

MONITORING REPORT

‘IBERPAPPEL’ SILVIPASTURAL SYSTEM ON DEGRADED LAND

Document Prepared By (Agustin Inthamoussu)

Agustin.inthamoussu@gmail.com

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Prepared By	Agustin Inthamoussu
Contact	Divina Comedia 1651, +59894527788, agustin.inthamoussu@gmail.com

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PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project comprises a total of 4,691 ha of land with a history of agriculture with intensive tillage or grazing by beef cattle, activities that have caused severe soil erosion and degradation. Forest plantations for obtaining pulpwood and sequestering carbon dioxide from the atmosphere are established. These plantations are part of a silvipastoral system.

This project activity is implemented on degraded lands, which are expected to continue to degrade in the absence of the project and hence the land cannot be expected to revert to a non-degraded state without human intervention.

Forests will be based on Eucalyptus globulus plantations managed with a rotation length from 10 to 20 years depending on achieved growth rates and access to wood market. Some areas were already harvested for production of pulp for cellulose. The plantations are established on land previously used for cattle grazing. The implementation of the project activity is not causing any displacement of cattle, on the contrary, the combination of grazing within project boundaries and the improvement of pastures on land outside project boundaries but under control of project participants will result in the maintenance or even increase of the cattle population as in the baseline.

The main objectives of the project activity are wood production, land restoration and carbon sequestration through afforestation. Forest plantation was completed by year 8 of project and forests are permanently replanted after clear-cut harvest. To avoid trees damage, cattle is allowed to enter the forest areas only sixteen month after planting. Silvicultural practices applied are compatible with FSC standard. Planted forests is removing carbon dioxide from the atmosphere and storing it in different carbon pools (living above-ground and below-ground biomass, soil organic carbon, litter, and dead wood). Monitoring event covers carbon stock changes in above ground biomass in direct way, while below ground biomass, litter and dead wood pools are calculated indirectly, based on above ground biomass.

The baseline study determined that continuation of extensive grazing is the most likely use of the land. In such scenario, the carbon stock is inexistent and the carbon stock measured in this monitoring event is the amount that will be requested as carbon credits (VCUs).

In this first monitoring event the carbon stock in different pools is measured and the total amount of carbon stocks stored in different carbon pools is 761,124 tCO₂.

1.2 Sectoral Scope and Project Type

The activity implemented by the project is the establishment of forests on land that had previously been under grassland or cropland for more than 50 years, and therefore corresponds to the VCS category Afforestation, Reforestation and Revegetation (ARR). 'Iberpapel' silvipastoral system on degraded land is a single GHG Project and not a grouped project.

1.3 Project Proponent

Organization name	Los Eucaliptus S.A.
Contact person	Francisco Cabello
Title	Country manager
Address	Charrúas 999
Telephone	(+598) 47224900
Email	zulimasa@adinet.com.uy

1.4 Other Entities Involved in the Project

Organization name	Pike & Co. Forestry Consulting
Role in the project	Measurement of plots for QA/QC
Contact person	Alvaro Pérez
Title	General Manager
Address	Costa Rica 1566
Telephone	
Email	alvaro.perez@pike.com.uy

Organization name	Carbosur
Role in the project	Preparation of documentation (monitoring report and non-permanence risk document)
Contact person	Alvaro Perez del Castillo
Title	Executive Director
Address	Costa Rica 1566
Telephone	+598 26056231
Email	Alvaro.perez@carbosur.com.uy

1.5 Project Start Date

The project start date is 10 September 2004, when the activities that lead to the generation of GHG emission reductions or removals (preparing land for planting) began.

1.6 Project Crediting Period

Project crediting period will be of 60 years, from 10 September 2004 to 10 September 2064.

1.7 Project Location

The project is located in South East Uruguay, covering a total of 11 land units in the Departments of Canelones, Maldonado and Lavalleja (**Figure 1**). The 11 land units are grouped into three locations: South-West (**Figure 2**), South-East (**Figure 3**), and North (**Figure 4**).

Geographical location of the units of land included within project boundaries are shown in Figure 1. Details of location of each unit of land, including, among other features, the cadastral number and geographic coordinates, are shown in Table 2 of the Project Document¹. All cadastral units are clearly and uniquely identified in Uruguay's Cadastral System, and have their boundaries delimited by wire fences.

¹ http://www.vcsprojectdatabase.org/#!/project_details/920

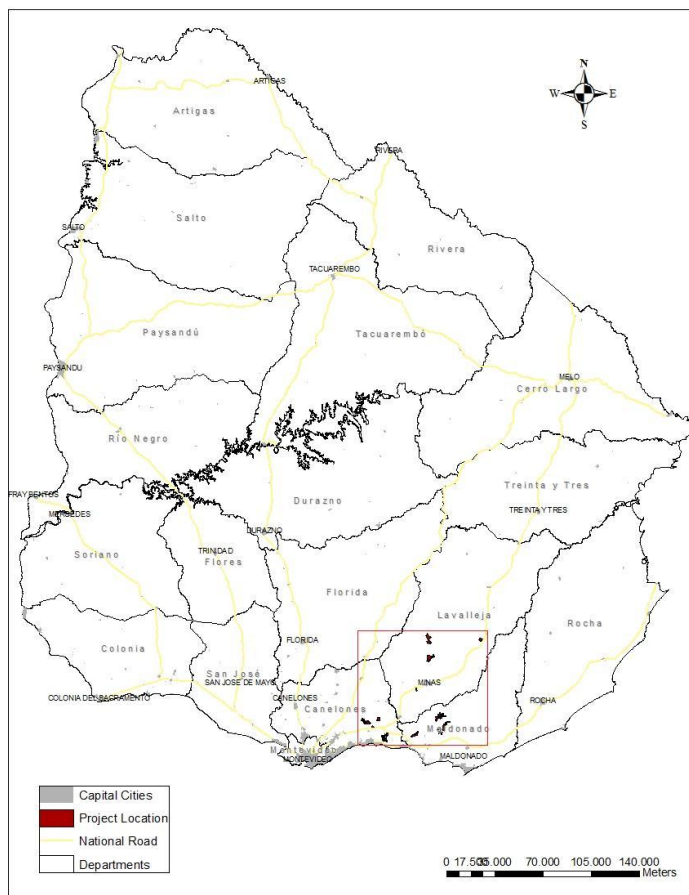


Figure 1. Location of the project in Uruguay

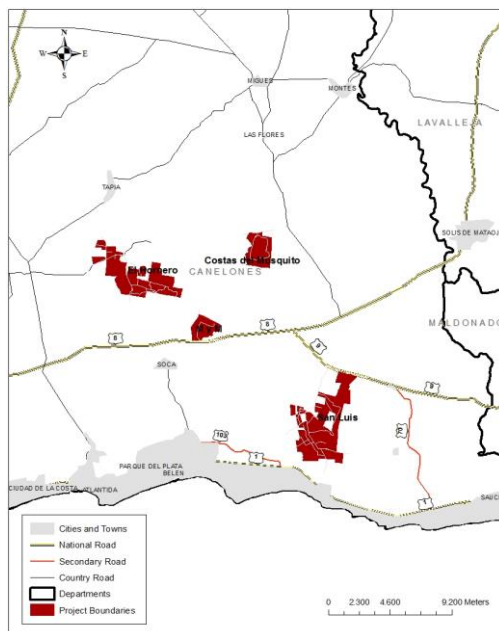


Figure 2. Boundaries of project sites of the Southwest region

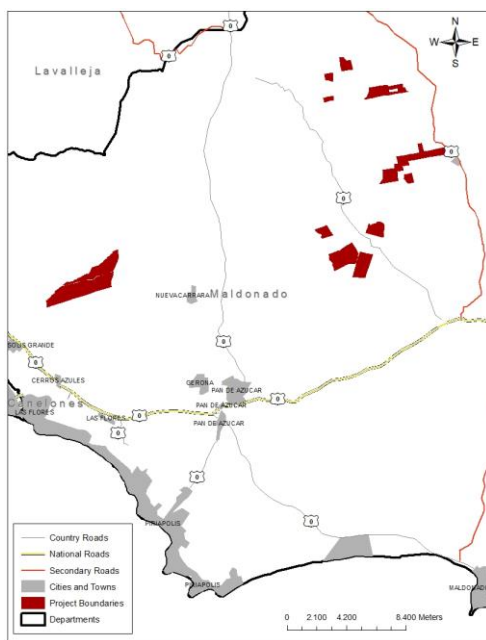


Figure 3. Boundaries of project sites of the Southeast region

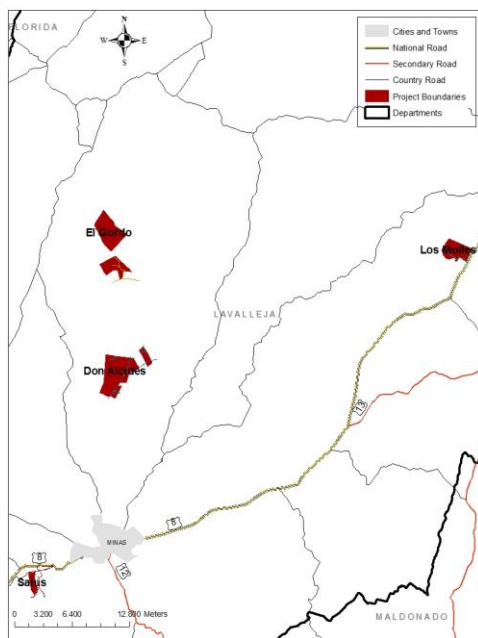


Figure 4. Boundaries of project sites of the North region

1.8 Title and Reference of Methodology

The consolidated CDM methodology AR-ACM0001 "Afforestation and reforestation of degraded land" (version 05.2.0, EB 65) was applied:

<http://cdm.unfccc.int/methodologies/DB/X4VOLW3Y7IJCH9WXSBC2Q0JKG9UZ>

The following methodological tools, to which the selected methodology refers to, were used:

- Version 01 of “Combined tool to identify the baseline scenario and demonstrate the additionality in A/R CDM project activities”;
- Version 01 of “Tool for testing significance of GHG emissions in A/R CDM project activities”;
- Version 04.0.0 of “Estimation of non-CO2 GHG emissions from burning of biomass attributable to a A/R CDM project activity”
- Version 01 of “Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities”;
- Version 02.0.0 of “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activity”.
- Version 03.0.0 of “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/RCDM project activity”.
- Version 01 of “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity”;
- Version 01.1.0 of “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”.

‘Iberpapel’ Silvopastoral System on Degraded Land was validated and ultimately registered under the VCS on the 14th November 2012. At that moment the methodology “AR-ACM0001 Afforestation and Reforestation on degraded land” (05.1.1, EB 60) was still valid to be used in Afforestation and Reforestation CDM (or VCS) projects. The methodology used for this monitoring has been changed to reflect the methodology that was valid at the time of registering: AR-ACM0001 “Afforestation and reforestation of degraded land” (version 05.2.0, EB 65).

1.9 Other Programs

N/A

1.10 Sustainable Development

The project contributes to achieve nationally stated sustainable development through the removal of carbon dioxide from the atmosphere.

Uruguayan government has approved its first Nationally Determined Contribution by Executive Decree number 310 in November 3rd, 2017, in the framework of the Paris Agreement, ratified by the Oriental Republic of Uruguay in October 19th, 2016. It establishes a conservative goal to maintain 100% of the native forest area of year 2012, forest plantation net area under management of year 2015 and shade and shelter forest plantation of year 2012. In a more optimistic scenario, with conditional on additional specific means of implementation, the government’s goal is to increase 5% in the native forest area of year 2012 and 25% in the shade and shelter forest plantations area of year 2012, including silvopastoral systems.

‘Iberpapel’ Silvopastoral System on Degraded Land project will contribute to achieve the government’s goal by the mere continuation of the project.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project is permanently being actualized in terms of harvestings and subsequent plantations. The first plantation occurred in 2004 and after 10 year rotation length, these stands were clear cut. The wood

obtained from the harvesting was sold to other companies, as pulp-wood. After some months, the forest was re-established by managing the sprouts of the stumps. Normal operations includes leaving two or three sprouts (the thickets and straights) out of ten or twenty that each stump can have.

All harvested areas and their management for each stand or farm can be visualized in the Geographical Information System.

2.2 Deviations

2.2.1 Methodology Deviations

N/A

2.2.2 Project Description Deviations

Project deviations are related to the project area and plantation years, compared to validation. The modification of these data is explained with multiple reasons; in some cases the mere actualization of the Geographical Information System explains the difference. The following table shows the values.

SW	El Hornero		183	285	90				31			589
	M y M			125								125
	San Luis			534			317	116				967
	Costas del mosquito						187					187
	Tot	0	183	945	90	0	503	116	31	0	0	
N	Los Molles									384		384
	El gordo								667			667
	Don Alcides				606		141					747
	Tot	0	0	0	606	0	141	0	667	384	0	
SE	Sophie Point				274	35	10					319
	Salus						67					67
	Doña Sara y los tocayos										640	640
	Tot	0	0	0	274	35	77	0	0	0	640	
Plantation year			2004	2005	2006	2007	2008	2009	2010	2011	2012	4691

		2005	2008	2009	2011	2012	2013	2014	2016	2017	2018	
	Property											
SW	El Hornero			31					468			499
	M y M										126	126
	San Luis	507	317	116								940
	Costas del mosquito		187									187
	Tot	507	504	146	0	0	0	0	468	0	126	1,752
N	Los Molles				220	144	100					464
	El gordo				540			127	137			804
	Don Alcides									746		746
	Tot	0	0	0	760	144	100	127	137	746	0	2,014
SE	Sophie Point									319		319
	Salus		67									67
They were together in PD	Doña Sara					566						566
	Los Tocayos					22		69	13			103
	Tot	0	67	0	0	588	0	69	13	319	0	1,055
TOTAL		1014	1141	293	1520	1464	200	390	1236	2131	252	4,821

In Doña Sara and Los Tocayos the stands were not established at the moment of validation and the project developer presented an estimation of the expect forest area in those farms. After plantation, the area of forest was 29 ha larger.

Another major deviation is the introduction of the species *Eucalypts dunnii*. This species has similar characteristic to *Eucalyptus globulus* but is better adapted to frosts. Those, some lowlands were planted with this species.

Also, the project developer decided to do a modification to the estimation procedure. It is common practice that forestry companies manage the sprouts that grows in every stump after clear cut. Thus, there is no need to replant again the stand. And the tree can grow faster and stringer because they have already formed all the root system. In this monitoring event, the project developer has decided to account the carbon stock of that mature root system as part of the carbon stock that is claiming as VCUs. Detailed calculations are presented in the calculation sheets.

2.3 Grouped Project

Iberpapel' Silvipastural System on Degraded Land is a single GHG Project.

2.4 Safeguards

2.4.1 No Net Harm

Iberpapel' Silvipastural System on Degraded Land does not cause negative environmental and socio-economic impacts.

2.4.2 Local Stakeholder Consultation

Iberpapel' Silvipastural System on Degraded Land does not follow a formal process for local stakeholder communication.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	A_i
Data unit	ha
Description	Area of stratum i
Source of data	Monitoring of strata and stand boundaries is done using a Geographical Information System (GIS) which allows for integrating data from different sources (including GPS coordinates and Remote Sensing data)
Value applied	Variable depending on stratum
Justification of choice of data or description of measurement methods and procedures applied	A description of the measurement methods is available upon request to project participant.
Purpose of the data	Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions

Comments	N/A
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Data / Parameter	BRD _{SF}
Data unit	Dimensionless
Description	Ratio of biomass per unit area in land having a shrub crown cover of 1.0 and default above-ground biomass content in forest in the region/country where the A/R CDM project is located
Source of data	N/A
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of the data	N/A
Comments	This variable is obsolete and not used in this monitoring report

Data / Parameter	BEF _{2,j}
Data unit	Dimensionless
Description	Biomass expansion factor for conversion of stem biomass to above-ground biomass for tree species or group of species j
Source of data	IPCC default values (e.g. Table 3 A.1.10 of IPCC GPG-LULUCF 2003)
Value applied	From 1.15 to 3.4, depending on the tree age
Justification of choice of data or description of measurement methods and procedures applied	The values applied are the unique source of information for such variable. No local or national values exist.
Purpose of the data	Estimation of aboveground biomass carbon content
Comments	N/A

Data / Parameter	CF _j
Data unit	t C t ⁻¹ d.m.

Description	Carbon fraction of tree biomass for species or group of species j
Source of data	The IPCC default value of 0.5 t C t ⁻¹ d.m.
Value applied	0.5
Justification of choice of data or description of measurement methods and procedures applied	The values applied are the unique source of information for such variable. No local or national values exist.
Purpose of the data	Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions
Comments	N/A

Data / Parameter	D _j
Data unit	t d.m. m ⁻³
Description	Basic wood density for species or group of species j
Source of data	National species-specific data from LATU: " <i>Evaluación de parámetros de calidad de Eucalyptus globulus y E. maidenii de plantaciones uruguayas para pulpa de celulosa</i> "
Value applied	0.52
Justification of choice of data or description of measurement methods and procedures applied	The value is a reliable source of information and applicable to national values
Purpose of the data	Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions
Comments	N/A

Data / Parameter	R _j
Data unit	Dimensionless
Description	Root-shoot ratio for species or group of species j
Source of data	Tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs"
Value applied	0.23 to 0.29, depending on the tree age

Justification of choice of data or description of measurement methods and procedures applied	The values applied are the unique source of information for such variable. No local or national values exist.
Purpose of the data	Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions
Comments	The equation used to obtain R is in chapter 4.2 of this Monitoring Report

Data / Parameter	$V_{TREE\ j\ p\ i}$
Data unit	m ³
Description	Stem volume of trees of species or group of species j in plot p in stratum i
Source of data	Local Growth Models
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of the data	Value used to determine the project ex – ante carbon sequestration
Comments	In ex ante estimation, growth was estimated based on field measurements made on existing plantations, and extrapolated to forests that will be planted in the future. Ex-post estimation of volume was obtained with commonly used equation: basal area x height x tree shape factor.

Data / Parameter	Bark volume
Data unit	m ³ /ha
Description	Bark volume of trees of species
Source of data	Methodological tool " <i>Estimation of carbon stocks and change in carbon stocks of trees and shrubs</i> "
Value applied	15% of total stem volume
Justification of choice of data or description of measurement methods	N/A

and procedures applied	
Purpose of the data	Value used to determine the project ex – ante carbon sequestration
Comments	Stem volume estimations of local growth models are under bark, thus this factor is applied. For ex-post estimations, this values is not applied any longer

Data / Parameter	SOC _{REF}
Data unit	t C ha ⁻¹
Description	Reference SOC stock corresponding to the reference condition in native lands (i.e., non-degraded, unimproved lands under native vegetation) by climate region and soil type applicable to stratum <i>i</i> of the areas of land
Source of data	Table 3 of “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”
Value applied	88 or 63 depending if soil is HAC or LAC
Justification of choice of data or description of measurement methods and procedures applied	There are no local, regional or national values for that variable.
Purpose of the data	Used to estimate the carbon sequestration in soils (Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions)
Comments	N/A

Data / Parameter	f _{LU,i}
Data unit	Dimensionless
Description	Relative stock change factor for baseline land-use in stratum <i>i</i> of the areas of land; dimensionless
Source of data	Tables 6 of “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project” activities.
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	There are no local, regional or national values for that variable.

Purpose of the data	Used to estimate the carbon sequestration in soils (Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions)
Comments	N/A

Data / Parameter	$f_{MG,i}$
Data unit	Dimensionless
Description	Relative stock change factor for baseline management regime in stratum i of the areas of land, dimensionless
Source of data	Table 6 of "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project" activities.
Value applied	0.70
Justification of choice of data or description of measurement methods and procedures applied	There are no local, regional or national values for that variable.
Purpose of the data	Used to estimate the carbon sequestration in soils (Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions)
Comments	N/A

Data / Parameter	$f_{IN,i}$
Data unit	Dimensionless
Description	Relative stock change factor for baseline input regime (e.g. crop residue returns, manure) in stratum i of the areas of land
Source of data	Tables 6 of "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project" activities.
Value applied	0.7
Justification of choice of data or description of measurement methods and procedures applied	There are no local, regional or national values for that variable.
Purpose of the data	Used to estimate the carbon sequestration in soils (Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions)

Comments	N/A
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Data / Parameter	B_{FOREST}
Data unit	t d.m.ha ⁻¹
Description	Default above-ground biomass content in forest in the region/country where the A/R CDM project is located
Source of data	N/A
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of the data	N/A
Comments	This variable was used for the elaboration of the PD but is not applicable any longer.

Data / Parameter	ΔB_{FOREST}
Data unit	t d.m.ha ⁻¹
Description	Default average annual increment in aboveground biomass in forest in the region/country where the A/R CDM project is located
Source of data	N/A
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of the data	N/A
Comments	This variable was used for the elaboration of the PD but is not applicable any longer.

Data / Parameter	R_s
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Data unit	Dimensionless
Description	Root-shoot ratio for shrubs
Source of data	N/A
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of the data	N/A
Comments	This variable was used for the elaboration of the PD but is not applicable any longer.

Data / Parameter	f_j (DBH, H)
Data unit	t d.m. tree ⁻¹
Description	Allometric function for species or group of species j linking a tree diameter (e.g. diameter at breast height), and possibly tree height (H), to above-ground biomass of living trees
Source of data	N/A
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of the data	N/A
Comments	This variable was used for the elaboration of the PD but is not applicable any longer.

Data / Parameter	Dead Wood
Data unit	t C ha ⁻¹
Description	Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass
Source of data	Tool "Estimation of carbon stocks and change in carbon stocks in

	dead wood and litter in A/R CDM project activities"
Value applied	8% of carbon stock in trees biomass
Justification of choice of data or description of measurement methods and procedures applied	There is no local, regional or national values for such pool in this type of forest
Purpose of the data	Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions
Comments	N/A

Data / Parameter	Litter
Data unit	t C ha ⁻¹
Description	Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass
Source of data	Tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"
Value applied	4% of carbon stock in trees biomass
Justification of choice of data or description of measurement methods and procedures applied	There is no local, regional or national values for such pool in this type of forest
Purpose of the data	Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions
Comments	N/A

3.2 Data and Parameters Monitored

Data / Parameter	A _i
Data unit	ha
Description	Area of stratum i
Source of data	Monitoring of strata and stand boundaries was done using a Geographical Information System (GIS)
Description of measurement methods and procedures to be applied	Strata area were measured based on cartography documents, related with GIS.

Frequency of monitoring/recording	Every time the project boundaries are modified. when disturbances events take place, the project participants shall re-build the stratum and add the area of the project under disturbance in the GIS
Value monitored	4,821
Monitoring equipment	Garmin GPS, model eTrex Legend.
QA/QC procedures to be applied	N/A
Purpose of the data	Determination of baseline scenario, calculation of baseline emissions and Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	DBH
Data unit	Cm
Description	Diameter at Breast Height of tree
Source of data	Field measurements
Description of measurement methods and procedures to be applied	DBH is measured at 1.3 m above ground, over the bark. In case of stem deformation at this level, measurement was done over the deformation once the stem took its normal shape, with the purpose of being conservative. DBH was measured in all trees within the plots.
Frequency of monitoring/recording	Every tree within sample plots
Value monitored	2,169 values in 13 strata in 78 plots
Monitoring equipment	In most of the cases, the instrument used for measuring DBH was a caliper model "Mantax Blue" of Haglof, Sweden; which image is following.  Also, for the minority of trees, it was used a diametric

	tape for measuring DBH. 
QA/QC procedures to be applied	A quality control procedure consisted in staff member periodical training. The staff members were trained to make DBH measurements without errors: using firstly a measuring tape (to determine exactly where 1,3 meters height is located in their own bodies). Afterwards, they measured DBH in front of experts and member's staff to achieve procedures consistency. Instruments were checked and tested before starting the verification process. Items checked: Correct visualization if numbers in the measuring tape. Lack of mechanical problems. The measuring tape length is not a problem since it is impossible the equipment stretches. Bark that is not stick to the stem was removed before measuring.
Purpose of the data	Calculation of project removals
Calculation method	N/A
Comments	The trees are considered to be inside the plot if more than 50% of DBH is inside the plot. Exact procedure to measure this variable is described in the ToR

Data / Parameter	H
Data unit	m
Description	Height of trees within sample plot
Source of data	Field measurement
Description of measurement methods and procedures to be applied	Every tree inside the plot is measured in height The measurement was done according to the following procedure:

	• Identification of the individual tree to measure. • At the same level (independently that the measuring equipment corrects the value according to the slope). • The expert always tried to be situated at a certain distance to the tree equivalent to the height of the tree.
Frequency of monitoring/recording	Every tree inside the plot
Value monitored	2,169 values in 13 strata in 78 plots
Monitoring equipment	Clinometer. See the following figure of the type of clinometer used during the monitoring events to measure tree heights. This image represents an electronic clinometer of Haglof, Sweden. 
QA/QC procedures to be applied	When referring to this electronic device, it is recommended to check the correct visualization of the display. The clinometer was always kept in safe places in order to avoid display rupture. The equipment was always full charge of batteries and back up batteries were always available in case of emergency. Make control measurements using all involved equipment (human error should be minimized at minimum with well training and cross-checked control measurement activities).
Purpose of the data	Calculation of project removals
Calculation method	N/A
Comments	N/A

Data / Parameter	Ap,i
Data unit	m ²
Description	Area of sampling plot
Source of data	Field measurement
Description of measurement	The center of the plot was marked with the assistance of

methods and procedures to be applied	a GPS. One staff member stayed at the center of the plot taking notes of the diameters and heights measured while the other expert of the team walked inside the plot measuring them. Both experts were always connected with a measuring tape, and every tree measured was previously checked in order to determine if the distance to the center was minor to 9.77 m (radius of a circular plot of 300m ²).
Frequency of monitoring/recording	Every plot measured in Los Eucaliptus, in total 78
Value monitored	300m ²
Monitoring equipment	Measuring tape
QA/QC procedures to be applied	In order to avoid over and under-estimations, every tree was considered inside the plot when the mark of 9.77 m overpassed the 50% of the diameter of every tree.
Purpose of the data	Calculation of project removals
Calculation method	$300\text{m}^2 = r^2(9.77).\pi$
Comments	Sample plots are permanent and circular. The plots were laid down in a shapefile, positioned systematically with a random start. The location of the plots within the forest plantation was done with a GPS. The area of each plot is not a variable but a fixed value, but must be measured by its radius in order to determine the variable "number of trees within the plot".

3.3 Monitoring Plan

As it was stated in the PD, the project boundary and the boundaries of pre-defined strata were adjusted after plantations. This was done by using GPS technology, and the information was organized in GIS format. Areas of each stratum were recalculated and adjusted accordingly.

The aim of the Monitoring Plan is to record and monitor a number of different parameters in order to ensure that the project followed the corresponding methodology in the validated and registered PD and that the inputs to the carbon calculations are both accurate and up-to-date.

Monitoring was done according to the consolidated methodology AR-ACM 0001 "Afforestation and reforestation of degraded lands" (version 05.2.0, EB 65). The PD was registered mentioning the version 5.1.1 of the referred methodology but the applicable version is the one stated above. Analysis of its applicability conditions have been developed in section 2.2 of the PD.

Monitoring stage comprised gathering information, performing calculations and making estimations of GHG removals. In this monitoring event, it is ensured that commonly established principles of forest inventory and management were put into practice with the elaboration of a Monitoring Plan. Strictly speaking the document is called "Terms of Reference" but it is used as a Monitoring Plan. This Monitoring Plan is a document prepared by Carbosur with the purpose of specifying the procedures and standardization for the measurement of each variable. This document is in Spanish and can be available for the verification team in a translated version in English. A summary of it was redacted to prepare the

Terms of Reference. Iberpapel presented the terms of reference to Pike Consultora Forestal and they were hired to perform the service.

All data gathered as part of the monitoring plan was archived electronically and will be kept at least for two years after the end of the crediting period.

According to the methodology applied, monitoring covered carbon stock changes for living above-ground. Below ground biomass was estimated indirectly based on above-ground biomass measurements and litter and dead wood were finally estimated as a percentage of carbon stock in tree biomass.

Sampling design and stratification

Geographic coordinates are established, recorded and archived. A Geographic Information System is implemented within the company and is updated periodically. All the geographical information is available for the verification team.

With the purpose of developing the monitoring plan, Los Eucaliptus was stratified into 13 strata. Stratification was done considering species and plantation date.

Permanent sampling plots are selected, since these are considered to be more efficient for estimating changes in carbon stocks by filtering out any variance due to plot effect. The plots allocation is registered in a GIS and can always be located. The plots were established at the field with a stick painted in blue at the center of the plot, every tree at the beginning or end of every row is also painted in blue (with its number in the plot). These marks are proved to be seen after four or five years.

The location of the plots followed the guidance given by the corresponding methodological tool, as well as IPCC Good Practice Guidance for LULUCF (2002), chapter 4.3. An Arc-Map software (NAPA) developed by Pike & Co. was used to randomly locate the permanent sampling plots (location is systematic, with random start). This software has a feature to enable the location of all plots on forest areas (i.e., it avoids plots from being located in firebreaks and other non-planted areas). The map with the location of the sampling plots was loaded on the GPS receptors used by forest inventory crews, so that they can reach the plots accurately. An example of the software output for two contiguous strata is shown in *Figure 5*.

Example of location of permanent sampling plots.

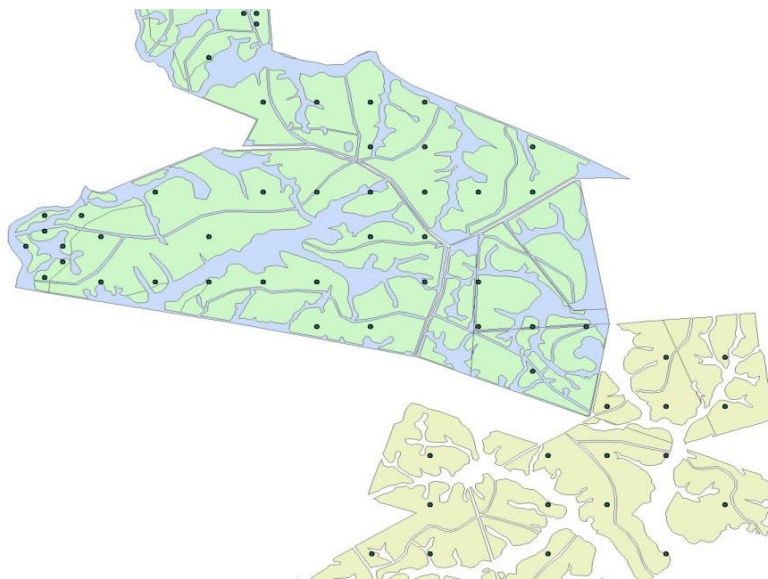


Figure 5. Example of location of permanent sampling plots.

Above ground carbon pool was measured following the methodology procedures and IPCC Good Practice Guidance for LULUCF (2003) established in the PD and Monitoring Plan. Carbon stocks in above ground biomass of trees are estimated by applying the BEF method, which calculates the biomass of trees of each species per unit area in each stratum at a given point of time, based on the following three dimensions: diameter, basal area and height, obtained from field measurements. By applying BEF

method, volume equations are used to convert tree dimensions to stem volume of trees based on DBH and height measurement in each plot. Stem volume of trees is then converted to above-ground and below-ground tree biomass using basic wood density (D) and root-to-shoot ratio (R). Default carbon fraction (CF) value was used in order to estimate the carbon stock.

Prior to the start of the inventory, all equipment used during the field work was checked and calibrated.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Since continuation of an activity that has been applied without changes for more than 20 years has been selected as the baseline scenario, it is assumed, in agreement with IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry (2003) that the net GHG removals by sinks in the baseline equals zero.

4.2 Project Emissions

Los Eucalyptus project activity does not have GHG emissions. However, this chapter refers to the removals of GHG performed by this project activity.

Net anthropogenic GHG removals by sinks is estimated as the actual net GHG removals by sinks minus the baseline net GHG removals, minus leakage. The following general formula described in the methodology is used to calculate the net anthropogenic GHG removals by sinks of an A/R project activity, in t CO₂-e:

$$C_{AR-CDM} = \Delta C_{ACTUAL} - \Delta C_{BSL} - LK$$

Where:

C_{AR-CDM} Net anthropogenic GHG removals by sinks; t CO₂-e.

ΔC_{ACTUAL} Actual net GHG removals by sinks; t CO₂-e.

ΔC_{BSL} Baseline net GHG removals by sinks; t CO₂-e.

LK Total GHG emissions due to leakage; t CO₂-e.

The actual net greenhouse gas removals by sinks were estimated using the following equation described in the methodology:

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

Where:

ΔC_{ACTUAL} Actual net greenhouse gas removals by sinks; t CO₂-e.

ΔC_P Sum of the changes in above-ground and below-ground tree biomass, dead wood, litter and soil organic carbon stocks in the project scenario; t CO₂-e.

GHG_E Increase in GHG emissions as a result of the implementation of the proposed A/R CDM

project activity within the project boundary; t CO₂-e.

The following formula described in the methodology is used in order to estimate GHG emission:

$$GHG_E = \sum_{t=1}^{t*} GHG_{E,t}$$

Where:

GHG_E Increase in GHG emissions as a result of the implementation of the proposed A/R CDM project activity within the project boundary; t CO₂-e.

$GHG_{E,t}$ Increase in non-CO₂ emissions due to biomass burning of existing vegetation as part of site preparation in year t; t CO₂-e.

t 1,2,3,.....,t* years elapsed since the start of the A/R CDM project activity.

The tool for “Estimation of non-CO₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” has been considered. The use of fire for site preparation and/or to clear the land of harvest residue prior to replanting is specifically excluded from the project management and therefore project emissions are estimated as zero.

Carbon stock changes

ΔC_P is the sum of the changes in above-ground and below-ground tree biomass, dead wood, litter and soil organic carbon stocks in the project scenario. For ex-ante estimation, all pools were accounted. Following is presented the equation for the estimation of ΔC_P . Calculations are described below.

$$\Delta C_P = \Delta C_{TREE} + \Delta C_{DW} + \Delta C_{LI} + \Delta C_{SOC}$$

Where:

ΔC_P Change in carbon stock in all selected carbon pools in the project scenario, t CO₂-e.

ΔC_{TREE} Change in carbon stock in tree biomass in project, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO₂-e.

ΔC_{DW} Change in carbon stock in dead wood biomass in project, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO₂-e.

ΔC_{LI} Change in carbon stock in litter biomass in project, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO₂-e.

ΔC_{SOC} Change in carbon stock in SOC in project, in areas of land meeting the applicability conditions of the tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities", as estimated in the same tool; t CO₂-e.

Biomass carbon pools

Above and below ground biomass have been estimated according to the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activity". Carbon estimations in trees are based on field measurements of monitored parameters, chapter 3.2 of the Monitoring Report. Estimations are archived as part of the project verification and will be available for the verification team.

The aboveground biomass corresponds to tree biomass, no shrubs are considered for estimation. The method used for estimating change in carbon stock in trees is the "stock change method". Change in carbon stock in trees in two successive points in time is calculated as the difference between the two estimated stocks. As this is the first monitoring report the carbon values in every pool is the final result, the starting point of the crediting period is zero carbon.

As in ex-ante estimations, the following equations were used in order to estimate above and below ground biomass ex-post measurements:

$$B_{TREEj,p,i,t} = V_{TREEj,p,i,t} * D_j * BEF_{2,j} * (1 + R_j)$$

Where:

$B_{TREEj,p,i,t}$ Biomass of trees of species j in sample plot p of stratum i at late 2012 – early 2013.

$V_{TREEj,p,i,t}$ Stem volume of tree species using field measurements of tree parameters (DBH and height), default values (tree shape factor) and complemented with worksheets data processing (interpolation of not-measured heights); m³.

The applied equation for volume estimation is no other formula than the cylinder volume equation corrected by a taper value (TSF):

$$V_{TREE} = Basal\ area \times height \times TSF$$

Where:

$$Basal\ area = \frac{\pi \times DBH^2}{4}$$

DBH: Diameter at Breast Height

TSF: Tree Shape Factor

According to the methodology, for ex post estimation, the volume equation used must be demonstrated to be appropriate for the purpose of estimation of tree biomass by applying the tool "Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A/R CDM project activities". The appropriateness of the equations is demonstrated through the satisfaction of the following condition, in the sense that the formula is very generic and applicable in any case:

- The equation has been used in commercial forestry sector in Uruguay for 10 years or more.

The tree shape factor values used in Los Eucalyptus carbon stock calculations is 0.5

D_j Basic wood density of tree species j. The species j corresponds to two species used in this project: *Eucalyptus globulus* is 0.52 t.d.m./m³. and *Eucalyptus dunnii* is 0.482 t.d.m./m³. T

$BEF_{2,j}$ Biomass expansion factor for conversion of stem biomass to above-ground tree biomass, for tree species j (Eucalyptus *sp.*); dimensionless. The BEF_2 is to be used in connection to growing stock biomass data and not with increment data, as described in chapter 3.2 of the GPG for LULUCF (2003)). The value was also available at validation and not monitored, it ranged from 3.4 (for young forest) to 1.34 (9 years old forests) and the exact values applied for different plantation dates are reported in the final worksheet for carbon stock calculation.

R_j Root-shoot ratio for tree species j ; dimensionless. The values applied were taken from the suggested equation from the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs":

$$R = \frac{\exp[-1.085 + 0.9256 \times \ln(A)]}{A}$$

Where A is aboveground biomass content (t.d.m/ha). The aboveground biomass was calculated per year of plantation and different values were obtained. See table 4 with the results of the estimation.

Finally, the carbon stock in tree biomass within the project boundary is estimated as follows:

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

Where

C_{TREE} Carbon stock in tree biomass within the project boundary; t CO₂-e.

B_{TREE} Biomass of trees within the project boundaries.

CF_{TREE} Carbon fraction of tree biomass; 0.5 t C td.m⁻³.

Soil organic carbon

Estimations of soil organic carbon (SOC) stocks were done in accordance to the "Tool for the estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activity". As suggested by the tool, it is assumed that the implementation of the project activity firstly decreases the SOC content of the lands from pre-project level, due to the site preparation.

Afterwards, the SOC increases to the level that is equal to the steady-state SOC content under native vegetation. The increase in SOC content in the project scenario takes place at a constant rate over a period of 20 years from the year of planting. The project meets the applicability conditions of this tool -as demonstrated in validation- since the areas of land to which the tool is applied do not fall into wetland category, do not contain organic soils and are not subject to any of the land management practices and application of inputs listed in the tool.

Litter remains on site and is not removed and soil disturbance is in accordance with appropriate conservation practices, limited to site preparation and not repeated within 20 years.

The correspondent carbon sequestration calculation is presented to the verification team in the total carbon stock estimation worksheet.

Litter and Dead Wood

Estimations were done in accordance with the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities" using a default and conservative value of 8% and 4% of carbon stock in tree biomass for dead wood and litter respectively.

VCUs to be obtained

The total amount of VCUs that Los Eucaliptus is requesting in this monitoring event is already corrected for large maximum allowable relative error. The error found in the field work was 58.4% and the methodology considers a discount rate of 21% in this case. The total amount of VCU per vintage is presented below.

Vintage	VCUs (tCO₂)
2005	579
2006	11,823
2007	14,926
2008	15,038
2009	28,497
2010	30,622
2011	33,871
2012	59,903
2013	83,327
2014	90,048
2015	95,007
2016	114,662
2017	182,822
Total	761,124

4.3 Leakage

Beef cattle breeding (cow-calf) was the dominant activity in the pre-project land. Cattle were based on a breeding herd where heifers are mostly placed with bulls at the age of 3 years. Sales include culling cows to be fattened, surplus heifers, and calves (at weaning). Average production is 33 kg per ha per year². Existing cattle in the pre-project situation may either stay within project boundaries or in the area controlled by project participant, or be sold to the market. Calves and surplus heifers are normally sold in the market for fattening in other grazing areas, while cows and a reduced number of bulls are sold to slaughterhouses. In addition, as a result of the silvipastoral system applied in the project activity, forage supply would increase in comparison with baseline scenario. Therefore, the number of animals after the implementation of the project remains more or less constant. As a consequence, the project activity would not cause any displacement of livestock existing before its start date.

Furthermore, according to data gathered from governmental Livestock Controller Division (DICOSE)³ there has been a smooth increase in the cattle and sheep stock in Canelones, Maldonado and Lavalleja departments (where the project activity is being held) in the last decade (from 1.36 million LSU in 2003 to 1.44 million livestock units in 2009). On the other hand, according to data taken from National Forest Directorate (DGF)⁴ forest plantations have been also increasing for the same period of time (from 100 thousand hectares in 2003 to 122 thousand hectares in 2009) in the same departments. In addition, native forest has been also increasing in terms of area in the last 43 years at the national level. According

² INIA., 2001. *Tecnologías forrajeras para sistemas ganaderos de Uruguay*. Boletín de Divulgación 76.

³ <http://www.mgap.gub.uy/DGSG/DICOSE/dicose.htm>

⁴ <http://www.mgap.gub.uy/portal/hgxpp001.aspx?7,20,442,O,S,0,,>

to National Forest Inventory (2010)⁵ and to the forest maps based on aerial photographs of 1967⁶ native forests have increased by 21% in terms of area. The fact that total forest area and amount of livestock have been increasing, analyzing Canelones, Maldonado and Lavalleja official data, is an evidence that project activity does not result in displacement of the previous productive system. Therefore, leakage is assumed to be zero.



Figure 6. Silvopastoral system in Uruguay

4.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2005	0	579		579
2006	0	11,823		11,823
2007	0	14,926		14,926
2008	0	15,038		15,038
2009	0	28,497		28,497
2010	0	30,622		30,622
2011	0	33,871		33,871
2012	0	59,903		59,903
2013	0	83,327	0	83,327
2014..	0	90,048	0	90,048
2015	0	95,007	0	95,007
2016	0	114,662	0	114,662

⁵ <http://www.mgap.gub.uy/portal/hgxpp001.aspx?7,20,440,O,S,0,,>

⁶ URUGUAY MAP. Forest Directorate.- First Forest Chart. Montevideo: MAP, 1979.

2017	0	182,822	0	182,822
Total		761.124	0	761.124

APPENDIX X: <TITLE OF APPENDIX>

NO APPENDIXES