emissions are estimated as zero.

$$GHG_{E,t} = 0$$

Actual net GHG removals by sinks

Change in the carbon stocks in project, occurring in the selected carbon pools in year t shall be calculated as follows:

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

Where,

$\Delta C_{P,t}$ = Change in the carbon stocks in project, occurring in the selected carbon

¹⁴⁷ Project emissions ex-ante calculations include fuel used in machinery. This value is equal to 0,07tCO₂/ha. Estimation is included in ex-ante spreadsheets available to VVB during validation/verification but considered insignificant in ex-post estimations.

pools, in year t ; tCO₂-e

$\Delta C_{TREE_PROJ,t}$ = Change in carbon stock in tree biomass in project in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; tCO₂-e

$\Delta C_{SHRUB_PROJ,t}$ = 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”; tCO₂-e

$\Delta C_{DW_PROJ,t}$ = Change in carbon stock in dead wood biomass 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”; tCO₂-e

$\Delta C_{LI_PROJ,t}$ = Change in carbon stock in litter biomass 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”; tCO₂-e

ΔSOC_{ALT} = Change in carbon stock in SOC in project, in year t , in areas of land meeting the applicability conditions of the tool “Tools 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; tCO₂-e

In this case, as mentioned, optional dead wood, litter and SOC pools won't be measured as carbon stocks.

Above and below ground biomass carbon pools

- Change in carbon stock in trees in a year

According to the tool referenced in the used methodology selected “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activity” v. 4.2, section 7, change in carbon stock in trees in a year (annual change) between two successive verifications is estimated on the assumption of linear change. Change in carbon stock in trees in a year is estimated as follows:

$$\Delta C_{TREE,t} = \frac{C_{TREE,t_2} - C_{TREE,t_1}}{T} \times 1 \text{ year}$$

Where,

$\Delta C_{TREE,t}$ = Change in carbon stock in trees within the project boundary in year t; tCO₂-e

C_{TREE,t_2} = Carbon stock in trees within the project boundary at time t2; tCO₂-e

C_{TREE,t_1} = Carbon stock in trees within the project boundary at time t1; tCO₂-e

T = Time elapsed between two successive estimations
(T=t2 - t1); yr

According to the tool, carbon stock in trees at a point of time can be estimated by using one or a combination of four methods, the selected method is detailed below for each case, ex-ante and ex-post estimations.

- **Ex-ante estimation (projection) of carbon stock in trees**

Ex-ante estimations were based on method (b) of the applicable tool: “Estimation by modelling of tree growth and stand development”, this method is used for ex-ante estimation (projection) of carbon stock in tree biomass. Under this method existing data are used in combination with tree growth models to predict the growth of trees and the development of the tree stand over time. In this case, biomass growth projections are estimated using software and peer reviewed bibliography.

Stand parameters such as stocking (e.g. number of stems per hectare or basal area per hectare), age-class structure, and species composition at different points of time are simulated from assumed (planned) tree planting and management practices (e.g. planting density, survival rate, thinning and pruning operations and their timing).

Tree growth (e.g. aboveground biomass) is simulated taking into account regional tree-growth data from software and peer reviewed studies (see Appendix 5 for more detail). These simulations take into consideration different variables such as age-diameter curves, yield tables, yield curves while also considering relevant site factors and stand parameters. These estimations

were conducted at stratum scale and later added to obtain total GHG emissions reductions expected.

Ex-ante estimation (projection) of carbon stock in tree biomass is not subjected to uncertainty control, still the best available data and models were applied to the project site and the tree species. In this line, information on native species growth rate is limited, so the ex-ante estimation was calculated based on available data for one of the species from the native mix in the project: *Enterolobium contortisiliquum*. See more detail in the projection estimation in the mentioned appendix 5, section “Native species mix”. In the case of the non-native strata, these are projected from simulation tools also further detailed in Appendix 5 and in the following equations.

The equations applied are as follows in order to obtain biomass stock:

$$B_{TREE} = V_{TREE} * DJ * BEF_{J,2} * (1 + RJ)$$

$$V_{TREE} = \text{Stem volume of tree species; m}^3$$

Vtree is obtained from growth projections from PlaForNEA, based on more than 100 years growth data in the region for pinus. This simulation tool was developed by INTA and is of public access¹⁴⁸.

For Eucalyptus, Vtree is obtained from growth projections using the recognized tool SIS Eucalipto based on the parameters for each specie (density, site index, etc)¹⁴⁹. SIS Eucalipto is considered a better projection tool for this species given the larger amount of data compared to PlaForNEA (further information on these tools is available in Appendix 5).

For Native species, there is general limited information available on Argentinean native species growth rates. For ex-ante estimations available information was analysed and *Enterolobium contortisiliquum* (Red Timbó) growth was used and projected over the crediting period, based on Arturi, M.F; et al. (2008) and other

¹⁴⁸ Keller, A.E; Crechi, E.H; Fassola, H.E; Colcombet, L; Barth, S.R; Winck, R.A; Di Rienzo, J. (2017). PlaForNEA, Plataforma de Gestión Forestal. INTA EEA Montecarlo. URL <http://www.plafornea.com.ar>

¹⁴⁹ SIS EUCALIPTO, EMBRAPA. Available at: <https://www.embrapa.br/florestas/transferencia-de-tecnologia/software-florestais>

references related to species' growth in the region^{150 151 152}. All calculation details are available in "Native species growth projection" spreadsheet¹⁵³ and further detailed in the Appendix 5.

D_j = Basic wood density of tree species j ; t d.m. /m³. This value varies according to the species and are obtained from official sources¹⁵⁴:

Pinus hybrid: 0.51 (based on *Pinus elliottii* values)

Pinus taeda: 0.46

: 0.56

Native mix: 0.74 (obtained from the average of densities for 11 of the species in the mix). An average density is considered for ex-ante estimations as the stands have a mix of different native species in different planting densities and mix (in ex-post estimations, the density will be that corresponding to each species –if available-.

$BEF_{j,2}$ = Biomass expansion factor for conversion of stem biomass to above-ground tree biomass, for tree species j ; dimensionless

The conservative default value of 1.15 is used, from CDM AR-TOOL14 in the case of non-native species and a value of 2 for native species, from *GPG-LULUCF (IPCC, 2003)* corresponding to tropical broadleaf.

R_j = Root-shoot ratio for tree species j ; dimensionless

For the case of *Pinus* and *Eucalyptus strata*, the value R is estimated as

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

where b is the above-ground tree biomass per hectare (in t

¹⁵⁰ Arturi, M.F; et al. (2008) Height and diameter growth and mortality in plantations of native species of the Yungas in Valle Morado, Salta.

¹⁵¹ Crechi et al (2005) Initial growth of 3 native broadleaved species of economic interest in Misiones (*Cordia trichotoma* (Vell.) Arrab. ex Steudel, *Balfourdendron riedelianum* (Engl.) Engl. *Enterolobium contortisiliquum* (Vell.) Morong.) Yvirareta 13 (2005) 1-9

¹⁵² Montagni et al (2006) Rehabilitation of degraded lands in Misiones, Argentina. BOIS ET FORÊTS DES TROPIQUES, 2006, N° 288 (2)

¹⁵³ Available for VVB in shared folder: "02. PD/MR References>Monitoring plan>Ex-ante removals calculation"

¹⁵⁴ INTI CITEMA. Densidad de maderas (Kg/m3) ordenadas por nombre común

d.m. ha-1), unless transparent and verifiable information can be provided to justify a different value.

For the case of native mix strata, the value considered is 0.14, based on the lower range values for secondary native forests, reported in Table 3.A.1.8 of IPCC Good Practice Guidance for LULUCF.

Once the B_{TREE} values are obtained, these are converted to tCO₂ with the next equation:

$$C_{TREE} = 44/12 * B_{TREE} * CF_{TREE}$$

Where,

C_{TREE} = Carbon stock in tree biomass within the project boundary at a given point of time; t CO₂-e

B_{TREE} = Biomass of trees within the project boundaries at a given point in time; t d.m

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.

- **Ex-post estimation of carbon stock in trees**

Ex-post estimations will be based on method (a) of the applicable tool (“Estimation by measurement of sample plots”) and more specifically in option (a) of this method: “Stratified random sampling”.

First, under this method, random sample plots are installed in the strata (e.g. systematic sampling with a random start) and measured.

According to this method, mean carbon stock in trees within the tree biomass estimation strata and the associated uncertainty will be estimated as follows:

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

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

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

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

Where,

C_{TREE} = Carbon stock in trees in the tree biomass estimation strata; tCO₂-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

Uc = Uncertainty in C_{TREE}

T_{val} = Two-sided Student's t-value for a confidence level of 90 percent 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_i² = 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 (b_{TREE}) and the associated variance (s_i²) will be estimated as follows:

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

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

Where,

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

n_i = Number of sample plots in stratum *i*

If estimated Uncertainty in C_{TREE} is greater than 10 per cent, is made conservative by applying uncertainty discount according to the procedure below (Appendix 2 of mentioned tool):

Uncertainty	Discount (% of U)	How applied
$U \leq 10\%$	0%	<i>Example:</i> Estimated mean = 60 ± 9 t d.m ha ⁻¹ i.e. $U=9/60 \times 100 = 15\%$ Discount = $25\% \times 9 = 2.25$ t d.m ha ⁻¹ Discounted conservative mean: In baseline = $60 + 2.25 = 62.25$ t d.m ha ⁻¹ In project = $60 - 2.25 = 57.75$ t d.m ha ⁻¹
$10 < U \leq 15$	25%	
$15 < U \leq 20$	50%	
$20 < U \leq 30$	75%	
$U > 30$	100%	

Finally, according to Appendix 1 (Methods of plot biomass measurement) of the tool, the plot biomass value will be determined as follows:

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

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

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

Where,

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

$B_{TREE,p,i}$ = Tree biomass in sample plot p of stratum i ; t.d.m.

$A_{PLOT,i}$ = Size of sample plot in stratum i ; ha

$B_{TREE,j,p,i}$ = Biomass of trees of species j in sample plot p of stratum i ; t.d.m.

$B_{TREE,l,j,p,i}$ = Biomass of tree l of species j in sample plot p of stratum i ; t.d.m.

With,

$$B_{TREE,l,j,p,i} = f_j(x_{1,l}, x_{2,l}, x_{3,l}, \dots) \times (1 + R_j)$$

$$B_{TREE,l,j,p,i} = V_{TREE,j}(x_{1,l}, x_{2,l}, x_{3,l}, \dots) \times D_j \times BEF_{2,j} \times (1 + R_j)$$

Where,

$f_j(x_{1,l}, x_{2,l}, x_{3,l}, \dots)$ = Above-ground biomass of the tree returned by the allometric equation for species j relating to measurements of three l to the above-ground biomass of the tree: t.d.m.

R_j = Root-shoot ratio for tree species j; dimensionless

The value of R_i is estimated as:

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

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.

$V_{TREE,j}(x_{1,l}, x_{2,l}, x_{3,l}, \dots)$ = Stem volume of tree l of species j in sample plot p of stratum i estimated from the tree dimension(s) as entry data into a volume table or volume equation; m³

Note. Where the volume table or volume equation predicts under-bark volume (i.e. wood volume, rather than gross stem volume), suitable correction will be applied to estimate the over-bark volume.

Moreover, when the allometric equation used provides biomass values (kg) the corresponding adjustments will be applied to the methodology. Including BEF2 dismissal when total biomass is obtained.

D_j = Density (over-bark) of tree species j ; t.d.m m^{-3}

Note. Where density (specific gravity) of the bark of a tree species is different from the density of the wood, suitable correction should be applied to estimate a conservative value of the overall (over-bark) density of tree stem.

Basic wood density of tree species j ; t d.m. / m^3 . This value varies according to the species and are obtained from official sources¹⁵⁵:

Pinus hybrid: 0.51 (based on *Pinus elliottii* values)

Pinus taeda: 0.46

Eucalyptus grandis: 0.56

Native mix: the density value for each species monitored will be used if recording to which species belongs every tree measured is feasible. If not, a weighted conservative average value of 0.74 will be used for the whole mix, calculated taking into consideration the individual densities for each component of the mix of species planted with available data in reference:

Parapiptaderia rigida: 0.95

Apuleia leiocarpa: 0.77

Patagonula americana: 0.73

Campomanesia xanthocarpa: 0.87

Cupania vernalis: 0.85

Jacaranda mimosifolia: 0.58

Cedrela fissilis: 0.53

Pterogyne nitens: 0.77

Diatenopteryx sorbifolia: 0.96

Cordia trichotoma: 0,60

Peltophorum dubium: 0.90

¹⁵⁵ INTI CITEMA. Densidad de maderas (Kg/m³) ordenadas por nombre común

Enterolobium contortisiliquum: 0.36

BEF_{2,j} = Biomass expansion factor for conversion of tree stem biomass to above-ground tree biomass, for tree species j; dimensionless

For ex-post estimation the conservative default value of 1.15 is used for *Eucalyptus* spp and *Pinus* spp, whereas for the Native Mix a value of 2 is used corresponding to the minimum range for tropical broadleaf in Table 3A 1.10 of IPCC GPG-LULUCF 2003, unless transparent and verifiable information can be provided to justify a different value. This value will be only used if needed, as allometric equations include total biomass estimation.

Moreover, density and BEF_{2,j} values will only be used when no BCEFs value is available, taking into consideration the 2019 refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories as the most recent source available (replacing 2003 LULUCF Good Practice Guidelines).

In line with AR-TOOL14 Appendix 1 “Demonstrating appropriateness of biomass equations for estimation of aboveground tree biomass in A/R CDM project activities”, only recognized by public entities or peer reviewed VTREE and Fi equations will be used, meaning national or regional forest inventories or research institutions recommendations.

For *Eucalyptus*, the equation used is the one recommended for Northeast region by the National Institution of Agricultural Technology (INTA) from Winck, R.A; et al. (2015) ¹⁵⁶:

$$\ln(\text{total biomass (kg)}) = -3.32 + 2.12 * \ln(\text{DBH}) + 0.65 * \ln(\text{H})$$

As demonstrated, the equation used for *Eucalyptus* is the one promoted by the national agroindustry Ministry and INTA for, at least, the last 10 years for commercial plantation inventories.

In the case of *Pinus* species biomass, the allometric equation used are those by peer reviewed research, extensively used and analyzed for the ecoregion:

Species	Allometric equation	Source
<i>Pinus hybrid</i>	Total biomass (kg) =0.7359*(1/DBH)^-2.3482*(1/h)^0.6043	Carvalho, R. R., et

¹⁵⁶Winck, R.A; et al. (2015) Modelos predictivos de biomasa aérea de *Eucalyptus grandis* para el Noreste de Argentina. *Ciência Florestal*, vol. 25, núm. 3, julio-septiembre, pp. 595-606. Universidade Federal de Santa Maria.

Species	Allometric equation	Source
		al. (2022) ¹⁵⁷ for <i>P. elliottii</i>
<i>Pinus taeda</i>	Total biomass (kg) = - 3,18 + 2,62*Ln(DBH)	Fassola, H.E; et al. (2010) ¹⁵⁸

For the case of native species mix plots, for those species with known allometric equation reported in the Second National Native Forest Inventory (INBN2)^{159 160}, the equation will be used, if not a general equation from the mentioned reference will be used:

Species	Allometric equation
General equation	$V_{TREE} = -0,27870 + 0,00084276 * DBH^2$ (V being stem volume over bark) ¹⁶¹
<i>Apuleia leiocarpa</i> (Grapia)	$V_{TREE} = -0,36367 + 0,00102635 * DBH^2$
<i>Cedrela fissilis</i> (Cedro misionero)	$V_{TREE} = -0,32029 + 0,00090151 * DBH^2$
<i>Diatenopteryx sorbifolia</i> (María petra)	$V_{TREE} = -0,30924 + 0,00088966 * DBH^2$

¹⁵⁷ Carvalho, R. R., Trautenmüller, J. W., Kohler, S. V., Serpe, E. L., Corte, A. P. D., Silva, D. A., & Figueiredo Filho, A. (2022). Biomass modeling in a mixed plantation of *Pinus taeda* L. and *Pinus elliottii* Engelm. *Scientia Forestalis*, 50, e3894. <https://doi.org/10.18671/scifor.v50.27>

¹⁵⁸ Fassola, H.E; et al. (2010) Regional prediction models for aboveground biomass estimation of *Pinus taeda* in Misiones and NE Corrientes region, Argentina. EEA Montecarlo, INTA. Available at: <https://core.ac.uk/download/pdf/335290727.pdf>

¹⁵⁹ MAGyP (2020) Segundo Inventario Nacional de Bosques Nativos (INBN2): informe Región Forestal Parque Chaqueño. Primera revisión. Section with equation at: Annex 4. Table 34. Available at: <https://www.argentina.gob.ar/ambiente/bosques/segundo-inventario-nacional-bosques-nativos>

¹⁶⁰

MAGyP (2020). Segundo Inventario Nacional de Bosques Nativos: informe Selva Paranaense: primera revisión. Buenos Aires. Section with equation at: Annex 4. Table 34. Available at: <https://www.argentina.gob.ar/ambiente/bosques/segundo-inventario-nacional-bosques-nativos>

¹⁶¹ Source for the equation: PINBN analysis

Species	Allometric equation
<i>Handroanthus heptaphyllus</i> (Lapacho negro)	$V_{TREE} = 0,000166288 * DAP^{1,29072} * LF^{1,5206}$
<i>Parapiptadenia rigida</i> (Anchico colorado Horco cebil)	$V_{TREE} = 0,0313 + 0,00077810 * DBH^2$
<i>Patagonula americana</i> (Guayubirá)	$V_{TREE} = -0,18563 + 0,00072140 * DBH^2$

Refer to sections 6.1 and 6.2 for further information regarding monitored parameters and method of plot biomass measurement.

- ***Change in carbon stock in shrub biomass in the project***

Regarding change in carbon stock in shrub biomass in the project, since the baseline scenario is the continuation of extensive cattle breeding in pastureland, this landscape does not present shrubs on it. Therefore, it is not a source of GHG emissions.

$$AC_{SHRUB_PROJ,t} = 0$$

Litter and Dead Wood Carbon Pools

Not included

Soil organic carbon Pool

Not included

5.3 Leakage Emissions

According to the methodology AR-ACM 0003 v.2.0, section 5.6, leakage emissions shall be estimated as follows:

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

Where,

LKt = GHG emissions due to leakage, in year t; tCO₂-e

$LK_{AGRIC, t}$ = Leakage due to the displacement of agricultural activities in year t, as estimated in the toll “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity”; tCO₂-e

According to the “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” tool v.2, leakage emission attributable to the displacement of agricultural activities due to implementation of an A/R CDM project activity is estimated as the decrease in carbon stocks in the affected carbon pools of the land receiving the displaced activity.

Leakage emission attributable to the displacement of grazing activities under the following conditions is considered insignificant by the Tool 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 lands.
- 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 a zero-grazing system.

In the proposed project option e) is valid as all livestock has been sent to a slaughterhouse¹⁶². Cattle breeding is an economic unit within Garruchos and it has been replaced, partly, by this carbon project. Cattle have not been sold to other cattle grazers but to slaughterhouses, and hence, not displaced to other existing grazing, non-grazing, forest or abandoned crop areas.

In addition, in the plot of land where the project activity is going to take place, there is no agriculture activity being developed hence there will be no displacement. Thus, it is concluded that the displacement of agricultural activities is considered insignificant and hence accounted as zero.

$$LK_t = 0$$

¹⁶² Evidence available to VVB in shared folder “Leakage” containing receipts for the cattle sales

5.4 Estimated GHG Emission Reductions and Carbon Dioxide Removals

According to the methodology AR-ACM 0003 v.2.0, section 5.7, net anthropogenic GHG removals by sinks shall be calculated as follows:

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

$\Delta C_{AR-CDM,t}$ = Net anthropogenic GHG removals by sinks, in year t; tCO₂-e

$\Delta C_{ACTUAL,t}$ = Actual net GHG removals by sinks, in year t; tCO₂-e

Where,

$\Delta C_{BSL,t}$ = Baseline net GHG removals by sinks, in year t; tCO₂-e

LK_t = GHG emissions due to leakage, in year t; tCO₂-e

Baseline net GHG removals and total GHG emissions due to leakage are zero, thus ex-ante estimation of C AR-CDM equals ΔC_{ACTUAL} . Based on the parameters detailed in section 6.1 and 6.2 equation and variables considered in section 5.2, the following table summarizes the GHG removals estimated for the project crediting period:

Vintage period	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions and reductions (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated buffer pool allocation (tCO ₂ e)	Estimated reduction VCUs (tCO ₂ e)	Estimated removal VCUs (tCO ₂ e)	Estimated total VCU issuance (tCO ₂ e)
01-Sep-2022 to 31-Dec-2022	0	-36	0	-	-	-	-
01-Jan-2023 to 31-Dec-2023	0	1,111.00	0	278.00	-	833.00	833.00
01-Jan-2024 to 31-Dec-2024	0	13,504.00	0	3,376.00	-	10,128.00	10,128.00
01-Jan-2025 to 31-Dec-2025	0	27,955.00	0	6,989.00	-	20,966.00	20,966.00
01-Jan-2026 to 31-Dec-2026	0	38,545.00	0	9,637.00	-	28,908.00	28,908.00
01-Jan-2027 to 31-Dec-2027	0	47,199.00	0	11,780.00	-	35,339.00	35,339.00
01-Jan-2028 to 31-Dec-2028	0	52,865.00	0	13,217.00	-	39,648.00	39,648.00
01-Jan-2029 to 31-Dec-2029	0	55,378.00	0	13,845.00	-	41,533.00	41,533.00
01-Jan-2030 to 31-Dec-2030	0	55,479.00	0	13,870.00	-	41,609.00	41,609.00
01-Jan-2031 to 31-Dec-2031	0	53,946.00	0	13,487.00	-	40,459.00	40,459.00

Vintage period	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions and reductions (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated buffer pool allocation (tCO ₂ e)	Estimated reduction VCUs (tCO ₂ e)	Estimated removal VCUs (tCO ₂ e)	Estimated total VCU issuance (tCO ₂ e)
01-Jan-2032 to 31-Dec-2032	0	51,551.00	0	12,888.00	-	38,663.00	38,663.00
01-Jan-2033 to 31-Dec-2033	0	48,749.00	0	12,188.00	-	36,561.00	36,561.00
01-Jan-2034 to 31-Dec-2034	0	45,741.00	0	11,436.00	-	34,305.00	34,305.00
01-Jan-2035 to 31-Dec-2035	0	42,798.00	0	10,700.00	-	32,098.00	32,098.00
01-Jan-2036 to 31-Dec-2036	0	39,944.00	0	9,986.00	-	29,958.00	29,958.00
01-Jan-2037 to 31-Dec-2037	0	37,321.00	0	9,331.00	-	27,990.00	27,990.00
01-Jan-2038 to 31-Dec-2038	0	34,901.00	0	8,701.00	-	26,100.00	26,100.00
01-Jan-2039 to 31-Dec-2039	0	32,513.00	0	8,129.00	-	24,384.00	24,384.00
01-Jan-2040 to 31-Dec-2040	0	30,422.00	0	7,606.00	-	22,816.00	22,816.00
01-Jan-2041 to 31-Dec-2041	0	28,493.00	0	7,124.00	-	21,369.00	21,369.00

Vintage period	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions and reductions (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated buffer pool allocation (tCO ₂ e)	Estimated reduction VCUs (tCO ₂ e)	Estimated removal VCUs (tCO ₂ e)	Estimated total VCU issuance (tCO ₂ e)
01-Jan-2042 to 31-Dec-2042	0	26,706.00	0	6,677.00	-	20,029.00	20,029.00
01-Jan-2043 to 31-Dec-2043	0	25,216.00	0	6,304.00	-	18,912.00	18,912.00
01-Jan-2044 to 31-Dec-2044	0	23,764.00	0	5,941.00	-	17,823.00	17,823.00
01-Jan-2045 to 31-Dec-2045	0	22,414.00	0	5,604.00	-	16,810.00	16,810.00
01-Jan-2046 to 31-Dec-2046	0	21,245.00	0	5,312.00	-	15,933.00	15,933.00
01-Jan-2047 to 31-Dec-2047	0	20,125.00	0	5,032.00	-	15,093.00	15,093.00
01-Jan-2048 to 31-Dec-2048	0	19,126.00	0	4,782.00	-	14,344.00	14,344.00
01-Jan-2049 to 31-Dec-2049	0	18,203.00	0	4,551.00	-	13,652.00	13,652.00
01-Jan-2050 to 31-Dec-2050	0	17,290.00	0	4,323.00	-	12,967.00	12,967.00
01-Jan-2051 to 31-Dec-2051	0	16,481.00	0	4,121.00	-	12,360.00	12,360.00

Vintage period	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions and reductions (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated buffer pool allocation (tCO ₂ e)	Estimated reduction VCUs (tCO ₂ e)	Estimated removal VCUs (tCO ₂ e)	Estimated total VCU issuance (tCO ₂ e)
01-Jan-2052 to 31-Dec-2052	0	15,759.00	0	3,940.00	-	11,819.00	11,819.00
01-Jan-2053 to 31-Dec-2053	0	15,062.00	0	3,766.00	-	11,296.00	11,296.00
01-Jan-2054 to 31-Dec-2054	0	14,446.00	0	3,612.00	-	10,834.00	10,834.00
01-Jan-2055 to 31-Dec-2055	0	13,819.00	0	3,455.00	-	10,364.00	10,364.00
01-Jan-2056 to 31-Dec-2056	0	13,257.00	0	3,315.00	-	9,942.00	9,942.00
01-Jan-2057 to 31-Dec-2057	0	12,730.00	0	3,183.00	-	9,547.00	9,547.00
01-Jan-2058 to 31-Dec-2058	0	12,200.00	0	3,050.00	-	9,150.00	9,150.00
01-Jan-2059 to 31-Dec-2059	0	11,734.00	0	2,934.00	-	8,800.00	8,800.00
01-Jan-2060 to 31-Dec-2060	0	11,239.00	0	2,810.00	-	8,429.00	8,429.00
01-Jan-2061 to 31-Dec-2061	0	10,785.00	0	2,697.00	-	8,088.00	8,088.00

Vintage period	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions and reductions (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated buffer pool allocation (tCO ₂ e)	Estimated reduction VCUs (tCO ₂ e)	Estimated removal VCUs (tCO ₂ e)	Estimated total VCU issuance (tCO ₂ e)
01-Jan-2062 to 31-Aug-2062	0	10,385.00	0	2,597.00		7,788.00	7,788.00
Total	0	1,090,185	0	272,574.00		817,647.00	817,647.00

In addition, according to the standard requirements, for those areas where harvesting practices are considered in the project activity, the loss of carbon due to harvesting shall be include in the quantification of the project emissions (LTA). Because no harvest is expected for this project, LTA is not estimated.

6 MONITORING

6.1 Data and Parameters Available at Validation

Data / Parameter	D_j
Data unit	t d.m. m ⁻³
Description	Density (over-bark) of tree species j
Source of data	Atencia, M.E (2003) INTI-CITEMA ¹⁶³
Value applied:	<p><i>Eucalyptus grandis</i>: 0.56</p> <p><i>Pinus taeda</i>: 0.46</p> <p><i>Pinus hybrid var. elliotii x caribaea</i>: 0.51</p> <p>Native mix:</p> <p>Ex- ante estimations: 0.74, an average from different species value available in mentioned reference.</p> <p>Ex-post estimations: a weighted conservative average value will be used taking into consideration densities for the mix of species planted with available data in reference:</p> <p><i>Parapiptaderia rigida</i>: 0.95</p> <p><i>Apuleia leiocarpa</i>: 0.77</p> <p><i>Patagonula americana</i>: 0.73</p> <p><i>Campomanesia xanthocarpa</i>: 0.87</p> <p><i>Cupania vernalis</i>: 0.85</p> <p><i>Jacaranda mimosifolia</i>: 0.58</p> <p><i>Cedrela fissilis</i>: 0.53</p>

¹⁶³ Atencia, M.E (2003) Densidad de maderas (Kg/m³) ordenadas por nombre científico. INTI-CITEMA. Available at: <https://www.inti.gob.ar/publicaciones/descargac/366>

Data / Parameter	D_j
	<i>Pterogyne nitens</i> : 0.77 <i>Diatenopteryx sorbifolia</i> : 0.96 <i>Cordia trichotoma</i> : 0,6 <i>Peltophorum dubium</i> : 0.9 <i>Enterolobium contortisiliquum</i> : 0.36
Justification of choice of data or description of measurement methods and procedures applied	<p>The densities used are of an official source: INTI, National Institution of Industrial Technology. It provides a wide list of species and corresponding densities for wet and dry wood.</p> <p>There is no data for <i>Pinus hybrid var. eliottii x caribaea</i>, so <i>Pinus eliottii</i>'s value is used. In the case of native species, the list is limited. For ex-ante estimations, a general average from the available densities of species planted is used, but during ex-post estimations, a weighted average will be used based on plot biomass participation to use a more representative density value.</p>
Purpose of data	Calculation of project emissions
Comments	In the case of ex-ante estimations, the value 0.36 is used, corresponding to <i>Enterolobium contortisiliquum</i> . species used due to general limited information available on Argentinean native species growth rates ¹⁶⁴ .

Data / Parameter	$BEF_{2,j}$
Data unit	Dimensionless
Description	Biomass expansion factor for conversion of stem biomass to above-ground biomass for tree species j
Source of data	AR-TOOL 14 Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities V. 04.2 page 26

¹⁶⁴ Arturi, M.F; et al. (2008) Height and diameter growth and mortality in plantations of native species of the Yungas in Valle Morado, Salta.

Data / Parameter	BEF _{2,j}
Value applied:	1.15 for Eucalyptus spp. and Pinus spp. 2 for Mix of native species
Justification of choice of data or description of measurement methods and procedures applied	According to the A/R methodological tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”, for ex post estimation the conservative default value of 1.15 will be used unless transparent and verifiable information can be provided to justify a different value.
Purpose of data	Calculation of project emissions
Comments	-

Data / Parameter	CF
Data unit	dimensionless
Description	Carbon fraction
Source of data	Table 4.3 <i>Carbon fraction of aboveground forest biomass in 2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
Value applied:	0.47
Justification of choice of data or description of measurement methods and procedures applied	Default value recommended by IPCC
Purpose of data	Calculation of project emissions
Comments	N/A

6.2 Data and Parameters Monitored

Data / Parameter	A _i
Data unit	ha

Data / Parameter	A _i				
Description	Area of stratum I				
Source of data	Monitoring of strata and stand boundaries was done using a Geographical Information System (GIS)				
Description of measurement methods and procedures applied	Strata areas were measured based on cartography documents, related with GIS.				
Frequency of monitoring/recording	The stratum area is monitored previous to every forest inventory. Every time the project boundaries are modified when disturbances events take place, the project participants shall rebuild the stratum and add the area of the project under disturbance in the GIS.				
Value applied:	Stratum	Gender	Species	Tree density (plants/ha)	Surface (ha)
	1	<i>Pinus</i>	<i>hybrid (elliottii x caribaea)</i>	833	473.82
	2	<i>Pinus</i>	<i>hybrid (elliottii x caribaea)</i>	1,250	123.09
	3	<i>Pinus</i>	<i>taeda</i>	1,250	41.39
	4	<i>Pinus</i>	<i>taeda</i>	833	19.43
	5	<i>Eucalyptus</i>	<i>grandis</i>	625	129.83
	6	<i>Eucalyptus</i>	<i>grandis</i>	1,250	157.25
	7	<i>Native mix</i>		625	7.37
	8	<i>Native mix</i>		1,250	5.98
	9	<i>Native mix + Eucalyptus</i>		625	7.76
	10	<i>Native mix + Eucalyptus</i>		1,250	7.22
Monitoring equipment	Garmin GPS, model etrex 10 y 20 and Garmin GPSMap 65; Google Earth, QGis				

Data / Parameter	A _i
QA/QC procedures applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.
Purpose of data	Calculation of project emissions
Calculation method	The value was used in equations N° 3, 12 y 24 of the Methodological tool AR TOOL 14 “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities” (Version 04.1)
Comments	N/A

Data / Parameter	A _{PLOT,i}
Data unit	ha
Description	Total area of sample plots in stratum i
Source of data	Field measurement
Description of measurement methods and procedures applied	<p>First, the centre of the plot is identified by navigating with the GPS until the planned waypoint is found and marked with a stake after the satellite location has 2 meters or less margin of error. The centre of the plot is determined in such a way that it is in the middle of 4 surrounding trees. From there, the limit of the plot is delimited considering a 400m² circle with a radio of 11.284mts around the centre, marking all the perimetral trees.</p> <p>The access to the plot is registered as a GPS point, taken on the road and a stake with the top painted white is placed, as well as the PPM number will be marked on a tree located on the road, provided that the diameter allows it.</p>
Frequency of monitoring/recording	Before every verification event.
Value applied:	Sample plots are circular of 400m ²
Monitoring equipment	Garmin GPS, model etrex 10 y 20 and Garmin GPSMap 65; Google Earth, QGis and measuring tape.

Data / Parameter	APLOT,1,
QA/QC procedures applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.
Purpose of data	Calculation of project emissions
Calculation method	The plots are located using a GPS, with previously loaded maps of plots, each having its own coordinates.
Comments	N/A

Data / Parameter	DBH
Data unit	cm
Description	Diameter at breast height of tree
Source of data	Field measurements in sample plots
Description of measurement methods and procedures applied	DBH is measured at 1.3 m above ground, over the bark. In case of stem deformation at this level, measurement was done over the deformation once the stem took its normal shape, with the purpose of being conservative. DBH was measured in all trees within the plots.
Frequency of monitoring/recording	During every forest inventory in every tree within sample plots
Value applied:	Varies with plot, see file "Forest inventory - Verification I" ¹⁶⁵
Monitoring equipment	For adult individuals (more than 10cm diameter), the instrument used for measuring DBH is a millimetric calliper with a 650 mm reach; with diameter accuracy, aluminium scales with clear digits anti-wear off, printed on both sides. In the case of young individuals, a measuring tape is used.
QA/QC procedures applied	A quality control procedure consists in qualified personnel conducting the measurements in the first place, and the first control is conducted by contractor.

¹⁶⁵ Removal spreadsheets available to VVB in shared folder "Monitoring Plan>Monitoring period>Forest inventory - Verification I"

Data / Parameter	DBH
	Secondly, instruments are checked and tested before starting the verification process. To calibrate the measuring tape, this is measured against a masonry fiber tape and metal masonry tape or metal rulers from the metallurgical industry.
Purpose of data	Calculation of project emissions
Calculation method	The trees are inside the plot if more than 50% of DBH is inside the plot.
Comments	N/A

Data / Parameter	R_j
Data unit	dimensionless
Description	Root-shoot ratio for tree species j
Source of data	Based on measured biomass and equation in AR-TOOL 14 Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities V. 04.2
Description of measurement methods and procedures applied	<p>R_j will be estimated using the recommended equation taken from the suggested equation from the source and calculated based on estimated aboveground biomass for each verification period and not a default value for ranges of biomass:</p> $R_j = \frac{e^{(-1.085+0.9256 \times \ln b)}}{b}$ <p>Where b is aboveground biomass content (t.d.m./ha). The aboveground biomass will be calculated per verification period.</p>
Frequency of monitoring/recording	Calculated during every monitoring period, for every plot measured
Value applied:	Varies with measuring plot depending on biomass see “Forest inventory – Verification I”
Monitoring equipment	Excel spreadsheet
QA/QC procedures applied	Calculations revised by third party within consultancy firm
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	H
Data unit	m
Description	Height of tree
Source of data	Field measurements in sample plots
Description of measurement methods and procedures applied	<p>Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.</p> <p>In relation to the height measurement, the following considerations according to each situation take place:</p> <ol style="list-style-type: none"> 1. Trees with zero slope: To achieve a correct measurement, the operator must be located at a distance equivalent to the tree height. It is important to keep in mind that the distance taken with the tape measure is the one entered in the inclinometer. 2. Measurements with slope (positive or negative): In those cases where the tree base is located over the contractor's visual sight, the measurement and total height will be a result of the subtraction of the measurements. If the operator is over a hill, the height will be the sum of the measurements. 3. Trees that are dead, burned, or broken will be excluded from the measurement.
Frequency of monitoring/recording	During every forest inventory, all trees within plot are measured
Value applied:	See file "Forest inventory - Verification I"
Monitoring equipment	All trees within the plot are measured with a telescopic rod or laser hypsometer.
QA/QC procedures applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	VTREE _{j,p,l} (ex-ante)
Data unit	m ³
Description	Stem volume of trees of species or group of species
Source of data	PlaForNEA simulation tool for <i>Pinus taeda</i> and <i>Pinus hybrid</i> . SIS Eucalipto simulation tool for <i>Eucalyptus grandis</i> For native mix plantation plots, Salas-Eljatib et al (2021) ¹⁶⁶ general growth equation was used, based on dasometric values from Arturi et al. (2008) ¹⁶⁷ and maximum volume rates for the region from INBN2 (2020) ¹⁶⁸ .
Value applied:	Varies with species and date of plantation. See project ex-ante spreadsheet ¹⁶⁹
Justification of choice of data or description of measurement methods and procedures applied	PlaForNEA ¹⁷⁰ is developed by a recognized organization in Argentina, INTA, which simulates <i>Pinus</i> growth, allowing to include detail on densities, forestry index, among other parameters. SIS Eucalipto ¹⁷¹ is a recognized simulation software, considered to be more precise for <i>Eucalyptus</i> growth projections. In the case of native mix stands, there is general limited information available on Argentinean native species growth rates. After analyzing available information, a sigmoidal growth curve was produced based on available information on dasometric parameters for native species in the region (specifically Red Timbó) (see Appendix 5)
Purpose of data	Calculation of project emissions (ex-ante)
Comments	For ex-post calculations, allometric equations will be used based on DBH and H values measured and estimated. When allometric

¹⁶⁶ Salas-Eljatib et al (2021) Growth Equations in Forest Research: Mathematical Basis and Model Similarities. Current Forestry Reports <https://doi.org/10.1007/s40725-021-00145-8>

¹⁶⁷ Arturi et al (2008) Height and diameter growth and mortality in plantations of native species of the yungas in Valle Morado, Salta. XIII Jornadas Técnicas Forestales y Ambientales (Misiones, 5-7 June, 2008)

¹⁶⁸ MAGyP (2020) Segundo Inventario Nacional de Bosques Nativos. Informe región forestal - Selva Paranaense. Primera revisión.

¹⁶⁹ Document in shared folder with VVB during validation/verification in "Monitoring Plan>ex-ante removal calculations>Garruchos carbon capture 40 years"

¹⁷⁰ PlaForNEA access through: <https://www.plafornea.com.ar/>

¹⁷¹ SIS EUCALIPTO, EMBRAPA. Available at: <https://www.embrapa.br/florestas/transferecia-de-tecnologia/software-florestais>

Data / Parameter	V _{TREE,j,p,l} (ex-ante)
	equations result in total biomass (kg) the corresponding adjustments will be applied.

Data / Parameter	V _{TREE,j,p,l} (ex-post)
Data unit	m ³ /ha
Description	Stem volume of tree of species j in sample plot p of stratum l
Source of data	<p>Estimation made by the project proponent based on the characteristics of the project area and the species involved. Biomass growth models were used for the specific plantations:</p> <ul style="list-style-type: none"> • PlaForNEA simulation tool for <i>Pinus spp.</i> • Siseucalipto simulation tool for <i>Eucalyptus grandis</i> • For native mix, Salas-Eljatib et al (2021)¹⁷² general growth equation was used, based on dasometric values from Arturi et al. (2008)¹⁷³ and maximum volume rates for the region from INBN2 (2020)¹⁷⁴.
Value applied:	<p>Varies with species and date of plantation. See project calculator spreadsheet for more details¹⁷⁵.</p> <p>Siseucalipto¹⁷⁶: $V = 0,00003055 * DBH^{2,0015} * H^{0,9993}$</p> <p>PlaForNEA¹⁷⁷: $V = 0,04076 * DAP^{2,01848} * H^{0,98123}$</p>
Justification of choice of data or description of	Allometric equations are used based on measured DBH and H values. These sources provide total biomass values (kg) and have

¹⁷² Salas-Eljatib et al (2021) Growth Equations in Forest Research: Mathematical Basis and Model Similarities. Current Forestry Reports. Available at: <https://doi.org/10.1007/s40725-021-00145-8>

¹⁷³ Arturi et al (2008) Height and diameter growth and mortality in plantations of native species of the yungas in Valle Morado, Salta. XIII Jornadas Técnicas Forestales y Ambientales (Misiones, 5-7 June, 2008). Available at: <https://sedici.unlp.edu.ar/handle/10915/130574>

¹⁷⁴ MAGyP (2020) Segundo Inventario Nacional de Bosques Nativos. Informe región forestal - Selva Paranaense. Primera revisión. Available at: https://www.argentina.gob.ar/sites/default/files/2019/07/inbn2_informe_nacional_de_resultados-comprimido.pdf

¹⁷⁵ LomaVerde_Calculator_v2_jul2025 available to VVB during validation in the shared folder "Documentation/ Section 4/ Section 4.4".

¹⁷⁶ [SisEucalipto e SisILPF Eucalipto: softwares para manejo de precisão de espécies de eucalipto em monocultivo e sistemas de integração lavoura-pecuária-fl oresta \(ILPF\)](#)

¹⁷⁷ [Inventario Forestal sobre Bosques Nativos de Argentina](#)

Data / Parameter	$V_{TREE,j,p,l}$ (ex-post)
measurement methods and procedures applied	been recognized by INTA (National Agriculture Technology Institution)
Purpose of data	Calculation of project emissions using the area-based quantification approach
Comments	Allometric equations are used based on measured DBH and H values. These sources provide total biomass values (kg) and have been recognized by INTA (National Agriculture Technology Institution)

Data / Parameter	Wi																																																																		
Data unit	dimensionless																																																																		
Description	Relative weight of stratum																																																																		
Source of data	Area field measurements																																																																		
Description of measurement methods and procedures applied	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.																																																																		
Frequency of monitoring/recording	During every verification event.																																																																		
Value applied:	<table border="1"> <thead> <tr> <th>Plantation season</th> <th>Surface (ha)</th> <th>Gender</th> <th>Species</th> <th>Tree density</th> <th>Wi</th> </tr> </thead> <tbody> <tr> <td>Q2 2023</td> <td>473.82</td> <td>PINUS</td> <td>Hybrid (Elliott x Caribaea)</td> <td>833 plants/ha</td> <td>48.69%</td> </tr> <tr> <td>Q4 2022</td> <td>123.09</td> <td>PINUS</td> <td>Hybrid (Elliott x Caribaea)</td> <td>1,250 plants/ha</td> <td>12.65%</td> </tr> <tr> <td>Q4 2022</td> <td>41.39</td> <td>PINUS</td> <td>TAEDA</td> <td>1,250 plants/ha</td> <td>4.25%</td> </tr> <tr> <td>Q2 2023</td> <td>19.43</td> <td>PINUS</td> <td>TAEDA</td> <td>833 plants/ha</td> <td>2.00%</td> </tr> <tr> <td>Q4 2022</td> <td>129.83</td> <td>EUCALYPTUS</td> <td>GRANDIS</td> <td>625 plants/ha</td> <td>13.34%</td> </tr> <tr> <td>Q4 2022</td> <td>157.25</td> <td>EUCALYPTUS</td> <td>GRANDIS</td> <td>1,250 plants/ha</td> <td>16.16%</td> </tr> <tr> <td>Q4 2022</td> <td>7.37</td> <td>Native mix</td> <td></td> <td>625 plants/ha</td> <td>0.76%</td> </tr> <tr> <td>Q4 2022</td> <td>5.98</td> <td>Native mix</td> <td></td> <td>1,250 plants/ha</td> <td>0.61%</td> </tr> <tr> <td>Q4 2022</td> <td>7.76</td> <td>Native mix + Eucalyptus</td> <td></td> <td>625 plants/ha</td> <td>0.80%</td> </tr> <tr> <td>Q4 2022</td> <td>7.22</td> <td>Native mix + Eucalyptus</td> <td></td> <td>1,250 plants/ha</td> <td>0.74%</td> </tr> </tbody> </table>	Plantation season	Surface (ha)	Gender	Species	Tree density	Wi	Q2 2023	473.82	PINUS	Hybrid (Elliott x Caribaea)	833 plants/ha	48.69%	Q4 2022	123.09	PINUS	Hybrid (Elliott x Caribaea)	1,250 plants/ha	12.65%	Q4 2022	41.39	PINUS	TAEDA	1,250 plants/ha	4.25%	Q2 2023	19.43	PINUS	TAEDA	833 plants/ha	2.00%	Q4 2022	129.83	EUCALYPTUS	GRANDIS	625 plants/ha	13.34%	Q4 2022	157.25	EUCALYPTUS	GRANDIS	1,250 plants/ha	16.16%	Q4 2022	7.37	Native mix		625 plants/ha	0.76%	Q4 2022	5.98	Native mix		1,250 plants/ha	0.61%	Q4 2022	7.76	Native mix + Eucalyptus		625 plants/ha	0.80%	Q4 2022	7.22	Native mix + Eucalyptus		1,250 plants/ha	0.74%
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Monitoring equipment	Excel - Microsoft Office based on data																																																																		
QA/QC procedures applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of																																																																		

	these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.
Purpose of data	Calculation of project emissions
Calculation method	Ratio of the area of stratum i to the sum of areas of biomass estimation strata (i.e. A_i/A)
Comments	N/A

Data / Parameter	S_i^2
Data unit	(t d.m. ha ⁻¹) ²
Description	Variance of tree biomass per hectare across all sample plots in each stratum
Source of data	Tree biomass from field measurements
Description of measurement methods and procedures applied	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.
Frequency of monitoring/recording	During every verification event.
Value applied:	See file “Forest inventory - Verification I”
Monitoring equipment	Excel - Microsoft Office based on measured data
QA/QC procedures applied	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied.
Purpose of data	Calculation of project emissions
Calculation method	Equation 17 from AR-Tool 14 $s_i^2 = \frac{n_i \times \sum_{p=1}^{n_i} b_{TREE,p,i}^2 - (\sum_{p=1}^{n_i} b_{TREE,p,i})^2}{n_i \times (n_i - 1)}$
Comments	N/A

Data / Parameter	T val
Data unit	Dimensionless
Description	Two-sided Student's t-value for a confidence level of 90 percent 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
Source of data	T-value equation from data analysis software (Excel) in line with table Tval from the tool "Calculation of the number of sample plots for measurements within A/R CDM project activities"
Description of measurement methods and procedures applied	From the equation, the value for a 90 percent confidence and infinite degrees of freedom is obtained.
Frequency of monitoring/recording	Every monitoring period
Value applied:	According to current estimates, with 102 plots for the whole project area, the t-value is equal to 1,984
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Uncertainty calculation
Calculation method	N/A
Comments	This value is for the uncertainty calculation when all the project area is monitored. During the first monitoring periods, where only part of the project area is surveyed, this value will vary according to the number of sample plots.

Data / Parameter	Number of sample plots in stratum j
Data unit	Dimensionless
Description	Number of sample plots for each stratum monitored
Source of data	Forest inventory based on plots estimated using the CDM tool "Calculation of the number of sample plots for measurements within A/R CDM project activities"
Description of measurement methods and procedures applied	CDM tool "Calculation of the number of sample plots for measurements within A/R CDM project activities" procedure is followed. In this sense, plot number are estimated based on

	<p>information on: Mean biomass stock, relative standard deviation, margin of error, all standard deviation and t-value. Later, allocation of sample plots per stratum is applied, based on stratum wi value. Every stratum is assigned at least 2 plots, even if this means increasing the number of plots estimated by the tool.</p> <p>Calculation in shared spreadsheet “Sample plots tool_Puerto Valle.Garruchos”.</p>																																																																																																
Frequency of monitoring/recording	Every monitoring period																																																																																																
Value applied:	<table border="1"> <thead> <tr> <th>Stratum</th> <th>Gender</th> <th>Species</th> <th>Tree density</th> <th>Date of plantation</th> <th>Area of stratum i (ha)</th> <th>Assigned plot n°</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>PINUS</td> <td>Hybrid (Elliotti x Caribaea)</td> <td>833</td> <td>Q2 2023</td> <td>479</td> <td>47</td> <td>47</td> </tr> <tr> <td>2</td> <td>PINUS</td> <td>Hybrid (Elliotti x Caribaea)</td> <td>1250</td> <td>Q4 2022</td> <td>123,3</td> <td>12</td> <td>12</td> </tr> <tr> <td>3</td> <td>PINUS</td> <td>TAEDA</td> <td>1250</td> <td>Q4 2022</td> <td>41,9</td> <td>4</td> <td>4</td> </tr> <tr> <td>4</td> <td>PINUS</td> <td>TAEDA</td> <td>1250</td> <td>Q2 2023</td> <td>19,4</td> <td>2</td> <td>2</td> </tr> <tr> <td>5</td> <td>EUCALYPTUS</td> <td>GRANDIS</td> <td>625</td> <td>Q4 2022</td> <td>142,66</td> <td>14</td> <td>14</td> </tr> <tr> <td>6</td> <td>EUCALYPTUS</td> <td>GRANDIS</td> <td>1250</td> <td>Q4 2022</td> <td>157,79</td> <td>15</td> <td>15</td> </tr> <tr> <td>7</td> <td colspan="2">Native mix</td> <td>625</td> <td>Q4 2022</td> <td>9,6</td> <td>1</td> <td>2</td> </tr> <tr> <td>8</td> <td colspan="2">Native mix</td> <td>1250</td> <td>Q4 2022</td> <td>6,8</td> <td>1</td> <td>2</td> </tr> <tr> <td>9</td> <td colspan="2">Native mix + Eucalyptus</td> <td>625</td> <td>Q4 2022</td> <td>5,9</td> <td>1</td> <td>2</td> </tr> <tr> <td>10</td> <td colspan="2">Native mix + Eucalyptus</td> <td>1250</td> <td>Q4 2022</td> <td>6,3</td> <td>1</td> <td>2</td> </tr> <tr> <td colspan="5"></td> <td>973,14</td> <td>97</td> <td>102</td> </tr> </tbody> </table>	Stratum	Gender	Species	Tree density	Date of plantation	Area of stratum i (ha)	Assigned plot n°	Total	1	PINUS	Hybrid (Elliotti x Caribaea)	833	Q2 2023	479	47	47	2	PINUS	Hybrid (Elliotti x Caribaea)	1250	Q4 2022	123,3	12	12	3	PINUS	TAEDA	1250	Q4 2022	41,9	4	4	4	PINUS	TAEDA	1250	Q2 2023	19,4	2	2	5	EUCALYPTUS	GRANDIS	625	Q4 2022	142,66	14	14	6	EUCALYPTUS	GRANDIS	1250	Q4 2022	157,79	15	15	7	Native mix		625	Q4 2022	9,6	1	2	8	Native mix		1250	Q4 2022	6,8	1	2	9	Native mix + Eucalyptus		625	Q4 2022	5,9	1	2	10	Native mix + Eucalyptus		1250	Q4 2022	6,3	1	2						973,14	97	102
Stratum	Gender	Species	Tree density	Date of plantation	Area of stratum i (ha)	Assigned plot n°	Total																																																																																										
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					973,14	97	102																																																																																										
Monitoring equipment	N/A																																																																																																
QA/QC procedures applied	N/A																																																																																																
Purpose of data	Calculation of project emissions																																																																																																
Calculation method	N/A																																																																																																
Comments	These values may change over time if new strata are identified or differences within the stratum need to be further divided in substrata. During the first monitoring periods, where only part of the project area is surveyed, these values for the monitored stratum will vary accordingly to reduce uncertainty.																																																																																																

Data / Parameter	T
Data unit	Year
Description	Time period elapsed between two successive estimations of carbon stock
Source of data	Recorded time

Data / Parameter	T
Description of measurement methods and procedures applied	N/A
Frequency of monitoring/recording	N/A
Value applied:	N/A
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	If the two successive estimations of carbon stock are carried out at different points of time in year t2 and t1, (e.g. in the month of November in year t1 and in the month of March in year t2), then a fractional value is assigned to T.

Data / Parameter	Margalef Diversity Index (DMg)
Data unit	Dimensionless
Description	Time period elapsed between two successive estimations of The Margalef Diversity Index measures the relative species richness of a plant community, considering both the total number of species and the total number of individuals recorded in a sample.
Source of data	Data obtain from inventories conducted in the project's sampling plots.
Description of measurement methods and procedures applied	Same sampling plots using for carbon inventory to record all natural regeneration species present and the number of individuals per species. Data will be compiled in a database and analyzed using the Margalef formula.
Frequency of monitoring/recording	Every monitoring period
Value applied:	Average value obtained across sampled plots

Data / Parameter	Margalef Diversity Index (DMg)
Monitoring equipment	GPS, field data sheets, camera, botanical identification guides, and/or statistical software
QA/QC procedures applied	Cross-checking of field data; validation of species identification through comparison with herbarium specimens or botanical databases.
Purpose of data	To assess plant species richness and diversity within the project's area, establish a baseline, monitor temporal changes, and evaluate potential environmental impacts
Calculation method	$DMg = (S-1) / \ln(N)$ <i>where:</i> <i>S = total number of species recorded</i> <i>N = total number of individuals recorded</i>
Comments	NA

6.3 Monitoring Plan

Garruchos S.A monitoring plan has been designed following the methodology AR-ACM0003 and its applicable tools referenced in sections 3.1 and 3.2 of the present PDD to provide all relevant data necessary to verify:

- The applicability conditions listed under section 3.2 are met
- Changes in carbon stocks in pools selected
- Project emissions and leakage emissions

All data which is mentioned in the present section will be collected and archived electronically and kept for at least 2 years after the end of the crediting period as required by the methodology.

As mentioned in section 1.1 of the present document, the Garruchos S.A afforestation project will be carried out considering the Manual of Good Forest Practices suggested by the Secretary of Agriculture, Fisheries, Livestock and Food (SAGPyA) of the Argentine Nation as a basic tool for the implementation of environmentally sustainable forestry, as well as the local Manual of Good Practices for the province of Corrientes (Resolution N° 875, Corrientes). In addition, standard operating procedures (SOPs) and quality control/quality assurance (QA/QC) procedures for inventory operations, including field data collection and data management are identified, recorded and applied (i.e.: SOPs from the "IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry 2003").

Due to the size of the project, it is not possible to measure the stock of the total project area. Therefore, it is necessary to take representative samples of the population. These sampling plots will include a representative sample of the whole area based on the stratification variables defined for the activity. These include year of plantation, species mix & density of trees.

The monitoring plan is designed to produce biomass stock estimates with a 90% confidence level in line with the precision requirements established in the Tool 14 Estimation of carbon stocks of trees and shrubs in A/R CDM Project activities” version 04.2.

Data collected will be archived for a period of at least two years after the end of the last crediting period of the project activity.

Sampling plan

The forest inventories will be performed considering statistical predefined parameters, with the objective of establishing the precision and the probability level of the results. The selection of the work methodology for developing forest inventory involves the determination of the following variables, in line with the *Monitoring Plan*:

- *Sample size*
- *Sampling error*
- *Sampling process*
- *Mapping of the sampling*
- *Recollection of field data (this will include the variables measured and the instruments which will be used)*
- Calculation process
- Statistical analysis.

Project boundaries will be defined at the beginning of project activity and updated, as needed, along the crediting period but always within the project boundaries initially validated. If any unplanned contingency occurs (fires, droughts, pests) new strata may be created and or boundaries may vary and be redefined.

Geographic coordinates are established, recorded and archived; geospatial file is provided. A Geographic Information System will be implemented with the following basic layers:

- Project boundaries
- Aerial photographs

- Infrastructure (nursery, roads, etc.)
- Permanent sampling plots

Other layers could be added in the future. The layers will be linked to several databases.

Stratification (Ai)

The characteristics of the population under study are heterogeneous in relation to the types and combinations of species, planting densities, year of planting, topography and soil types of the planting lots/rootstocks. Due to the existence of this variation, it is convenient to divide the population into subpopulations called strata to increase precision, so that the variable of interest reduces its variability, since they will have a marked influence on the changes in the carbon stock both above and below ground. Stratification eliminates sources of variation that can mask the inventory results, so that the variability within strata is less than the variability of the entire population. It will also be possible to obtain more precise estimators thanks to stratification. Stratification also facilitates data collection and data processing by stratum and is also convenient for planning and conducting field work.

The variable types and combinations of species, planting density and spacing, and year of planting were considered to determine the number of strata, while topography and soil type were considered previously at the time of defining planting designs. For the pine genus, considering the two planted species: *hybrid* and *taeda*, and their two planting densities (833 plants/ha and 1,250 plants/ha), 5 strata were defined. In the case of the eucalyptus genus, it is planted at two densities (625 plants/ha and 1,250 plants/ha), defining 2 more strata. Last, in the case of native species mix, 4 stratifications were defined taking into consideration the two densities ´ design (625 plants/ha and 1,250 plants/ha) both, for all native species mix and native mix+eucalyptus. This last, as explained in section 1.11, is part of the domestication study where eucalyptus individuals will be used as shelter for native young individuals during the first years. The total number of strata is 11. The strata are mapped and identified in the GIS (Geographic Information System).

Sampling

Design

The design includes the setting of the different variables to be used in the sampling, that is, the distribution of plots, setting their quantities and sizes, as well as the information analysis techniques. In this case, the design used was "Systematic Random", through the implementation of a rectangular grid and location of the plots in each stratum. The plots have been distributed over the area of interest to be inventoried in homogeneous units (lots), determining the dasometric parameters corresponding to the lots they represent.

The stratum is characterized by homogeneity in species, age, density, in order that the variability is absorbed within the batch and thus improve inventory precision.

Permanent sampling plots are used to measure and monitor changes in carbon stocks over time. These are more efficient for estimating changes in carbon stocks by filtering out any variance due to plot effect. For the location definition of the plots, QGIS tools are used. Thus, a perimeter buffer of 15 mts. is made for each polygon, to avoid that the plots are in the border areas of the polygons. Then, to determine the random location of the plots (only for the first time) these are defined over a grid, trying that each polygon has one, according to its surface. The plots will be located with GPS.

Sample size

The plot size involves the number of plots to be distributed with a certain statistical criterion in every stratum. The representative number of plots of the total project area and of every stratum shall be previously decided to accomplish the predefined level of accuracy and precision.

The size of the sample plot is a trade-off between accuracy, precision, and time (cost) of measurement. The size is also related to the number of trees, their diameter and the carbon stock variance among plots. The plot should be large enough to contain an adequate number of trees per plot to be measured. IPCC Good Practice Guidance for LULUCF, Chapter 4.3 recommends using a single plot varying between 100 m² to 600 m², increasing the size from densely planted stands of 1000 trees per hectare to sparsely planted stands of multi-purpose trees.

Thus, taking into consideration the project-specific conditions and the IPCC guidance, circular plots of 400 m² have been selected for monitoring the stratum.

Plots number

Permanent sampling plots are used to measure and monitor changes in carbon stocks from the most relevant carbon pools over the time. These are more efficient for estimating changes in carbon stocks by filtering out any variance due to plot effect. The plots will be located with GPS and although physically marked, they will be as invisible as possible to avoid any possible special treatments (e.g. during site and soil preparation, weeding, fertilization, harvesting, etc.) that could affect growth. They will also be prevented from being deforested over the crediting period.

The number of sample plots was first estimated according to the “Calculation of the number of sample plots for measurements within A/R CDM project activities” tool. This tool takes into consideration expected standard deviations in the measured biomass (in the case of ex-ante estimations all plots are assumed to have the same deviation), the mean biomass stock (for ex-ante the biomass at the end of the crediting period is considered), as well as other variables as two sided t-student value for 90% confidence level and infinite degrees of freedom, as well as margin of error, and others (see table below with the considered values). The outcome for the estimation of number of sample plots with the tool was 97 for the whole project area.

Parameter	Value	Unit	Description
n	97,13	-	Number of sample plots
N	33.088	-	Project area divided by the size of the sample plot
t VAL	1,645	-	Two-sided Student's t-value; Table Tval from the tool "Calculation of the number of sample plots for measurments within A/R CDM project activities". 90% confidence level and infinite degrees of freedom
Mean Biomass stock	608	t d.m./ha	The mean biomass stock is the expected biomass at the time of monitoring weighted per stratum. For ex ante estimations it can be calculated as the average biomass stock of species at harvest age. Note: if biomass stock is modified through the years, "n" remains unchanged due to the propotionality between s, E and s2
s	30%	%	For stratum without preliminary measurement, 30% of relative standard deviation was assumed.
E	5%	%	A default value equal to 10% of the mean biomass stock was used as the acceptable margin of error. Thus, according to the tool, E = 5% (half the margin error)
s	182,34	t d.m./ha	For exante estimations all std deviations of biomass stock in each stratum are considered equal
E	30,39	t d.m./ha	E result based on mean biomass stock

For each stratum, a total number of circular sampling plots was determined proportionally to the area of each stratum, being distributed according to the table below. To ensure statistical independence per stratum, a minimum number of 2 plots was established for each stratum. In strata where the distribution of sampling units was less than 2, they were adjusted to reach this minimum. This number was defined to achieve a 10% significance. Calculations are archived as part of project documentation. The new number estimated for the whole project area is of a total of 103 sample plots described in the table below, for each stratum:

The frequency of measurement of the permanent plots will be annual and a specific area of Garruchos S.A. will oversee coordinating the measurement. Calculation measurements will be outsourced by a specialized service provider and reviewed by Garruchos S.A.

Table 7 Plots detail per stratum

Stratum	Gender	Species	Tree density	Date of plantation	Area of stratum i (ha)	Assigned plot n°	Total
1	Pinus	Hybrid (Elliotti X Caribaea)	833	Q2 2023	479	47	47
2	Pinus	Hybrid (Elliotti X Caribaea)	1250	Q4 2022	123,3	12	12
3	Pinus	Taeda	1250	Q4 2022	41,9	4	4
4	Pinus	Taeda	1250	Q2 2023	19.4	2	2
5	Eucalyptus	Grandis	625	Q4 2022	142,66	14	14
6	Eucalyptus	Grandis	1250	Q4 2022	157,79	15	15
7		Native mix	625	Q4 2022	9,6	1	2
8		Native mix	1250	Q4 2022	6,8	1	2

Stratum	Gender	Species	Tree density	Date of plantation	Area of stratum i (ha)	Assigned plot n°	Total
9		Native mix + Eucalyptus	625	Q4 2022	5,9	1	2
10		Native mix + Eucalyptus	1250	Q4 2022	6,3	1	2
					973,14	97	102

Table 8 Plots per sub-stratum for first monitoring period

Stratum & substratum	Genus	Species	Trees density (plants/ha)	YOP	Surface (ha)	Plots (n°)
5.1	<i>Eucalyptus</i>	<i>grandis</i>	625	Q4 2022	56.5	7
6.1	<i>Eucalyptus</i>	<i>grandis</i>	1250	Q4 2022	22.8	12
6.2	<i>Eucalyptus</i>	<i>grandis</i>	1250	Q4 2022	65.3	13

Mapping

The location of the plots will follow the guidance given by the corresponding methodological tool, as well as IPCC Good Practice Guidance for LULUCF (2002), Chapter 4.3.

Permanent sample plots

It was developed by remote sensing by the following steps: First, the polygons to be sampled were selected. Then, to reduce the edge effect of random drawing, a buffer of 15 meters was made to prevent plots from falling on the edge. Last, the vector tool in GIS *Random points within polygons* was used. This algorithm creates a point layer, randomly placed on the polygons of the input polygon layer.

For each feature in the input polygon layer, the algorithm attempts to add the specified number of points for each feature to the output layer. A minimum distance between points and an overall minimum distance between points can be specified. A point will not be added if there is already a point generated within this (Euclidean) distance from the generated location.

With the minimum distance between points, only points on the same polygon feature are considered, while for the global minimum distance between points all previously generated points are considered. If the global minimum distance between points is set equal to or greater than the minimum (local) distance between points, the latter has no effect.

If the minimum distance between points is too large, it may not be possible to generate the specified number of points for each feature, but all generated points are returned. The maximum number of attempts per point can be specified.

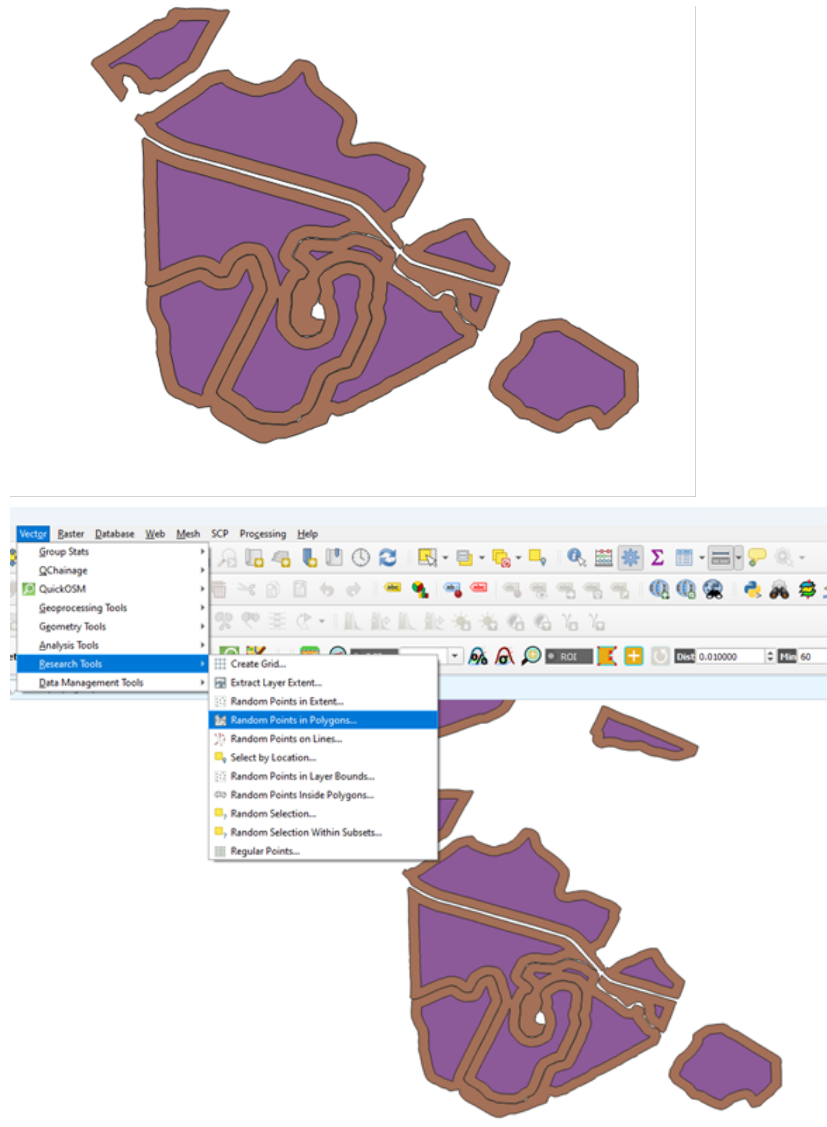


Figure 45 Permanent plot's location process with a) Buffer areas to border, roads, etc to define sample plots and b) GIS function to assign random points in polygons.

The location of the plot centre is established and recorded by means of a GPS point, which can also be identified by marking a tree as a reference (focal tree). The stake that will form the plot centre can be placed next to it. To avoid inconveniences during field work, for example when the GPS loses signal due to interferences, it is possible to use other procedures to locate them in the field. One of them is to find a known point (e.g. focal tree) and from there locate the other points using tape and compass or to orient the direction of advance.

Diametric measurements

Each pool will be measured following the methodology procedures and IPCC Good Practice Guidance for LULUCF (2003).

The measurements of biometric variables such as diameter and height of the trees, for the determination of volumes and growth, will be carried out annually, on a predetermined date, which should be done at approximately the same time (date) each year. Although winter is considered a favourable season for measurements, because the trees do not grow due to the physiological recess in which they find themselves in, and access is facilitated, it is important to consider evaluating other variables such as planting date, logistics, verification dates, among others.

Diameter measurement at breast height (DBH)

By convention, the diameter is measured at 1.30 m above ground level, which is why it is called DBH. This measurement is standardized independently of the operator and his height, and at this height the measuring instrument is easy to handle. The DBH is measured with measure tape or forceps according to individual's size. Woody stems with a DBH equal to or greater than 2 cm should be measured, always approaching them in the same orientation (N-S). Those individuals with less than 1.3m height will not be measured.

Height measurement

The height of a tree or portion of a tree is the linear distance along its main axis, from the ground to the apex or to another reference point, always in accordance with the type of height to be measured. The height serves essentially for the calculation of volume and for the calculation of increments in height and volume. Total height will be measured for carbon credits monitoring.

For height measurement the base of the plant to be measured is cleaned. The operator is then positioned at a minimum distance equivalent to twice the height of the plant. The device is turned on and the laser automatically appears; Trigonometry key is pressed 3 times, then the operator aims at the base of the plant as close to the ground; and after pressing the Trigonometry key again it raises the laser pointer until it points to the apex of the plant. If, due to light impairment, or other, the plant apex cannot be seen, zoom lens 1x, 2x or 4x can be used.

Area of measurement:

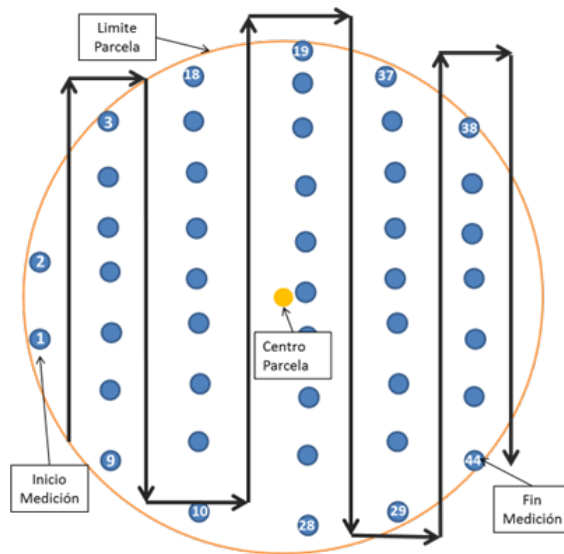
To locate the plot centre, the operator will navigate with the GPS until the planned waypoint is found and wait until the margin of error of the satellite location is 2 meters or less. Then the centre of the plot is determined in such a way that it is in the middle of 4 surrounding trees. A cairn or rustic stake is installed there. After, all the perimeter trees are marked with paint.

Measurement

The area of sample plot must be properly delimited and identified to be located easily and without incurring errors in subsequent measurements. In this case the plots will be installed and located with the help of a Global Positioning System (GPS) equipment. The use of GPS makes it possible to efficiently and accurately locate or relocate the plots, particularly in places with few roads. The boundaries of the sampling plots will be visible, as no management or treatment (silvicultural and cultural) will take place throughout the project.

The operator will start by measuring the leftmost row in relation to the access road to the plot. Then, will move along the line to the end and return in the opposite direction. And so on. The first tree will be identified with the number 1 painted on it. All measured plants will be painted with a spray mark at 1.3m.

The procedure includes the measurement of all trees with Diameter at Breast height (DBH) greater than or equal to 2 cm, starting from the north radius and moving clockwise. The dendrometric variables of all the trees covered by the Area of Sample Plot are measured and recorded. Trees within the boundaries of the plot should be measured if more than half of the trunk falls within the plot.



The data to be collected and entered in the field form includes:

- Measurement date: day/month/year
- Polygon
- Plot number
- Plot Size (m²) and Slope (%) of the plot.
- Plot Location: Latitude and Longitude.
- Management Characteristics
- Regarding individual measurement:
- N° of tree: corresponding to the correlative measurement number.

- Quality: it is measured for all trees

Code	Quality
0	Normal
1	Fault
2	Stump
3	Dead
4	Fork < 1,3m
5	Fork > 1,3m
6	Fork in last third
7	Simple smooth sinuosity
8	Simple severe sinuosity in the first third
9	Double severe sinuosity in the first third
10	Double severe sinuosity in the second or third third
11	Inclined
12	Broken, usable
13	Broken, non-usable
14	Atacked by plage
15	Others

Once the measurement stage is finished, on the entrance road, a stake with the upper part painted in white will be placed, and the permanent plot number marked on a tree (if the diameter allows it).

According to the measuring equipment used the configuration of the measuring team shall be defined. In general, measurements take place with 2 to 3 qualified operators: one crew foreman and two assistants, of which one will be the planner in charge of recording all the variables of interest in spreadsheet, the other will measure height and determine the plot limits with it, and the other will measure diameters and other variables of interest.

Biodiversity index

Identify all regenerating plant species (seedlings, saplings, and juveniles).

Count the number of individuals per species.

Record data on standardized field sheets, including GPS coordinates and microhabitat observations.

Taxonomic identification:

Conducted in the field or verified in the laboratory through comparison with herbarium specimens or botanical databases (e.g., SIH (Sistema Nacional de Datos sobre Biodiversidad – CONICET, Argentina), Flora Argentina, Tropicos (Missouri Botanical Garden), GBIF (Global Biodiversity Information Facility), Herbaria of national institutions such as the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” (MACN) or Instituto de Botánica Darwinion (IBODA), etc.).

List of Materials

- Forest inventory and biomass sampling procedures manual.
- Field plans, aerial photographs, thematic charts.
- Field sheets
- Plastic/aluminum labels
- Spray paint (orange, yellow)
- Colored plastic tapes preferably biodegradable
- Permanent markers
- Stakes
- Machete
- First aid kit
- Security equipment

Measurement plots maintenance:

All plots should be maintained at least once per year to avoid losing the data or the accuracy of the measurements, in some cases even the plot can be lost. Stakes (placement and numbering), tree numbering and DBH lines will be checked. They should be in perfect condition and the trees should be well identified, otherwise they should be fixed immediately. The ideal time to do the maintenance is during the measurement.

During installation, a reference tree is marked, from which the bearing and distance from the plot centre is taken. If the plot centre stake is lost, the reference tree is used to relocate the stake.

Quality assurance and Quality control

The implementation of the monitoring plan includes a QA/QC system to minimize errors in measurement and data analysis, and to provide documentation and consistency in data archiving. Quality Assurance measures are implemented, to verify that data quality objectives are met, and in general, to support the effectiveness of the QC system.

QA/QC plan includes procedures such as (1) hiring experienced third-party contractors, if needed (2) assuring reliable field measurements, (2) documenting data entry and analysis techniques and (3) data maintenance and archiving.

Operating procedure

There is an operating procedure in place for permanent sample plots¹⁷⁸. Compliance with this Operating Procedure will be verified through the recording of nonconformities and their corresponding corrective action. For verification of compliance with this procedure the Head of Forestry Planning Area, Forestry Supervisor or a quality control contractor company may conduct audits of the permanent plots installed and/or measured in the current year or previous years. If a deviation from what is expressed in this Operating Procedure is found, it will be recorded as a Nonconformity.

Non-Conformity for the purposes of this procedure is understood as any action that contradicts or does not comply with the precepts established in this procedure. Corrective Action is understood as the actions that correct the deviations registered in the Nonconformity. The Corrective Action shall be carried out within a reasonable period.

Data Analysis

- Calculate the Margalef Diversity Index (DMg) for each plot and monitoring period.
- Determine the mean, standard deviation, and temporal trends of the index.
- Graphically represent changes in the index by site and/or monitoring year.
- Relate the results to environmental variables, where applicable.

Evaluation Criteria

Category	DMg Value	Ecological Interpretation
Low diversity	< 2.0	Low natural regeneration and low habitat heterogeneity
Moderate diversity	2.0 – 4.0	Developing and stable regeneration process
High diversity	> 4.0	Advanced regeneration and more mature ecosystem conditions

Data records

The system area of Garruchos S.A. will be in charge of the safekeeping and security of the data files.

Quality Control System will be implemented for routinely checking for data consistency, correctness, and completeness; for identifying and correcting errors and omissions; and for properly documenting and archiving data and documentation related with the monitoring activities. Quality Assurance measures will be implemented, to verify that data quality objectives are met, and in general, to support the effectiveness of the QC system.

As mentioned, Garruchos S.A. is a forestry company with over 20 years of experience. This company has highly professional and qualified personnel with experience for the realization of all

¹⁷⁸ Procedure available to VVB during validation/verification in shared folder "Monitoring plan>PO 010 Permanent sample plots"

the tasks of measurements in the field and for the realization of the data entry necessary for this type of project.

Garruchos S.A maintains accurate, complete, up-to-date, accessible records and reports, which are maintained for at least 5 years, covering all aspects of the Project. The records are managed by the CWA system, in real time, through a cumulative database.

Data entry, record and report management are performed by managers who log into the program exclusively by means of user ID and password.

The CWA database is recorded daily on magnetic tape and preserved for 7 days. Copies are made automatically, at a preset time (11:00 p.m.). The tapes are archived at the offices of Garruchos S.A. In addition, a monthly copy is made at the accounting-administrative closing and the tape is archived in the security box.

Organizational structure, responsibilities and competencies.

The organizational structure and responsibilities of the forestry team with regards to the monitoring system are as follow:

Managers: Provide the necessary economic and human resources for compliance with this procedure.

Area Managers: To enforce compliance with this procedure in their respective Operational Areas.

Supervisors: Control the application of the operating procedure by the service providers.

Contractors: To apply the stipulations of this procedure, having to train their personnel and adapt to the requirements of current legislation.

Field operators: Apply all the directives given in this procedure.

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1 Data and Parameters Monitored

Data / Parameter	A _i				
Data unit	ha				
Description	Area of stratum I				
Value applied:	Stratum & substratum	Genus & species	Tree density (plants/ha)	Homogeneity	Surface (ha)
	5.1	<i>E. grandis</i>	625	<i>homogeneous</i>	56.47
	6.1	<i>E. grandis</i>	1,250	<i>homogeneous</i>	22.78
	6.2	<i>E. grandis</i>	1250	<i>heterogeneous</i>	65.32
Comments	<p>Stratum numbers were assigned considering projected stratums– 1. Pinus hybrid 833 density, 2. Pinus hybrid 1250 density, etc. As only stratum with individuals with a minimum height of 1.5mts were measured, the stratum shown in the table above do not follow a linear numbering. The total number is expected in 10 stratums.</p> <p>Moreover, during this monitoring period, a higher heterogeneity was observed in the measured plots, for this reason new substratum were created, this is expected to be homogenised over time.</p>				

Data / Parameter	A _{PLOT,i} ,
Data unit	ha
Description	Total area of sample plots in stratum i

Value applied:	Stratum & substratum	Surface (ha)	Plots (n °)	Plot size (ha)
	5.1	56.47	7	0,04
	6.1	22.78	12	0,04
	6.2	65.32	13	0,04
Comments	During this first monitoring period 32 plots were measured, representing 0,9% of surface area for the analyzed stratum			

Data / Parameter	DBH
Data unit	cm
Description	Diameter at breast height of tree
Value applied:	Varies with plot, see file "Forest inventory - Verification I"
Comments	N/A

Data / Parameter	R_j
Data unit	dimensionless
Description	Root-shoot ratio for tree species j
Value applied:	Varies with measuring plot depending on biomass see "Forest inventory - Verification I"
Comments	N/A

Data / Parameter	H
Data unit	m
Description	Height of tree
Value applied:	Varies with measuring plot. See file "Forest inventory - Verification I"
Comments	N/A

Data / Parameter	$V_{TREE,j,p,I}$ (ex-post)
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Data unit	m ³
Description	Stem volume of trees of species or group of species
Value applied:	Varies with each individual based on species and date of plantation. See project ex-ante spreadsheet ¹⁷⁹
Comments	When total biomass is used in carbon removal equations, based on allometric equation results, adjustment will be implemented to the equation (ex. no use of BEF or D variables).

Data / Parameter	Wi																									
Data unit	dimensionless																									
Description	Relative weight of stratum																									
Value applied:	<table border="1"> <thead> <tr> <th>Plantation Year</th> <th>Species</th> <th>Stratum</th> <th>Eligible area (ha)</th> <th>wi</th> </tr> </thead> <tbody> <tr> <td>Q4 2022</td> <td>Eucalyptus</td> <td>5.1</td> <td>56.47</td> <td>0.391</td> </tr> <tr> <td>Q4 2022</td> <td>Eucalyptus</td> <td>6.1</td> <td>22.78</td> <td>0.158</td> </tr> <tr> <td>Q4 2022</td> <td>Eucalyptus</td> <td>6.2</td> <td>65.32</td> <td>0.452</td> </tr> <tr> <td colspan="3">Total</td> <td>144.57</td> <td>1</td> </tr> </tbody> </table>	Plantation Year	Species	Stratum	Eligible area (ha)	wi	Q4 2022	Eucalyptus	5.1	56.47	0.391	Q4 2022	Eucalyptus	6.1	22.78	0.158	Q4 2022	Eucalyptus	6.2	65.32	0.452	Total			144.57	1
Plantation Year	Species	Stratum	Eligible area (ha)	wi																						
Q4 2022	Eucalyptus	5.1	56.47	0.391																						
Q4 2022	Eucalyptus	6.1	22.78	0.158																						
Q4 2022	Eucalyptus	6.2	65.32	0.452																						
Total			144.57	1																						
Comments	N/A																									

Data / Parameter	Si ²
Data unit	(t d.m. ha-1) ^2
Description	Variance of tree biomass per hectare across all sample plots in each stratum
Value applied:	See file “Forest inventory - Verification I”
Comments	N/A

¹⁷⁹ Document in shared folder with VVB during validation/verification in "Monitoring Plan>ex-ante removal calculations>Garruchos carbon capture 40 years"

Data / Parameter	T val
Data unit	dimensionless
Description	Two-sided Student's t-value for a confidence level of 90 percent 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
Value applied:	1,696
Comments	This value will vary when all the project area is monitored. During the first monitoring periods, only part of the project area was included in the forest inventory.

Data / Parameter	Number of sample plots in stratum j			
Data unit	dimensionless			
Description	Number of sample plots for each stratum monitored			
Value applied:	Stratum & substratum	Surface (ha)	Plots (n °)	Plot size (ha)
	5.1	56.47	7	0,04
	6.1	22.78	12	0,04
	6.2	65.32	13	0,04
Comments	These values may change over time if new strata are identified or differences within the stratum need to be further divided in substrata. During the first monitoring periods, where only part of the project area is surveyed, these values for the monitored stratum will vary accordingly to reduce uncertainty.			

Data / Parameter	T
Data unit	Year
Description	Time period elapsed between two successive estimations of carbon stock
Value applied	September 1 st , 2022, to November 16 th , 2023. This is the first monitoring period and T1 considered is project start date.
Comments	N/A

7.2 Baseline Emissions

As mention in Section 5.1, since continuation of cattle breeding in moderately degraded land has been demonstrated as baseline scenario, an activity that has been applied without changes for more than 20 years, predominately in the whole project area, it is assumed, in agreement with IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry (2003), Chapter 3 ¹⁸⁰, that the net GHG removals by sinks in the baseline equals zero.

Baseline net GHG removals by sinks

According to methodology AR-ACM 0003 v.2.0, section 5.4, baseline net GHG removals by sinks are calculated as follows:

$$\Delta C_{BSL,t} = \Delta C_{TREE_BSL,t} + \Delta C_{SHRUB_BSL,t} + \Delta C_{DW_BSL,t} + \Delta C_{LI_BSL,t}$$

Where,

$\Delta C_{BSL,t}$: = Baseline net GHG removals by sinks in year t; tCO₂-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”; tCO₂-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”; tCO₂-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”; tCO₂-e

¹⁸⁰ In the case of biomass it is mentioned in Section 3.4.1.1.1.2: “(Note: It is important, in deriving estimates of biomass accumulation rates, to recognize that net changes in biomass stocks will occur primarily during the first years (e.g. 20 years) following changes in management. After which time biomass stocks will tend towards a new steady-state level with little or no change in biomass stocks occurring unless further changes in management conditions occur).” For the case of soil C pools, the maintenance of the same land use, management and input practices imply the use of the same default values in table 3.4.5 for equation 3.4.8

$\Delta C_{LI_BSL,t}$ = 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”; tCO₂-e

As it was demonstrated in previous sections, the baseline scenario is the continuation of historic use of land, which consists of extensive continuous cattle grazing. This means that the project area without the project activity would have remained as modified pastureland. Thus, based on IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry (2003), given that the activity of the identified baseline scenario has been the same for the last decades, it is assumed that the net GHG removals in the baseline are null.

Change in carbon stock in baseline tree and shrub biomass within the project boundary

The only existing trees within the project area are scattered individuals. Those scattered trees present in the project area will be neither harvested, nor cleared, nor removed; will not suffer mortality because of competition from trees planted in the project, or damage because of implementation of the project activity, and will not be inventoried along with the project trees in monitoring of carbon stocks. Furthermore, their continued existence, consistent with the baseline scenario, will be monitored throughout the crediting period of the project activity. In summary, taking into consideration the conditions in the AR-TOOL 14 – Section 5 are met, carbon stock in trees in the baseline can be accounted as zero.

Moreover, in terms of baseline emissions, it is important to note the common practices for livestock production. It is estimated that in savannas and wet pastures the fire interval is 1-2 years. Fire is considered a management alternative because of its low cost and simple application, whose main purpose is to remove senescent or dry material rejected by livestock. It stimulates the growth of new, softer, more palatable and better-quality grass used by ruminants, thus achieving better results in animal production (Heringer & Jacques, 2001). In this sense, whenever the shrub generates a significant encroachment, it is recently burned, generating GHG emissions. For this project, a conservative approach has been taken and emissions from burning have not been estimated^{181 182}. In this line, changes in carbon stocks in shrubs and trees in the baseline may be accounted as zero complying with point f, and g as previously mentioned, of section 5 in the stated Tool.

Change in carbon stock in baseline dead wood and litter biomass within the project boundary

¹⁸¹ Heringer, I., & Jacques, A. V. A. (2011). Effect of burning and management alternatives on forage litter composition of a native pasture. Available at: <https://uknowledge.uky.edu/igc/19/9/10/>

¹⁸² Fernández, J. A., Schroeder, M. A., Goldfarb, M. C., & Bernardis, A. C. (2011). Efecto de la frecuencia de quema prescrita sobre la composición mineral de los pastizales en el nordeste argentino. *Ecología Aplicada*, 10(1), 23-29. Available at: http://www.scielo.org.pe/scielo.php?pid=S1726-22162011000100003&script=sci_arttext

Likewise, it is expected that the dead wood and litter carbon pools will not increase in the baseline in line with the description above. Given it corresponds to an optional pool, and expected to increase in the project scenario, it is considered null in the baseline.

Thus,

$$\Delta C_{BSL,t} = 0$$

7.3 Project Emissions

The monitoring period of this report is from the start date (01/09/2022) to November 16th, 2023, which is the date the last parcel from the inventory was measured. The actual net greenhouse gas removals by sinks were estimated using the following equation described in the methodology:

$$\Delta C_{ACTUAL} = \Delta C_P - GHG_E$$

Where,

ΔC_{ACTUAL} = Actual net greenhouse gas removals by sinks; tCO₂-e

ΔC_P = Sum of the changes in above-ground and below-ground tree biomass, dead wood, litter and soil organic carbon stocks in the project scenario; tCO₂-e

GHG_E = Increase in GHG emissions as a result of the implementation of the proposed A/R CDM project activity within the project boundary; tCO₂-e

Stratification:

Stratification was defined according to section 5.3 of the "AR-ACM0003 A/R Consolidated Large Scale Methodology Afforestation and reforestation of lands except wetlands Version 02.0". The methodology states that if the distribution of biomass in the project area is not homogeneous, stratification should be performed to improve the accuracy of biomass estimation.

For actual net GHG removals, for the areas monitored under this monitoring event, apart from the stratification originally based on the project planting plan -considering the year of plantation- and the species combination a sub-stratification was considered for stratum 5 and 6 based on the growth homogeneity observed during this first monitoring period.

GHG emissions:

According to methodology AR-ACM 0003 v.2.0, section 5.5, 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 zero¹⁸³.

The use of fire for site preparation and/or to clear the land of harvest residue prior to replanting will not take place as the project does not include harvesting, thus excluded from the project management. Hence, project emissions are estimated as zero.

$$GHG_{E,t} = 0$$

Carbon stock changes:

ΔCP is the sum of the changes in above-ground and below-ground tree biomass, dead wood, litter and soil organic carbon stocks in the project scenario. Calculations are described below:

$$\Delta C_p = \Delta C_{TREE} + \Delta C_{DW} + \Delta C_{LI} + \Delta C_{SOC}$$

Where,

ΔC_p = Change in carbon stock in all selected carbon pools in the project scenario, tCO₂-e

ΔC_{TREE} = Change in carbon stock in tree biomass in project, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; tCO₂-e

ΔC_{DW} = Change in carbon stock in dead wood biomass in project, 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”; tCO₂-e

ΔC_{LI} = Change in carbon stock in litter biomass in project, 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”; tCO₂-e

ΔC_{SOC} = Change in carbon stock in SOC in project, in areas of land meeting the applicability conditions of the tool “Estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”, as estimated in the same tool; tCO₂-e

Neither ex-ante estimations, nor this monitoring period estimations accounted for dead wood, litter and soil organic carbon pools in the project. Following is presented the equation used for the estimation of ΔCP :

$$\Delta C_p = \Delta C_{TREE}$$

¹⁸³ Project emissions ex-ante calculations include fuel used in machinery. This value is equal to 0,07tCO₂/ha. The estimation is included in ex-ante spreadsheets available to VVB during validation/verification.

Where:

ΔC_p = Change in carbon stock in all selected carbon pools in the project scenario; tCO₂-e

ΔC_{TREE} = Change in carbon stock in tree biomass in project, 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”; tCO₂-e

Biomass carbon pools

Above and below ground biomass have been estimated according to the AR TOOL 14 “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activity Version 4.2”. Carbon estimations in trees are based on field measurements of monitored parameters, described in section 7.1 for this monitoring period. Calculations are archived as part of the project verification and will be available for the verification team¹⁸⁴.

The aboveground biomass corresponds to tree biomass, no shrubs are considered for estimation. The method used for estimating change in carbon stock in trees is in section 8.1.1 of the mentioned tool: “estimation of carbon stock in trees at a point in time”, using estimation based on sample plots, in this case random stratified sampling.

Plot biomass measurement

First, based on Appendix 1 (Methods of plot biomass measurement) of the tool, the plot biomass value was determined as follows, based on the results from the forest inventory for the monitoring period:

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

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

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

Where,

¹⁸⁴ See calculation spreadsheet in shared folder “Monitoring plan>Forest Inventory-Verification I”

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

$B_{TREE\ p,i}$ = Tree biomass in sample plot p of stratum i ; t.d.m.

$A_{PLOT\ i}$ = Size of sample plot in stratum i ; ha

$B_{TREE\ j,p,i}$ = Biomass of trees of species j in sample plot p of stratum i ; t.d.m.

$B_{TREE\ l,j,p,i}$ = Biomass of tree l of species j in sample plot p of stratum i ; t.d.m.

During this monitoring period, and for the studied species (Eucalyptus), to estimate above and below ground biomass the volume to biomass conversion was avoided as the allometric equation results in dry total above-ground biomass value (kg). In this line, an adaptation to equation 5 of the tool was used was used:

Equation 5 in the tools is:

$$BTREE_{j,p,i,t} = VTREE_{j,p,i,t} * DJ * BEF_{2,J} * (1 + R_j)$$

While in this case, total biomass (above and below-ground) was estimated as follows:

$$BTREE_{j,p,i,t} = AGB_{j,p,i,t} * (1 + R_j)$$

Where,

$BTREE_{j,p,i,t}$ = Biomass of trees of species j in sample plot p of stratum i at late 2023. (t d.m)

$AGB_{j,p,i,t}$ = Above-ground biomass of trees of species j in sample plot p of stratum i at late 2023. (t d.m)

R_j = Root-shoot ratio for tree species j ; dimensionless.

The values applied were taken from the suggested equation from the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs": $R = [-1.085 + 0.9256 \times (A)] / A$. Where A is aboveground biomass content (t.d.m./ha). The aboveground biomass was calculated per year of plantation and different values were obtained.

$V_{TREE,j,p,i,t}$ = Stem volume of tree l of species j in sample plot p of stratum i, estimated from the tree dimension(s) as entry data into a volume table or volume equation; m³
In this case, the allometric equation used provides biomass values in kg.

For *Eucalyptus*, the equation used is the one recommended for Northeast region by the National Institution of Agricultural Technology (INTA) from Winck, R.A; et al. (2015) ¹⁸⁵

$$\ln(\text{total biomass (kg)}) = -3.32 + 2.12 * \ln(\text{DBH}) + 0.65 * \ln(H)$$

D_j = Density (over-bark) of tree species j; t d.m. m⁻³ Values are taken from Table 3A.1.9 of IPCC GPGULUCF 2003 unless transparent and verifiable information can be provided to justify different values.
(not used during this monitoring period as the allometric equation used results in biomass values (kg)

$BEF_{2,j}$ = Biomass expansion factor for conversion of tree stem biomass to above-ground tree biomass, for tree species j; dimensionless. Not used in this monitoring period as the equation used results in total above-ground biomass

A summary of key data used for calculations is detailed below:

	Species	Key data	Reference
Carbon fraction	All	0.47	IPCC Guidelines for National Greenhouse Gas Inventories . 2006. Table 4.3.
Biomass Expansion Factor (BEF)	<i>E. grandis</i> and <i>P.elliottii</i>	1.15	CDM_AR_tool_14. "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities". Page 26
	Native Mix*	2.00	
Wood density (kg/m3)	<i>E. grandis</i>	0.56	INTI-CITEMA
	<i>P. taeda</i>	0.46	
	<i>P. Hybrid</i>	0.41	
	Native Mix*	0.74	
Root/Shoot Ratio (R)	Trees	$R = \frac{\text{EXP}(-1,085 + 0,9256 * \ln B)}{B}$	CDM_AR_tool_14. "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities". Page 25
Plot area (ha)	All	0.04	
Factor C to CO2	All	3.67	CDM_AR_tool_14. "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities". Page 14
Species	Volume and tree Biomass equations	Comments	Reference
<i>E. grandis</i>	$(\text{EXP}[-3,32 + 2,12 * \ln(\text{DBH}) + 0,65 * \ln(H)])$		Winck et al, 2015
<i>P. taeda</i>		No monitoring	
<i>P. Hybrid</i>		No monitoring	
Native Mix		No monitoring	

Mean tree biomass per hectare in a stratum (b_{TREE}) and the associated variance (s_i^2) was estimated as follows:

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

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

¹⁸⁵Winck, R.A; et al. (2015) Modelos predictivos de biomasa aérea de *Eucalyptus grandis* para el Noreste de Argentina. *Ciència Florestal*, vol. 25, núm. 3, julio-septiembre, pp. 595-606. Universidade Federal de Santa Maria.

Where,

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

n_i = Number of sample plots in stratum i

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

Strata biomass measurement

In line with this method, mean carbon stock in trees within the tree biomass estimation strata and the associated uncertainty was estimated as follows:

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

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

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

$$u_C = \frac{t_{VAL} \times \sqrt{\sum_{i=1}^M w_i^2 \times \frac{S_i^2}{n_i}}}{b_{TREE}}$$

Where,

C_{TREE} = Carbon stock in trees in the tree biomass estimation strata; tCO₂-e

CF_{TREE} = Carbon fraction of tree biomass; t C (t.d.m)⁻¹

A default value of 0.47 was used.

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 = Ration 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_{TREEi} = Mean tree biomass per hectare in stratum *i*; t.d.m. ha⁻¹
- Uc = Uncertainty in C_{TREE}
- T_{val} = Two-sided Student's t-value for a confidence level of 90 percent 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*

Summary results per sub-stratum are shown below:

	Substratum	Average AGB (Tdm/ha)	Average AGB+BGB (Tdm/ha)	Average C Tree (tCO2e/ha)	Standard deviation AGB+BGB Biomass (tdm/ha)	Area (ha)	Number plots	Age (years)
E.grandis	5.1	2.345	3.084	5.314	1.45	0.28	7	1.13
E.grandis	6.1	6.129	7.926	13.659	3.83	0.48	12	1.13
E.grandis	6.2	4.348	5.649	9.734	3.50	0.52	13	1.13

Regarding uncertainty values, considering a tval of 1.696, the uncertainty assessed for CTREE was equal to 17.5%, above the 15% threshold. Hence, discounts over the CTREE were applied due to uncertainty:

Year	Management Unit (MU)	N° Plots	Sp	Eligible Area (Ha)	Monitored area (Ha)	Percentage of area sampled (%)	Total biomass (tn/ha)	wi	si	wi*bTRE E _i	wi ² *si ² /ni
Q4 2022	Puerto Valle	7	grandis 625 hom	56.5	0.3	0.5	3.1	0.4	1.5	1.2	0.05
Q4 2022	Puerto Valle	12	grandis 1250 hom	22.8	0.5	2.1	7.9	0.2	3.8	1.2	0.03
Q4 2022	Puerto Valle	13	grandis 1250 het >	65.3	0.5	0.8	5.6	0.5	3.5	2.6	0.19
		32		144.6	1.3						

Summary results per stratum are shown below:

Plantation Year	Species	Stratum	Eligible area (ha)	Average biomass (AGB+BGB) (t/ha)	wi	Standard deviation AGB+BGB Biomass (tdm/ha)	Uncertainty correction (tdm/ha)	AGB+BGB corrected (tdm/ha)	AGB+BGB in the stratum (tdm/stratum)	Total Carbon (tCO ₂ /stratum)	Buffer pool allocation (tCO ₂ /stratum)	Net carbon /strata Buffer 25% NPRT
Q4 2022	Eucalyptus	5.1	56.47	3.084	0.391	1.451	0.73	2.4	133.2	229.0	57.0	172.0
Q4 2022	Eucalyptus	6.1	22.78	7.926	0.158	3.826	1.91	6.0	137.0	236.0	59.0	177.0
Q4 2022	Eucalyptus	6.2	65.32	5.649	0.452	3.497	1.75	3.9	254.8	439.0	109.0	330.0
		Total	144.57	5.55	1.00			3.6	524.9	904.0	226.0	678.0

7.4 Leakage Emissions

As it has been stated in previous sections of this document, the methodology requires the assessment of sources of leakage due to activity displacement (conversion from grazing land to forestry). Application of the tool “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” led to the conclusion that this source can be neglected.

The Project activity does not expect any displacement of agricultural activities present in the Project’s boundary before the beginning of it, as all cattle has been sold to slaughterhouses¹⁸⁶, thus leakage emissions are considered insignificant and hence accounted as zero.

According to the methodology AR-ACM 0003 v.2.0, section 5.6, leakage emissions shall be estimated as follows:

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

Where,

LK_t = GHG emissions due to leakage, in year t; tCO₂-e

LK_{AGRIC, t} = Leakage due to the displacement of agricultural activities in year t, as estimated in the toll “Estimation of the increase in GHG emissions attributable

¹⁸⁶ Sale invoices available to VVB during validation/verification in shared folder “Leakage”

to displacement of pre-project agricultural activities in A/R CDM project activity”;
tCO₂-e

According to the “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” tool v.2, leakage emission attributable to the displacement of agricultural activities due to implementation of an A/R CDM project activity is estimated as the decrease in carbon stocks in the affected carbon pools of the land receiving the displaced activity.

Thus, it is concluded that the displacement of agricultural activities is considered insignificant and hence accounted as zero.

$$LK_t = 0$$

7.5 GHG Emission Reductions and Carbon Dioxide Removals

Net anthropogenic GHG removals by sinks is estimated as the actual net GHG removals by sinks minus the baseline net GHG removals, minus leakage. The following general formula described in the methodology is used to calculate the net anthropogenic GHG removals by sinks of an A/R project activity, in t CO₂-e:

$$C_{AR-CDM} = \Delta C_{ACTUAL} - \Delta C_{BSL} - LK$$

Where,

C_{AR-CDM}	=	Net anthropogenic GHG removals by sinks; tCO ₂ -e
ΔC_{ACTUAL}	=	Actual net GHG removals by sinks; tCO ₂ -e
ΔC_{BSL}	=	Baseline net GHG removals by sinks; tCO ₂ -e
LK	=	Total GHG emissions due to leakage; tCO ₂ -e

Based on the methodology and parameters detailed in section 7.1 to 7.4 for this monitoring period Net anthropogenic GHG removals by sinks, before uncertainty discounts, equals 1,247tCO₂e as a result of actual net GHG removals by sinks for the strata considered during this monitoring period (144.6ha), as there is no baseline removals nor leakage emissions.

In addition, taking into consideration that plantation of the considered strata took place in the last quarter of 2022, only in 2023 net anthropogenic GHG removals are reported.

Moreover, uncertainty is estimated and when higher than 10% a correction factor is used in accordance to methodology tool AR TOOL 14:

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

Where,

U_C = Uncertainty in C_{TREE}

T_{val} = Two-sided Student's t-value for a confidence level of 90 percent 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

w_i = Ration 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} = Mean tree biomass per hectare in the tree biomass estimation strata; t.d.m ha^{-1}

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

For this monitoring period, the value equals 17.5% which in accordance to the tool means a 50% correction factor to the standard deviation included in the table below:

Plantation Year	Species	Stratum	Eligible area (ha)	Average biomass (AGB+BGB) (t/ha)	w_i	Standard deviation AGB+BGB Biomass (tdm/ha)	Uncertainty correction (tdm/ha)	AGB+BGB corrected (tdm/ha)
Q4 2022	Eucalyptus	5.1	56.47	3.084	0.391	1.451	0.73	2.4
Q4 2022	Eucalyptus	6.1	22.78	7.926	0.158	3.826	1.91	6.0
Q4 2022	Eucalyptus	6.2	65.32	5.649	0.452	3.497	1.75	3.9
Total			144.57	5.55	1.00			3.6

Regarding buffer pool allocation, the table below summarizes the value considered:

State the non-permanence risk rating (%)	25%
Has the non-permanence risk report been attached as either an appendix or a separate document?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
For ARR and IFM projects with harvesting, state, in tCO _{2e} the Long-term Average (LTA).	Not occurring
Has the LTA been updated based on monitored data, if applicable?	<input type="checkbox"/> Yes <input type="checkbox"/> No Not estimated
State, in tCO _{2e} , the expected total GHG benefit to date	904
If a loss occurred (including a loss event or reversal), state the amount of tCO _{2e} lost:	No loss event or reversal took place

In summary, total VCU issuance eligible per vintage for this first monitoring period are shown in the table below:

Vintage period	Baseline emissions (tCO _{2e})	Project emissions (tCO _{2e})	Leakage emissions (tCO _{2e})	Buffer pool allocation (tCO _{2e})	Reductions VCUs (tCO _{2e})	Removals VCUs (tCO _{2e})	Total VCU issuance (tCO _{2e})
01-Sep-2022 to 31-Dec-2022	0	0	0	0	0	0	0
01-Jan-2023 to 16-Nov-2023	0	0	0	226	0	904	678
Total	0	0	0	226	0	904	678

Vintage period	Ex-ante estimated removals	Achieved removals	Percent difference	Explanation for the difference
01-Sep-2022 to 31-Dec-2022	-36	0	0	No removals are estimated for this period, considering a very short period since plantation (last quarter of 2022). Ex-ante estimations were calculated taking into consideration project emissions from fuel combustion of machinery during land preparation, although insignificant, while in the project removals ex-post this source is not considered in line with methodology.
01-Jan-2023 to 16-Nov-2023	971	904	-6.91%	Not all the project area was monitored and so carbon removals for part of the project area was not included in these achieved removals total. Moreover, ex-ante estimations are based on growth projection software while achieved reductions depend on many variables occurring on site. At young age differences can be significant and associated with the first year's conditions for plant establishment, such as weather. In this case, the monitoring period was characterized by abundant precipitations.
Total	971	904	-6.91%	

APPENDIX 1: COMMERCIALY SENSITIVE INFORMATION

No commercially sensitive information

APPENDIX 2: CATTLE SALES TO SLAUGHTERHOUSE INVOICE

Colombo y Magliano S.A.
Comigratarios

Remates Forjas - Consignaciones - Ventas de Campos
Avda. de Mayo 580 1º Piso - C1064AAN - Bs. As. - Tel.: 4334-9511 - Fax: 4343-3618
Internet: <http://www.colomboymagliano.com.ar>
E-Mail: cym@colomboymagliano.com.ar

I.V.A.: RESPONSABLE INSCRIPTO

GARRUCHOS FORESTACION S.A.

AVDA URUGUAY 4578
C.P. 3300 POSADAS

N - Misiones

I.V.A. Responsable Inscripto

Cuenta N°: 35511

C.U.I.T.: 33-65810857-9

A	N° 1045-00002869
Código N° 180	Fecha: 17/10/2022
CUENTA DE VENTA	
C.U.I.T.: 30-5076053-5 N° INSCRIPCIÓN ING. BRUTOS UNIFICADO CONVENIO MULTILATERAL N° 901-915292-6	O N C C A. 034620-4 A. N. ADUANAS: 14.991/3-3 INICIO ACTIVIDADES: 22-12-99

78° REMATE TELEVISADO DEL N.O.A
MIÉRCOLES 21 DE SEPTIEMBRE DEL 2022 -
TRANSMISIÓN EN VIVO VIA STREAMING Y CANAL RURAL

RAZON SOCIAL	CABEZAS	CLASIFICACION	KILOS	PROM.	PRECIO	IMPORTES PARCIALES
EL VIRACHO S.A.	21	TERNERA/S	4.620	220	375.000	1.732.500,00
TOTAL CABEZAS	21	TOTAL KILOS	4.620		IMPORTE BRUTO	1.732.500,00



ADMINISTRACION CENTRAL
Urquiza 454 (3240) Villaguay E.R.
03455-421050
haciendavillaguay@viguay.com.ar
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RESPONSABLE INSCRIPTO



SEDE CORRIENTES
Pellegrini 2072
(3400) Corrientes
0379-4690697
www.umcsa.net

A
CUENTA DE VENTA Y LIQUIDO PRODUCTO SP
180
0005-00014398

Fecha: 21/09/2022

HACIENDAS VILLAGUAY S.R.L.

C.U.I.T.: 30-58511655-2
Ing. Brutos: 30-58511655-2
Inicio de Actividades: 01/04/1981

CUIT: 33-65810857-9
3327

R.Social: **GARRUCHOS FORESTACION S A**
Dirección: **ruta 12 km 1346.50 0**
Localidad: POSADAS
Provincia: MISIONES
Cond.IVA: RESPONSABLE INSCRIPTO

REMATES TELEVISADOS - INVERNADA						
Razón social	RP	Cabezas	Categoría	Kilos	Precio	Importe
BOLLO Y CIA. S.A.		53	VACAS	22.144	242,0000	5.358.848,00



ADMINISTRACION CENTRAL
 Urquiza 454 (3240) Villaguay E.R.
 03455-421050
 haciendasvillaguay@viguay.com.ar
 www.haciendasvillaguay.com.ar

RESPONSABLE INSCRIPTO

R.Social: **GARRUCHOS FORESTACION S A**
 Dirección: **RUTA 12 KM 1346.50 0**
 Localidad: POSADAS
 Provincia: MISIONES
 Cond.IVA: RESPONSABLE INSCRIPTO



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180

CUENTA DE VENTA Y LIQUIDO PRODUCTO SP
0005-00014397

Fecha: 21/09/2022

HACIENDAS VILLAGUAY S.R.L.

C.U.I.T.: 30-58511655-2
 Ing. Brutos: 30-58511655-2
 Inicio de Actividades:01/04/1981

CUIT: 33-65810857-9
3327

REMATES TELEVISADOS - INVERNADA

Razón social	RP	Cabezas	Categoría	Kilos	Precio	Importe
MANUEL ALBERTO GIMENEZ		45	VACAS	19.067	242,0000	4.614.214,00

MARZO

Comunidad vecina

En marzo continuamos acompañando a la comunidad vecina continuamos con los aportes en la Escuela del Paraje San Alonso. Realizamos el control de hormigas en el parque de la Escuela primaria 152 de Paraje Colonia Unión.

Nos preparamos para el voluntariado corporativo en los barrios El Provenir 1 y 2 y en la Escuela primaria 222 del Paraje Santa Tecla, donde esperamos la participación de las familias.

Participación

Durante marzo participamos de reuniones de Grupo de trabajo de la Comisión de ambiente. Participamos de las reuniones de Consejo Directivo de AFOA y en la Mesa de Carbono forestal. Continuamos con la participación en el Grupo de Trabajo Empresas Forestales FSC.

También participamos de la mesa de mujeres forestales en el panel en la mesa temática "El rol de las mujeres en el sector forestal", en donde compartió su experiencia profesional con otras colegas de América Latina.



Estuvimos en el Congreso Forestal Latinoamericano y Argentino (CONFLAT). Estuvimos como disertantes en el Simposio "Aportes de la sociedad al desarrollo y la conservación forestal", sobre los programas educativos y de monitoreo y conservación de fauna participativa.



3.4 Programme “Más bosques, más futuro” evidence with Garruchos community

Jornada Educativa

Realizamos una jornada presencial del Programa Educativo “Más bosques más futuro” en la Escuela primaria de Garruchos. Participaron un total de 144 alumnos, de los cuales 24 fueron de nivel inicial, 70 de primer ciclo, y 50 de segundo ciclo. Durante la jornada se desarrollaron los tres ejes temáticos del programa en el espacio principal del centro educativo, donde tuvo lugar seguidamente las propuestas de juego para cada tema. El cierre estuvo presidido por la Sra. Directora Lilita Franco, quien nos hizo entrega de ilustraciones y otros presentes elaborados por las niñas y niños, junto con sus Maestras. Pomer hizo entrega de las lámina de ecorregiones, fauna silvestre, e infografías de los temas tratados. Participaron del equipo de Pomer maderas de zona Uruguay con el acompañamiento de la visita de FSC Internacional.



APPENDIX 4 – IDENTIFICATION OF DEGRADED LANDS -DATA REQUIRMENTS UNDER AR-ACM0003

Following the A/R Large-scale Consolidated Methodology for “Afforestation and reforestation of lands except wetlands”, the project “Mixed afforestation with native and non-native species in Argentina I” presents its data requirements under the methodology in this Annex.

In order to further evidence the compliance of section 3.19.29 of VCS Standard V.4.6 on degraded lands condition, the Tool A/R Methodological “Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities”. The result from this analysis is added to the evidence that the project area corresponds to modified natural ecosystems, mainly, due to years of cattle grazing, with pasture implantations as well as small areas which have previously been planted with non-native species.

First, it must be stated that the project is located in the Puerto Valle and Garruchos establishments, department of Ituzaingó and Santo Tomé, respectively, in the province of Corrientes, Argentina. As it can be seen in the Mapping of IPCC Climate Zone, northeast Argentina is categorized as Tropical moist (Figure 1). This category is confirmed by Earth Engine Apps, using IPCC Climate Zone layers, where the departments of Santo Tomé and Ituzaingó are well located in a Tropical Moist climate (Figure 2).

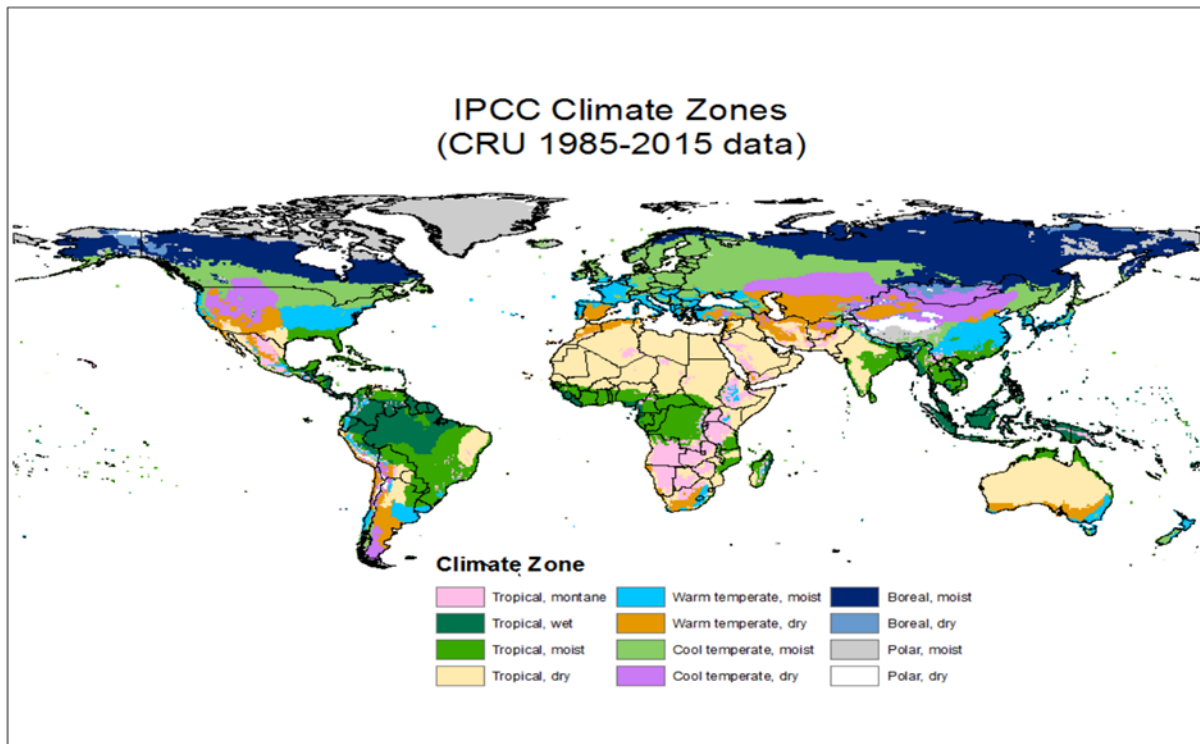


Figure 46 Mapping of IPCC climate zones (taken from Volume 4, Chapter 3, Annex 3A.5).
 Extracted from Gavrilova et al. (2019).

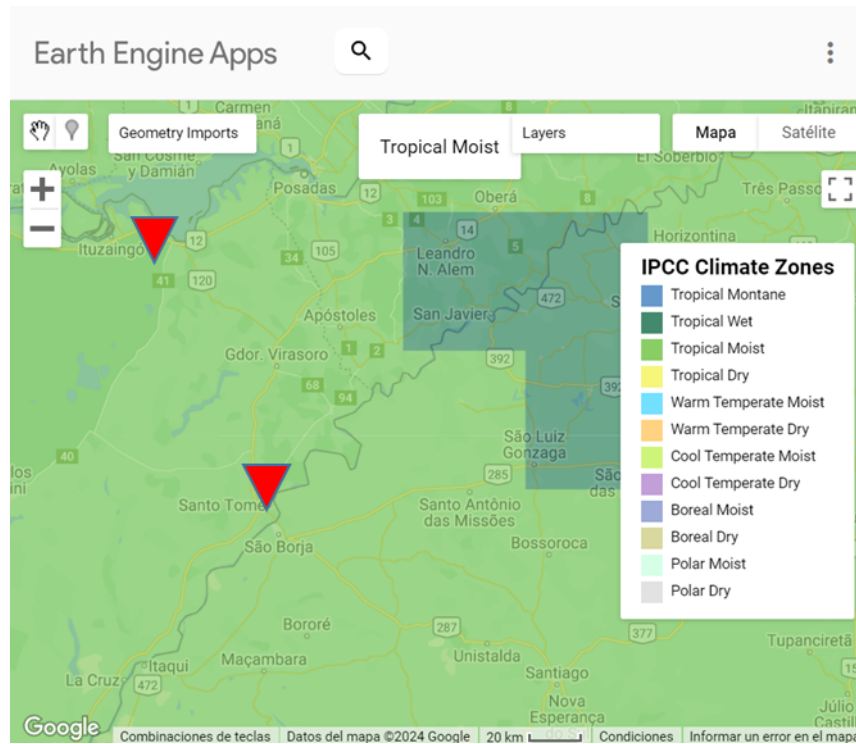


Figure 47. Location of the department of Ituzzaingó and Santo Tomé in a tropical moist climate (marked in red), within the Earth Engine App and IPCC Climate Zones layers.

Regarding the “Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities”, we use an approach based on spectral indices developed by Pereira et al. (2023). Pereira et al. (2023) assessed the degradation of “Malezales” in the western part of the department of Santo Tomé (near Garruchos and Puerto Valle) and concluded that the “Malezales” were degraded. To assess the degree of degradation of Garruchos and Puerto Valle, we carried out the same analysis using vegetation cover (VC) and the pasture degradation index (IDP) as a proxy for environmental degradation. VC was calculated as a spectral index that estimates vegetation cover using NDVI, and IDP is an index that determines the level of degradation of a given area based on VC.

VC was calculated using the following equation:

$$VC = (NDVI - NDVI_s) / (NDVI_v - NDVI_s) \quad \text{(Equation 1)}$$

Where NDVI is the actual value of NDVI in the terrain, NDVI_s is the lowest NDVI value for bare ground and NDVI_v is the maximum NDVI value in grasslands areas. All the NDVI values were obtained and estimated from Landsat 5, 8 and 9.

Seven steps were carried out to calculate the VC. First, NDVI values were obtained from Landsat 5, 8 and 9 for the period January 2010 - December 2022. Second, a classifier was created to classify the images into two classes: vegetation cover and bare ground. The classifier was trained by identifying areas of bare ground and vegetation cover by remote sensing in a Landsat composite from October to December 2022. Third, the median NDVI for each year was calculated for the wet season (1 February to 30 April), and for the dry season (1 July to 30 September). Fourth, the images for each year and season were classified into vegetation cover and bare soil. Fifth, NDVIs was calculated as the 1st percentile NDVI value of all pixels classified as bare ground. The 1st percentile was used in order to remove outliers. Sixth, the NDVI value was calculated as the 99th percentile of all pixels classified as grassland from the 2022 Mapbiomas Pampa and Mapbiomas Chaco land cover classification. The 99th percentile was used in order to remove outliers. Seventh, the VC was calculated as in Equation 1 and the values were classified into different degradation categories as shown in Table 1. This classification used in Pereira et al. (2023) is derived from Pereira et al. (2018).

Pereira et al. (2023) used two classifications of grassland degradation according to VC, one developed by Pereira et al. (2018) for grasslands in Minais Gerais, Brazil, and another developed by Gao et al. (2006) for grasslands in northern Tibet, China (Table 1). In this Annex, the Pereira et al. (2018) classification has been used instead of Gao et al. (2006) for two reasons. First, because it was developed for grasslands in Brazil, which are geographically and climatically closer to the Garruchos and Puerto Valle grasslands than those studied in Gao et al. (2006). Secondly, because we consider it to be a conservative assumption, since the lower limit of “No Degradation” is lower in Pereira et al. (2018). We know that the upper limit of “Extreme Degradation” is higher in Pereira et al. (2018), but we consider that the upper limit of “Strong Degradation” is similar in both classifications and for the practical purposes of this Annex, the distinction between “Strong” and “Extreme Degradation” is not of particular interest.

Table 9 Degradation level and score classification based on Vegetation Cover (VC) values from Pereira et al. (2018) and Gao et al. (2006).

Score - Degradation level	VC - Pereira et al. (2018)	VC - Gao et al. (2006)
1 - No Degradation	≥ 77.5 %	≥ 90 %
2 - Light Degradation	71 - 77.5 %	75 - 90 %
3 - Moderate Degradation	63.5 - 71 %	60 - 75 %
4 - Strong Degradation	45 - 63.5 %	30 - 60 %
5 - Extreme Degradation	≤ 45 %	≤ 30%

Pereira et al. (2023).

The IDP index for each site was calculated using the following equation

$$IDP = (\sum_{i=1}^5 Di \times Ai) / A \tag{Equation 2}$$

Where IDP is the pasture degradation index, D_i is the degradation level score (Table 2), A_i is the area corresponding to each degradation level, and A is the total pasture area. First, a zonal histogram of the 2022 wet season VC image was performed to obtain the number of pixels occupied by each degradation category for each site. Secondly, equation 2 was applied to each site. The number of pixels of category i within the site was used as the value of A_i , and the number of pixels of the whole site was used as the value of A . Finally, the IDP values of each site were classified into the categories defined in Table 2.

Table 10 Interpretation of IDP Values (Gao et al., 2006)

Pasture Degradation Index (IDP)	Degradation Status
$IDP \leq 1$	No Degradation
$1 < IDP \leq 2$	Slight Degradation
$2 < IDP \leq 3$	Moderate Degradation
$3 < IDP \leq 4$	Strong Degradation
$4 < IDP$	Extreme Degradation

Pereira et al. (2023).

As a first result, the VC image of the 2022 wet and dry season was obtained for Garruchos and Puerto Valle, classified according to the degradation categories from Table 1 (Figures 3 and 4). For Garruchos farm plantation sites, Figure 1 shows a predominance of Moderate and Strong Degradation pixels in the wet season, and a predominance of Strong Degradation pixels in the dry season. For Puerto Valle farm, Figure 4 shows a predominance of No degradation Pixels in the wet season, however in the dry season, half of the plantation sites have a predominance of Strong and Extreme degradation, and half has a predominance of No degradation.

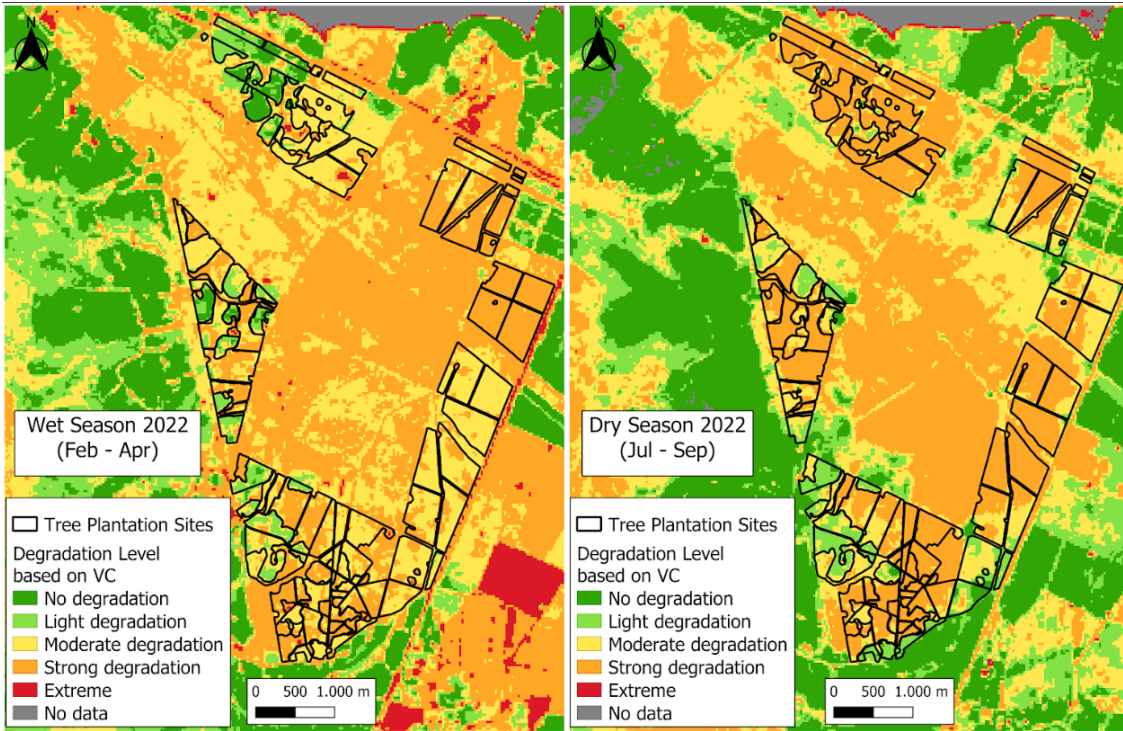


Figure 48 Degradation levels map for wet and dry season based on Vegetation Cover (VC) for Garruchos farm. The wet season map is presented on the left side, and the dry season map on the right.

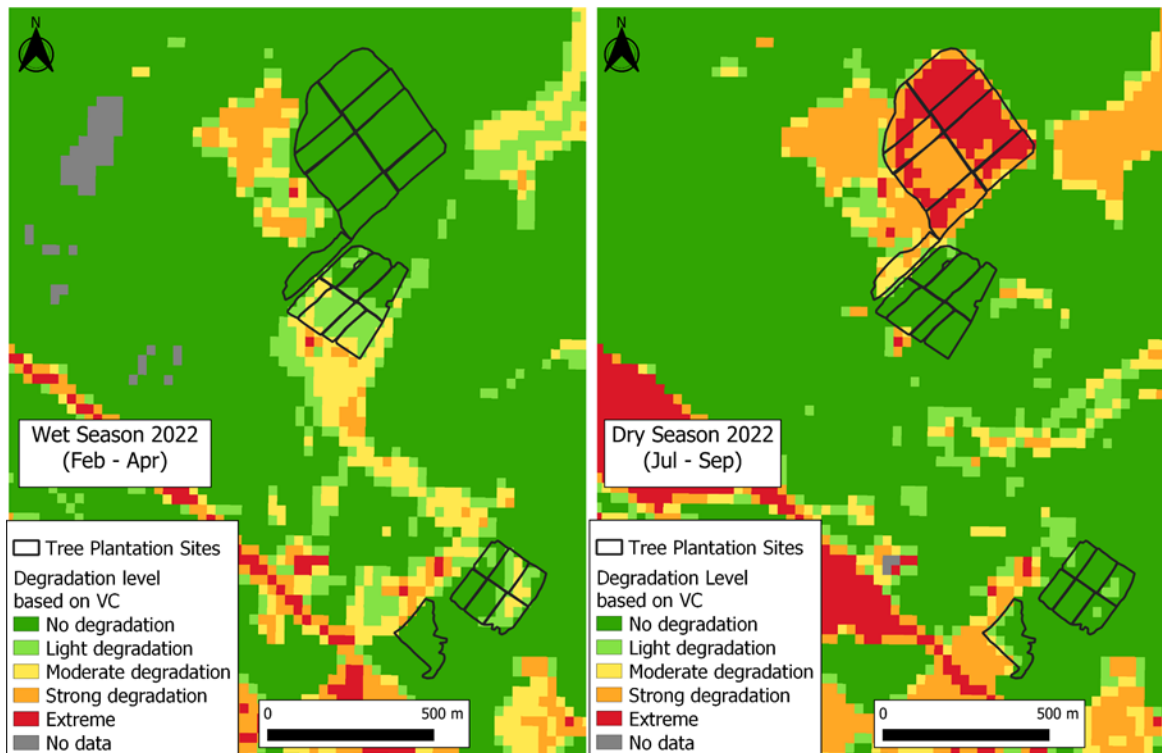


Figure 49. Degradation levels map for wet and dry season based on Vegetation Cover (VC) for Puerto Valle farm. The wet season map is presented on the left side, and the dry season map on the right.

As a second output, the plantation plots were analyzed with the IDP index. For this analysis, we calculated the number of plots and the sum of plot areas in each IDP degradation category (Figures 5). In terms of number of plots, Figure 5a shows that for the wet season 80% of the plots have Moderate and Strong Degradation (60% Strong and 20% Moderate Degradation) and 20% has Slight and No degradation. For the dry season it shows that approximately 90% of the plots have Moderate, Strong and Extreme degradation, while only 10% has Slight or No Degradation. However, in terms of plot areas (Figure 5b), for both wet and dry season, less than 10% of the area has Slight or No Degradation. Approximately 75% of the area has Strong or Extreme Degradation, and 15% of Moderate Degradation.

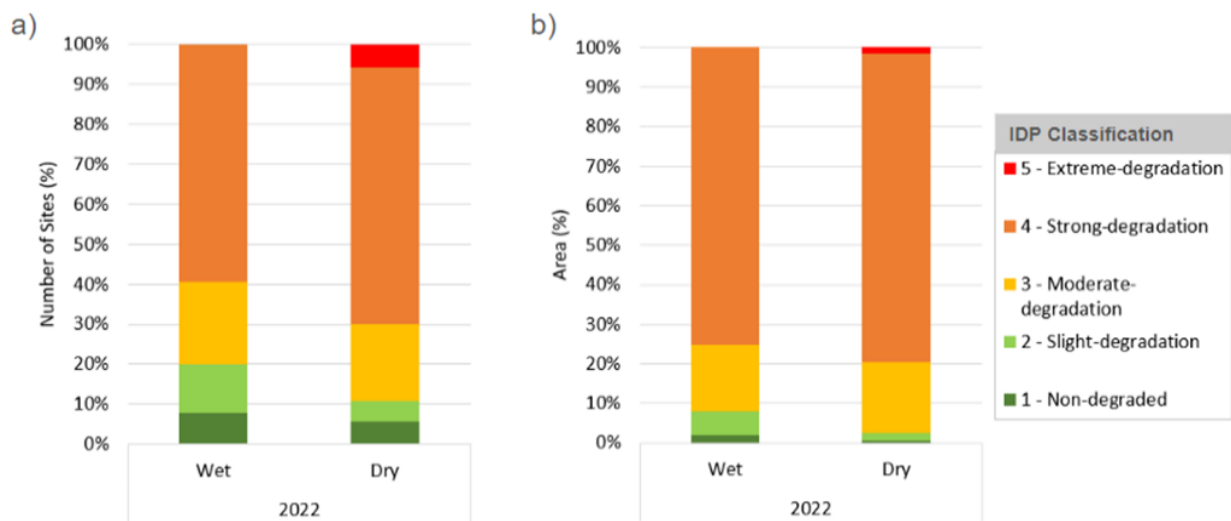


Figure 50 2022 wet and dry season column bar charts for percentage of plots (a) and percentage of areas (b) in each IDP degradation category.

In conclusion, the analysis of the spectral indices associated with degradation shows that most of Garruchos and Puerto Valle grasslands are degraded. Considering that lands are identified as degraded using the "Tool for identification of degraded or degrading lands for consideration in implementing CDM A/R project activities", the value used for f_{MG} should be 0.70, corresponding to the severely degraded level.

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APPENDIX 5 – DEVELOPMENT OF GROWTH CURVES FOR EX-ANTE ESTIMATES

Estimates of Pinus, Eucalyptus and native species growth were made using different softwares and bibliography:

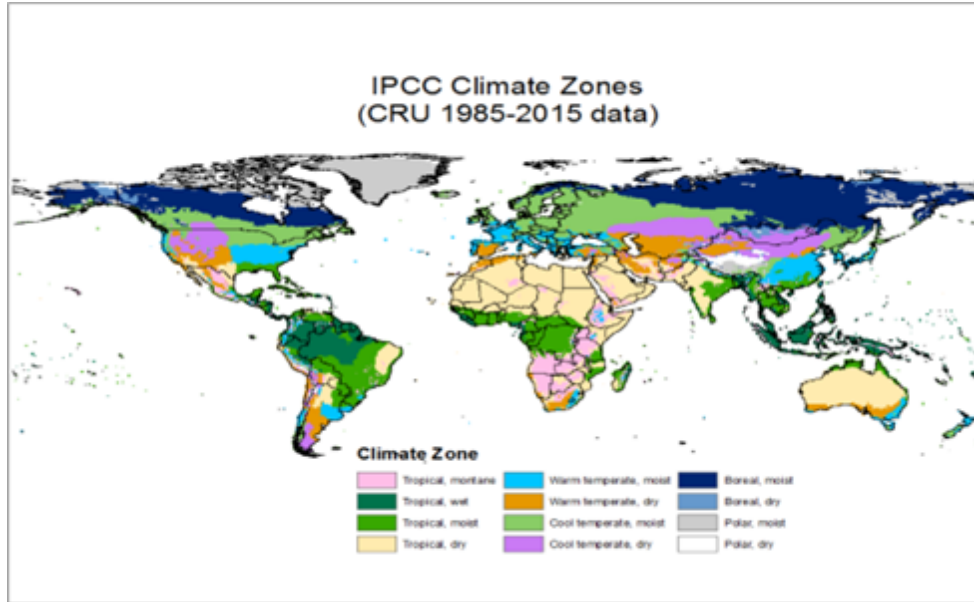
1. SIS Eucalipto models developed by Embrapa florestas¹
2. PlaForNEA models developed by INTA for Pinus²
3. Arturi, M.F; et al. (2008) for *Enterolobium contortisiliquum* and adjusted based on a general sigmoidal growth curve.

EMBRAPA florestas

The Brazilian Agricultural Research Corporation (EMBRAPA - Empresa Brasileira de Pesquisa Agropecuária) is a Brazilian federal public institution linked to the Brazilian Ministry of Agriculture, Livestock and Supply, founded on 26 April 1973, whose objectives are to develop technologies, knowledge and technical and scientific information for Brazilian agriculture and livestock. Its mission is to create research, development and innovation solutions for the sustainability of agriculture for the benefit of Brazilian society. It operates with a system composed of 41 research centres, five service units and 17 central units, present in almost all states of the Federation, with 9790 employees, of which 24444 are researchers. It works in coordination with the National System of Agricultural Research - SNPA - which is made up of federal and state public institutions, universities, private companies and foundations that collaborate to carry out research in different geographical areas and fields of scientific knowledge.

Embrapa is a case of successful institutional innovation that has as main characteristics: a public corporation model of organization; scale of operation at national level; spatial decentralization; specialized research units; enhanced training and remuneration of human resources and a vision of an agriculture based on science and technology. Moreover, from the beginning the organization has always been result oriented. Based on the perception of one who has participated in its life from the beginning, first as one of the formulators of the Embrapa project, then as a leader for twelve years – both as director and president, and finally as a researcher, I will try to describe the main factors that paved Embrapa's road to success³.

More than 50% of the Brazilian territory lies in the same IPCC climate zone as the project area (Figure 1). In this sense, Embrapa's SIS models take into account very similar ecoregional conditions from Corrientes Province, where the project is located.



**Figure 51 Mapping of IPCC climate zones (taken from Volume 4, Chapter 3, Annex 3A.5).
Extracted from Gavrilova et al. (2019).**

The Campos y Malezales ecoregion (see sections 1.13 and 1.14 for more details) is also shared with the Brazilian department of Rió Grande do Sul^{4 5}. The environmental proximity of the Brazilian forest areas and the Corrientes province in Argentina makes the Embrapa SIS models one of the most widely used for estimating pinus and eucalyptus growth in the region. In this case, it was only selected to estimate Eucalyptus projections as it is believed to have a much wider data base for this species than PlaForNEA, which was selected for Pinus because of its wide data base for Pinus species, leading to more accurate projections.

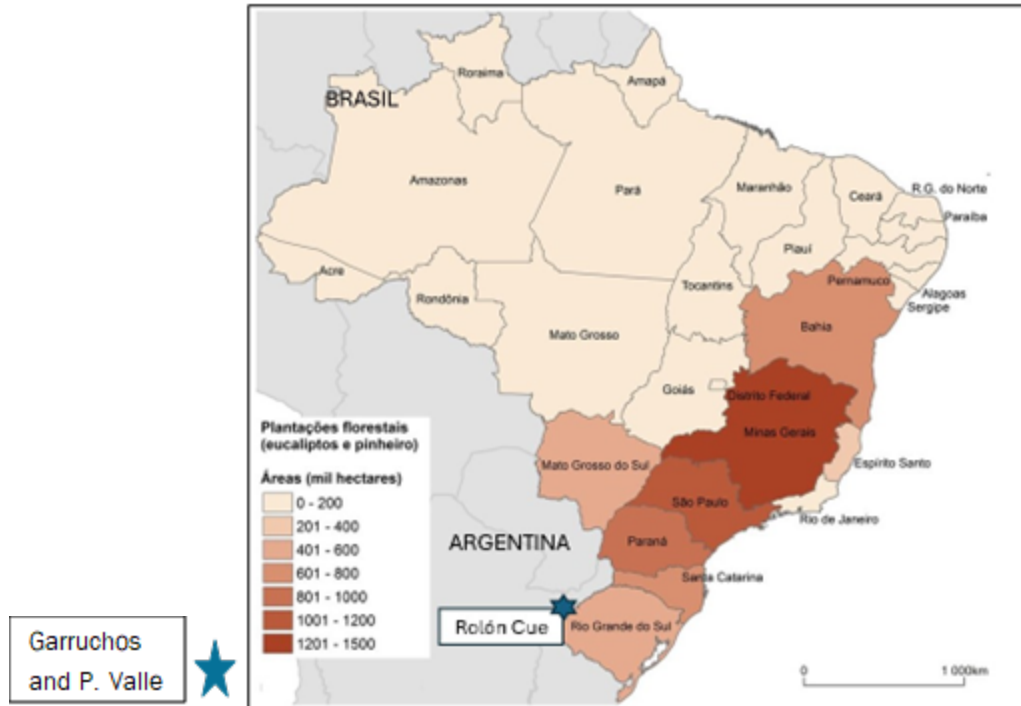


Figure 52 Forest plantation areas of Eucalyptus and Pinus in Brazil in 2012. Mateus, Ricardo & Padilha, Damaris. (2017)⁶.

In this case, the parameters loaded to the tool are:

Site index: 36.5

Survivance rate: 98 %

Initial age: 1

The result includes projections, among others, of: DBH, Basal area, Volume per hectare, Mean annual increment and annual current increase. For the ex-ante calculation spreadsheet, the volume per hectare is considered and, using the tree density, the column “volume per tree (m³)” is estimated for the whole period.

PlaForNEA – INTA

PlaForNEA is a simulator that allows estimating the growth and production at stand level of the main forest species planted in the Argentinean Mesopotamia such as loblolly pine, Eucalyptus grandis, Pinus elliottii and Araucaria angustifolia. The areas for which the models were adjusted correspond to the province of Misiones, northeast of Corrientes and Concordia in the province of Entre Ríos.

According to Keller et al (2019)¹⁸⁷ extended summary, the simulator of PlaForNEA (Forest Management Platform, for its Spanish acronym) is a software for simulating the growth of homogeneous and monospecific forest plantations, which can be subjected to different silvicultural management. It is one of three forest growth simulators developed so far in the country, two of which were developed for the Mesopotamian region and one for Patagonia.

The work team was made up of professionals from the Forest Management area of INTA EEA Montecarlo⁷ and the programming was carried out by a professional from the National University of Cordoba.

The current version (2017) was based on the initial version (PlaForNEA 1.0), both developed in the framework of projects funded by the National Agricultural Technology Institute (Spanish: Instituto Nacional de Tecnología Agropecuaria¹⁸⁸). This institution, known as INTA, is an Argentine federal extension agency in charge of the generation, adaptation and diffusion of technologies, knowledge and learning procedures for the agriculture, forest and agro-industrial activities within a sustainable approach.. The INTA has a directive board composed of members of both the official and the private sector; they define the politics at national level. The national direction executes the planning of the board, assisted by the organization and administration technical areas.

For the current version of the model (2017), new models and calculation routines have been added to the growth, production and shape models developed some years ago to create the current version, which allows to know the biomass by compartments and the volume by products as a result of cutting the trees into logs defined from their diameter in fine point and length, which also allows to assign differential prices depending on whether they are pruned or not.

A relevant aspect of this type of development is that it allows the use and dissemination among producers, technicians, professionals and institutions linked to the forestry sector of the new volume, shape, growth and production equations developed for the main forest species grown in the region, such as *Pinus elliottii*, *P. taeda*, *Eucalyptus grandis* and *Araucaria angustifolia* (Paraná pine).

According to the institutional context of the development of the tool, its design is expected. Some examples of its practical usefulness are:

- Establishing the most appropriate management regime (timing, quantity and intensity of thinning and final felling) for each plot, according to its productivity and production objective.
- It would allow the organization in advance of operational requirements (number of operators or crews and harvesting and transport equipment) and volumes of timber to be harvested according to destination.

¹⁸⁷ Keller et al (2020) Simulador de crecimiento y producción forestal PLAFORNEA. XIII Jornadas técnicas forestales y ambientales. 2019. El Dorado, Misiones

¹⁸⁸ INTA, Official website hosted by the National Government web platform. Available at: <https://www.argentina.gob.ar/inta>

- Update timber stocks without the need to carry out inventories every year (requires prior adjustment tests).

The results obtained from the simulator include:

- Table of expected production;
- Diametric distributions expected for each intervention;
- Volumes by products defined according to diameter in fine point and length, expected for each intervention;
- Estimated income expected for each intervention;
- Financial indicators for each simulation.

In Garrucho's experience, PlaForNEA estimates with higher accuracy growth projections for Pinus species, for this reason it was used for Pinus strata estimations. In this case, the parameters loaded to the tool are:

Site index:

-Pinus hybrid: 24

-Pinus taeda: 23

Survivance rate: 95 %

Initial age: 1

The result includes projections, among others, of: DBH, Basal area, Volume per hectare, Mean annual increment and Annual current increase. In the case of Eucalyptus, the volume per hectare is considered and, using the tree density, the column "volume per tree (m³)" in the spreadsheet is estimated for the whole period.

Native species mix

In view of the above, the SIS and PlaForNEA models are suitable for the region and have different specific models for pine, eucalyptus and other species, but it can be assumed that there is no model adapted to simulate the growth of a mixed native species in South America. Moreover, there are very few experiments for this type of plantation. Some experience has been developed for commercial native wood in Argentina, but most research and results are for monoculture systems⁸.

In this line, Garrucho, the forestry company and landowner, has extensive experience in the forestry industry. It is important to mention that regarding the plantation design and the ecological region, Garrucho has worked with the Misiones National University in the design of the native species strata.

Timbó colorado (*Enterolobium contortisiliquum*), is one of the species selected for the native species scheme. It is considered a local species of northeastern Argentina and was one of the few species from the mix with information on growth rate. Arturis et al publication aggregates different studies showing

information on native species' growth rates under different conditions: natural forest, beneath non-native species and open air. In this case, the open-air projections were considered for Yungas Region as well as Selva Paranaense. The two references for *Enterolobium contortisiliquum* were taken into consideration: Crechi et al (2005)¹⁰ for initial DBH values (1-4 years) and Montagni et al (2006)¹¹ for DBH values at 14 years of age. A regression was adjusted for the missing periods based on the existing data.

Regarding the tress densities through the crediting period, a 98% survivance is assumed annually till year 14 in the case of stratum 8 and 10 (625 plants/ha of initial density), while 2% mortality rate is extended to 20 years in the case of stratum 9 and 11 (1250 plants/ha of initial density), given a higher competition for resources.

From a first volume projection, parameters are calculated using a general growth sigmoidal equation¹⁸⁹:

$$y_t = \frac{\alpha}{1 + e^{\beta_0 - \beta_1 t}}$$

Sigmoid growth function: $V = a / (1 + e^{(b-c \cdot t)}) - d$			
Source / Link	Growth Equations in Forest Research		
alfa	beta 0	beta1	d
1.14	4.16	0.119	0.01700

Based on these parameters, an adjusted curve is projected and compared to maximum volumes for regional forests reported in the National Native Forest inventory - Selva Paranaense Regional Forest Report¹⁹⁰. In all cases ex-ante estimates result in lower values for the final volume of trees (m³/ha) The inventory reports, a value of 713.9m³/ha for Selva Paranaense, while the projection for the native mix stratum in the project is below 670m³/ha if projected to a 100-year horizon (657m³/ha for plots with a density of 1250plants/ha and 522m³/ha for plots with 625plants/ha)

The values reported in Arturis et al., 2008¹⁹¹ correspond to a tree density of 300 species/hectare, but due to lack of further information they were directly considered for stratum with native mix at 625plants/ha. In the case of volumes for the native mix at 1250plants/ha, a correction factor was applied to that calculated for a tree density of 625plants/ha. This correction factor was obtained from the non-native ratio for the same densities (see ex-ante calculations spreadsheet).

¹⁸⁹ Salas-eljatib (2021) Growth Equations in Forest Research: Mathematical Basis and Model Similarities https://eljatib.com/myPubs/2021growthEq_currForReports.pdf

¹⁹⁰ National Native Forest Inventory - Selva Paranaense regional forest. Available at: https://www.argentina.gob.ar/sites/default/files/informe_region_forestal_selva_paranaense_primera_version.rar

¹⁹¹ Arturi, M.F; et al. (2008) Height and diameter growth and mortality in plantations of native species of the Yungas in Valle Morado, Salta. In XIII Jornadas Técnicas Forestales y Ambientales (Misiones, 5 al 7 de junio de 2008).

APPENDIX 6 – NATIVE SPECIES DESCRIPTION SHEET

Scientific Name:	<i>Cordia trichotoma</i>
Common name:	Peterevy or Loro Negro



Picture: Cambium

Conservation status:	Least Concern
Blade Nature:	Deciduous
Height at maturity (m)	20 to 30 meters
DBH (cm):	From 40 to 100 centimeters diameter at maturity
Sun tolerance:	High, heliophyte
Waterlogging tolerance:	Temporary
Remarks:	<p>Pioneer species with a wide geographical distribution and frequent presence in the upper stratum of the high forest. Very suitable for forestry, although the seeds lose their germinative power quickly, so it is advisable to sow them immediately after harvesting, or to keep them in a cold room until sowing in spring.</p> <p>It is a honey tree, made of semi-hard and semi-heavy wood (650 kg/m³)</p>

Scientific Name:	<i>Enterolobium contortisiliquum</i>
Common name:	Pacar or Timb Colorado (not to be confused with <i>Albizia inundata</i>)



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Deciduous
Height at maturity (m)	From 15 to 40 meters
DBH (cm):	From 60 to 250 centimeters diameter at maturity
Sun tolerance:	High, heliophyte
Waterlogging tolerance:	Medium, hygrophilous
Remarks:	It is the largest native species of the Paran basin. Very fast growth (up to 2.5 m in height and 4 cm in diameter per year). Lightweight wood (360 kg/m ³) resistant to water and rot. High concentration of tannins (6.2%).Hygrophilic behavior.

Scientific Name:	<i>Pterogyne nitens</i>
Common name:	Yvyraro



Photo: Cambium

Conservation status:	Near threatened
Blade Nature:	Deciduous
Height at maturity (m)	From 20 to 35 meters
DBH (cm):	From 60 to 95 centimeters diameter at maturity
Sun tolerance:	High, heliophyte
Waterlogging tolerance:	Temporary
Remarks:	<p>Tree of the upper stratum of the Paraná jungle; The seeds remain on the tree for a long time and when it is detached it is able to disperse to distant areas, as it is a winged samara.</p> <p>Rapid growth (up to 2 m/year) and heavy wood (700 to 800 kg/m³) which has historically been highly exploited for its mechanical strength and resistance to rot</p>

Scientific Name:	<i>Cedrela fissilis</i>
Common name:	Cedro Misionero



Photo: Cambium

Conservation status:	Vulnerable
Blade Nature:	Long ones composed of even, oval and plush leaflets. Deciduous
Height at maturity (m)	20-30 m
DBH (cm):	Around 70 centimeters diameter at maturity
Sun tolerance:	High
Waterlogging tolerance:	Temporary
Remarks:	The predominant use of <i>C. fissilis</i> is for timber. This is an important timber species that is internationally traded due to its high quality. Timber can be used to make plywood, sculptures, models, frames, doors and be used for turnery and construction (CNCFlora 2012). The species may also be used for medicinal purposes. It is shown to have antimalarial, bacterial and diuretic properties. An aromatic oil can also be obtained from the bark of the species (Nunes et al. 2007) CITES listings II Populations of the Neotropics. Listing adopted at CoP18 in August 2019

Scientific Name:	<i>Peltophorum dubium</i>
Common name:	Yvyrapyta or caña fistula



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Deciduous
Height at maturity (m)	From 20 to 35 meters
DBH (cm):	From 40 to 200 centimeters diameter at maturity
Sun tolerance:	High, heliophyte
Waterlogging tolerance:	Temporary
Remarks:	Very fast growth (up to 3 m in height and 2 cm in diameter per year). Nitrogen fixer and suitable for poor soils.

Scientific Name:	<i>Apuleia leiocarpa</i>
Common name:	Grapia



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Deciduous
Height at maturity (m)	From 20 to 32 meters
DBH (cm):	From 30 to 80 centimeters diameter at maturity
Sun tolerance:	Intermediate
Waterlogging tolerance:	Low, needs well-drained soil in high areas
Remarks:	Slow initial development. High-density wood (750 to 850 kg/m ³)

Scientific Name:	<i>Handroanthus heptaphyllus</i>
Common name:	Lapacho negro



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Foliate 5(-7) palmate leaves. Deciduous.
Height at maturity (m)	Tree up to 20-30 m tall
DBH (cm):	From 80 to 150 centimeters diameter at maturity
Sun tolerance:	High, heliophyte
Waterlogging tolerance:	Medium, occupies low and humid soils, dominating the upper stratum of these forests
Remarks:	A hardwood, heavy tree, very resistant to weathering, used in construction and carpentry; cultivated as an ornamental in many Argentine cities and abroad. High resistance wood, highly valued. It is one of the most important and well-known trees of the Atlantic rainforest. It is found from the Humid Chaco to the Paraná River and is abundant in the north of the country. It prefers fertile and deep soil, inhabiting both sandy and clay soils. It requires openings in the canopy for its development. In the past, there were many large specimens of this species, but now it is rare to find giant trees due to intensive logging. CITES listings II Listing adopted at CoP19 in November 2022

Scientific Name:	<i>Parapiptadenia rigida</i>
Common name:	Anchico Colorado



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Compound leaves with numerous greyish-green leaflets. Deciduous
Height at maturity (m)	Tree up to 20-30 m tall
DBH (cm):	From 80 to 90 centimeters diameter at maturity
Sun tolerance:	High, heliophyte
Waterlogging tolerance:	Low
Remarks:	It is used for bridge beams because it withstands the weather. It has medicinal properties. Very resistant wood, 6% to 20% tannins. It prefers clay soils, but it can grow on both wet and dry soils. High percentage of germination after 5 days of immersion. It is used for bridge beams because it withstands the weather.

Scientific Name: ***Cordia americana***

Common name: **Guayubirá**



Photo: Cambium

Conservation status: **Least Concern**

Blade Nature: **Deciduous leaves with petioles 0.1-0.7 cm, hairy with the presence of multicellular glandular trichomes with a globose unicellular head and ferruginous content**

Height at maturity (m) **Tree up to 20-30 m tall**

DBH (cm): **From 80 to 90 centimeters diameter at maturity**

Sun tolerance: **Medium**

Waterlogging tolerance: **Low**

Remarks: **C. americana wood is highly appreciated in carpentry and furniture with multiple uses such as the elaboration of parquet floors, frames, musical instruments, piano pieces, tool ropes and shoe plugs. Species that present desirable characteristics for phytoremediation, since it has extensive root growth and biomass production. High potential for sawmilling (sawn and roundwood). It is an abundant species in the upper stratum of the forest of the Paraná Basin. It prefers low and humid sites, where it is found together with *Nectandra angustifolia*, *Luehea divaricata* and other species. It is also frequent in forests near streams and better-drained soils.**

Scientific Name:	<i>Handroanthus albus</i>
Common name:	<i>Lapacho Amarillo</i>



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Leaves palmate 5-7(-9) foliolate; petiole 10.5-13 cm long. x 0.2-0.3 cm lat., with dense pubescence of whitish or yellowish dendroid trichomes. Deciduous.
Height at maturity (m)	15-28 m
DBH (cm):	From 40 to 90 cm diameter at maturity
Sun tolerance:	High
Waterlogging tolerance:	High
Remarks:	Its flowers are pollinated by bumblebees and other insects, the presence of which attracts insectivorous birds. Hummingbirds feed on their nectar by piercing the corollas, without pollinating the flower. Other birds, such as baby dogs and pips, feed by eating their flowers and buds. Timber used for construction. It grows in the high forest of the Paraná River Basin. It has a limited distribution. It almost exclusively inhabits low sites with moist and deep soils, where it forms part of the upper strata. Very rare in other micro-environments.

Scientific Name:	<i>Campomanesia xanthocarpa</i>
Common name:	Guabirá



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Simple, large, shiny leaves with brown veins. Deciduous
Height at maturity (m)	15-25 m
DBH (cm):	From 30 to 50 centimeters diameter at maturity
Sun tolerance:	Low
Waterlogging tolerance:	Temporary
Remarks:	Edible and juicy fruits

Scientific Name:	<i>Campomanesia xanthocarpa</i>
Common name:	Guabirá



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Simple, large, shiny leaves with brown veins. Deciduous
Height at maturity (m)	15-25 m
DBH (cm):	From 30 to 50 centimeters diameter at maturity
Sun tolerance:	Low
Waterlogging tolerance:	Temporary
Remarks:	Edible and juicy fruits

Scientific Name:	Jacaranda Caroba
Common name:	Caroba



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Leaves sometimes subopposite, impar bipinnate, 50 cm long or more, 4-10 pairs of pinnae with 4-10 pairs of leaflets; petiole 10-18 cm long. Deciduous
Height at maturity (m)	15-28 m
DBH (cm):	From 40 to 85 cm diameter at maturity
Sun tolerance:	High, heliophyte
Waterlogging tolerance:	Medium
Remarks:	The uses are mainly ornamental, since its beautiful y striking violet flowers make it a highly appreciated tree in gardens y parks. In addition, its wood is used in carpentry y cabinetmaking. Ornamental, landscaping and urban forestation. Medicinal anti-inflammatory. Diuretic, antispasmodic, analgesic, antimicrobial and antioxidant due to the amounts of flavonoids, tannins and oils. It is found in the Paranaense rainforest. Its dispersion is wide, but its frequency is low. It prefers the deep clayey soils of the Paraná Basin. It is scarce in sandy soils and it has a certain affinity for humid sites.

Scientific Name	<i>Plinia rivularis</i>
Common name:	Ibaporoiti



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Petiolate leaves with glabrous lamina, papyraceous to leathery, ovate to lanceolate, acuminate to rostrate and cuneate base. Deciduous.
Height at maturity (m)	12 m
DBH (cm):	Around 60 centimeters diameter at maturity
Sun tolerance:	Medium
Waterlogging tolerance:	Temporary
Remarks:	Fruit tree

Scientific Name:	<i>Cupania vernalis</i>
Common name:	Camboata Colorado/Yaguá ratay



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Leaflets 8-12 (14-16), discolored, toothed-serrated, oblong-narrow or oblong-obovate, 78-160 x 23-50 mm. Deciduous.
Height at maturity (m)	12-25 m
DBH (cm):	From 20 to 60 cm diameter at maturity
Sun tolerance:	Low
Waterlogging tolerance:	Medium
Remarks:	Rapid growth. Recovery of degraded ecosystems. This species has medicinal (leaves), food (avifauna) and timber properties. Medicinal plants (leaves) for the treatment of respiratory, digestive, circulatory and skin diseases . Forms part of the middle stratum of the Atlantic Forest. It is common, especially in humid and rocky areas. Very shade tolerant. Regeneration is often abundant within tall forests. In thickets, it occurs as a small tree.

Scientific Name:	<i>Cabralea oblongifoliola</i>
Common name:	Cancharana



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Leaves composed of even, oval leaflets, smooth to the touch with a characteristic wavy. Deciduous
Height at maturity (m)	20-30 m
DBH (cm):	From 70 to 120 centimeters diameter at maturity
Sun tolerance:	High
Waterlogging tolerance:	Temporary
Remarks:	Species of the high forest of the Paraná jungle, occupying intermediate strata, with a preference for moist and deep soils.

Scientific Name:	<i>Diatenopteryx sorbifolia</i>
Common name:	Maria preta



Photo: Cambium

Conservation status:	Least Concern
Blade Nature:	Leaflets 8-12, asymmetrical, oblong or elliptical-narrow, glabriuscule, smaller basal pair. Deciduous.
Height at maturity (m)	15-25 m
DBH (cm):	From 40 to 80 centimeters diameter at maturity
Sun tolerance:	Medium
Waterlogging tolerance:	Temporary
Remarks:	A species characteristic of the primary forest of Paraná (Paraguay, Brazil and northern Argentina), but also observed in southeastern Bolivia