AFFORESTATION OF DEGRADED GRASSLANDS IN A CAAZAPA

Document Prepared by South Pole Carbon Swiss Value

Project Title	Afforestation of degraded grasslands in a Caazapa
Version	1
Date of Issue	April-2021
Prepared By	South Pole Carbon Swiss value
Contact	South Pole Carbon Swiss Value Contact Name: Sindy Marsiglia Rivera

	Email: s.marsiglia@southpole.com Address: Technoparkstr. 1, 8005 Zurich, Switzerland Phone: +57 4 520 5000

CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Project

Miller Forest investment implements forest plantations in Paraguay. Miller brings together more than 500 investors in order to ensure the permanence of the project and generate cash flow that allows the maintenance of forestry activities.

The project consists of 2,716.71 hectares established between 2016 and 2020 with the species *Pinus ellioti, Pinus taeda, Eucaliptus urograndis, Eucaliptus urophila* and 1,112.55 hectares to be established in the future. The implementation of the project is carried out by Felber Forestal S.A, in charge of the plantation establishment and permanence.

The objective of the project is the production of solid wood, charcoal and wood chips, in order to satisfy the country's forest demand and reduce the pressure on natural forests. The project is expected to capture 27,718,692 tCO_2e during the crediting period (2016-2045) as a result of growth of forest biomass.

The project is located in the eastern region of Paraguay, in the municipalities of Cazaapá, Maciel, Doctor Moisés Bertoni (department of Caazapá) and Ñumi (department of Guaira). This region is characterized by agricultural production, mainly, extensive livestock for meat purposes. Before the implementation of the project, 100% of the land was dedicated to extensive cattle raising, which has historically deforested the natural grassland and degraded the soil.

1.2 Sectoral Scope and Project Type

Grouped project developed in accordance with sector 14, “Agriculture, forestry and other land uses”, in the Aforestation, Reforestation and Revegetation (ARR) category. The objective is to reduce GHG through the implementation of mixed commercial forest plantations in Paraguay.

1.3 Project Eligibility

The project activity is within the eligible category of the AFOLU sector according to the “Appendix 1 eligible AFOLU Project categories”, thus fulfilling the eligibility requirements.

The eligibility analysis was carried out for the first instance, an area of 3,833.55 ha, of which, 2,721 ha have been established in the 2016-2020 period and 1,112.55 ha are expected to be established in the future. The methodological process consisted of 6 steps (Table 1), where the non-forest area during the analyzed period constitutes the eligible area and the rest is defined as the ineligible area.

Table 1. Steps to perform the eligibility analysis

Step 1	Acquisition of multispectral Landsat images 5 and 8
Step 2	Atmospheric and radiometric correction of Landsat images 5 and 8
Step 3	Classification of land cover classes: forest, non-forest and water
Step 4	Calculation of the classification precision
Step 5	Final layer: forest, non-forest
Step 6	Eligibility analysis for the evaluated years

For this analysis, a forest[1] is an area of more than 0.5 hectares with trees of more than 5 meters (m) in height and a canopy cover of more than 25% or trees capable of reaching these thresholds in situ. It does not include lands that are predominantly under agricultural or urban use. The rest of the areas are considered non-forest.

This analysis used medium-resolution multispectral Landsat 5 images (years 2006, 2007, 2008, 2009 and 2010) and Landsat 8 images (years 2016, 2017, 2018, 2019 and 2020) to obtain forest and non-forest cover through a supervised classification.

Of the total area analyzed, 3,827.91 ha are eligible, that is, 99.85% of the total planted area in the first instance. Table 2 shows the results of the eligibility analysis per period[2] and Figure 1 shows the eligibility map of the first instance (Zone I).

Table 2: Eligibility analysis results

Period	Eligible (ha)	Non Eligible (ha)	% Eligible area	% Non eligible area
2006 - 2016	1,233.76	1.35	32.18%	0.04%
2007 - 2017	587.03	0.06	15.31%	0.00%
2008 - 2018	519.95	2.46	13.56%	0.06%
2009 - 2019	185.84	0.41	4.85%	0.01%
2010 - 2020	1,301.33	1.35	33.95%	0.04%

[1] Definition of forest for Paraguay: https://cdm.unfccc.int/DNA/index.html

[2] The full description of the eligibility analysis is located in the path: *Gestión documental/análisis de elegibilidad*

Total	3,827.91	5.64	99.85%	0.15%

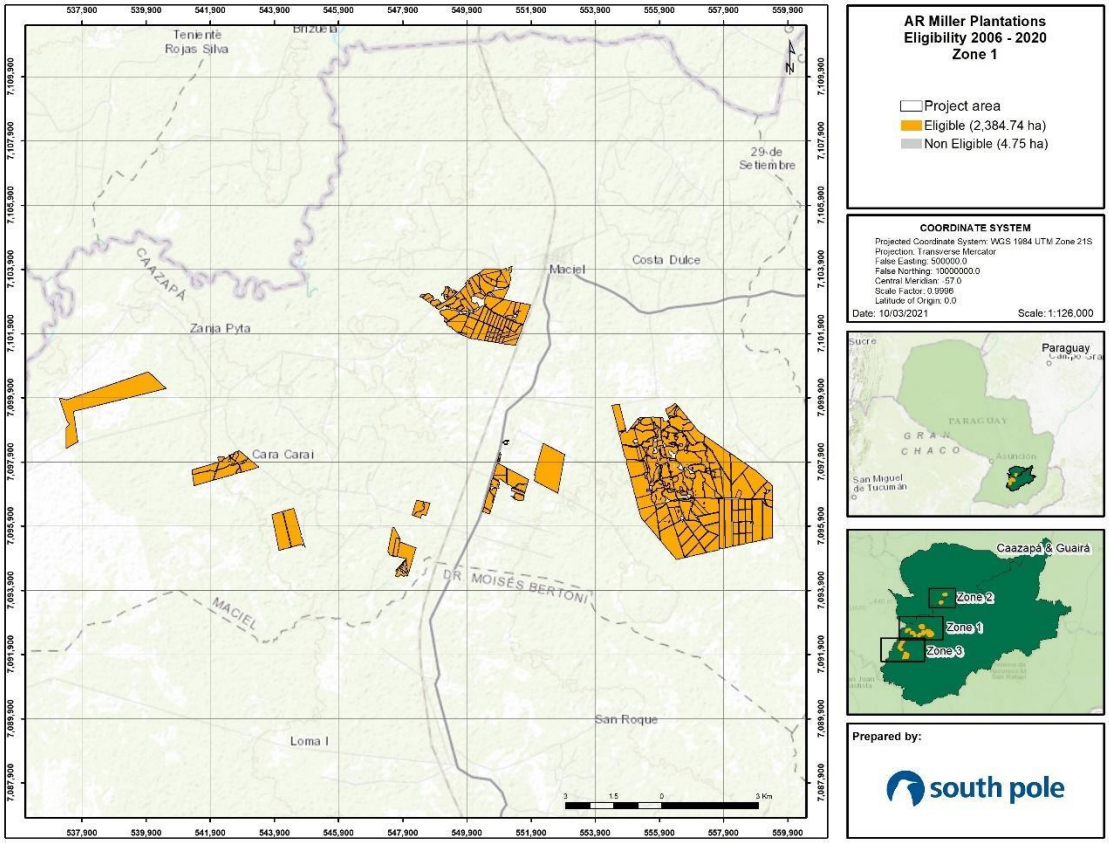


Figure 1. Project eligibility map of zone I.

1.4 Project Design

The Project has been designed as a grouped project. In each verification, the inclusion of new areas will be evaluated. The project includes reforestation activities with mixed commercial species in Paraguay.

1.5 Project Proponent

Organization name	Miller Forest Investment AG
Contact person	Josef Miller
Title	CEO
Address	88281 Schlier, Germany

Telephone	+49 7529 971 395
Email	jom@miller-ag.de

1.6 Other Entities Involved in the Project

Organization name	Felber Forestal S.A.
Role in the project	Establishment and management of forest plantations
Contact person	Carsten Felber
Title	President
Address	Estancia Curuzu - Maciel Caazapá, Paraguay
Telephone	+595981303556
Email	carsten.felber@felber-forestal.com

Organization name	Swiss Carbon Value Ltd
Role in the project	Project developer South Pole elaborates and oversees the development of appropriate project design and monitoring techniques in line with the guidelines of the VCS
Contact person	Mr. Christian Dannecker
Title	Director Global Sourcing Team
Address	Technoparkstr. 1, 8005 Zurich, Switzerland
Telephone	+ 41 43 501 35 50
Email	sourcing@southpole.com

1.7 Ownership

In accordance with standard property requirements, the project demonstrates the legal rights of the project through property (ownership) rights that arise under a legal right and through an agreement that arises with the legal right holder.

Miller Forest Investment AG is a company that offers direct investments in the forestry sector, through the establishment of forest plantations. The investor has the option to buy or lease (rent) the property. The owners of the plantations are small and medium investors, who invest in areas larger than 5 hectares.

The Project properties are under three tenure modalities (see Table 3); leasing (renting), where there are contracts that follow the legal requirements of the country; legal property (ownership), these properties have legally registered property rights, and, in transfer process, where there is a purchase contract from the original owner, but the transfer of the property has not yet finished.

Table 3: Land (Property) tenure

Tenure situation	Area (ha)
Lease (Rent)	1,494.7
Legal property (ownership)	597.1
Purchase transfer	849.9

1.8 Project Start Date

The Project start date is 01/13/2016[3]

1.9 Project Crediting Period

The project's crediting period is 30 years starting from January 13, 2016 and ending on January 12, 2045.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

[3] The start date support is located in the path: *Gestión documental/Fecha de inicio*

Year	Estimated GHG emission reductions or removals (tCO_2e)
2016	-
2017	65,888.94
2018	179,749.83
2019	297,298.15
2020	463,980.08
2021	646,580.95
2022	862,130.09
2023	920,901.14
2024	873,314.06
2025	965,578.78
2026	1,174,008.23
2027	1,421,256.05
2028	1,517,098.68
2029	1,151,430.72
2030	1,214,633.33
2031	947,207.82
2032	851,300.18
2033	914,238.78
2034	783,366.38
2035	858,918.84
2036	1.116,752.45
2037	1,163,027.91
2038	1.,01,912.83
2039	1,179,432.82
2040	1,376,128.10
2041	1,417,773.21
2042	898,487.88
2043	1,162,120.97

2044	1,211,920.77
2045	982,254.97
Total estimated ERs	27,718,692.96
Total number of crediting years	30
Average annual ERs	955,816.97

1.11 Description of the Project Activity

Reforestation with commercial species

The project currently has 2,716.55 ha, which are distributed in six stances and 248 lots that are destined to the production of raw material (solid wood and biomass) in order to satisfy the country's forest demand and reduce the pressure on the natural forests. The project plantations have a different purpose according to the final destination, where the timber plantations that produce sawn-wood or solid wood are located; plantations for energy use (biomass), that is, to obtain fuel-wood (firewood) and charcoal; silvopastoral systems, which combine wood production with livestock; and, finally, those for multiple use that combine the production of solid wood with biomass.

Activities in the project

Each of these activities carried out by the project that are aimed at reducing and removing GHG in Paraguay is described below:

1. Forest nursery

Felber Forestal S.A. has a registered clonal forest nursery, with the aim of providing the genetic material that confers high uniformity to the plantations, wood production with provenance guarantee and adequate industrial performance (output).

The production of plant material is obtained by means of regrowth of previously selected strains, to which cuts of 30-45 cm in height are made at the end of winter in order to take this material as mother plants. This material is subsequently placed in inert substrates and in greenhouse conditions to favor rooting, where average temperatures of 26°C and a relative humidity greater than 80% are maintained. After about 25 days, in spring, the rooting of the plants is verified for their subsequent rustification, by means of gradual exposure of the seedlings to external environmental conditions for a period of 90 days, covering them with half-shade meshes in the moments of maximum insolation.[4]

Species sown (planted)

[4] For more details on silvicultural activities, refer to the forest management plan, located in the path: *Gestión documental/planes de manejo*

To determine the success of forest plantations, the first step is the correct choice of species that adapt to each site (place), taking into account the different variables such as soil and climate.

The tree species used in the project belong to eucalyptus and pine and two production cycles are planned: 12 years for the optimization of solid wood and 6 years for plantations for energy purposes. In addition, there are also silvopastoral production systems, which integrate livestock for meat production and the management of trees for wood production.

Among the species produced in the nursery and stocked in the project are: *Eucalyptus grandis* W. Mill ex Maiden, *Eucalyptus urophylla* S.T. Blake, *Eucalyptus saligna* Sm., *Corymbia citriodora* (Hook.) K.D. Hill & L.A.S. Johnson, *Corymbia maculata* (Hook.) K.D. Hill & L.A.S. Johnson, *Eucalyptus urograndis, Eucalyptus grancam, Pinus elliottii* Engelm. y *Pinus taeda* L. (Table 4).

Table 4. Species and their ecological requirements

Species	Elevation (m)	Temp (°C)	Precipitation (mm/year)	Soil and others
E. grandis *E. grancam*[5]	1,000-2,200	15-22	1,000-4,000	Wide adaptability. Optimal conditions: soil over 1 m deep, of light to medium texture, and with a slightly acidic pH, fertile, humid and well drained of both volcanic and alluvial origin. It is very sensitive to boron deficiencies. Tolerates short flood cycles. E. *grancam* has a higher tolerance to frost.
E. urophylla[6]	0-3,000	8-34	700-3,500	Wide adaptability. Optimal conditions: soil more than 1.5 m deep, with a loamy texture, and with a slightly acidic pH, fertile, humid and well drained.
E. saligna[7]	1,000-2,100	15-22	800-4,000	Requires deep, well-drained, moist soils of medium to high fertility; clayey, clayey loam, sandy loam or sandy texture. Supports a slightly acidic pH with a tendency to neutrality. It does not tolerate compacted or flooded soils.
C. citriodora[8]	100-1,300	16-27	600-1,600	Optimal: deep to moderately deep soils, well drained, sandy to sandy loam soils, slightly acid soils with a tendency to neutrality. It can tolerate poor lateritic and gravelly, gray and reddish, loamy soils.

[5] https://www.forestalmaderero.com/articulos/item/eucalipto-grandis.html

[6] https://www.researchgate.net/profile/David-Palma

[7] https://elsemillero.co/semillas-forestales/145-semilla-de-eucalipto-saligna.html

[8] http://elsemillero.net/nuevo/semillas/listado_especies.php?id=47

E. urograndis[9]	0-2,000	15-22	1,000-1,750	Optimal: deep, clay loam soils with neutral to acidic pH.
P. elliottii[10]		13-23	899 – 1,550	Optimal: deep, rich, moist and well-draining. It does not support dry periods with water deficit. It adapts to superficial, hydrometric soils. It supports very well frost and strong heat.
P. taeda[11]		13-24	900 – 1,550	Wide adaptability. Optimal: deep, rich, moist and well-draining. Its fertility requirement is minimal and in relation to acidity, the range of soils with a pH of between 4.5 and 5.5 (acid soils) is recommended.

2. Forest plantations and silvopastoral systems

The project manages two types of production systems consisting of pure plantations (obtaining solid wood and/or energy purposes) and plantations under silvopastoral systems (meat production and wood production). According to the final destination of the wood, different sowing (planting) designs, species and sivicultural activities were used as described in Table 4, where it can be seen that the highest densities were managed in the plantations for energy production, since these do not require higher biomass productions, while the lower densities were presented in silvopastoral systems, in order to allow the adequate development of natural or implanted field pastures.

Table 5: Harvest characteristics by type of product and type of plantation

Parameters	Timber (12-year rotation)	Energetic (6-year rotation)	Silvopatoral system
Plantation density	780 trees /ha 1,100 trees /ha	1,315 trees / ha	714 trees /ha 570 trees /ha
Spacing	4x2.2 m (Pino) 4x3.2 (Eucalyptus)	4x1.9 m	7x2 m 7x2.5 m

9 http://repositorio.unsch.edu.pe/bitstream/handle/UNSCH/3164/TESIS%20AF03_Mau.pdf?sequence=1&isAllowed=y

10 https://www.santafe.gob.ar/index.php/web/content/download/106405/522212/file/Boletin%20Forestal%20Diciembre%202010%20Nro.%204.pdf

11 https://www.santafe.gob.ar/index.php/web/content/download/106405/522212/file/Boletin%20Forestal%20Diciembre%202010%20Nro.%204.pdf

Species	Eucalyptus hybrids Pine hybrids	Eucalyptus hybrids	Eucalyptus hybrids
Thinning	Years 2, 5 y 7	Without thinning	Years 2, 5 y 8
Pruning	Years 1, 2, 3, 5, 7	Without pruning	Years 1, 2, 3, 5
Harvests	Clear-felling year 12	Clear-felling year 6	Clear-felling year 12
Regrowth management (handling)	No	Yes	No
Growth (MAI)	35 m^3/ha/ year	40 m^3/ha/ year	30 m^3/ha_1/ $year_1$

Source: Forest management plan, Felber forestal S.A., 2020

Silvicultural activities

Below is a description of the forestry activities contemplated in the project[12]:

Mapping

The planting area is determined with the help of computer programs from the office and the proposed areas of interest are delimited. As a result, a map is obtained with the limits and dimensions of the future (forest) stands. At the same time, each of the plots is demarcated by means of agricultural tractors with incorporated GPS, as well as internal roads and canalizations (water channeling).

Canalizations (Water channeling)

The property has open-air trapezoidal canals (channels), which have the purpose of draining the accumulated water in the rainy season to carry out activities more efficiently, as well as to improve soil conditions, increasing water absorption. The canal system consists of primary, secondary and tertiary canals, which will serve for the collection of surface runoff.

[12] For more details on silvicultural activities, refer to the forest management plan, located in the path: *Gestión documental/planes de manejo*

The existing canals will be cleaned, extracting weeds, and some extensions will be considered in the future if necessary.

Soil preparation

The soil must be decompressed with tools, such as the cross harrow and subsoilers, until it is well triturate (crushed) and clean, so that the planted trees have good aeration and water absorption in times of rain. After the work with harrow and subsoiler with the tiller (*taipeadora*) machine, the furrows on which the sowing is carried out will be aligned and marked.

Control of ants and other insects

It is made with citrus peels plus Fipronil in the sectors identified with a significant presence; nebulized insecticide is applied to the nests of (leaf) cutter ants. A periodic monitoring should be carried out and preventively control with ant baits and insecticides.

Sowing (Planting)

The sowing (planting) of the seedlings is done manually. After preparing the soil, the following activities are carried out:

- Making planting holes: the holes are made (opened) with wooden stakes, deep enough to fit the root balls that the trees contain. The plants should be 1 to 2 cm buried below the level of the neck.
- Distribution: the trees are transported to the front of the hole that was made for planting.
- Sowing (planting): the trees are placed in the hole made, vertically and gently pressing the base of the plant, in such a way that the soil surface is completely flat.
- Replacement: it is carried out immediately or 15 or 20 days after the initial sowing (planting), replacement is made with specimens of the same age, in order to preserve the uniformity of the (forest) stand. A replacement of 10% to 15% of the total number of trees per hectare is estimated.

Fertilization

Prior to the sowing (planting) activities, a physical-chemical properties analysis of the soil will be carried out in order to determine the corrective activities and the fertilization plans necessary for each one of the lands (properties). However, the use of the macro elements nitrogen (N), phosphorus (P) and potassium (K) (NPK 22-10-6) is considered as the main corrective measure.

Weed control

Weed control is carried out according to the plantation system, in all plantations, selective herbicides for forest use are applied, whose active principle is isoxaflutole., In all plantations non-selective agricultural herbicides will be applied if necesary. The application of the herbicide will

be done by means of tractors with a sprayer prior to planting and after planting. In the case of pure plantations, weed control will be carried out during the first 180 days after planting and, for silvopastoral systems, for a period of approximately 18 months (corresponding to the period in which cattle rotation is allowed).

In addition, herbicide cleaning activities will be carried out in the planting lines 3 to 5 times during the first year and a half of establishment. In the second year, there will be two cleaning activities, in which it can be applied to the leaves, injected into trunks and stems, or sprayed onto stumps as a forest herbicide.

Formative pruning

Formative pruning will only be carried out in systems where the destination (aim) is to obtain solid wood. The sown (planted) species will be subjected to formative pruning from the first six months of planting and up to the fifth year for silvopastoral systems and the seventh year for pure plantations, the frequency of pruning for each of the systems is stipulated in Table 4.

Cleaning

It is carried out between furrows, in order to avoid the uncontrolled growth of weeds that affect the growth of the plantation; It will be done with a light harrow 1 to 3 times a year, depending on the need.

Thinning

For the best development of trees for timber use, competitive trees of poor shape or poor growth will be eliminated. The intensity of thinning will be between 50 and 550 trees/ha according to the need and age of the plantation (Table 4).

Final harvest

At the end of the planting cycle, the final harvest is carried out in the form of clear-felling. The felling will be carried out manually, with a harvester or feller buncher according to the conditions of the terrain and will be piled up in storage areas within the property. Table 4 shows the handling and harvest characteristics by type of final product.

Chipping

When the wood is used for energy, the wood is chipped in the storage places with a mobile chipper.

Replanting

After the harvest the area is prepared for a new planting. Old stumps will be eliminated with “standard” herbicide, leaving the stump for decomposition or removed with heavy machinery.

In the case of plantations for biomass (fuel-wood (firewood) and charcoal), the regrowth technique will be used, where the regrowth with the best conditions will be chosen per stump, therefore, no stump removal or replanting activities will be required.

1.12 Project Location

The project is located in the departments of Cazaapá and Guaira, in the eastern part of Paraguay, in the municipalities of Cazaapá, Maciel, doctor Moisés Bertoni and Ñumi. The Project comprises an established area of 2,716.7ha.[13] The coordinates of each property are shown in table 6 and the Figure 3 shows the location of the project area.

Table 6. Coordinates of each property

Estancia	X	Y
Curuzu	-56,513	-26,251
Bertoni	-56,63	-26,427
Laguna Kare	-56,449	-26,233
Ñumi	-56,342	-26,012
Pozo Azul	-56,678	-26,334
San Pablo	-56,577	-26,237

[13] The cartographic information in KML format can be found in the path: *Gestión documental/área de proyecto/KML*

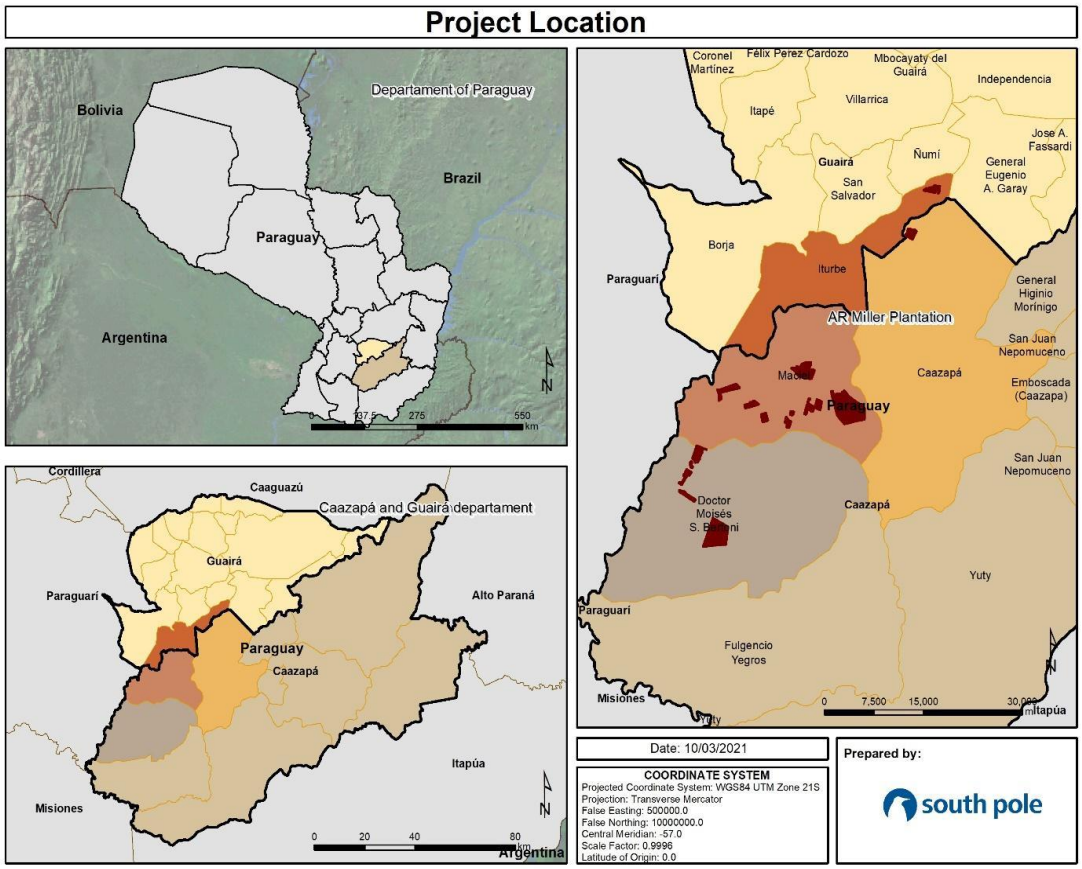


Figure 3. Location of the project area

1.13 Conditions Prior to Project Initiation

A general description of the reference region condition is presented below, in order to have this information as a baseline for the project.

PHYSICAL CHARACTERISTICS

Climate

Eastern Paraguay has a sub-tropical climate, with an average temperature of 23°C and 1,300 mm of precipitation, decreasing along the forest from east to west and higher in the austral summer. Relative humidity varies from 60 to 90% throughout the year and the average potential for evaporation and perspiration is 1,100 mm per year. This area has hot and humid springs and summers, mild and humid autumns, and cold and dry winters.

Precipitation

The study area is characterized by presenting a humid temperate climate, with rains throughout the year, with the highest rainy peaks in autumn and spring and minimum in the winter season

(with rainfall up to 100 mm/month),[14] see Figure 5. In the spatial distribution, it can be observed that the rainiest districts are found on the north side of the department of Caaguazú and the south side of Caazapá with an average of 1,600 mm per year, while the area between the west side of the department of Paraguarí, western part Caaguazú and Caazapá, show a slight decrease in average precipitation with approximate values of 1,300 mm per year (Figure 4). The high rainfall in the area is mainly due to the warm and humid winds from the Atlantic Ocean, which, combined with strong winds, makes this area prone to the occurrence of storms, especially during the October-April period.

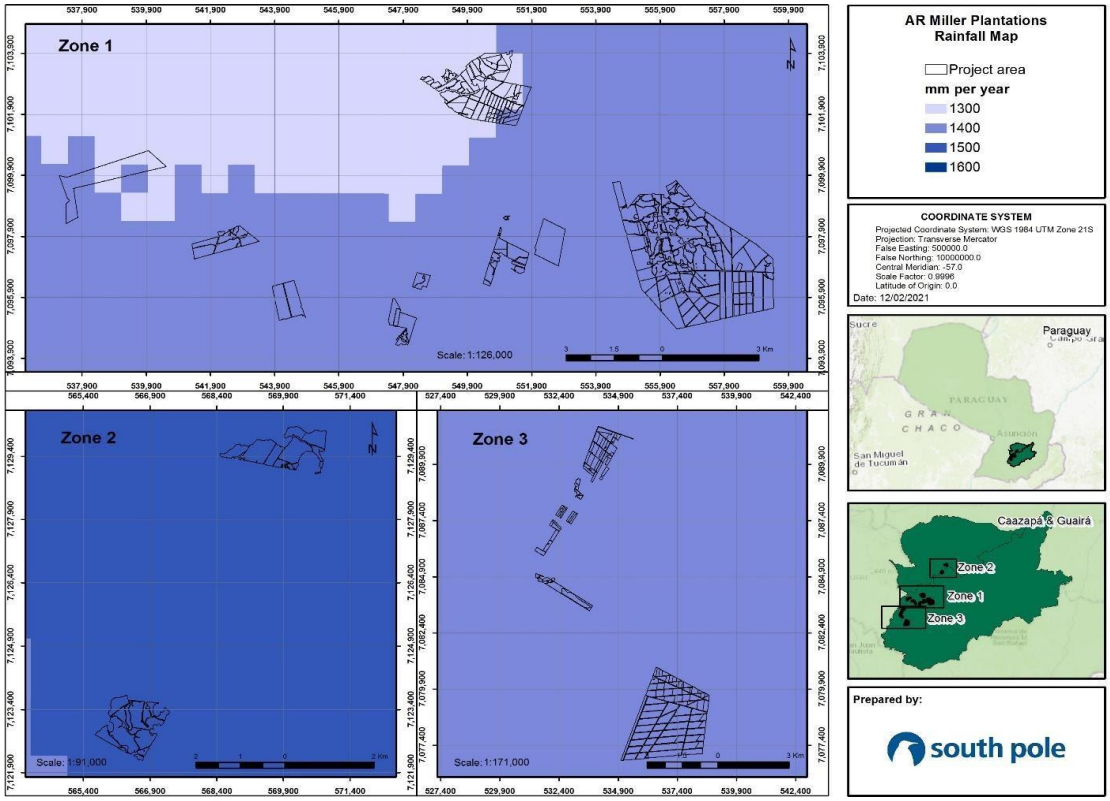


Figure 4. Spatial distribution of precipitation in the study area[15]

[14] Grassi, B., Vázquez, F. y Rodríguez, R. 2020: *Evidencias científicas e impactos económicos del cambio climático en el departamento de Guairá* (Scientific evidence and economic impacts of climate change in the department of Guairá). MADES-STP. Asunción, Paraguay. <http://dncc.mades.gov.py/wp-content/uploads/2020/10/Guair%C3%A1-Evidencias-cient%C3%ADficas-e-impactos-econ%C3%B3micos-del-cambio-clim%C3%A1tico.pdf>

[15] WorldClim map

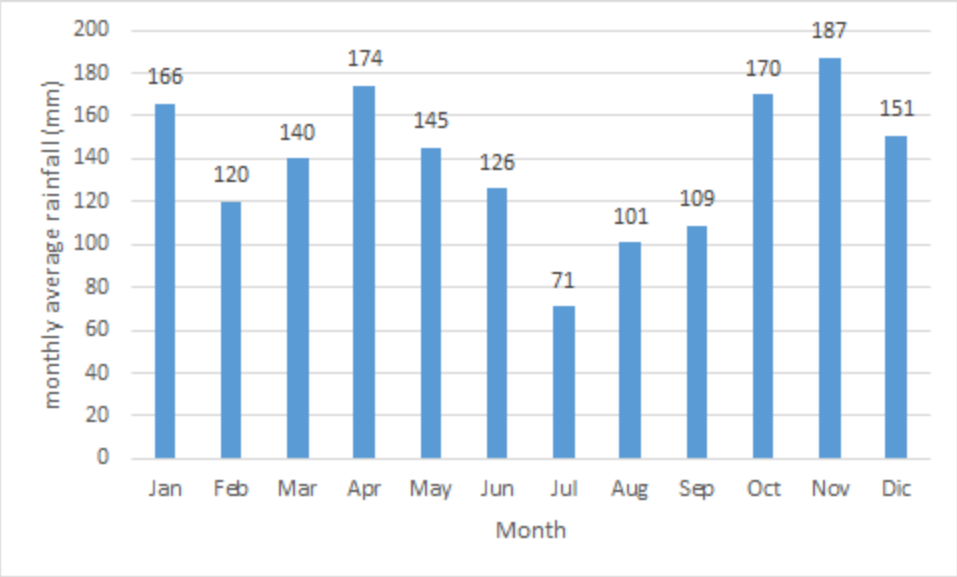
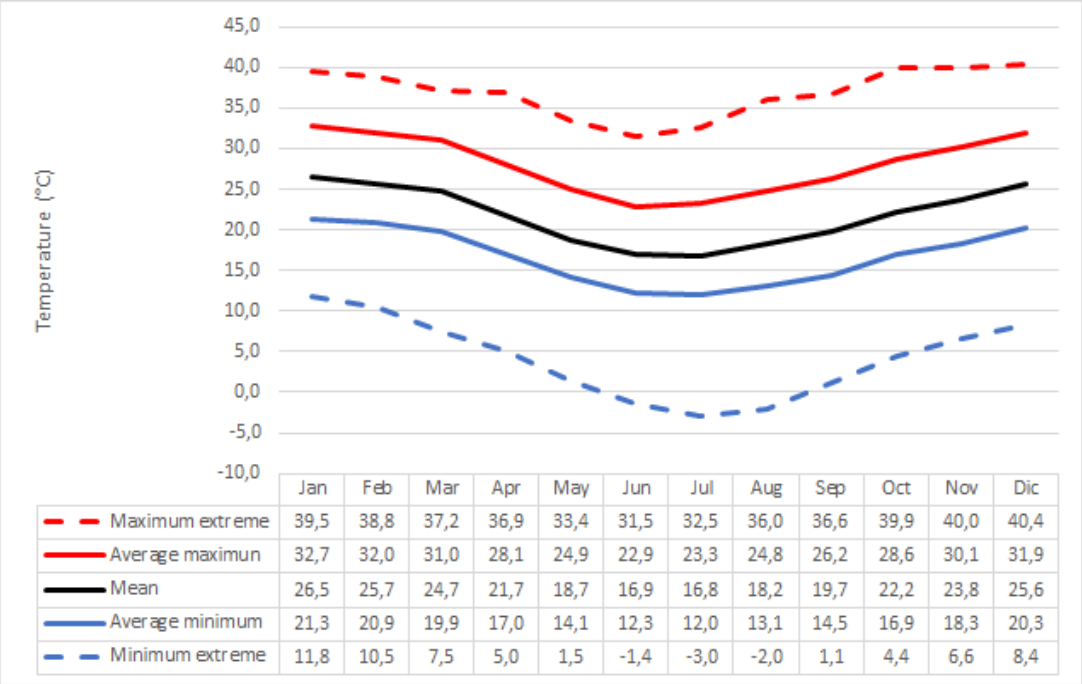


Figure 5. Temporal distribution of precipitation in the study area. Data from the Villarica meteorological station (1971-2000). Source: Scientific evidence and economic impacts of climate change in the department of Guairá (2020).

Temperature

Data from the Villarrica meteorological station indicate that the average temperature of the study area is approximately 21.7°C, reaching the highest values in the summer, with an average monthly temperature of 26.5°C (in the month of January) and the lowest winter temperatures, with 16.8°C (in June-July). The maximum temperature in the area was 40.4°C, which was recorded in December 1985 and the extreme minimum of -3°C in June 2000 (Figure 6). In the study area, frost phenomena frequently occur during winter, caused by the frequent invasion of subpolar cold air, through the southerly winds.[16]

[16] Grassi, B., Vázquez, F. y Rodriguez, R. 2020: *Evidencias científicas e impactos económicos del cambio climático en el departamento de Guairá* (Scientific evidence and economic impacts of climate change in the department of Guairá). MADES-STP. Asunción, Paraguay. <http://dncc.mades.gov.py/wp-content/uploads/2020/10/Guair%C3%A1-Evidencias-cient%C3%ADficas-e-impactos-econ%C3%B3micos-del-cambio-clim%C3%A1tico.pdf>



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dic
Maximum extreme	39,5	38,8	37,2	36,9	33,4	31,5	32,5	36,0	36,6	39,9	40,0	40,4
Average maximun	32,7	32,0	31,0	28,1	24,9	22,9	23,3	24,8	26,2	28,6	30,1	31,9
Mean	26,5	25,7	24,7	21,7	18,7	16,9	16,8	18,2	19,7	22,2	23,8	25,6
Average minimum	21,3	20,9	19,9	17,0	14,1	12,3	12,0	13,1	14,5	16,9	18,3	20,3
Minimum extreme	11,8	10,5	7,5	5,0	1,5	-1,4	-3,0	-2,0	1,1	4,4	6,6	8,4

Figure 6. Temporal distribution of mean monthly temperatures. Data from the Villarica meteorological station (1971-2000). Source: Scientific evidence and economic impacts of climate change in the department of Guairá (2020).

Life zones

Paraguay is considered a transition or ecotone[17] area. Its biogeography has been studied on several occasions, using various methodologies and parameters for its definition, which has resulted in biogeographic classifications rich in terminologies, nomenclatures and also in disparities and contradictions. Following the classification of the life zones of Holdridge (1969), Paraguay is adapted to the characteristics of the warm temperate moist forest (BhTc), in the eastern region.

Geology, Geomorphology and soils

Eastern Paraguay is located on the former western margin of Gondwana, where the Precambrian crystalline foundations are found, the Caapucú to the south and the Alto Apa to the north, divided by a large faulted block (aulacogene-Bajo de San Pedro). This aulacogen is filled with sedimentary rocks that in age range are possibly from the Cambrian to the Lower Mesozoic. It is located between the final margin, in the north, of the Craton of the Río de la Plata (Alto de Caapucú) and the final margin, in the south, of the Craton del Amazonas (Alto Apa). The distribution of Paleozoic-

[17] Acevedo, C. (1998). *La diversidad biológica del Paraguay: una visión general. La Diversidad Biológica de Iberoamérica* (The biological diversity of Paraguay: an overview. The Biological Diversity of Ibero-America), 3, 3-38.

Mesozoic deposits in Paraguay have been greatly influenced by two major events - the separation of America from Africa and the Andean orogeny[18] .

The geological base has given rise to large areas where sandstone and basalt is the source material and in turn, a mosaic of predominantly alfisol and ultisol, interspersed with smaller areas of entisol and inceptsol. Carboniferous sandstones and tilites predominate, of fluvial and glacial origin.

These soils present some limitations in terms of erosion due to superficial sand layers, acidity and fertility. The eastern region is dominated by highly fertile red soils.

Most of the eastern region has a slightly undulating relief with gentle slopes towards the water courses. The extensive plains alternate with gentle hills that do not exceed 200 masl and rise towards the Cordillera (mountain range) del Ybytyruzú.

Its major orographic systems are the Amambay, Mbaracayú, Ybytyrusú and Caaguazú mountain ranges. The highest point is Cerro Pero (Cerro Tres Kandu) with 842 meters, located in the IV Department of Guairá. Its topography is low relief with numerous swampy areas locally called "estuaries". The topographically highest points are elevations of granitic porphyritic rocks. The Cordillera (mountain range) Caazapá, its branches (extensions), Ybytyruzú, Monte Rosario and San Rafael, cross from east to west, with medium-height hills such as Mbatoví, Ñú Cañy, Pacurí and Morotí. This mountain range marks the territory in two well differentiated zones, to the northwest, low lands, estuaries and crop fields and pastures; in the southeast, with undulating and elevated terrain, covered with forests.

Hidrology

In the project area are the two main hydrographic basins of Paraguay, the Paraguay river basin and Paraná, which contribute to the macro-basin of the La Plata water system. These basins have a drainage area of 2,605,000 km2 and an average flow of 3,191 and 12,520 mm/year, respectively (Table 7[19]).

Table 8, shows all the main drains (flows) that contribute to the Paraguay River, on the eastern side, and those of the Paraná River, with the average precipitation, ETR and runoff. Here, the sub-basin of the Tebicury River stands out for being the largest tributary of the Paraguay River and the Alto Paraná and South Paraná basins, the largest contributors to the Paraná River. The tributaries associated with the project area are the Tebicuary, Tebicuary-me, Pirapó, Capiibary

[18] Fúlfaro, V. J. (1996). *Geología del Paraguay Oriental. Magmatismo Alcalino en Paraguay Central-Oriental Relaciones con Magmatismo Coeval en Brasil* (Geology of Eastern Paraguay. Alkaline Magmatism in Central-Eastern Paraguay Relations with Coeval Magmatism in Brazil). Edusp/Fapesp, S ao Paulo, 11-29

[19] FMAM, PNUMA, OEA, FONPLATA, OMM. 2004. *Vision de los recursos hidricos en paraguay* (vision of water resources in paraguay)

and Ypety rivers and the springs of the Capiibary and Ypeti streams and the Iñaro, Guazú and Charará streams.

Table 7. Average monthly flows of the Paraná and Paraguay rivers

River	Paraná	Paraguay
Station (Season)	Encarnación	Asunción
JAN	14,882	2,686
FEB	16,984	2,761
MAR	15,928	2,928
APR	13,771	3,300
MAY	12,138	3,890
JUN	12,111	4,209
JUL	10,619	3,858
AUG	9,290	3,466
SEP	9,684	3,107
OCT	11,421	2,848
NOV	11,287	2,632
DEC	12,128	2,601
Average	12,520	3,191

Source: FMAM, PNUMA, OEA, FONPLATA, OMM (2004)

Table 8. Hydrology of the sub-basins of the Paraná and Paraguay rivers in the eastern area

Basin	Sub-Basin	Drainage Area km²	Precipitation [P] mm	Real (Actual) Evapotranspiration [ETR] mm	Runoff [R]	
					mm	m³/s
Paraguay Oriental River	Apa River	15,560	1,435	1,025	410	202
	Aquidaban	11,532	1,494	1,025	469	172
	Ypané	9,935	1,549	1,025	524	165
	Jejui Guazú	20,073	1,535	1,025	510	325
	Manduvira	9,401	1,481	1,025	456	136
	Piribebuy	1,405	1,407	1,025	382	17
	Salado	1,066	1,412	1,025	387	13
	Asunción	2,557	1,350	1,025	325	26
	Alberdi	519	1,364	1,002	362	6
	Tebicuary	31,317	1,537	1,027	510	506
	Riacho La Paz	3,884	1,303	1,013	290	36
	Arroyo Saladillo	914	1,360	1,025	335	10
	Riacho Cuarepoti	5,682	1,343	1,025	318	57
	Pilar	3,003	1,360	991	369	35
Paraná River	Alto Paraná(Py y Br)	20,472	1,713	1,066	647	420
	Acaray	9,802	1,631	1,053	578	180
	Monday	6,557	1,674	1,072	602	125
	Ordoñez	938	1,750	1,075	675	20

	Ñacunday	2,568	1,750	1,075	675	55
	Paraná Sur	18,951	1,750	1,052	698	419
		7,764	1,750	1,052	698	172
	Isla Yacyreta	7,221	1,623	1,052	571	131
	Paraná Conf. (Py y Arg)	3,966	1,424	1,052	372	47

Source: FMAM, PNUMA, OEA, FONPLATA, OMM (2004)

Vegetation and land uses

The project lots are distributed between the ecoregions of the Atlantic Forest of the Alto de Paraná and the Chaco Húmedo. The first ecoregion is characterized by being the wettest region in Paraguay and by presenting high and humid subtropical forests, while the second ecoregion is characterized by presenting extensive savannas, with wetlands, estuaries, islands of sub-humid forests, and gallery forests located mainly in sedimentary soils. Table 9, shows the distribution of the districts and their respective Ecoregions.

Table 9. Ecoregions by district

Departament	Ecorregion	District
Caazapá	Atlantic Forest of Alto Paraná	3 de Mayo Abai Buena Vista Caazapá General Higinio Morinigo Maciel San Juan Nepomuceno Tavai

Guairá	Chaco Húmedo	Yuty
		4 de Mayo
		Buena Vista
		Caazapá
		Fulgencio Yegros
		General Higinio Morinigo
		Maciel
		Moises Bertoni
		Yuty
	Atlantic Forest of Alto Paraná	Borja
		Colonia Independencia
		Coronel Martinez
		Dr. Bottrell
		Felix Perez Cardozo
		General Eugenio A. Garay
		Itape
		Iturbe
		Jose Fassardi
		Mauricio Jose Trouche
		Mbocayaty
		Natalicio Talavera

	Chaco Húmedo	Ñumi
		Paso Yobai
		San Salvador
		Tebicuary
		Villarrica
		Yataity
		Borja
		Coronel Martinez
		Felix Perez Cardozo
		General Eugenio A. Garay
		Iturbe
		Jose Fassardi
		Tebicuary
		Yataity

Source: LIFE (2016)[20]

The natural ecosystems in this region of the country have been highly intervened mainly due to the expansion of the agricultural boundary, leaving only approximately 7% of the natural covers[21] (Figure 9). Historically, the loss of forests has been due to forestry in the 1930s to the 1960s,

[20] Lasting Iniciative for Earth (LIFE). 2016. *ECORREGIONES DEL PARAGUAY - DEFINICIÓN DE PRIORIDADES EM CONSERVACIÓN. Versión 1*. (ECOREGIONS OF PARAGUAY - DEFINITION OF CONSERVATION PRIORITIES. Version 1).<http://institutolife.org/wp-content/uploads/2018/11/Ecorregiones_del_Paraguay.pdf>

[21] WWF. 2004. Managing the Soy Boom: Two scenarios of soy production expansion in South America. Jan Maarten Dros. A I D E nvironment

followed by the expansion of the livestock boundary between the 1960s and 1980s and in recent decades, the expansion of mechanized farming, mainly soybean[22] [23] [24]

Beef cattle farming is of great importance in the eastern region of the country, since 63% of the total stock is produced in this area (Figure 8), most of which is exported[25]. Livestock in Paraguay consists mainly of the exploitation of natural grasslands and wetlands, through a pastures rotation system and periods of pasture renewal through soil tillage (chiselling and harrowing intervention) and subsequent sowing (planting). These livestock systems are accompanied by crops for the internal consumption of livestock, which consists mainly of oats, to produce hay, and corn, to produce silage. These crops acquire greater relevance in the winter season as a supplement to the diet of cattle.

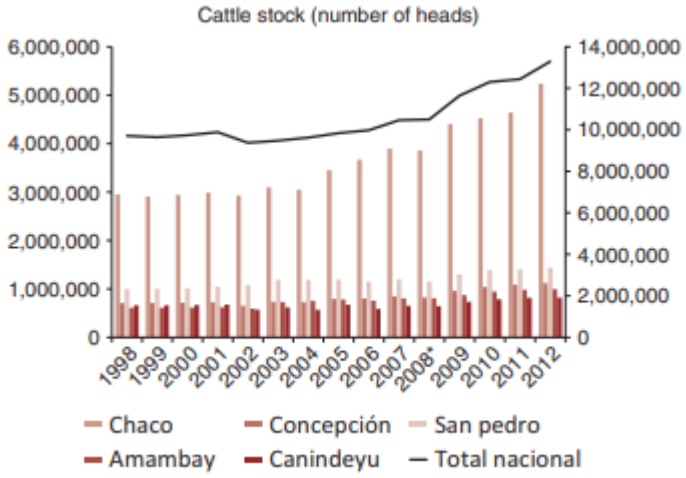


Figure 8. Cattle stock of Paraguay. Source: World Bank (2015).

[22] Chengquan Huang *et al.* 2006. Rapid loss of Paraguay's Atlantic forest and the status of protected areas — A Landsat assessment, Remote Sensing of Environment. doi:10.1016/j.rse.2006.09.016

[23] Huang *et al.* 2009, Assessment of Paraguay's forest cover change using Landsat observations. Global and Planetary Change 67: 1–12

[24] Correia, Joel. 2017. Soy states: resource politics, violent environments and soybean territorialization in Paraguay. The Journal of Peasant Studies, 2017 https://doi.org/10.1080/03066150.2017.1384726

[25] Costantini, Michele *et al.* 2021. Environmental impact assessment of beef cattle production in semi-intensive systems in Paraguay. Sustainable Production and Consumption. 27:269-281. https://doi.org/10.1016/j.spc.2020.11.003

BIOTICAL CHARACTERISTICS

Biodiversity

Originally, the vegetation of Paraguay consisted of more than 80% of subtropical forests, which, together with the forests of Brazil, Argentina and Uruguay, formed the "Atlantic Forest". This region presents a deforested landscape today, replaced by mechanized cereal production.

The wild nature of the region, along the mountain range, is a sample of the rich vegetation of the country, located in the area, the Atlantic Forest of Alto Paraná[26] and the Eco-region of the Central Jungle.[27] Its high biological diversity and endemic species make this region a global biodiversity hotspot. These forests also play a fundamental role in protecting river basins, preventing soil erosion, and maintaining the environmental conditions necessary for the development of cities and rural areas. However, only 7% of its original surface remains, highlighting the very serious situation that this eco-region[28] is going through.

In the region there are the protected areas of: The Caazapá National Park with 16,000 ha, the Ypeti Natural Reserve with 13,592 ha and the Tapytá Natural Reserve with 4,736 ha.

Flora

The project area is found between the ecoregions of the Central Jungle and the Alto Paraná Jungle, which are characterized by lush vegetation, from grasslands and estuaries to the high subtropical jungle. This is due to its undulating topography, the high irrigation of rivers and streams, and the physicochemical properties of the soils.[29] In addition, this area acts as a corridor for the migration of species between humid and semi-deciduous forests, and between the Atlantic forests and the Cerrado, harboring greater diversity.[30]

---

[26] Dinerstein, E., Olson, D. M., Graham, D. J., Webster, A. L., Primm, S. A., Bookbinder, M. P., & Ledec, G. (1995). *Una evaluación del estado de conservación de las ecoregiones terrestres de América latina y el Caribe* (An assessment of the conservation status of the terrestrial ecoregions of Latin America and the Caribbean). Washington D.C.: WWF - World Bank. Pp.: 135.

[27] SEAM. (2003). *Estrategia Nacional y Plan de Acción para la conservación de la Biodiversidad del Paraguay* (National Strategy and Action Plan for the conservation of the Biodiversity of Paraguay) 2004-2009. SEAM/PNUD/ GEF, Asunción. Pp.: 105.

[28] Lanzone, C., Labaroni, C. A., Formoso, A. E., Buschiazzo, L. M., Da Rosa, F. A., & Teta, P. (2018). *Diversidad, sistemática y conservación de roedores en el extremo sudoccidental del Bosque Atlántico Interior* (Diversity, systematics and conservation of rodents in the extreme southwestern part of the Inland Atlantic Forest).

.

[29] Leipzig (1996). Paraguay: *Informe nacional para la conferencia técnica internacional de la FAO sobre los recursos filogenéticos* (Paraguay: National Report for the FAO International Technical Conference on Phylogenetic Resources).

[30] Bartrina, L. U. C. I. A. (2007). *Contexto geográfico general. Biodiversidad del Paraguay: Una aproximación a sus realidades* (General geographic context. Biodiversity of Paraguay: An approach to its realities) (Salas–Dueñas, DA, and JF Facetti, eds.). Fundación Moisés Bertoni. Asunción, Paraguay, 25-32.

The characteristic forest species of the forests of the Central Jungle and Alto de Paraná are: *Cedrela fissilis* (cedar), *Peltophorum dubium* (Ibirá-pitá), *Tabebuia sp*. (roble), *Balfourodendron riedelianum* (guatambú), *Enterolobium contortisiliquum* (pacara earpod tree), *Parapiptadenia rigida* (Angico), *Astronium fraxinifolium* (kingwood or locustwood), *Anadenanthera colubrina* (vilca or huilco), *Pterogyne nitens* (guiraró or palo coca), *Lonchocarpus leucanthus* (yvyra itá).

Los principales ecosistemas encontrados en esta región son el bosque Oriental de Paraguay y las praderas de la región oriental, las cuales se describen a continuación:

Oriental Forest of Paraguay

This is part of the subtropical forests of Brazil and the South, which can harbor more than 250 species of flora. This area is divided into four forest formations:

High forest: this formation comprises the individuals of greatest commercial importance, whose structure is classified by three main strata, a dominant stratum where the emerging and larger individuals are found, reaching heights of 25-30 m; followed by an intermediate stratum which includes individuals between 12 and 29 m high, in this stratum the evergreen species, sciophytes and with intermediate light requirements predominate; finally, there is the lower stratum predominated by sciophytic species. Table 10 shows the most representative species of this type of forest, classified according to their predominance by stratum.

Table 10. Predominant species in the high forest according to the stratum

Dominant		Intermediate		Lower	
Common name	Scientific name	Common name	Scientific name	Common name	Scientific name
Kingwood, locustwood	*Astronium fraxinifolium*	Aratiku	*Rollinia emarginata*	Sapirangy	*Tabernaemontana australis*
Pink trumpet tree, pink tab	*Tabebuia heptaphylla*	Tapia guasu'y	*Alchornea triplinervia*	Kanelon	*Rapanea spp.*
Peterevy	*Cordia trichotoma*	Saptrees, mangosteens	*Rheedia brasiliensis*	Yvyra kamby	*Sebastiana spp.*
Guajayvi	*Patagonula americana*	Sweetwood	*Nectandra y Ocotea spp.*	Inga'í	*Inga marginata*
Vilca, huilco	*Anadenanthera colubrina*	Yvyra pepé	*Holocalyx balansae*	Katigua pyta	*Trichilia catigua*

Yvyra pere	*Apuleia leiocarpa*	Ysapy'y morotí	*Machaerium minutiflorum*	Yrupe rupá	*Guarea kunthiana*
Pacara earpod tree	*Enterolobium contortisiliquum*	cancharana	*Cabralea canjerana*	Ñandypa'í	*Sorocea bonplandii*
Yvyra itá	*Lonchocarpus leucanthus*	Guavira pytá	*Campomanesia xanthocarpa*	Yvyra ta'i	*Pilocarpus pennatifolius*
Ibirá-Payé, Incienso	*Myrocarpus frondosus*	Yvaporoity	*Myciaria rivularis var. baporei*	Ñiño azoté	*Calliandra tweediei*
Angico	*Parapiptadenia rigida*	Koku	*Allophylus edulis*	Bitter orange, Seville orange	*Citrus aurantium*
Ibirá-pitá	*Peltophorum dubium*	Jaguarata'y	*Cupania vernalis*	ND	ND
Guiraró or palo coca	*Pterogyne nitens*	Aguaí	*Chrysophyllum gonocarpum*	ND	ND
Argentine cedar, cedro batata,	*Cedrela fissilis*	Pykasu rembiú	*Chrysophyllum marginatum*	ND	ND
Tatajyva	*Chlorophora tinctoria*	ND	ND	ND	ND
Fig trees or figs	*Ficus enormis*	ND	ND	ND	ND
Yvyra ñetí, guatambú	*Balfourodendron riedelianum*	ND	ND	ND	ND
Yvyra pi'ú, Maria preta	*Diatenopteryx sorbifolia*	ND	ND	ND	ND

Source: Leipzig (1996)

- Riparian forest: these forests are those associated with water sources and are characterized by their low size. These ecosystems have soils with a high accumulation of organic matter deposited by tributaries, especially during flood periods. These forests are characterized by having a more homogeneous structure, with no obvious vertical strata. The representative species of this formation are: Ka'a ovetí (Luehea divaricata), Ñuatí arroyo (Sebastiana spp.), Yvyra pi'u guasu (Ruprechtia laxifolia), Jaguarata'y (Cupania vernalis) and Uruku'ra or sangre de drago (Croton urucurana).).

- Low humid forest: these forests present characteristics similar to the riparian, but they are distributed in the form of islands mainly in the departments of Misiones, Paraguarí, Guairá and Cordillera Ka'aguasu. These areas are highly limited as they are poorly drained most of the year. The yvyra pytá (Peltophorum dubium) species predominate in this formation, as well as Ka'a ovetí (Luehea divaricate), pacara earpod tree (Enterolobium contortisiliquum) and Yvyra say'jú (Terminalia triflora).

- Savanna forest: this formation is mainly composed of pastures, low bushes and small forests, where the yatai palm (Butia jatay) predominates, in addition to species such as Guavira'mí (Campomanesia sp.), Ka'a mbara (Gochnatia polymorpha), Yvyra ovi (Helietta apiculata), sara (Lantana sp.), Kurupay (Anadenanthera peregrina), Platypodium elegans, and Vochysia spp.

Prairies of the eastern region

This area refers to the savannas located on the eastern side of the Paraguay River, which is characterized by its extensive plains and by flooding periods that are classified into the following prairies:

- Flat prairies with tall grasses, being the plains that present short flooding periods and where the species Andropogon lateralis, Sorghastrum agrostoides, Andropogon condensatum, Panicum prionitis, Cyperus sp. and creeping (low-growing) species: Axonopus compressus, A. affinis, Paspalum notatum, Paspalum guaraniticum and Cyperus spp. predominate.

- Low prairies of depressed lands located in depressed areas and with permanent water retention. In these areas the species Panicum prionitis, Sorghastrum agrostoides, Andropogon lateralis, Imperata brasiliensis, Paspalum devicenzii, Cyperus giganteus and Thypa latifolia and low grasses such as Leersia hexandra and Panicum elephantipes predominate.

- Swampy prairies, which present greater flooding most of the year, so the associated vegetation is characteristic of humid environments such as water hyacinth, brownseed paspalum, pirí, California bulrush or southern bulrush, bent alligator-flag or arrowroot and yahapé. These areas, being wetlands, are of great importance for wildlife and recreational-cultural areas.

Fauna

The following species have been described in the eastern region of Paraguay: Tiririca, margay, giant otter or giant river otter, aira'y, mbykure, nine-banded armadillo or long-nosed armadillo, six-banded armadillo or yellow armadillo, kaguaré, capuchin monkey, howler monkey, South American coati, crab-eating raccoon or South American raccoon, crab-eating fox or forest fox, tayra, jaguarundi, Chacoan peccary or tagua, tañykatu, red brocket, gray brocket or brown brocket, Brazilian guinea pig, tapiti or Brazilian, southern tamandua (*Tamandua tetradactyla*).

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The environmental framework of Paraguay, part of article 7 of the National Constitution that guarantees and promotes the right to a healthy environment, for which, through Law No. 1561/00, the National Environmental Council and the Secretariat of the Environment are created (SEAM), which will have the responsibility of regulating, controlling and creating laws aimed at studying and using the biological diversity of the national territory in a sustainable way. The SEAM has four thematic general directions, and the one that has priority for the project is the General Directorate for the Protection and Conservation of Biodiversity, which is in charge of administering and managing Protected areas and establishing strategies for the use and conservation of biodiversity. Together with SEAM, the project will be regulated by the National Forestry Institute (INFONA), created by Law No. 3464/08, which is in charge of regulating all forestry matters in the country and the Ministry of the Environment and Sustainable Development (MADES), which is in charge of implementing and controlling Paraguay's environmental regulations.

On the other hand, taking into account that this project focuses on removing GHG emissions from the atmosphere through the implementation of forest plantations, it accepts the agreement with the commitment acquired by Paraguay to guarantee the right to a healthy environment and promote adaptation and mitigation of Climate Change. This was ratified through Law No. 251/93 "That approves the Convention on Climate Change adopted during the United Nations Conference on Environment and Development", Law No. 1447/99 "That approves the Kyoto Protocol of the United Nations Framework Convention on Climate Change" and Law No. 5,681/2016 "That approves the Paris Agreement on Climate Change".

Finally, there is the regulation that ensures labor well-being through the establishment of the minimum wage, the mandatory nature of the provision of social security, benefits and freedom of association. These regulations correspond to Law No. 213/93 (Labor Code - modified and partially updated by Law No. 496/95) and Law No. 742/61 (Labor Procedure Code).

The most important environmental regulations related to the project and compliance with them are presented in Table 11.

Tabla 11. Regulatory compliance of the project before national regulations

Regulation	Description	Compliance Project

Law No. 294/93, Decree No. 453/13 and Decree No. 954/13	Environmental Impact Assessment. "Afforestation for Multiple Uses". They declare mandatory and regulate the assessment of environmental impacts to any project that affects the environment or human activity that affects the quality of life, biodiversity, quantity of natural or environmental resources and their use (utilization), well-being, health, safety, legitimate habits, customs, cultural heritage or livelihoods.	The firms Ferber Forestal S.A. and Ganatapi Forestal S.A. have the Environmental Impact Assessment for the projects of "Afforestation for Multiple Uses", requirement of article 2 "The agricultural, cattle, forestry and farm exploitation". Both properties have forestry as their productive unit.
Law No. 294/93 and Decree No. 453/13	Environmental Management Plan "Multiple Use Forestry, Forest Nursery, Greenhouse, Fuel-wood (Firewood) and Charcoal Production".	The firm Ferber Forestal S.A. presented an adjustment to the Environmental Management Plan for the project where the activity of Fuel-wood (Firewood) and Charcoal Production is reported in a timely manner.
Law No. 4241/10 Decree No. 9824/12	The buffer zones of streams and rivers will be protected. The exact width depends on the size of the body of water.	The project establishes the conservation and protection of buffer forests along streams and rivers and restrictions in areas with steep slopes.
Law No. 422/73	Declares of public interest the rational use (utilization) and management of the country's forests and forest lands, as well as the renewable natural resources that are included in the regime of this law. In addition, it declares of public interest and mandatory, the protection, conservation, improvement and enhancement (increase) of forest resources. By means of this law it is also established that plantations must register and present the Forest Management Plan prior to the activities of harvesting and marketing of wood. Furthermore, this Law stipulates that all rural farms (estates) with an area > 20 ha must keep (have) 25% of the existing forest cover in 1986 (Art. 42).	The project was implemented on grazing lands, so the Project did not carry out forest use (utilization). See baseline and eligibility sections for more detail.
Law No. 2524/04, followed by the laws No. 3139/06, No. 3663/08, No. 5045/13 and No. 6256/18	The objectives are to protect, recover, and improve the native forest in the Eastern (Oriental) Region. The conversion of forest land to agricultural land is prohibited. All rural farms (estates) with a surface (area) > 20 ha must keep (have) 25% of the existing forest cover in 1986.	The project was implemented on grazing lands, so the Project did not carry out forest use (utilization). See baseline and eligibility sections for more detail.

Law No. 352/94	Law of protected wilderness areas. Forestry activities involving exotic species are not allowed in protected areas.	The project is not located in protected areas.
Law No. 716/96	Crimes against environmental law are punished.	The project aligns with the focus of the law. The project does not harm the environment, on the contrary, it supports wildlife with the implementation of reforestation.
Law No. 536/95	Law to Promote Afforestation and Reforestation. Afforestation is understood as the action of establishing forests, with native or exotic species on lands that lack them or where they are insufficient.	The project was implemented in areas where the main land use was grazing for extensive cattle ranching.
Law No. 4890	Real (Actual) right of forest surface. The owner of the domain of a property capable of containing forest plantations or natural forests, constitutes in favor of third parties or surface workers, a right of use (utilization) or dispose of the forest assets planted on the surface of his property. The project has all the land tenure documents that allow its use (utilization).	The project has all the land tenure documents that allow its use (utilization).
Law No. 5875/17	National Law on Climate Change. It establishes the general regulatory framework that allows planning and responding, in an urgent, adequate, coordinated and sustained manner, to the impacts of climate change.	The project is in accordance with the objectives of the law.

1.15 Participation under Other GHG Programs

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

The project is not registered and will not be registered under any other GHG program.

1.15.2 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG program GEI.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The project does not participate in emissions trading program.

1.16.2 Other Forms of Environmental Credit

Indicate whether the project has sought or received another form of GHG-related environmental credit, including renewable energy certificates, during this monitoring period. Include all relevant information about the GHG-related environmental credits and the related program. Additionally, provide a list of all and any other programs under which the project is eligible to create another form of GHG-related environment credit.

1.17 Additional Information Relevant to the Project

1. Leakage Management

Where applicable, describe the leakage management plan and implementation of leakage and risk mitigation measures.

2. Commercially Sensitive Information

Indicate whether any commercially sensitive information has been excluded from the public version of the project description and briefly describe the items to which such information pertains.

Note - Information related to the determination of the baseline scenario, demonstration of additionality, and estimation and monitoring of GHG emission reductions and removals (including operational and capital expenditures) cannot be considered to be commercially sensitive and must be provided in the public versions of the project documents.

3. Sustainable Development

Describe how the project contributes to achieving any nationally stated sustainable development priorities, including any provisions for monitoring and reporting same.

4. Further Information

Include any additional relevant legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and/or temporal information that may have a bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 SAFEGUARDS

2.1 No Net Harm

Summarize any potential negative environmental and socio-economic impacts and the steps taken to mitigate them.

2.2 Local Stakeholder Consultation

Describe the process for, and the outcomes from, the local stakeholder consultation conducted prior to the joint validation and verification. Include details on the following:

- *The procedures or methods used for engaging local stakeholders (e.g., dates of announcements or meetings, periods during which input was sought).*
- *The procedures or methods used for documenting the outcomes of the local stakeholder consultation.*
- *The mechanism for on-going communication with local stakeholders.*
- *How due account of all and any input received during the consultation has been taken. Include details on any updates to the project design or justify why updates are not appropriate.*

For AFOLU projects, also demonstrate how the project has or will communicate the following:

- *The project design and implementation, including the results of monitoring.*
- *The risks, costs and benefits the project may bring to local stakeholders.*
- *All relevant laws and regulations covering workers' rights in the host country.*
- *The process of VCS Program validation and verification and the validation/verification body's site visit.*

2.3 Environmental Impact

Summarize any environmental impact assessments carried out with respect to the project, where applicable.

2.4 Public Comments

Demonstrate how due account of all and any comments received during the public comment period has been taken. Include details on any updates to the project design or demonstrate the insignificance or irrelevance of comments.

2.5 AFOLU-Specific Safeguards

For AFOLU projects, provide details on the following:

- *Local stakeholder identification process and a description of results.*

- *Risks to local stakeholders due to project implementation and how the project will mitigate such risks.*
- *Risks to local stakeholder resources due to project implementation and how the project will mitigate such risks, including the plans to ensure the project will not impact local stakeholder's property rights without the free, prior and informed consent.*
- *Processes to ensure ongoing communication and consultation with local stakeholders, including a grievance redress procedure to resolve any conflicts which may arise between the project proponent and local stakeholders.*

For AFOLU projects with no impacts on local stakeholders, provide evidence of such.

For non-AFOLU projects, this section is not required.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The estimation of the removals generated by the project's plantations was made based on the AR-ACM0003 methodology – "A/R Large-scale Consolidated Methodology Afforestation and reforestation of lands except Wetlands"[31] Version 2.0.

The tools applicable to the AR-ACM003 version 2.0 methodology are:

- "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" version 04.2;
- "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities" version 03.1;
- "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" version 01.1.0;
- "Estimation of non-CO2 greenhouse gas (GHG) emissions resulting from burning of biomass attributable to an A/R CDM project activity" version 04.0;
- "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity"version 02.0;
- "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" version 01.

[31] https://cdm.unfccc.int/methodologies/DB/C9QS5G3CS8FW04MYYXDFOQDPXWM4OE

3.2 Applicability of Methodology

Table 12. AR-ACM0003 methodology applicability conditions

Applicability condition	Description of compliance
The land subject to project activities does not belong to the wetlands category.	According to the distribution map of RAMSAR Sites in Paraguay[32] and information from CIFOR, as well as the official maps on Wetland Regions and Wetland Distribution prepared by the Environment Secretariat of the Ministry of Environment and Sustainable Development (MADES), the Project area is not within areas with wetland or peatland ecosystems.
Soil disturbance attributable to the project activity does not cover more than 10% of the area on each of the following types of lands, when these lands are included within the project boundaries: - Areas containing organic soils. - Areas in the baseline are subject to land use and management practices with application of the inputs (elements) listed in appendices 1 and 2 of the AR-ACM0003 methodology.	Organic soils were defined by the IPCC (2006) as those that have at least 12% organic carbon by weight (around 20% organic matter) and are subject to episodes of water saturation, and are defined as histosols and other soils with histic horizons.[33] The project area does not present soils classified as organic soils according to the information in the database of the soil organic carbon map GLOSIS-GSOCmap V1.5.0[34] of the Food and Agriculture Organization of the United Nations (FAO) and the international soil database ISRIC World Soil information Most of the soils belong to the ultisol category (Arquic Paleudul) with a distribution of 98.23% and only 1.77% with Inceptisol (Oxyaquic Dystrochrept).[35] This coincides with the general situation of the eastern region of Paraguay, which, according to the soil information, shows that sandstone and basalt are the source material and, in turn, a mosaic of predominantly alfisol and ultisol, interspersed with smaller areas of entisol and inceptisol. These soils have some limitations in terms of erosion due to superficial sand layers, acidity and fertility, and this eastern region is dominated by highly fertile red soils. These characteristics hinder the accumulation of organic matter and the presence of organic soils in the project boundaries. The uses prior to the implementation of the project did not present activities described in appendices 1 and 2 of the AR-ACM0003 methodology, since they corresponded to pastures[36] with a minimal presence of livestock and occupying 89.2% and short-term crops occupying only 10.7%. In the absence of project activities, the baseline is

[32] https://www.ramsar.org/es/humedal/paraguay

[33] IPCC (Intergovernmental Panel on Climate Change), 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston, In: H. S., Buendia L., Miwa K., Ngara T., and Tanabe K. (Eds.), IGES, Japan

[34] http://54.229.242.119/GSOCmap/

[35] Environmental Impact Report. Available in the path: *Gestión documental/Licencias ambientales*

[36] See section 3.4, baseline scenario

	expected to remain unmanaged grasslands, which have less carbon compared to plantations and forest cover.

Table 13. Applicability conditions of the AR-ACM0003 methodology tools

Tool	Applicability condition	Description of compliance
AR Tool 8- Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity- Version 4.0.0[37]	This tool is applicable for all fire events that occur within the project limit. All non-CO2 GHG emissions (other than CO2) resulting from any fire that occurs within the project limits will be accounted for each occurrence of fire that affects an area greater than the minimum area reported by Paraguay (0.5 ha) for the purpose of defining forest, provided that the accumulated area affected by such fires in a given year is ≥5% of the total project area.	All non-CO2 emissions resulting from any fire that occurs within the project limits are accounted for and discounted, provided that the accumulated affected area in a given year is greater than or equal to 5% of the project area
AR Tool-12 "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities" – Version 3.1[38]	This tool does not have internal applicability conditions and considers the assumptions of linearity in the change of biomass in dead wood and litter over a period of time, and the adequacy of the shoot-root relation for dead trees.	This tool has no internal conditions of applicability.
AR-Tool 14- Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project	This tool has no internal conditions of applicability.	This tool has no internal conditions of applicability.

[37] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v4.0.0.pdf/history_view

[38] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v1.1.0.pdf/history_view

activities - Version 4.2[39]		
AR-Tool 15- Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity – Version 2.0[40]	This tool is not applicable if it is anticipated that the displacement of agricultural activities will directly or indirectly affect the drainage of wetlands or peatlands.	Since the project area does not have wetland or peatland zones, the tool is applicable. In other words, the displacement of grazing activities (baseline) in the project area will not directly or indirectly cause the drainage of wetlands or peatlands.
AR-Tool 16- Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities – Version 1.1.0.	This tool is applicable when the land areas, the baseline scenario, and the project activity meet the following criteria: a. The land surfaces to which this tool is applied (i) do not fall into the wetland category, (ii) do not contain organic soils as defined in Annex A: IPCC GPG LULUCF 2003 glossary; (iii) are not subject to any of the land management and input (element) application practices listed in Tables 1 and 2. b. The project activity meets one of the following criteria: i) the litter remains in place and is not removed in the project activity; ii) Soil disturbance attributable to the A/R project activity, if it exists, is in accordance with good soil conservation practices (e.g. follow contour lines), is limited to soil disturbance for preparation of the land before planting and this alteration is not repeated in less than twenty years.	The establishment activities do not meet the applicability condition, criterion b
AR-Tool 2- "Combined tool to identify the baseline	Afforestation of the land within the boundaries of the proposed project, carried out with or without being registered as an A/R CDM project activity, will not result in the violation	Afforestation of the land will not lead to the violation of any applicable law (see section 3.5. Additionality and section 1.14 Compliance with

[39] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v2.1.0.pdf/history_view

[40] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v2.0.pdf/history_view

scenario and demonstrate additionality in A/R CDM project activities".	of any applicable law, even if the law is not applied. This tool is not applicable to small-scale afforestation and reforestation project activities.	Laws, Statutes and other regulatory frameworks). Not applicable.

3.3 Project Boundary

Table 14. Carbon pools in baseline and project scenarios

Source		Gas	Included?	Justification/Explanation
Baseline	Above and below-ground biomass	CO2	Yes	Due to the burning activity practices for the renovation of pastures, it does not allow the accumulation of carbon, therefore, it is zero.
Project	Above and below-ground biomass	CO2	Yes	This corresponds to the largest carbon reservoir subject to the project activity. Carbon storage in above and below-ground biomass is expected to increase as a result of the implementation of the project activity.
	Litter and dead wood	CO2	Yes	Carbon storage in this compartment could increase as a result of the reforestation project activity.

Source		Gas	Included?	Justification/Explanation
Biomass burning		CO2	Yes	CO2 emissions due to biomass burning are accounted for as a change in carbon stocks.
		CH4	No	The project does not use biomass burning practices as part of the activities. In the event of a fire event, it will be reported and accounted for in the monitoring report.
		N2O	No	The project does not use biomass burning practices as part of the activities. In the event of a fire event, it will be reported and accounted for in the monitoring report.

3.4 Baseline Scenario

Multispectral Landsat images were downloaded, dated August 2015, before the Project start date. These images were provided by the United States Geological Survey (USGS) and can be accessed and downloaded free of charge at https://earthexplorer.usgs.gov/.https://earthexplorer.usgs.gov/. The images were downloaded on January 27, 2021.

For the classification of the soil cover, the methodology based on supervised remote sensing techniques is used to generate the soil cover such as forest land, cropland, prairies and wetlands.

Table 13 shows the types of coverage and their amount of area at the project site prior to project implementation. According to the results obtained, grassland coverage predominates.

Table 15. Proportion of land cover prior to project start

Land cover	Area (ha)	Percentage of area
Forest land	4.69	0.12%
Grasslands	3,828	99.86%
Settlements	0.60	0.02%
Total	3,833.53	100.00%

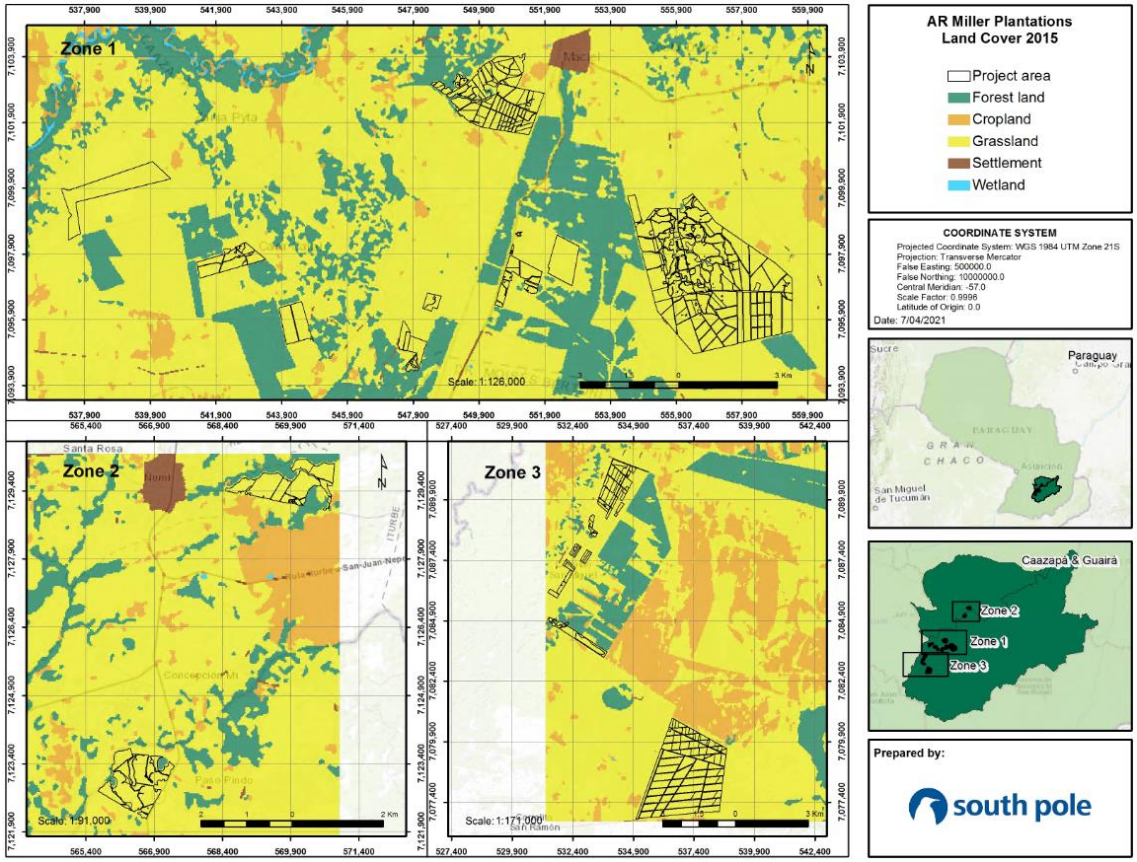


Figure 9. Land use prior to project start

For more details of the baseline see section 1.13 and 3.5.

3.5 Additionality

The additionality analysis is performed by using the CDM "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities, Version 01".

According to the additionality tool, the following steps have been applied:

STEP 1. Identification of alternative scenarios

STEP 2. Barrier analysis

STEP 4. Common practice analysis

Step 1. Identification of alternative scenarios

Sub-step 1a. Identification of credible alternative land use scenarios to the proposed VCS AFOLU project activity

Paraguay's economy is highly dependent on the farming sector, which represents 30.4% of the gross domestic product. The same is classified in the activities of agriculture (22.2%), livestock

6.6%, forestry (1.5%) and fishing (0.1%). The Eastern region, where the Project is located, covers 39% of the national territory, houses 97% of its population and is the area with most of the country's agricultural and economic activity (World Bank, 2015).

Scenario 1. Extensive livestock

Livestock farming is an activity with approximately 480 years of tradition in the country and meat is the main product exported due to its high quality. Historically, livestock in Paraguay has extended over vast natural grasslands and wetlands, with intensive production (animal housing) having been barely implemented (Constantitni et al. 2021)[41]. As a result, prairies and pastures in the country, which cover an area of about 17 million hectares, are mainly dedicated to agricultural uses (FAOSTAT 2019)[42].

According to Montes (2010)[43], 63% of the cattle population was located in the Eastern region in 2010. Likewise, the Rural Association of Paraguay indicates that in 2017, 60% of the cattle population was in this region (ARP 2017)[44]. According to the country's livestock statistics provided by the National Animal Health and Quality Service (SENACSA)[45], there were 13,801,993 bovines in Paraguay in 2019, of which 7,285,545 were in the Eastern region, and specifically 308,731 in the department of Caazapá (SENACSA 2019)[46]. Meat production throughout the country totaled around 560,000 metric tons of dressed weight, of which 365,000 were exported (USDA 2019 [47].

Figure 1 illustrates the evolution of the cattle grazing area (in hectares), the growth of the cattle herd (thousands of bovines) and the capacity of the pastures between the years 1950 and 2010 (Montes, 2010).

41 *Costantini, M., Vázquez-Rowe, I., Manzardo, A., & Bacenetti, J. (2021). Environmental impact assessment of beef cattle production in semi-intensive systems in Paraguay. Sustainable Production and Consumption, 27, 269-281.*

42 *http://www.fao.org/faostat/en/#data/QC*

43 *Montes Narbondo, Esteban. Ganadería. Paraguay y su ganadería. In: Revista Plan Agropecuario. Page 31. Available at: https://www.planagropecuario.org.uy/publicaciones/revista/R139/R_139_30.pdf*

44 *Rural Association of Paraguay. 2017. Introducción a Paraguay y su sector cárnico. April, 2017. Available at: https://www.arp.org.py/images/Paraguay-y-el-Sector-Carnico.pdf*

45 *https://www.senacsa.gov.py/index.php/informacion-publica/estadistica-pecuaria*

46 *SENACSA (Servicio Nacional de Calidad y Salud Animal - National Service for Animal Quality and Health), 2020. Estadística Pecuaria. Available at: https://www.senacsa.gov.py/index.php/informacion-publica/estadistica-pecuaria. Consulted on February 2021.*

47 *USDA, 2019. Paraguay, Livestock and products annual 2019. Available at: GAIN (Global Agricultural Information Network) database: https://gain.fas.usda.gov/. Consulted on February 2021.*

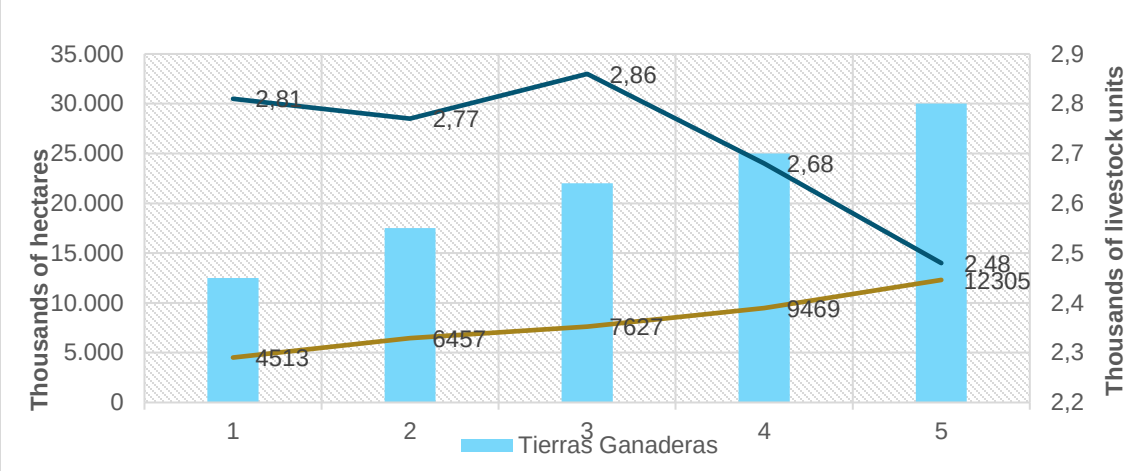


Figure 10. *Evolution of the relationship between cattle grazing lands, cattle herds and land capacity).*
Source: Vasconcellos (2008) cited by Medina, Rural Association of Paraguay (Montes, 2010).

In recent years, the livestock sector has made progress in terms of genetic enhancement and production chain efficiency, which has contributed to improve export competitiveness. This is evidenced in the increase of exports, going from 155,000 tons of meat in 2008 to 247,000 in 2019 (SENACSA 2019). Those advances are added to the government efforts to maintain high sanitary standards that position the sector at the international level (World Bank, 2015). In the cases when some areas of the Eastern region are no longer used for livestock, these are commonly dedicated to the expansion of soybean crops since small farmers find in the sale or lease of their lands to soy producers an attractive source of income (OECD 2018)[48].

Scenario 2. Agricultural crops

According to the statistics of the National Bank of Paraguay[49], the agricultural sector represents 30% of GDP, with a growth of 13.2% in the third quarter of 2020 that was associated with better levels of soy production and other agricultural products such as sugarcane, rice and corn[50]. Paraguay (along with Argentina, Brazil and Uruguay) is part of the Group of Producing Countries

[48] *OECD. (2018). Estudio Multidimensional de Paraguay. Volume I. Evaluación Inicial. Chapter 4. Hacia un entorno sostenible en Paraguay. Available at: https://www.oecd-ilibrary.org/sites/9789264301924-9-es/index.html?itemId=/content/component/9789264301924-9-es*

[49] *Banco Central del Paraguay (BCP) (2020), Boletín de Cuentas Nacionales. Available at: https://www.bcp.gov.py/boletin-de-cuentas-nacionales-trimestrales-i371*

[50] *https://www.bcp.gov.py/userfiles/getFile.php?file=userfiles/files/Informe%20III-2020%283%29.pdf*

from the Southern Cone that provide about 30% of food in the world[51] and is also one of the main soybean producers.

Soybean cultivation is a clearly defined business with a high export share (IDB 2010)[52]. Crop yield has improved significantly, especially in the Eastern region where the soybean area has tripled in the last 20 years (OECD 2018)[53]. Farmers are organized into business associations and trade chains, and receive support from the government (Szulecka & Monges 2017).

For its part, small-scale agriculture has traditionally focused on products for family self-consumption such as white corn, beans, broad beans and cassava. This type of agriculture is mainly concentrated in the Eastern region, in the departments of San Pedro, Caaguazú, Caazapá, Paraguarí, Guairá and Cordillera (World Bank, 2015). Cassava is economically and socially important, ranking third in production after soybeans and corn. The national government has implemented actions in order to improve the conditions and increase the profitability of the product through genetic improvement programs, the provision of technical assistance and its commercialization (USAID, 2010).

Scenario 3. The reforestation activity is not registered under the VCS

Deforestation and the geographical conditions of the country make reforestation a strategic activity to meet the domestic demand for wood, create jobs and maintain rural contributions to GDP by reducing the use of natural forest resources. However, plantations are not considered as lucrative as other land uses like agriculture (especially soybeans cultivation) or cattle ranching given the long payback period and the high initial costs that they require (Szulecka & Monges 2017)[54].

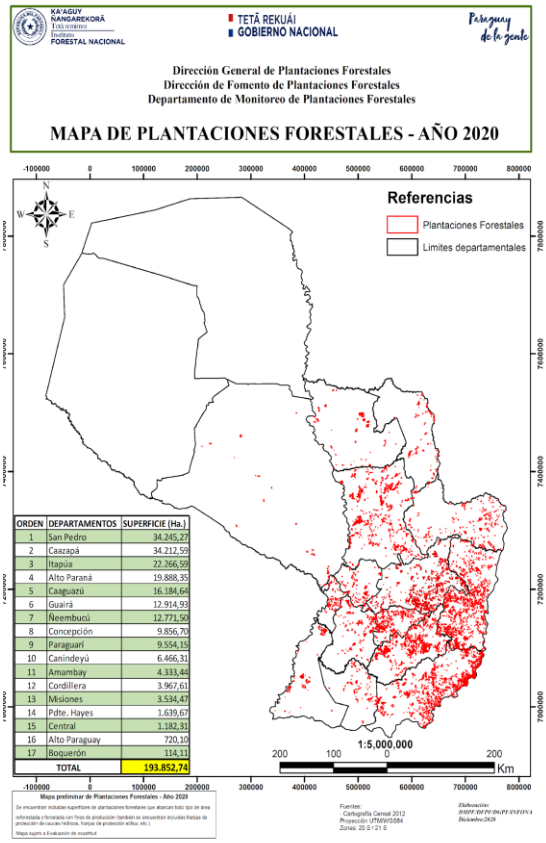
In 2012, the National Reforestation Plan was launched with the purpose to establish 450,000 ha of forest plantations (390,000 ha of solid wood and 60,000 ha of species for energy production) across the country in 15 years. However, by 2020 there were only 193,852 ha (INFONA, 2020, Figure 1), which has demonstrated the need for incentives to achieve the proposed objectives and make plantation an attractive economic activity.

51 https://www.py.undp.org/content/paraguay/es/home/presscenter/pressreleases/2020/produccion-sostenible-paraguay.html

52 *IDB. (2010). Movilizando el sistema bancario para la financiación de inversiones forestales en Paraguay. Proyecto PR-T1077. Producto 6. Caso Paraguay. Inter-American Development Bank; Capital Markets and Financial Institutions Department; Institutional Capacity and Finance Sector; Environment, Rural Development and Disaster Risk Management Department; and Infrastructure and Environment Department, Washington, D.C.*

53 https://www.oecd-ilibrary.org/sites/9789264301924-9-es/index.html?itemId=/content/component/9789264301924-9-es

54 *Szulecka, J., & Zalazar, E. M. (2017). Forest plantations in Paraguay: Historical developments and a critical diagnosis in a SWOT-AHP framework. Land Use Policy, 60, 384-394.*



ORDEN	DEPARTAMENTOS	SUPERFICIE (Ha.)
1	San Pedro	34.245,27
2	Caazapá	34.212,59
3	Itapúa	22.266,59
4	Alto Paraná	19.888,35
5	Caaguazú	16.184,64
6	Guairá	12.914,93
7	Ñeembucú	12.771,50
8	Concepción	9.856,70
9	Paraguarí	9.554,15
10	Canindeyú	6.466,31
11	Amambay	4.333,44
12	Cordillera	3.967,61
13	Misiones	3.534,47
14	Pdte. Hayes	1.639,67
15	Central	1.182,31
16	Alto Paraguay	720,10
17	Boquerón	114,11
TOTAL		193.852,74

Figura 11. Forest plantations in 2020. Source: INFONA (2020).[55]

Sub-step 1b. Consistency with mandatory applicable laws and regulations

Alternative land use activities comply with the national laws. For instance, cattle ranching is regulated by a set of provisions included in the Compilation of Laws and Regulations Related to the Production of Natural Meat (Rural Association of Paraguay, 2015)[56], which do not define restrictions for the development of this activity in the region and, on the contrary, highlight its advantages as a mean to promote meat consumption in both the domestic and international markets.

In regards to agriculture, Law N° 1863 of 2002 (the Agrarian Statute) details the aspects related to family farming and states that this activity can be carried out on soils with suitable agrological conditions except for mandatory forest reserve areas (Forestry Law N° 422/73 and Law of Forest Resources N° 542/95), privately-owned protected wilderness areas (Law N° 352/94) and

55 *Available at: https://nube.infona.gov.py/index.php/s/mfz32nixiep39ZK*

56 *Rural Association of Paraguay. 2015. Compilación de leyes y reglamentos relacionados a la producción de carne natural. Asunción, Paraguay. Available at: http://www.arp.org.py/images/files/COMPILACION%20DE%20LEYES%20RELACIONADOS%20(8).pdf*

natural forests and natural areas dedicated to the supply of environmental services as defined by the corresponding authority.

Step 2. Barrier analysis

Sub-step 2.a. Identification of barriers that would prevent the application of alternative scenarios

Below is a list of applicable barriers for the identified land use alternatives:

- *Investment barriers*
    - *Financing mechanisms: Various programs have been created in the country with the aim of encouraging the establishment of forest plantations:*
        I. *The Financing Program for Commercial Reforestation Products, also known as "Proforestal"[57] of the Financial Agency for Development (AFD) whose objective is to finance forest projects using fast-growing native or exotic species with a focus on responsible cultivation. The program finances up to 100% of the project total value in a 12-year term, with an AFD rate of 6% and an IFI (Intermediary Financial Institution) rate of 9% to 12%.*
        II. *The BNF forestry credit for timber and mixed (silvopastoral), energy and forest nurseries utilization[58].*
        III. *The Law N° 4890 that created the formal right of forest surface[59]. It allows foreign investments in plantations without the need of making land transactions but through the signature of agreements between owners and investors.*

      According to Szulecka & Monges (2017) and the results obtained from the project consultations conducted with actors from the institutional sector, the existing mechanisms are not fully operational and have access barriers.
    - *Investment barriers in the forestry sector due to the high initial investments that are required and the long payback periods compared to common land uses such as agriculture and livestock. Sustainable and profitable production of timber products requires a high initial investment for land preparation, as well as for the establishment and maintenance of plantations. Given the absence of financing mechanisms, the reforestation activity becomes viable only by having investors willing to benefit from its profitability in the long term.*
- *Institutional barriers*

[57] *https://www.afd.gov.py/producto/proforestal*

[58] *https://www.arp.org.py/images/files/10_ManuelFerreira-PresentacionForestal-PNUD-16-09-2016.pdf*

[59] *http://www.infona.gov.py/application/files/6914/2902/7121/Ley_N_4890_DERECHO_REAL_DE_SUPERFICIE_FORESTAL.pdf*

- *Limited capacity of the institutions to ensure compliance with forest management laws in force (Forestry Law N° 422 of 1973, Law for Forestation and Reforestation Promotion N° 536 of 1995, and Law for the Prohibition of Transformation and Conversion Activities in Areas with Forest Cover in the Eastern Region N° 2524 of 2004). The commercialization of native forest products illegally harvested affects the market for forest plantations as products acquired require a lower initial investment and a shorter payback period.*
- *In recent years, the National Forestry Institute (INFONA) has been promoting the establishment of productive forest plantations in order to sustainably supply the country's energy and wood demands. Some actions have been developed mainly through plantation promotion days and under the leadership of the General Directorate of Forest Plantations, which has the aim of promoting, encouraging, and establishing regulations and technological applications for genetic improvement and the development of forest plantations with productive and protective purposes, in accordance with the legislations in force[60]. To date, INFONA's activities have helped strengthen the regulatory framework but continue to have investment barriers.*

- *Barriers due to local ecological conditions*
  - *Despite the high potential of the country and the Eastern region for the establishment of commercial plantations given their good biological conditions for wood production and their large extensions of suitable areas, forestry production is not economically competitive with the main commodities of the country (meat and soybean). However, commercial plantations could compete with agricultural uses in the cases when they are located in areas with strong limitations for mechanized agriculture and where soils are considered not suitable for agricultural use (e.g., they are sandy and shallow, with very fast drainage, low water storage capacity and low nutrient content).*
- *Technological barriers*
  - *Technical capacity for the establishment, maintenance and harvest of forest plantations: In order to ensure an optimal production, in addition to identifying the appropriate lands and carrying out the relevant land tenure or ownership proceedings, it is also necessary obtaining environmental licensing. Additionally, the activity must be planned in its entirety, including building drainage systems, preparing soils, providing seedlings, preventing pests and diseases, looking after the plantation (through fertilization, pruning and thinning), building and providing maintenance to road infrastructure, acquiring machinery for the efficient use of plantations and signing commercial agreements that guarantee wood demand.*

    The technical capacities of Paraguayan institutions to support reforestation activities are under development. In fact, the country has invested more in the implementation and improvement of agricultural and livestock systems given their contribution to GDP, which explains why the design of strategies to encourage the expansion of forest plantations is

[60] *INFONA. (2017). Balance Anual de Gestión Pública, Instituto Forestal Naciona,l Año 2017. Presupuesto por Resultados. Available at: https://chm.cbd.int/api/v2013/documents/4406F62E-6E7A-1826-E2B9-082208FCC685/attachments/INFONA%202017.pdf*

taking place only recently. Therefore, reforesting agents must build their own capacities and hire foreign consultants and firms.

- *Barriers related to local traditions*
    - *Local people still choose the most traditional land uses such as cattle ranching or agriculture: Most traditional owners are cattle ranchers, own large inherited extensions of land and are not interested in investing in new productive uses or models. Although small farmers had been involved in the plantation promotion policy, which aimed at benefiting small-scale projects, most of them did not receive the promised subsidies as a result of the country's financial crisis in the mid-1990s. While it could be assumed that this was a government supporting mechanism for the common development of this forestry activity type, many plantations were abandoned or destroyed and the farmers became more interested in the financial bond than in the plantations management or the wood sales (Szulecka and Monges 2017).*

Sub-step 2.b. Elimination of alternative scenarios that are constrained by the identified barriers

Extensive livestock is the only alternative land use that does not face any of the identified barriers. For this reason, it is the baseline scenario. Table 16 lists land use scenarios and the respective limitations or barriers identified.

Tabla 16. ***The use of land and the barriers identified***

Alternative scenario	*Type of barrier*
Livestock	*No barrier identified.*
Agriculture	*Barriers due to local ecological conditions: The establishment of agricultural crops in the areas of interest for the forestry activity requires a high initial investment due to the limitations in the soil structure and quality.*
Forest plantation that has not been registered in the VCS	*Financing mechanisms, regulation of the illegal extraction of timber products from natural forests, technical capacity, local ecological conditions and traditional land use.*

Sub-step 2c. Determination of the baseline scenario (according to the barrier analysis)

Is the plantation that has not been registered as an A/R CDM project activity included in the list of land use scenarios not constrained by any barriers? → NO

- *If the answer is NO, does the list contain only one land use scenario that is not constrained by a barrier? → YES*
- *If the answer is YES, indicate the activity representing the remaining land use or the baseline scenario → Livestock*
- *Continue with Step 4, Common practice analysis*

Step 4. Common practice analysis

According to INFONA, in 2020 the plantations in Paraguay covered 193,852 ha, which represent 43% of the area projected by 2027 (450,000 ha) according to the National Reforestation Plan of 2012. Most of the plantations that remain standing belong to large and medium-sized business groups whose purpose is the production of roundwood and wood chips. The reforestation project to be registered under the VCS has characteristics that do not represent the common practice: creation of a group of more than 500 investors, investment in infrastructure and technical capacity, training of internal qualified staff and generation of alliances with wood processing industries in order to ensure the demand for raw materials and improve market competitiveness via products with higher added value such as charcoal, immunized wood and carpentry items.

3.6 Methodology Deviations

Describe and justify any methodology deviations applied during this monitoring period. Include evidence to demonstrate the following:

- The deviation will not negatively impact the conservativeness of the quantification of GHG emission reductions or removals.
- The deviation relates only to the criteria and procedures for monitoring or measurement, and does not relate to any other part of the methodology.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Describe the procedure for quantification of baseline emissions and/or removals in accordance with the applied methodology. Include all relevant equations, and explain and justify all relevant methodological choices (e.g., with respect to selection of emission factors and default values).

4.2 Project Emissions

Describe the procedure for quantification of project emissions and/or removals in accordance with the applied methodology. Include all relevant equations, and explain and justify all relevant methodological choices (e.g., with respect to selection of emission factors and default values).

4.3 Leakage

Describe the procedure for quantification of leakage emissions in accordance with the applied methodology. Include all relevant equations, and explain and justify all relevant methodological choices (e.g., with respect to selection of emission factors and default values).

4.4 Estimated Net GHG Emission Reductions and Removals

Describe the procedure for quantification of net GHG emission reductions and removals. Include all relevant equations. For AFOLU projects, include equations for the quantification of net change in carbon stocks.

Provide the ex-ante calculation (estimate) of baseline emissions/removals, project emissions/removals, leakage emissions and net GHG emission reductions and removals in the table below for the project crediting period.

For data and parameters monitored, use the estimates provided in Section 4.2 below. Document how each equation is applied, in a manner that enables the reader to reproduce the calculation. Provide example calculations for all key equations, to allow the reader to reproduce the calculation of estimated net GHG emission reductions or removals.

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year A				
Year B				
Year C				
Year...				
Total				

5 MONITORING

5.1 Data and Parameters Available at Validation

Complete the table below for all data and parameters that are determined or available at validation, and remain fixed throughout the project crediting period (copy the table as necessary for each data/parameter). The values provided are used to estimate the net GHG emissions and removals for the project crediting period in Section 3 above. Data and parameters monitored

during the operation of the project are included in Section 4.2 (Data and Parameters Monitored) below.

Data / Parameter	
Data unit	*Indicate the unit of measure*
Description	*Provide a brief description of the data/parameter*
Source of data	*Indicate the source(s) of data*
Value applied:	*Provide the value applied*
Justification of choice of data or description of measurement methods and procedures applied	*Justify the choice of data source, providing references where applicable. Where values are based on measurement, include a description of the measurement methods and procedures applied (e.g., what standards or protocols have been followed), indicate the responsible person/entity that undertook the measurement, the date of the measurement and the measurement results. More detailed information may be provided in an appendix.*
Purpose of Data	*Indicate one of the following:* ● *Determination of baseline scenario (AFOLU projects only)* ● *Calculation of baseline emissions* ● *Calculation of project emissions* ● *Calculation of leakage*
Comments	*Provide any additional comments*

5.2 Data and Parameters Monitored

Complete the table below for all data and parameters to be monitored during the project crediting period (copy the table as necessary for each data/parameter). The values provided are used to estimate the net GHG emissions and removals for the project crediting period in Section 3 above. Data and parameters determined or available at validation are included in Section 4.1 (Data and Parameters Available at Validation) above.

Data / Parameter	
Data unit	*Indicate the unit of measure*
Description	*Provide a brief description of the data/parameter*

Source of data	*Indicate the source(s) of data*
Description of measurement methods and procedures applied	*Specify the measurement methods and procedures, any standards or protocols followed, and the person/entity responsible for the measurement. Include any relevant information regarding the accuracy of the measurements (e.g., accuracy associated with meter equipment or laboratory tests).*
Frequency of monitoring/recording	*Specify measurement and recording frequency*
Value applied:	*Provide an estimated value for the data/parameter*
Monitoring equipment	*Identify equipment used to monitor the data/parameter including type, accuracy class, and serial number of equipment, as appropriate.*
QA/QC procedures applied	*Describe the quality assurance and quality control (QA/QC) procedures applied, including the calibration procedures where applicable.*
Purpose of data	*Indicate one of the following:* ● *Calculation of baseline emissions* ● *Calculation of project emissions* ● *Calculation of leakage*
Calculation method	*Where relevant, provide the calculation method, including any equations, used to establish the data/parameter.*
Comments	*Provide any additional comments*

5.3 Monitoring Plan

Describe the process and schedule for obtaining, recording, compiling and analyzing the monitored data and parameters set out in Section 4.2 (Data and Parameters Monitored) above. Include details on the following:

- *The methods used for generating/measuring, recording, storing, aggregating, collating and reporting data and parameters. Where relevant, include the procedures for calibrating monitoring equipment.*
- *The organizational structure, responsibilities and competencies of the personnel that carried out monitoring activities.*
- *The policies used for oversight and accountability of monitoring activities.*
- *The procedures used for internal auditing and QA/QC.*
- *The procedures used for handling any internal auditing performed and any non-conformances identified.*

- *The implementation of sampling approaches, including target precision levels, sample sizes, sample site locations, stratification, frequency of measurement and QA/QC procedures. Where applicable, demonstrate whether the required confidence level or precision has been met.*

Where appropriate, include line diagrams to display the GHG data collection and management system.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Complete the table below for all data and parameters monitored during the monitoring period (copy the table as necessary for each data/parameter). The values provided are used to quantify actual GHG emissions and removals achieved for the monitoring period. Data and parameters determined or available at validation which remain fixed throughout the project crediting period are included in Section 4.1 (Data and Parameters Available at Validation) above.

Data / Parameter	
Data unit	*Indicate the unit of measure*
Description	*Provide a brief description of the data/parameter*
Value applied:	*Provide the monitored value for the data/parameter*
Comments	*Provide any additional comments*

6.2 Baseline Emissions

Quantify the baseline emissions and/or removals for this monitoring period, providing sufficient information to allow the reader to reproduce the calculation. Attach electronic spreadsheets as an appendix or separate file to facilitate the verification of the results.

6.3 Project Emissions

Quantify project emissions and/or removals for this monitoring period, providing sufficient information to allow the reader to reproduce the calculation. Attach electronic spreadsheets as an appendix or separate file to facilitate the verification of the results.

6.4 Leakage

Quantify leakage emissions for this monitoring period, providing sufficient information to allow the reader to reproduce the calculation. Attach electronic spreadsheets as an appendix or separate file to facilitate the verification of the results.

6.5 Net GHG Emission Reductions and Removals

Quantify the net GHG emission reductions and removals achieved for this monitoring period, summarizing the key results using the table below. Specify breakdown of GHG emission reductions and removals by vintages where the intent is to issue each vintage separately in the VCS registry system.

For non-AFOLU projects, use the following table:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year A				
Year...				
Total				

For AFOLU projects, include quantification of the net change in carbon stocks. Also, state the non-permanence risk rating (as determined in the AFOLU non-permanence risk report) and calculate the total number of buffer credits that need to be deposited into the AFOLU pooled buffer account. Attach the non-permanence risk report as either an appendix or a separate document.

For AFOLU projects, use the following table:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation	VCUs eligible for Issuance
Year A						
Year...						
Total						

2. APPENDIX X: <TITLE OF APPENDIX>

Use appendices for supporting information. Delete this appendix (title and instructions) where no appendix is required.