# CLEAN DEVELOPMENT MECHANISM
# PROJECT DESIGN DOCUMENT FORM FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) Version 04

## CONTENTS



**Annexes**

**PROJECT DESIGN DOCUMENT FORM**
**FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 04**

## SECTION A. General description of the proposed A/R CDM project activity:

### A.1. Title of the proposed A/R CDM project activity:

>>'*Guanaré*' Forest Plantations on Grasslands under Extensive Grazing
28 February 2008
Version 1

### A.2. Description of the proposed A/R CDM project activity:

>>
The project will comprise a total of 25,050 ha of land currently under extensive grazing by beef cattle, on which forest plantations for obtaining high-value, long-lived timber products and for sequestering large amounts of carbon dioxide from the atmosphere will be established.

Forests will be based on *Eucalyptus grandis* and *E. globulus* plantations in 22-year rotations, managed with pruning (to a minimum height of 12 m) and three to four thinning operations, to obtain knot-free, high-diameter logs suitable for saw-milling and veneering. Plantation will be completed by year 5 of project and forests will be replanted after clear-cut harvest. An Environmental Management System will be implemented, and practices will be compatible with FSC (or similar) standard. Planted forests will remove carbon dioxide from the atmosphere and store it in different carbon pools (living above-ground and below-ground biomass, soil, litter, non-tree vegetation, dead wood and harvested wood products). Monitoring will cover carbon stock changes for all these pools. The potential non-permanence of stored carbon will be considered by the issuance of temporary carbon credits (as stated in "Modalities and Procedures for Afforestation and Reforestation Projects under the CDM"), and by the fact that a significant fraction of the sequestered carbon will be stored in long-lived products.

The baseline study determined that continuation of extensive grazing is the most likely use of the land. Additionality is demonstrated through the fact that the expected internal rate of return of the proposed project activity without considering carbon finance is lower than the benchmark internal rate of return for this type of investment in Uruguay. In addition, barriers analysis and common practice analysis showed that afforestation in the area of the proposed project activity is not likely to occur.

The project will result in a significant contribution to sustainable development of Uruguay, mainly through: i) increased employment and quality of employment; ii) more job opportunities for women; iii) rural development (decentralization); iv) increased gross value of production; v) improved fiscal balance; vi) biodiversity preservation; and vii) improved beauty of landscape, among other benefits.

## A.3. Project participants:

>>

| Name of Party involved (*) ((host) indicates a host Party) | Private and/or public entity(ies) project participants (*) (as applicable) | Indicate if the Party involved wishes to be considered as a project participant (Yes/No) |
|---|---|---|
| Uruguay | • Government | No |
| **Guanaré SARL**<br>Rincón 487/201<br>Montevideo 11.000<br>Uruguay | • Private entity | Yes |
| **Carbosur SRL**<br>Misiones 1372/304<br>Montevideo 11.000<br>Uruguay | • Private entity | Yes |
| (*) In accordance with the CDM A/R modalities and procedures, at the time of making the CDM-AR-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required. | | |
| Note: When the CDM-AR-PDD is prepared to support a proposed new baseline and monitoring methodology (form CDM-AR-NM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified. | | |

## A.4. Description of location and boundaries of the A/R CDM project activity:

### A.4.1. Location of the proposed A/R CDM project activity:

#### A.4.1.1. Host Party(ies):

>>Uruguay

#### A.4.1.2. Region/State/Province etc.:

>>Cerro Largo, Treinta y Tres, Lavalleja.

#### A.4.1.3. City/Town/Community etc:

>> Project area is scattered over a large region. The towns located near project land units are: Melo, Tupambaé, Cerro Chato, Retamosa, María Albina and Valentines.

### A.4.2 Detailed geographic delineation of the project boundary, including information allowing the unique identification(s) of the proposed A/R CDM project activity:

>>

The following map (Fig. A1) shows the exact location of the project, and the cadastral units owned by '*Guanaré*', where the project will be located.

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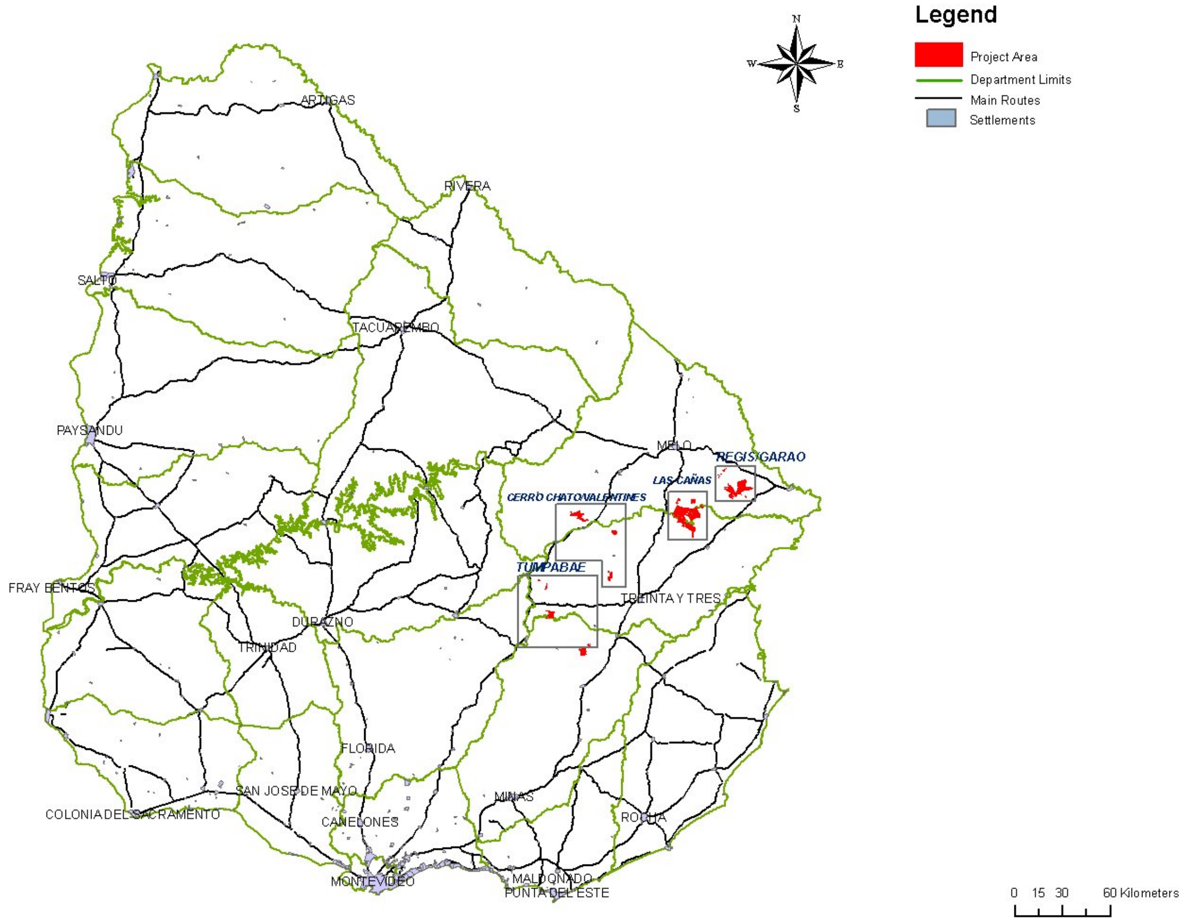


**Figure A1.** Map of Uruguay showing the location of the areas included in the proposed project activity (in red).

For the purpose of defining the baseline strata, the project area has been divided into four regions, which are shown in Fig. A2. The areas are very homogeneous in terms of soil types, climate, land use history and socio-economic conditions. The division into four regions is mostly based on geographic location.

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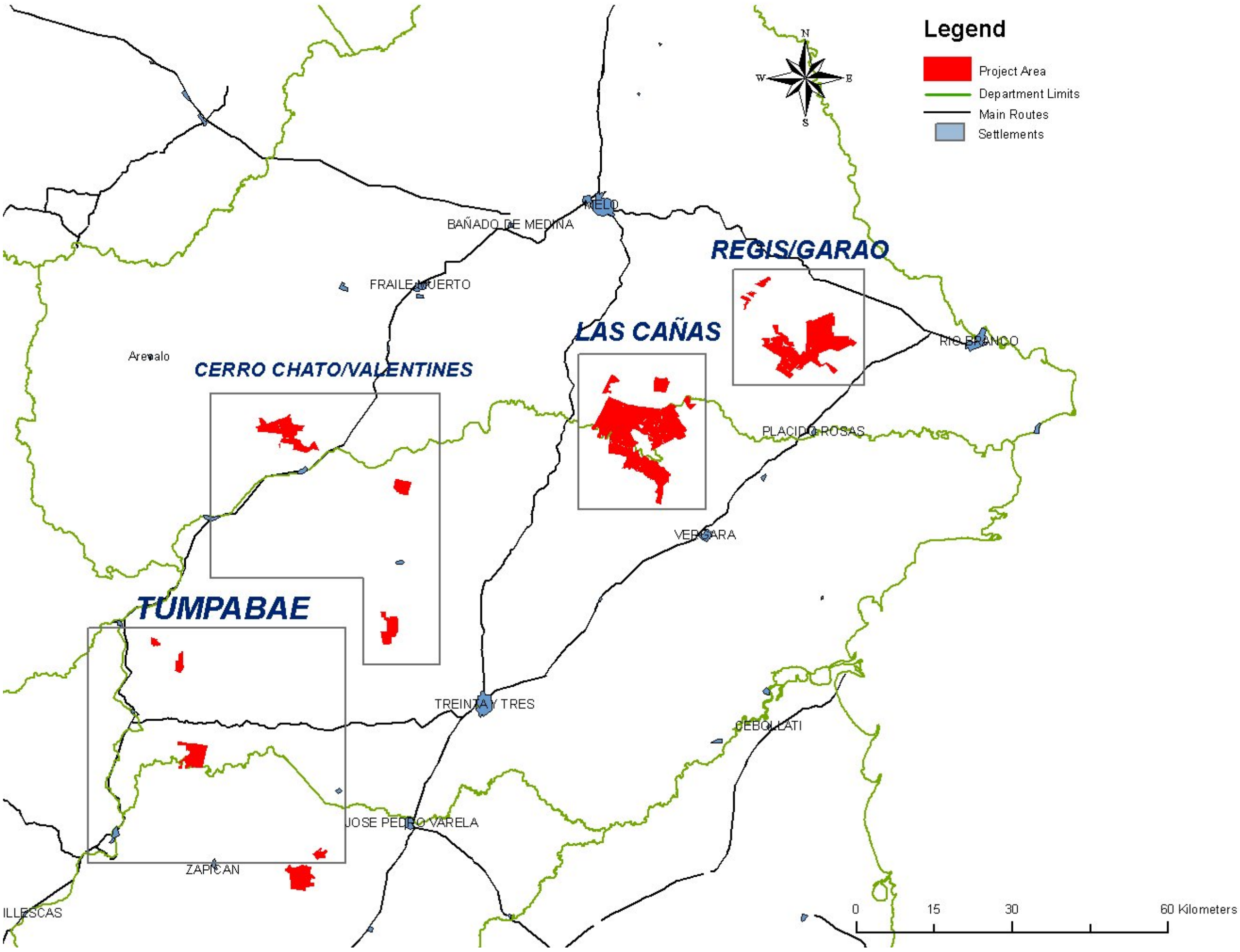


**Figure A2.** Map indicating the four project regions and the detail of the land units where the project will be implemented (in red).

Project boundaries include all the areas that will be afforested. These areas have been defined based on the criteria discussed below.

- Land eligibility for afforestation under the CDM: only areas complying with land eligibility requirement (e.g., areas that have not been under forest since at least 1990) and with methodology applicability conditions (e.g., degraded land) are included within project boundaries.
- Soil map and topographic position: those areas imposing restrictions to tree growth or with high vulnerability to water erosion were excluded; for instance, soils too shallow were discarded because soil water storage capacity is very low, or because tree root anchorage may be impaired, or because there is a risk of frost damage; soils occupying low areas were excluded because of risk of frost or waterlogging damage; areas with very steep slopes were excluded to prevent serious soil erosion loss.

- Past soil erosion: any highly eroded areas (e.g., gullies) will receive special management with the objective of soil restoration and will therefore be excluded from project boundaries.
- Site aptitude for tree species to be planted: areas suitable for eucalypt trees, e.g., middle-slope sites with relatively shallow to deep, well-drained, acidic soil, were included.
- Biological richness and diversity value: buffer zones and fauna corridors are excluded from project area. Buffer areas will be created at the interface between eucalypt plantations and native forests. These buffer zones will be basically 50-m wide strips on the edge of eucalypt planted areas, where special management and harvest practices will be adopted (e.g., no interventions during nesting periods of certain birds, etc.) in order to avoid disturbing fauna in the protected zones. Fauna corridors will connect key native forest restoration areas, to allow for communication between isolated groups of animals.
- Firebreaks: a network of 30-m wide firebreak strips will separate forest blocks with a maximum size of 50 ha, according to Uruguayan regulations. Cattle will graze these firebreak areas, in order to minimize the fuel volume and prevent fires.
- Infrastructure needs: areas needed for infrastructure (e.g., areas needed for roads, cattle fences, buildings,stocking of harvested wood, and other) were excluded from the project area.

Project boundaries have been identified by the use of GPS, and have been laid on a geographic information system. No visible landmarks have been established on the field. Maps with project boundaries for each of the four project regions are shown in Figures A3 through A6.

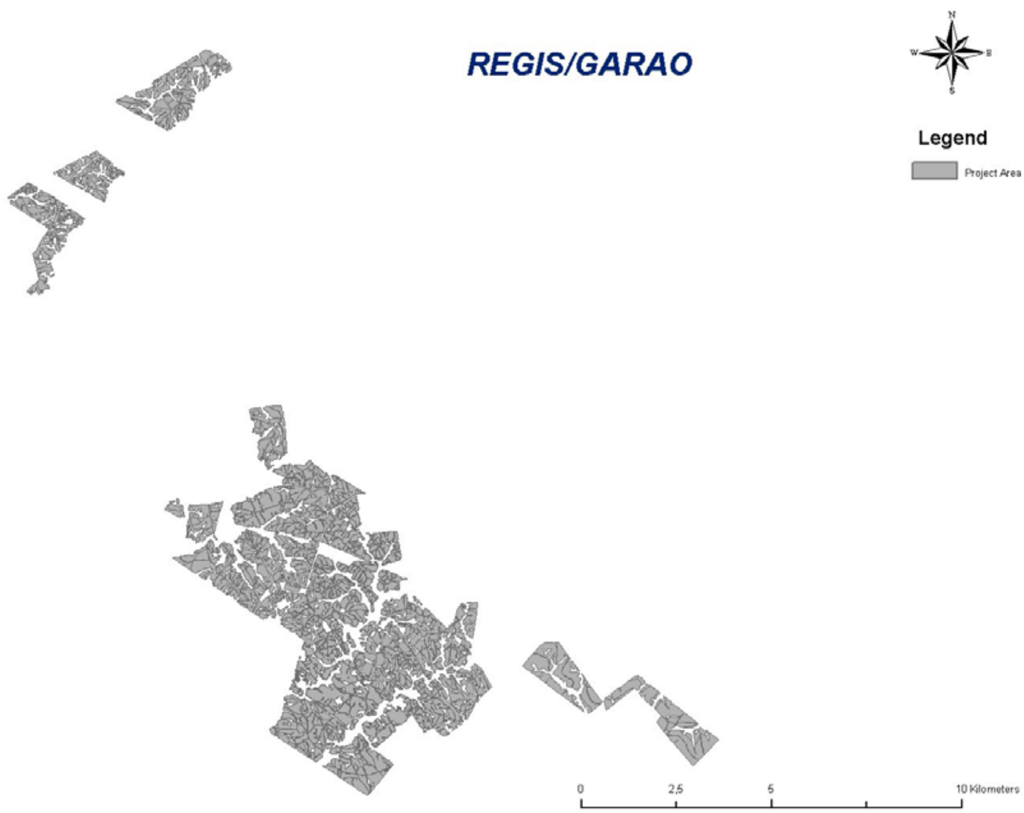


**Figure A3.** Project boundaries (delimited by edges of shaded areas) in ‘*Regis/Garao*’ region.

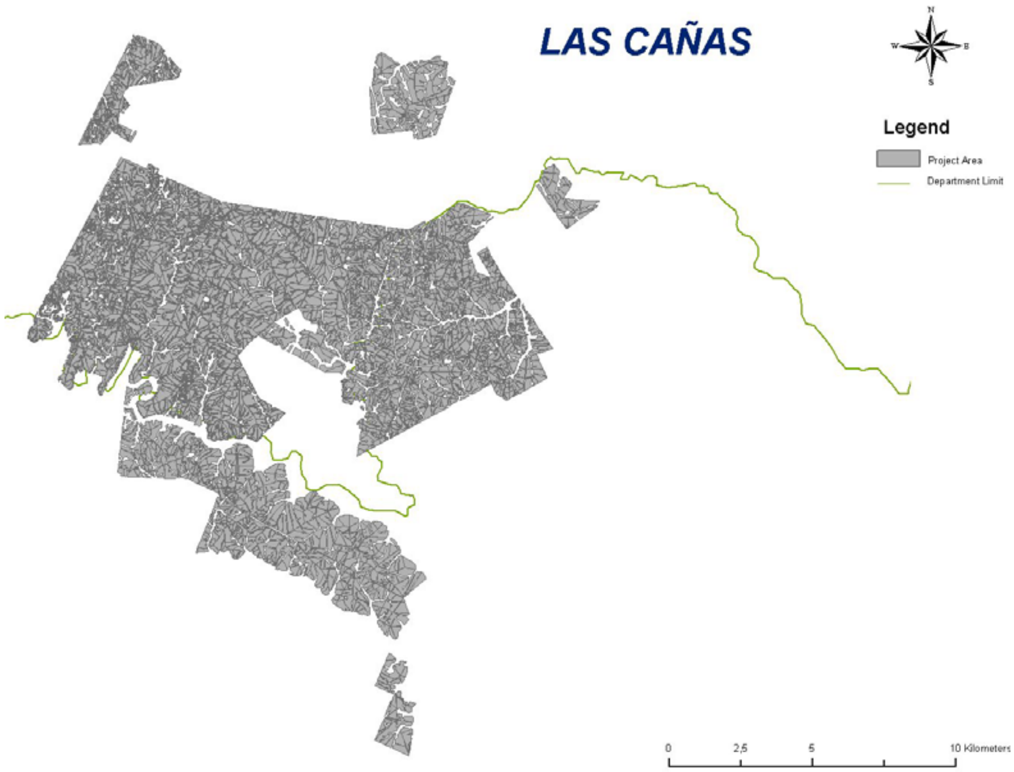


**Figure A4.** Project boundaries (delimited by edges of shaded areas) in '*Las Cañas*' region.

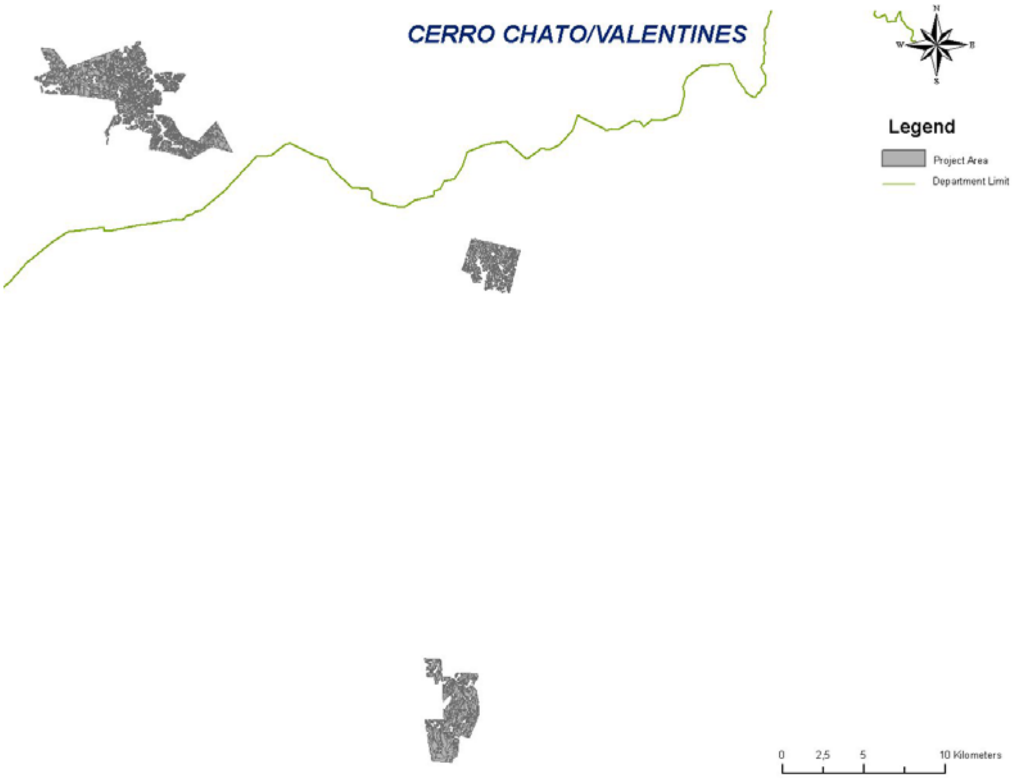


**Figure A5.** Project boundaries (delimited by edges of shaded areas) in '*Tupambaé*' region.

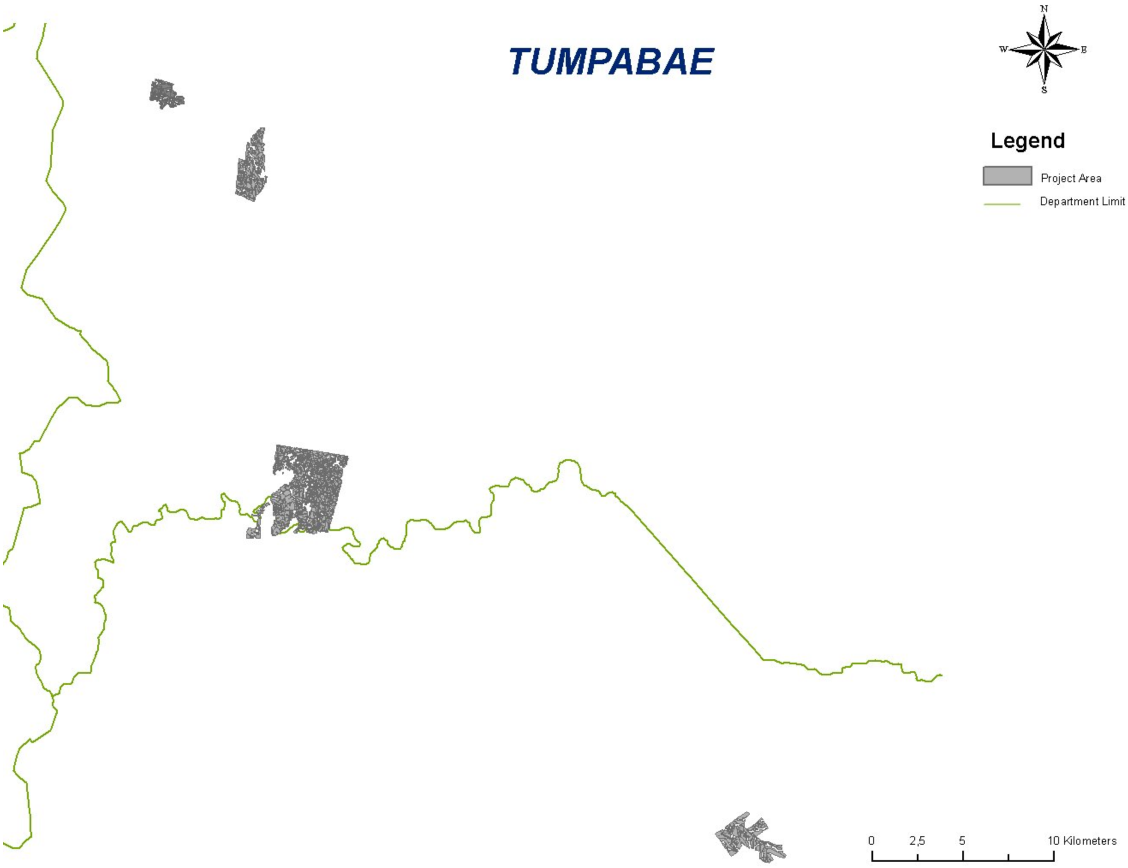


**Figure A6.** Project boundaries (delimited by edges of shaded areas) in '*Cerro Chato/Valentines*' region.

**A.5. Technical description of the A/R CDM project activity:**

**A.5.1. Description of the present environmental conditions of the area planned for the proposed A/R CDM project activity, including a concise description of climate, hydrology, soils, ecosystems (including land use)**:

>> The topography of the area has rolling hills of less than 300 m altitude, with abundant water streams. The mean annual temperature is 18 ºC, varying from 12 ºC (July) to 25 ºC (January). Night frosts occur during the winter (from mid-May to early October), with an average of 30 days with frost per year, with temperatures seldom falling below –5 ºC. Annual precipitation in the area ranges from 1,100 to 1,300 mm, homogeneously distributed along the year, although periods of severe drought and severe water excess are rather frequent. Potential evapotranspiration is about 900 mm/year. Runoff and drainage are on average in the order of 300 mm/year, feeding an extensive network or rivers and the Guaraní Aquifer, one of the largest of the world.

Soils are generally not very deep, of medium-to-coarse texture, and of low natural fertility. Dominant land cover in the area is grassland, with predominance of herbaceous vegetation (mainly grass species) with interspersed shrubs. The vegetation is highly determined by land use (grazing of cattle and sheep). Native vegetation before cattle was introduced in the XVII Century, was richer in shrubs and small trees, although grass and other herbaceous species were also abundant. In spite of high rainfall level and quite fertile and deep soils, trees appear naturally only at the side of rivers and streams, covering only 3 to 5 % of the land area. This has been attributed to the natural occurrence of frequent droughts and fires, which prevented slow growing trees from becoming established against an aggressive competition by grasses.

As it was stated above, the project area consists basically of grassland altered by many years of grazing. This would have caused a significant change in species, as well as some soil loss due to laminar erosion due to frequent over grazing. Besides soil erosion, the lands of the project have been degraded by the removal of the native vegetation and its substitution by a short-grass cover, which has caused a decrease in soil organic matter content due to reduced input of plant residues to the soil.

This grazing-degraded grassland covers virtually all the project area. Associated with this, there are lowland, humid zones, with richer biodiversity and higher conservation value. The forests of the project will be planted on grazing-degraded zones, and the project was designed with the objective of preserving the most valuable areas outside project boundaries but within the land owned by '*Guanaré*'.

These conservation areas include natural forests by the rivers and minor water streams, composed by hydrophilic species close to the streams, and xerophytic species of shrubs and tall grasses surrounding them in a transition to the grasslands. These ecosystems have suffered alterations in the past, due to human intervention. Valuable tree species include *Salix humboldtiana*, *Sebastianoia schottiana*, *Sapium sp.*, *Pouteria salicifolia* and *Erythrina cristagalli*. Also, in the most humid areas *Lueha divaricata*, *Quillaja brasiliensis*, *Cupania vernalis*, *Ocotea acutifolia*, *Allophylus edulis*, *Sebastiana klotzchiana* and *Citarexylum montevidense* appear frequently. In intermediate zones, it is common to find *Schinus longifolius* and *Acanthosyris spinecens*, whereas the most common species in the drier zones are *Gochinatha malmei*, *Aloysia gratissima* and *Lithraea melloides*.

**A.5.2. Description of the presence, if any, of rare or endangered species and their habitats:**

>> No threatened species have been indentified in the project areas. In spite of this, the project has provisions for improving the richness and diversity of the ecosystems surrounding the project boundaries and located within '*Guanaré*' property. This will be achieved by proper plantation design (Fig. A7) and management for conservation of all native forests and valuable wetlands existing in the area; excluding cattle grazing from areas on the margins of water streams, in order to regenerate native forest areas; creating buffer zones and fauna corridors.

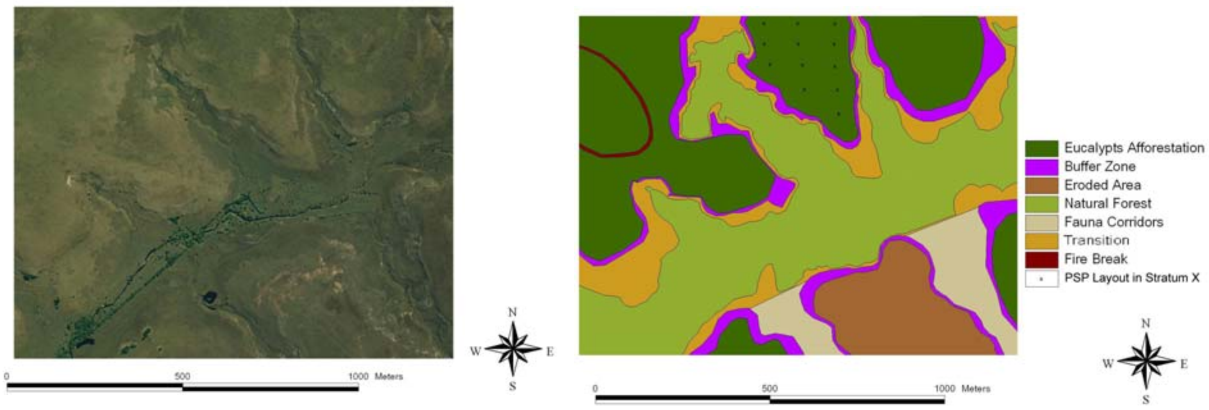


**Figure A7.** Example of land use planning in '*Guanaré*' property. The aerial photograph on the left corresponds to a fraction of land of approximately 140 ha, with a water stream running on NE direction from the SW. The diagram on the right shows the planned land use for the same 140-ha area. Dark green polygons represent areas within project boundaries. All other areas are managed for biodiversity enhancement.

### A.5.3. Species and varieties selected for the proposed A/R CDM project activity:

>> The proposed project activity will use mostly *Eucalyptus grandis* and, to a lesser extent, *E. dunnii* (in lower areas where *E. grandis* can be affected by frost damage), *E. globulus* and *E. maidenii*. None of these species are native to the area. The choice of species is due primarily to the fact that they ensure an adequate productivity level and a market access for the products to be obtained, which would not be possible if other species were used.

It is worth mentioning that there are no tree species native to the ecosystem where forests will be established, since the original vegetation is grassland. Native forests, located on low areas at the margins of an extensive network of rivers and minor water streams, cover less than 5% of Uruguay's territory. Native tree species have usually short, contorted stems, and very slow growth rates. Because of these features, there are currently no native tree species suitable for large-scale commercial plantations. A few species with potential commercial uses have been identified, but there is very limited knowledge on their management. Also, their feasibility would largely depend on finding a market value for their wood products.

Eucalypt plantations in Uruguay are mostly used for pulpwood production, in short rotations (i.e., 7-10 years), although a few companies are testing longer rotations (e.g., 15 years) for obtaining solid wood products. These plantations are managed in a highly sustainable way, and nearly one half of the area has been granted FSC certification. '*Guanaré*' project will go beyond current practice in Uruguay, and will adopt a 22-year rotation for all eucalypt species, thus greatly minimizing any impacts due to harvest interventions, and maximizing the amount of carbon sequestration.

*E. grandis* Hill ex Maiden (rose gum), a member of the *Myrtaceae* family is not native to Uruguay. However, it originates in a region of Australia with ecological conditions highly similar to those in Uruguay (Table A1). This similarity explains why this species adapted so well to Uruguayan conditions, where it has been successfully grown and bred for many years (the National Institute of Agricultural

Research of Uruguay has released a few locally developed varieties, which will be used by '*Guanaré*' project). In addition, there are numerous native relatives of *Eucalyptus* in Uruguay, including more than 20 native tree species belonging to the *Myrtaceae* family

**Table A1.** Comparison of climatic conditions between site of origin of *E. grandis* and '*Guanaré*' project site

| | **Conditions in site of origin** | **Conditions in Uruguay** |
|---|---|---|
| | **New South Wales and Queensland, Australia** | **Treinta y Tres, Cerro Largo y Lavalleja** |
| Latitude | 26°-33° S | 32° S |
| Annual precipitation | 1,020-1,780 mm | 1,200-1,300 mm |
| Mean maximum temperature in January | 29 °C | 30 °C |
| Mean minimum temperature in July | 2-9 °C | 3-6 °C |
| Occurrence of frosts | Occasional, mild | Occasional, mild |

The example given in Table A1 for *E. grandis* applies, with minor variations, to all other eucalypt species to be used by the project.

### A.5.4. Technology to be employed by the proposed A/R CDM project activity:

>>Following are the main features of plantation and forest management technology to be applied in '*Guanaré*' project:

- production of seedlings in relatively large-scale nurseries designed to make efficient use of water and minimal use of chemicals;
- primary delineation of layers (e.g., project boundaries, roads, conservation areas, etc.) in the project's GIS, based on aerial photographs and/or satellite images, soil maps, terrain elevation maps, and other sources of information.
- establishment of internal roads, fire breaks, buffer zones surrounding protected areas, fauna corridors, etc., and recording of all boundaries with GPS;
- adjustment of GIS based on GPS data;
- ant control over the whole area, using low-impact insecticides that are selectively applied on ant paths (this continues until several months after plantation);
- vegetation control by using glyphosate, an environmentally friendly herbicide (glyphosate can be applied over the whole area or just over 1-m wide strips where the tree rows will be located, depending on site-specific conditions);
- soil tillage, with tools used, extent of operation (i.e., whole area or tree row strips), and number of passes varying according to site specific conditions; in-row deep tillage (subsoiling) may be required in many cases;
- herbicides may be necessary before planting (depending on site specific conditions and on tillage tools used); it is likely that a combination of glyphosate (to control existing vegetation at the time of planting) with a pre emergent herbicides (e.g., oxyfluorfen) to ensure a weed free environment for the establishment of seedlings, will be applied;
- planting of seedlings (manually or mechanized) and fertilization (localized around each seedling); plantation density will be 1,100 seedlings/ha, in rows spaced every 4 m;

- localized irrigation may be required in extreme cases where plantation was performed on very dry soil and there is no rain for a few days after plantation;
- survival control and reposition: within a few weeks after planting, checks are performed to identify and replace lost seedlings;
- weed control continues for several months after planting (i.e., until the end of the first summer); this includes localized glyphosate spraying around each tree (using protective screens to avoid the herbicide coming into contact with the trees), and/or mechanized weed control of the inter-row areas.
- pruning of all trees to a height of 3 m from the ground, by the second year after planting; manual saws or pneumatic scissors will be used; all residues will be left on site;
- a second pruning of selected trees (ca. 60 % of total trees, including all trees that will remain after the first thinning), to a height of 6 m will be performed by year 4 after planting; all residues will be left on site;
- first thinning at year 7 after planting will remove more than half of the trees, including those with thinner stems and poor shape; a relatively reduced volume of low-priced merchantable wood will be obtained; due to reduced wood volume of harvested trees, felling will be mostly manual (i.e., by using chain saws), although the other operations will be mechanized; remaining tree population will be in the order of 400 to 500 per hectare and all residues, including bark will be left on site;
- third pruning to a height of 9 m will be performed on selected trees (ca. 80 % of total trees, including all trees that will remain after the second thinning), 8 years after planting; all residues will be left on site;
- second thinning at year 10 after planting will leave a remaining population of ca. 300 trees/ha; a relatively important volume of medium-priced merchantable wood will be obtained; this operation will likely be completely mechanized and all residues, including bark will be left on site;
- fourth pruning to a height of 12 m will be performed on selected trees (ca. 60 % of total trees, including all trees that will remain after the third thinning), 11 years after planting; all residues will be left on site;
- third thinning at year 15 after planting will leave a remaining population of ca. 150 trees/ha; a relatively important volume of medium-to-high-priced merchantable wood will be obtained; this operation will likely be completely mechanized and all residues, including bark will be left on site;
- clear-cut harvest at year 20 after planting; an important volume of high-priced merchantable wood will be obtained; this operation will likely be completely mechanized, and all residues, including bark will be left on site;
- site preparation for re-planting starts immediately after clear-cut harvest; tillage will be performed on the inter-row spaces, where the second-rotation trees will be established.

**A.5.5. Transfer of technology/know-how,if applicable:**

>>N/A

**A.5.6. Proposed measures to be implemented to minimize potential leakage:**

>>Implementation of the proposed project activity will not cause any leakage from increased use of wood posts for fencing, since there will be a limited use of these posts, and all posts will originate in sustainably managed forests, without causing any permanent loss of carbon stocks.

There will also be no displacement of pre-project activities. All cattle will be either remain within '*Guanaré*' property or sold to the market.

Leakage due to use of fossil fuels will be of relatively low significance, and will mostly arise from the transportation of wood products. Some measures to be considered to minimize this source of leakage include the promotion of wood manufacturing industries to be established near the project areas (which would reduce the transportation distance), the use of biofuels or biofuel mixes and the use of efficient transport equipment.

**A.6. Description of legal title to the land, current land tenure and rights to tCERs / lCERs issued for the proposed A/R CDM project activity:**

>>
All properties in Uruguay have legal title clearly defined and titles are identified in a National Registry, which also keeps truck of all land transactions. All cadastral units are measured with sub-meter precision, and legal titles include the corresponding maps with clear identification of visible landmarks. Seven-wire fencing is enforced in Uruguay on the boundaries of all cadastral units.

Project land is property of '*Guanaré S.A.R.L*', and so will be the forests to be established on this land. Private property is fully recognized and respected in Uruguay, and '*Guanaré*' is fully entitled to property rights over the land, the forests and all the products and services derived from these goods. This includes all tCERs to be obtained by the proposed project activity.

**A.7. Assessment of the eligibility of the land:**

>>The methodological tool "*Procedures to demonstrate the eligibility of lands for A/R CDM project activities*" are used here to assess the eligibility of the land. Following is a detail of application of the various steps of the tool (text of the tool is in italics font).

*1. Project participants shall provide evidence that the land within the planned project boundary is eligible for an A/R CDM project activity by following the steps outlined below.*

*(a) Demonstrate that the land at the moment the project starts does not contain forest by providing transparent information that:*
*i. Vegetation on the land is below the forest thresholds (tree crown cover or equivalent stocking level, tree height at maturity in situ, minimum land area) adopted for the definition of forest by the host country under decisions 16/CMP.1 and 5/CMP.1 as communicated by the respective DNA; and*
*ii. All young natural stands and all plantations on the land are not expected to reach the minimum crown cover and minimum height chosen by the host country to define forest; and*
*iii. The land is not temporarily unstocked, as a result of human intervention such as harvesting or natural causes.*

Uruguay's DNA has adopted the following levels of the parameters used for definition of forests:

- Minimum tree height: 3 m

- Minimum crown coverage: 30%
- Minimum land area: 0.5 ha

This definition has been communicated to the CDM Executive Board, and it is consistent with the parameters used by Uruguay for reporting to FAO.

There are virtually no trees within the project boundaries, and therefore, vegetation on the land is below the forest thresholds. This is evident from the analysis of aerial photographs and satellite images that have been analysed and archived as project documentation. In addition, there is abundant ground photography documentation, also archived as project documents, proving the total absence of forests within project boundaries. As an example of this documentation, please see Figures A8 through A11.

Since there are no forests in the project area, there are no young natural stands or plantations that may reach the minimum crown cover and minimum height chosen by the host country's DNA.

Finally, since the land has no past records of the presence of forests, as it is shown below through analysis of historical remote sensing data, the land cannot be temporarily unstocked as a result of human intervention or natural causes.

**Figure A8**. Representative views of pre-project situation in '*Garao/Regis*' region.

**Figure A9**. Representative views of pre-project situation in '*Las Cañas*' region.

**Figure A10**. Representative views of pre-project situation in '*Tupambaé*' region.

**Figure A11**. Representative views of pre-project situation in '*Cerro Chato/Valentines*' region.

*(b) Demonstrate that the activity is a reforestation or afforestation project activity:*
*i. For reforestation project activities, demonstrate that the land was not forest by demonstrating that the conditions outlined under (a) above also applied to the land on 31 December 1989. If the land was forested after 31 December 1989 and converted to non-forest land before commencement of an A/R CDM project activity then provide transparent information that demonstrates that the land was not intentionally converted to non-forest land for the purpose of implementing an A/R CDM project activity*[1].
*ii. For afforestation project activities, demonstrate that for at least 50 years vegetation on the land has been below the thresholds adopted by the host country for definition of forest.*

According to recent guidance from the AR Working Group (18th meeting) it is not essential to differentiate between afforestation and reforestation A/R CDM project activities in order to demonstrate eligibility of land. Therefore, even though the proposed project activity is an afforestation case, it is sufficient to demonstrate that vegetation on the land within project boundaries was below the thresholds of forest definition.

From information derived from satellite images, aerial photographs and expert judgment, it was inferred that the project area was completely covered by grassland on 31 December 1989, and at all times after that until the time of project start. This is in agreement with the fact that most of Uruguay, and particularly so in the regions where the project is located, is covered by grassland vegetation which is used mainly for extensive grazing. This can be appreciated in Figure A12, which shows a land use map for 1990 and 2000, produced by the government of Uruguay (Ministry of Livestock, Agriculture and Fisheries). Even though the maps in Fig. A12 have low spatial resolution, it is clear that the four project regions are in areas where dominant land use is extensive grazing with sheep and cattle, on unmanaged pasture (i.e., with pasture improved area being less than 10% of total).

Another piece of evidence of historical land use comes from government regulations. Afforestation is highly regulated in Uruguay. The forest policy implemented by the government in 1988 strongly discourages plantation outside the so-called ‘forest-priority soils’. These soils, which occupy a total area of 3.9 million ha (nearly 20% of the country’s land territory), are defined based on their low suitability for agricultural uses, and/or their current degradation status due to erosion, overgrazing, and other factors. At the time of forest policy implementation (1988) the area of forest priority soils was virtually all under grassland, with a very minor fraction under cropland. No forest land was included, and in fact, deforestation was successfully forbidden in the country. ‘*Guanaré*’ project plantations will be restricted to forest priority soils and, therefore, must be established on grassland.

All the information used has been archived as project documentation. Some examples of satellite images of different fractions of the project area at around 1990 and at the time of project start are shown in Figures A13 through A16.

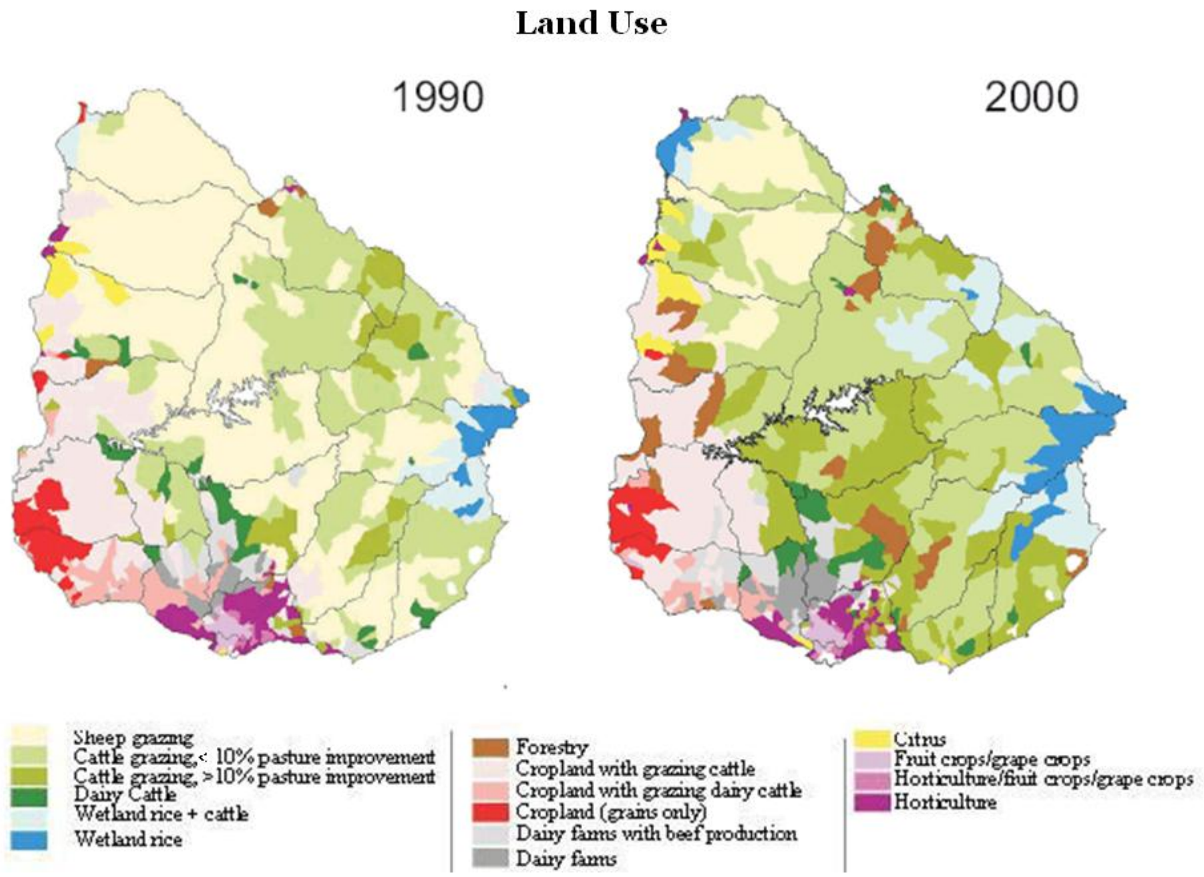


**Figure A12**. Land use map of Uruguay in 1990 and 2000.

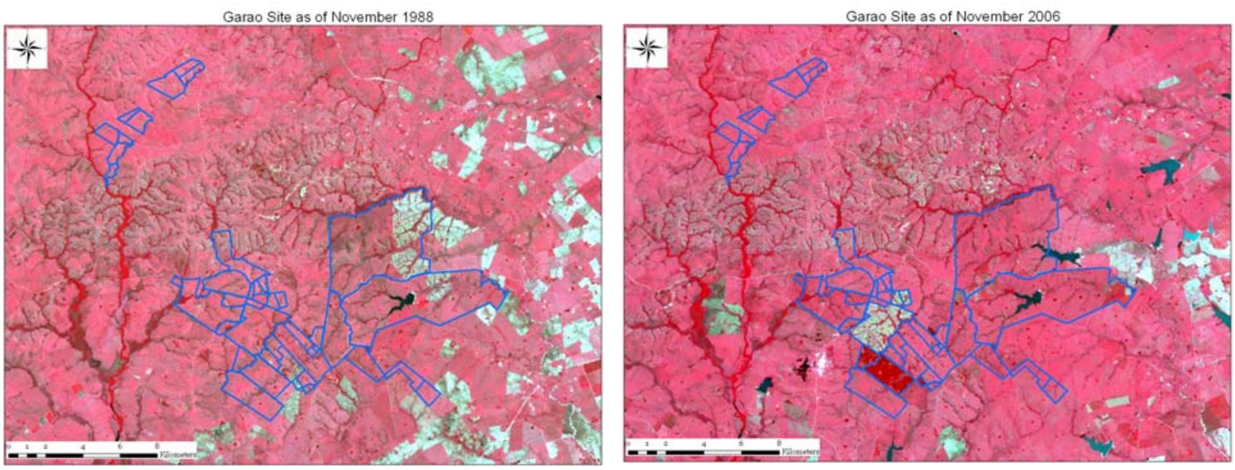


**Figure A13**. Landsat images of Garao site (*Garao/Regis*' region) corresponding to November 1988 and November 2006. Note: the red block in the lower central portion of the 2006 image indicates soil tillage in an area where site preparation had already started.

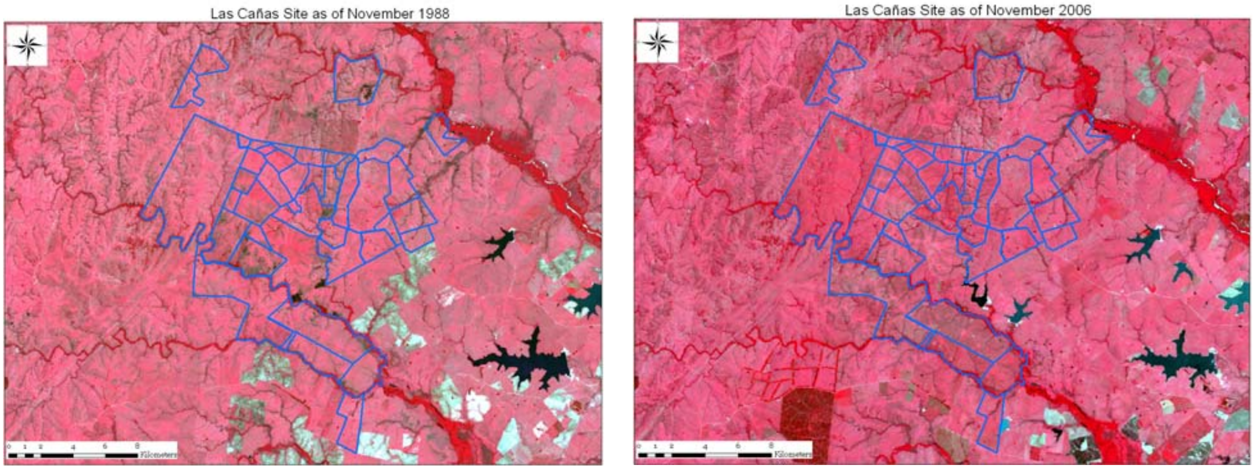


**Figure A14**. Landsat images of '*Las Cañas*' region) corresponding to November 1988 and November 2006.

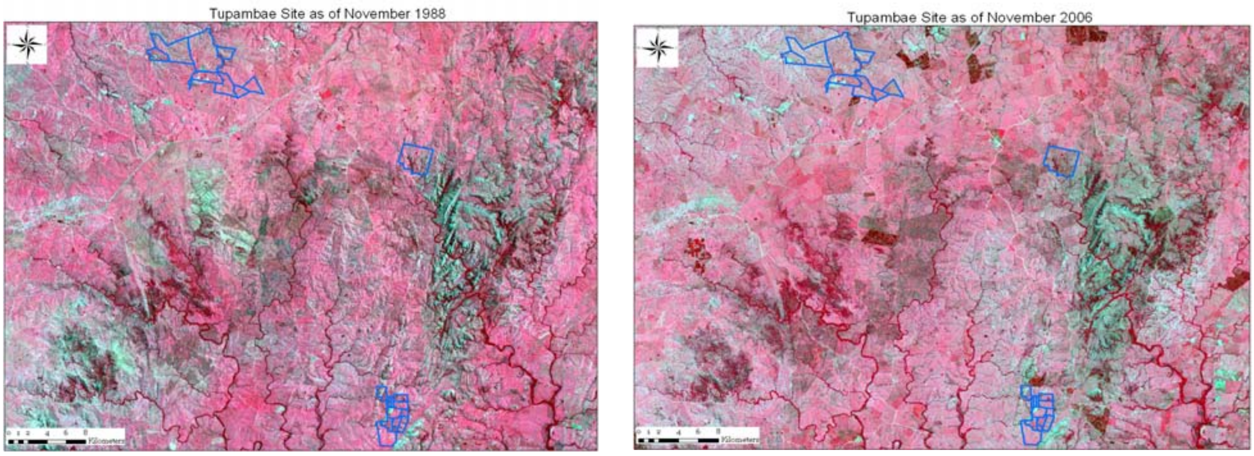


**Figure A15**. Landsat images of '*Tupambaé*' region) corresponding to November 1988 and November 2006.

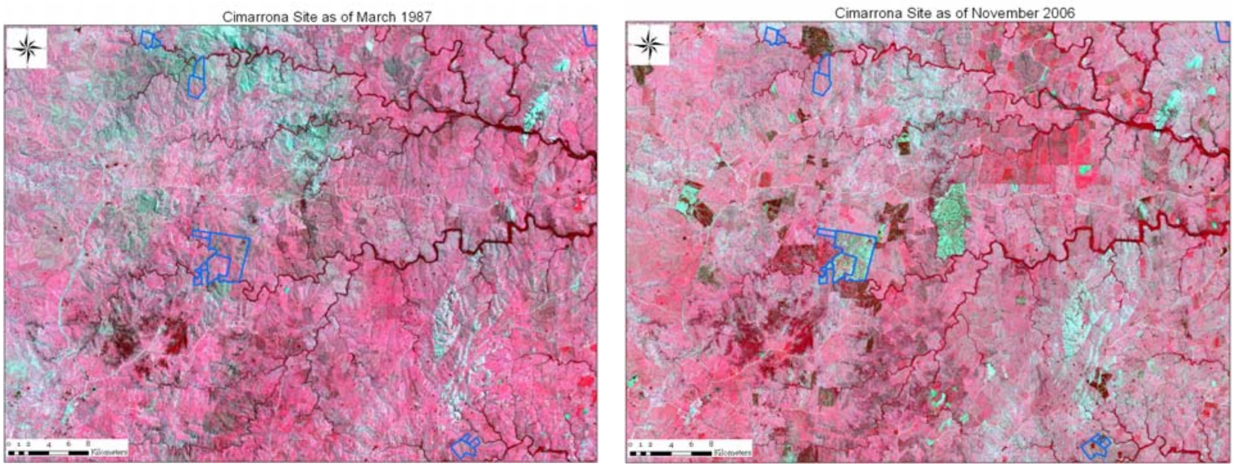


**Figure A16**. Landsat images of '*La Cimarrona/Valentines*' region) corresponding to March 1987 and November 2006. Note: the green block in the central portion of the 2006 image indicates soil tillage in an area where site preparation had already started

*2. In order to demonstrate steps 1 (a) and 1 (b), project participants shall provide information that reliably discriminates between forest and non-forest land according to the particular thresholds adopted by the host country, inter alia:*

*(a) Aerial photographs or satellite imagery complemented by ground reference data; or*

*(b) Land use or land cover information from maps or digital spatial datasets; or*

*(c) Ground based surveys (land use or land cover information from permits, plans, or information from local registers such as cadastre, owners registers, or other land registers);*

As stated above, satellite images, land use maps and expert judgment were the main sources of information used to demonstrate that the lands within project boundaries have not been under forest at least since 31 December 1989.

**A.8. Approach for addressing non-permanence:**

>> tCERs will be chosen

**A.9. Estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period:**

>> The project is estimated to result in net anthropogenic GHG removals by sinks over the 20 years crediting period of 14,121,031 t $CO_2$-e. Estimations of baseline removals, leakage and actual; as well as net GHG removals expected over the crediting period are given in Table O.

Summary of results obtained in Sections C.7., D.1., and D.2.

| Year | Estimation of baseline net GHG removals by sinks (tonnes of $CO_2$ e) | Estimation of actual net GHG removals by sinks (tonnes of $CO_2$ e) | Estimation of leakage (tonnes of $CO_2$ e) | Estimation of net anthropogenic GHG removals by sinks (tonnes of $CO_2$ e) |
|---|---|---|---|---|
| 2006 | 0 | 40,923 | 72 | 40,851 |
| 2007 | 0 | 269,451 | 192 | 269,259 |
| 2008 | 0 | 558,865 | 312 | 558,553 |
| 2009 | 0 | 738,182 | 192 | 737,990 |
| 2010 | 0 | 782,101 | 48 | 782,053 |
| 2011 | 0 | 782,155 | 0 | 782,155 |
| 2012 | 0 | 782,155 | 0 | 782,155 |
| 2013 | 0 | 782,155 | 0 | 782,155 |
| 2014 | 0 | 782,155 | 0 | 782,155 |
| 2015 | 0 | 782,155 | 0 | 782,155 |
| 2016 | 0 | 782,155 | 0 | 782,155 |
| 2017 | 0 | 782,155 | 0 | 782,155 |
| 2018 | 0 | 782,155 | 0 | 782,155 |
| 2019 | 0 | 782,155 | 0 | 782,155 |
| 2020 | 0 | 782,155 | 0 | 782,155 |
| 2021 | 0 | 782,155 | 0 | 782,155 |
| 2022 | 0 | 782,155 | 0 | 782,155 |
| 2023 | 0 | 782,155 | 0 | 782,155 |
| 2024 | 0 | 782,155 | 0 | 782,155 |
| 2025 | 0 | 782,155 | 0 | 782,155 |
| **Total** (tonnes of CO2 e) | 0 | 14,121,842 | 816 | 14,121,031 |

**A.10. Public funding of the proposed A/R CDM project activity:**

>> There will be no public funding.

## SECTION B. Duration of the project activity / crediting period

### B.1 Starting date of the proposed A/R CDM project activity and of the crediting period:

>> 1 September 2006

### B. 2. Expected operational lifetime of the proposed A/R CDM project activity:

>> More than 60 years

### B.3 Choice of crediting period:

A renewable crediting period is chosen.

#### B.3.1. Length of the renewable crediting period (in years and months), if selected:

>>20 years

#### B.3.2. Length of the fixed crediting period (in years and months), if selected:

>>N/A

## SECTION C. Application of an approved baseline and monitoring methodology

### C.1. Title and reference of the approved baseline and monitoring methodology applied to the proposed A/R CDM project activity:

>> The consolidated methodology AR-ACM0001 "Afforestation and reforestation of degraded land" (version 01) is selected.

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

- Procedures to demonstrate the eligibility of lands for afforestation and reforestation CDM Project Activities (version 01);
- Combined tool to identify the baseline scenario and demonstrate the additionality in A/R CDM project activities (version 01);
- Estimation of GHG emissions related to fossil fuel combustion in A/R project activities (version 01);
- Estimation of emissions from clearing, burning and decay of existing vegetation due to implementation of a A/R CDM project activity (version 01);
- Estimation of direct nitrous oxide emission from nitrogen fertilization (version 01);
- Estimation of GHG emissions related to displacement of grazing activities in A/R CDM project activity (version 01);
- Procedure to determine when accounting of the soil organic carbon pool may be conservatively neglected in A/R CDM project activities (version 01);
- Calculation of the number of sample plots for measurements within A/R CDM project activities (version 01);
- Tool for testing significance of GHG emissions in A/R CDM project activities (version 01).

### C.2. Assessment of the applicability of the selected approved methodology to the proposed A/R CDM project activity and justification of the choice of the methodology:

>>The selected methodology defines five applicability conditions. Following is an assessment of the application of this condition to the proposed project activity, as well as a justification of the choice of the methodology.

1. Applicability conditions

### *1.1 Degraded land*

The project will be implemented on degraded lands which are expected to remain in a degraded state in the absence of the project. Evidence is provided here showing that, due to extensive grazing activity practiced for more than 300 years, the lands have lost the original vegetation and a fraction of the soil organic matter, an essential component determining land productivity. In addition, due to frequent periods of overgrazing causing the soil to become exposed to erosive processes (i.e., due to lack of vegetation cover) combined with dominating moderate slopes in the terrain, erosion gully processes have affected most of the lands within project boundaries.

Native vegetation in the project region was originally composed mainly by tall grasses and shrubs. The turnover of plant residues maintained relatively high levels of organic matter in the soil. Introduction of cattle in the 17th Century brought about a degradation of the vegetation, which became dominated by grasses that were kept short by grazing, particularly after introduction of sheep a few decades later. The sheep and cattle extensive grazing activity has prevailed, more or less unchanged, until present. Due to the extensive nature, the production system is vulnerable to climate extremes, the relatively frequent droughts that occur in Uruguay (e.g., dry periods every summer, with extreme droughts every 10 years or so) are associated to overgrazing.

The change in vegetation due to grazing reduced the turnover of plant residues and, consequently the organic matter content of the soil, thus leading to a more degraded state of the lands. Two recent studies support this statement. Piñeiro et al (2006)[1] have found that 370 years of grazing have caused, on average for 11 grassland sites in Argentina and Uruguay, decreases in soil organic nitrogen content (−880 kg $ha^{-1}$ or −19%), soil organic carbon content (−21,200 kg $ha^{-1}$ or −22%) and net primary productivity (−2,192 kg $ha^{-1}$ or −24%).

The second study (Altesor et al., 1998)[2] focused on the effects of more recent changes due to grazing. Five sample plots on grassland sites in N Uruguay that had been measured in 1935 were revisited in 1990. It was concluded that continued grazing caused an increase in the frequency of weedy species and a decrease in the palatable forage species. This is an indication of continued degradation at present.

A survey of all soils in the project area was conducted with the objective of producing a semi-detailed soil map. In the process, several soil samples were taken to determine various soil physical and chemical properties, including soil organic matter. The soil organic matter content for the main soil types in each site was compared with that of representative samples of the same soil types as measured in the National soil survey that took place in the 1960's. The analysis showed a consistent decrease in soil organic matter content across all project sites of between 5 and 11% (Table C1). This decrease is very likely due to a loss of topsoil caused by erosion, and is an additional evidence of continued soil degradation under current extensive grazing practices.

**Table C1**. Soil organic matter content of selected soil types at '*La Cimarrona*' site and of representative samples of the same soil types from the National Soil Survey of ca. 1965. Note: the same comparison was made for all project sites with very similar results, and a report has been archived as part of project documentation.

| Soil type | Soil organic matter content | 2006/1965 |
|---|---|---|

[1] Piñeiro, G., Paruelo, J.M. and Oesterheld, M. 2006. Potential long-term impacts of livestock introduction on carbon and nitrogen cycling in grasslands of Southern South America. Global Change Biology 12:1267–1284.

[2] Altesor, A., Di Landro, E, May, H. and Ezcurra, E. 1998. Long-term species change in a Uruguayan grassland. Journal of Vegetation Science, 9:173-180

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| | (% weight) | | |
|---|---|---|---|
| | **2006** | **1965** | |
| Typical Luvisol (deep) | 3.6 | 3.9 | 0.92 |
| Abruptic Luvisol (shallow) | 3.6 | 3.8 | 0.95 |
| Inceptisol | 3.9 | 4.3 | 0.91 |
| Haplic Brunosol | 3.3 | 3.6 | 0.92 |

The final piece of evidence of the state of degradation of project lands is given in Figure C1, which shows the spatial distribution of areas affected by soil erosion gully processes in the country. It can be appreciated that all of the project area is located within regions with light to severe intensity of gully formation. This is mostly related with the topography with relatively steep slopes prevailing in the lands within project boundaries.

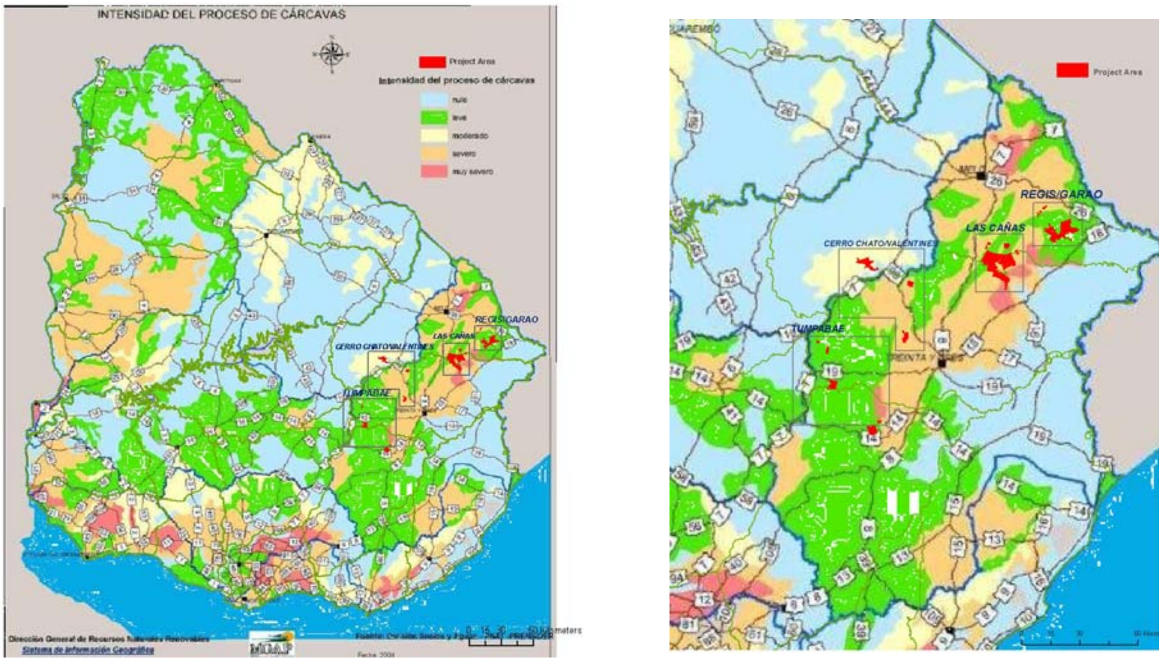



**Figure C1**. Occurrence of soil erosion gully processes in Uruguay. Light blue areas indicate no gully erosion; all other colours indicate varying degree of gully erosion from light (green areas) to very severe (red areas). Source: '*Ministerio de Ganadería, Agricultura y Pesca*' of Uruguay (Ministry of Agriculture). (http://www.mgap.gub.uy/Renare/SIG/ErosionAntropica/intdelprocesodecarcavas.jpg) Web site visited 29 February 2008.

### *1.2 Encroachment of natural tree vegetation*

Native vegetation in project area is grassland. Therefore, evolution of current vegetation cover (dominated by grasses kept short by grazing) to forest is not possible.

1.3 ***Flooding irrigation***

No flooding irrigation will occur in the project.

***1.4 Drainage of organic soils***

There are no organic soils in the project area.

***1.5 Nitrogen-fixing trees***

No N fixing trees will be used in the project activity.

2 Justification of the choice of methodology

As shown above, the proposed project activity complies with all applicability conditions defined in the methodology. In addition, the baseline approach "Existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary" is suitable for the proposed project activity because only land use types that have occurred within the project boundaries in the past are feasible alternatives for the baseline scenario.

**C.3. Assessment of the selected carbon pools and emission sources of the approved methodology to the proposed CDM project activity:**

>> All carbon pools are selected. Above-ground and below-ground biomass must be selected according to the methodology. All other carbon pools are optional, and they are also selected because they are expected to increase by implementation of the proposed project activity. In the case of dead wood and litter, this is very clear, since these pools are virtually non-existent in the pre-project situation, and will appear under forest. In the case of soil organic carbon the situation is more complex. Even though the soils are degraded, there still may be a transient reduction in soil organic carbon due to site preparation (e.g., tillage). However, the establishment of forest is expected to cause an increase in net primary productivity and, therefore, in the turnover of plant residues into the soil. This would lead to a long-term increase in the soil organic carbon pool.

The three GHG emission sources indicated in the methodology ($CO_2$ from use of fossil fuels, $N_2O$ from use of fertilizers, and $CH_4$ from biomass burning) are selected.

**C.4. Description of strata identified using the *ex ante* stratification:**

>> For the purpose of determining the baseline net GHG removals by sinks, all the project area is included in a single stratum. The four regions defined for the project are highly similar in terms of climate, soil types, vegetation cover, land use and socio-economic circumstances. All the drivers of land use and land use changes are therefore homogeneous across the four regions.

For the ex-ante estimation of actual net GHG removal by sinks, the project area was stratified based on the plantation plan, considering species and planting date (Table C2).

**Table C2**. Plantation plan (ha planted every year) of the project. Each combination of species and plantation year constitutes one stratum for ex-ante estimation of actual net GHG removals by sinks. Note: due to similitude of species, *E. dunnii* was included in the same strata as *E. grandis*; and *E. maidenni* was included in the same strata as *E. globulus*.

| **Species** | Plantation year | | | | | **Total** |
|---|---|---|---|---|---|---|
| | **2006** | **2007** | **2008** | **2009** | **2010** | |
| *E. grandis* | 354 | 7,396 | 8,825 | 5,314 | 1,300 | **23,189** |
| *E. globulus* | 1,033 | 0 | 468 | 360 | 0 | **1,861** |
| **Total** | **1,387** | **7,396** | **9,293** | **5,674** | **1,300** | **25,050** |

## C.5. Identification of the baseline scenario:

>> The baseline scenario was defined by using the "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities", version 01. Since only one stratum was identified for the baseline scenario, the procedure is only applied once. Following is a description of the application of this tool.

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

The afforestation activity started on September 2006, this is, before the registration date.

The starting date occurred after 31 December 1999. This is demonstrated by the evidence obtsained from the analysis of remote sensing data (Figures A13 through A16, and respective reports archived with project documentation).

The incentive from the planned sale of CERs was seriously considered in the decision to proceed with the project activity. This is clearly documented in the documentation submitted to the National Forest Agency from the '*Ministerio de Ganaderia, Agricultura y Pesca*' since before the project start date (project documents are prepared and submitted for government approval for each estate just before it is planned to be planted). The various documents submitted to the government stated very clearly that carbon sequestration by the forests and the sale of carbon credits were one key objective of the project. Dated and signed (by a Ministry's officer) copies of all the documents that were submitted are kept in project documentation archive.

**Step 1. Identification of alternative land use scenario to the proposed A/R CDM project activity**

The four regions defined for the project have a combined area of nearly 1 million ha of land. Grassland under extensive grazing (i.e., with no pasture improvement) is the dominant land use in the project stratum, covering 88% of the area (Table C3).

**Table C3.** Land use in the project stratum in 2003 (Ministry of Livestock, Agriculture and Fisheries)

| **Land Use** | **Management** | **Area** | |
|---|---|---|---|
| | | **ha** | **%** |
| Grassland | Extensive grazing | 867,280 | 88.2 |
| | Improved pastures | 58,982 | 6.0 |
| Forest land | Forest plantations | 12,016 | 1.2 |

| | | | |
|---|---|---|---|
| | Native forest | 34,406 | 3.5 |
| Cropland | Annual grain crops | 4,300 | 0.4 |
| Other | Settlements, other | 6,043 | 0.6 |
| **Total** | | **983,027** | **100.0** |

*Sub-step 1a*. The following realistic and credible alternatives to the proposed project activity are identified:

1. **The continuation of the extensive grazing cattle and sheep business orientation, with no pasture improvements**

Cattle and sheep production has been the traditional rural activity in the project area and all its surrounding region since the 17th Century. In soils of low productivity, such as those designated as of forestry priority like the ones in the project area, the main products obtained are wool sold to textile industry, and calves to be sold for fattening on more fertile soils. A combination of sheep and cattle is the preferred production mix. Pasture improvement practices (e.g., fertiliser application) are almost exclusively restricted to the best quality soils that do not occur within project boundaries. There is abundant information regarding the economic and financial aspects of this activity. Information from the '*Plan Agropecuario*' has been used for the alternatives studied[3].

2. **Continuation of the cattle and sheep business orientation with pasture improvement on one fraction of the land area**

This would be a case similar to the previously described. The fundamental difference with the first alternative is that pastures are improved by introducing more productive species and adding phosphate fertiliser over one fraction of the land area. This type of system requires more investment and more careful management as compared to alternative 1 above. At the same time, productivity in terms of meat equivalent would increase by 30%.

3. **Conversion to cropland**

The areas suitable for afforestation (e.g., those lands defined as of forest priority by current government policy) are usually marginal lands for crop production. Most of the soils within project boundaries are too shallow and/or of too low fertility, and susceptible to degradation, as to be considered suitable for crop production.

4. **Afforestation**

This is the proposed project activity. Afforestation for pulpwood (short rotation) is the most common type in Uruguay, with nearly 80% of forest plantations being currently used for this purpose. These plantations are normally combined with extensive grazing of forest service areas. The extension of forest plantations in the regions defined for the project is very low (1.2% of total area), mostly intended for providing shelter to the cattle. The type of forest management to be applied in the proposed project activity (long rotation with pruning and thinning) is not very widespread in Uruguay.

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

[3] http://www.planagro.com.uy

All land use alternatives identified above comply with all mandatory regulations in the country. No alternatives are eliminated base don this criterion.

**Step 2. Barrier analysis**

*Sub-step 2a*. List of barriers

Following is a list of possible barriers for the land-use alternatives identified above :

- Low soil quality
- Lack of access to credit (both short and long term)
- Climate risk
- Market risk (price of products)
- Remoteness of land area
- Land tenure characteristics

*Sub-step 2b*. Elimination of scenarios prevented by barriers

**Alternative 1** is not prevented by any barrier. It is the current land use, and the one that has been practised for more than 300 years.

**Alternative 2** is prevented by several of the barriers mentioned above. Mirroring the successful experiences in New Zealand, a country with several common features with Uruguay, pasture improvement has been promoted by the government through its extension agencies and by many local experts since the 1950's. All the attempts to promote these improved systems failed systematically over the years. In particular, the adoption of this technology is virtually nil in soils such as the ones in the project area, which are too shallow and/or lacking sufficient fertility.

At least three of the barriers listed above would apply to this alternative. The land tenure feature is perhaps the most important one. More than 70% of the owners of large land units (i.e., more than 2,000 ha) in Uruguay live off their farms, and usually have their main way of living from sources other than their rural properties. Because of this, they are generally reluctant to implement pasture improvement because of the more stringent requirement for proper management. In addition, market fluctuations in the prices of meat or wool are very frequent, and this makes the investment in improvement or intensification of livestock production somewhat risky. On top of this, climate fluctuations, and particularly, the frequent occurrence of droughts in Uruguay, add to the uncertainty.

An extensively documented report has been produced to demonstrate the impacts of these barriers that prevent alternative 2 from being feasible in the project area. This report is archives as a project document.
**Alternative 3** is prevented by the low soil quality. No cropland has developed in Uruguay in soils such as the ones in the project area.

**Alternative 4** is prevented by lack of access to credit for long-term investments and remoteness of land area, which imposes high transportation cost for wood products, particularly for cases where the wood product is a low-value commodity such as pulpwood.

An extensively documented report has been produced to demonstrate the impacts of these barriers that prevent alternative 4 from being feasible in the project area. This report is archives as a project document.

*Sub-step 2c.* Baseline scenario

Continuation of pre-project activity has been identified as the most plausible scenario in the absence of the proposed project activity.

**C.5.2. Description of the identified baseline scenario (separately for each stratum defined in Section C.4.):**

>> Baseline scenario is the continuation of the pre-project activity, in the same was as it has been done for many years.

**C.6. Assessment and demonstration of additionality:**

>> Additionality is demonstrated through application of Steps 0 to 2 in Section C.5 above, and Step 4 (in this section).

**Step 4. Common practice analysis**

Very limited afforestation activity has occurred in the region around the project areas recently. In the past, forest plantations in the region were almost non-existent, or restricted to cattle shelters in ranch farms. The extensive afforestation process that occurred in Uruguay during the 1990's, with the establishment of more than 500,000 ha left the proposed region completely out. The main reason for this was very likely the remote location, away from wood exporting harbours and from manufacturing industries. Poor site quality (e.g., shallow soils, steep slopes) may have been an additional reason.

Some afforestation activity has started to occur in the area within the last couple of years, simultaneously with the development of the proposed project activity. All these new investments in forest plantations in the project region are aiming at selling carbon credits.

A documented report with an assessment of the current trends in afforestation in the project region has been produced and archived as part of the project documentation.

**C.7. Estimation of the *ex ante* baseline net GHG removals by sinks:**

>>>> 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.

| ID number[4] | Data variable | Data unit | Value applied | Data Source | Comment |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

[4] Please provide ID number for cross-referencing in the PDD.

| Please present final results of your calculations using the following tabular format. | |
|---|---|
| **Year** | **Annual estimation of baseline net anthropogenic GHG removals by sinks in tonnes of $CO_2$ e** |
| 2006 | 0 |
| 2007 | 0 |
| 2008 | 0 |
| 2009 | 0 |
| 2010 | 0 |
| 2011 | 0 |
| 2012 | 0 |
| 2013 | 0 |
| 2014 | 0 |
| 2015 | 0 |
| 2016 | 0 |
| 2017 | 0 |
| 2018 | 0 |
| 2019 | 0 |
| 2020 | 0 |
| 2021 | 0 |
| 2022 | 0 |
| 2023 | 0 |
| 2024 | 0 |
| 2025 | 0 |
| **Total estimated baseline net GHG removals by sinks (tonnes of CO2 e)** | 0 |
| **Total number of crediting years** | 20 |
| **Annual average over the crediting period of estimated baseline net GHG removals by sinks (tonnes of CO2 e)** | 0 |

**C.8. Date of completion of the baseline study and the name of person(s)/entity(ies) determining the baseline:**

>> Baseline study completed on 30 January 2008, and was determined by Daniel Martino and Alvaro Pérez del Castillo (Carbosur, Uruguay), Makino Yamada (Japan Overseas Plantation Center for Pulpwood, Japan) and Motoshi Hiratsuka (Mitsubishi UFJ Research & Consulting, Japan).

## SECTION D. Estimation of *ex ante* actual net GHG removals by sinks, leakage and estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period

### D.1. Estimate of the *ex ante* actual net GHG removals by sinks:

>> For *ex-ante* estimation, dead wood, litter and soil organic carbon pools were assumed to not increase due to implementation of project activity. Calculations for tree biomass carbon pools and project GHG emissions are described below.

Data used for estimating tree biomass are shown in Table D1.

**Table D1**. Assumed parameters used for estimation of tree biomass carbon stocks

| Parameter | Symbol | *E. grandis* | *E. globulus* | Source |
|---|---|---|---|---|
| Mean Annual Increment ($m^3.ha^{-1}.yr^{-1}$) | $MAI_j$ | 28 | 20 | Project design |
| Wood basic density ($Mg.m^{-3}$) | $D_j$ | 0.43 | 0.57 | Country-specific values |
| Biomass expansion factor (dimensionless) | $BEF_{1j}$ | 1.2 | 1.2 | IPCC Good Practice Guidance for LULUCF (2003), Table 3A.1.10 |
| Carbon fraction (dimensionless) | CF | 0.5 | 0.5 | IPCC Good Practice Guidance for LULUCF (2003), Section 4.3 |
| Root-to-shoot ratio (dimensionless) | $R_j$ | 0.2 | 0.2 | IPCC Good Practice Guidance for LULUCF (2003), Table 3A.1.8 |

Data used for estimating GHG emissions within project boundaries are shown in Table D2.

**Table D2**. Assumed parameters used for estimation of project GHG emissions

| Parameter | Symbol | Value | Source |
|---|---|---|---|
| Use of diesel fuel ($L.ha^{-1}.yr^{-1}$) | --- | 163 | Project design |
| CO2 emission factor of diesel fuel ($tCO_2/GJ$) | $EF_{CO2\,i}$ | 74,070 | IPCC default |
| Net calorific value of diesel fuel ($GJ/m^3$) | $NCV_i$ | 36.18 | IPCC default |
| Mass of N fertilizer of type *i* applied ($kgN.ha^{-1}$) at planting | $M_{SFi,t}$ | 12 | Project design |
| Fraction of applied N that is lost by volatilization (dimensionless) | $Frac_{GASF}$ | 0.1 | IPCC default |
| $N_2O$ emission factor (%) | $EF_1$ | 1.25 | IPCC default |

The expected *ex ante* actual net GHG removals by sinks during the first crediting period (2006-2025) is detailed in Table D3.

**Table D3**. Ex-ante estimation of actual net GHG removal by sinks during the first crediting period.

| Year | GHG removals by afforestation and reforestation (tonnes of $CO_2$ e) | GHG from fossil fuel use (tonnes of $CO_2$ e) | GHG sources from N fertilisers (tonnes of $CO_2$ e) | Actual net GHG removals (tonnes of $CO_2$ e) |
|---|---|---|---|---|
| 2006 | 41,587 | 606 | 58 | 40,923 |
| 2007 | 273,598 | 3,837 | 310 | 269,451 |
| 2008 | 567,150 | 7,896 | 389 | 558,865 |
| 2009 | 748,793 | 10,375 | 237 | 738,182 |
| 2010 | 793,097 | 10,942 | 54 | 782,101 |
| 2011 | 793,097 | 10,942 | 0 | 782,155 |
| 2012 | 793,097 | 10,942 | 0 | 782,155 |
| 2013 | 793,097 | 10,942 | 0 | 782,155 |
| 2014 | 793,097 | 10,942 | 0 | 782,155 |
| 2015 | 793,097 | 10,942 | 0 | 782,155 |
| 2016 | 793,097 | 10,942 | 0 | 782,155 |
| 2017 | 793,097 | 10,942 | 0 | 782,155 |
| 2018 | 793,097 | 10,942 | 0 | 782,155 |
| 2019 | 793,097 | 10,942 | 0 | 782,155 |
| 2020 | 793,097 | 10,942 | 0 | 782,155 |
| 2021 | 793,097 | 10,942 | 0 | 782,155 |
| 2022 | 793,097 | 10,942 | 0 | 782,155 |
| 2023 | 793,097 | 10,942 | 0 | 782,155 |
| 2024 | 793,097 | 10,942 | 0 | 782,155 |
| 2025 | 793,097 | 10,942 | 0 | 782,155 |
| **Total** (t $CO_2$-e) | 14,320,682 | 197,792 | 1,048 | 14,121,842 |

Accumulated GHG removals over the crediting period amount to 14,121,842 t $CO_2$-e.

## D.2. Estimate of the *ex ante* leakage:

>> The methodology requires the assessment of three sources of leakage: fossil fuel consumption, activity displacement (conversion to grazing land and fuelwood collection) and wood posts for fencing. The project will not cause any displacement of fuelwood collection because this activity does not occur in the pre-project situation, since there are no forests in the project area. Therefore, this source of leakage is neglected. Also, the project activity is not expected to increase the use of wooden posts for fencing, thus enabling to also neglect this source.

Application of the tool for "estimation of GHG emissions related to displacement of grazing activities in A/R CDM project activity" led to the conclusion that this source can also be neglected. There are only two options for the cattle existing in the project area before the date of project start: to remain in the project area or to be sold to the market. Since the project plantation plan extends over a period of five years, most of the cattle stay in the project area until it naturally reaches its slaughtering age. All the cattle leaving the area (mostly calves) are sold to the market. Uruguayan law is enforced to keep a record of all movements of cattle between farms, which are documented in special forms provided by the government.

These forms, along with sale invoices are kept as part of project documentation to demonstrate that cattle are not displace in a way as to cause leakage.

For estimation of leakage due to use of fossil fuels outside project boundaries, daily displacement of project workers to and from the project area was the only source considered. Table D4 shows the main assumptions made to estimate this source of leakage.

**Table D4**. Assumed parameters used for estimation of leakage from use of fossil fuels

| Parameter | Value | Source |
|---|---|---|
| No. of workers per hectare of forest | 0.02 | Project design |
| No. of buses per worker | 0.05 | Project design |
| Distance travelled ($km.day^{-1}$) | 80 | Project design |
| Emission factor of bus ($tCO_2.km^{-1}$) | 0.3 | Project design |

The expected *ex ante* leakage for the first crediting period is shown in Table D5. Accumulated GHG emissions over the crediting period amount to 816 t $CO_2$-e.

**Table D5**. Estimation of project leakage in the first crediting period

| Year | GHG Emissions from leakage (tonnes of $CO_2$ e) |
|---|---|
| 2006 | 72 |
| 2007 | 192 |
| 2008 | 312 |
| 2009 | 192 |
| 2010 | 48 |
| 2011 | 0 |
| 2012 | 0 |
| 2013 | 0 |
| 2014 | 0 |
| 2015 | 0 |
| 2016 | 0 |
| 2017 | 0 |
| 2018 | 0 |
| 2019 | 0 |
| 2020 | 0 |
| 2021 | 0 |
| 2022 | 0 |
| 2023 | 0 |
| 2024 | 0 |
| 2025 | 0 |
| **Total** (t $CO_2$-e) | 816 |

## SECTION E. Monitoring plan

### E.1. Monitoring of the project implementation:

>>

#### E.1.1. Monitoring of forest establishment and management:

>> The project boundary and the boundaries of pre-defined strata will be adjusted after plantations are established. This will be done by using GPS technology, and the information will be organized in GIS format. Areas of each stratum will be recalculated and adjusted accordingly.

All activities performed in each stratum will be recorded and relevant parameters quantified. This includes the following:

- Site preparation: application of herbicides, tillage operations (date of operation, tools used, number of passes, width of operation in cases of strip tillage, depth of operation, etc.), mechanical weed control, and others. Burning of biomass will not be used as a site preparation practice.
- Planting date, number of trees planted per unit area, tree species.
- Tree survival rate
- Fertilization date, application form, type and amount of fertilizer used.
- Pruning date, pruning height.
- Thinning date, thinning intensity, volumes of wood removed by type of product.
- Harvesting date, volumes of wood removed by type of product.
- Disturbances: date, location, affected area (using GPS and/or remote sensing data), type of disturbance, biomass lost.

| ID number | Data variable | Data unit | Measured (m), calculated (c) estimated (e) or default (d) | Recording frequency | Number of data points / Other measure of number of collected data. | Comment |
|---|---|---|---|---|---|---|
| 1 | Project boundaries and predefined stratum boundaries | Geographic coordinates | m | Once after establishment of plantation | Very large number | |
| 2 | Forest area | ha | m | Once after establishment of plantation | All area will be monitored | |
| 3 | Area of disturbances | ha | m | After occurrence of disturbance | All area will be monitored | |

**E.1.2. If required by the selected approved methodology, describe or provide reference to, SOPs and quality control/quality assurance (QA/QC) procedures applied.**

>>

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

QA/QC plan includes a number of activities aiming at achieving accuracy and precision of data, and transparency of procedures, such as:

- *development of Standard Operating Procedures for field measurements,* clearly defining all staff responsibilities and raising awareness about the importance of each tasks for producing reliable results;
- *proper training of field measuring teams*;
- *periodical check and maintenance of measuring instruments*; all mechanical, optical and electronic instruments will be periodically checked by qualified personnel. In addition, consistency of field data will be permanently monitored, in order to detect any malfunctioning.
- *perform area measurements using different methods (e.g., aerial photograph, cadastral data, satellite images, ground measurements), and check for accuracy and consistency*; to minimize area measurement calculations, the project will acquire high-resolution satellite images (e.g. Ikonos or QuickBird)
- *development of electronic worksheets for data processing*; special software will be designed for the monitoring process, with graphical capabilities and data consistency checking functions.
- *fully document and archive field and processed data, as well as all procedures used*; to ensure data preservation, all relevant data, data analyses, static factors, photos, images, GIS outpus, etc, will be stored in electronic and paper format.
- *establish procedures for eliminating inconsistent or erroneous field data; perform random checks of field measurements in order to detect measurement errors or systematic biases*; some of such measures are: 1) use field computers and automatic data loggers (e.g., electronic recording caliper), and hire independent workers for transferring field data to digital media. (IPCC GPG 5.3.6.1); 2) during field work, double check 10% of sampling measurements with an independent party team or with a team different from the one that performed the measurement or sampling; if the difference between measurements is higher than 5%, a third definitive measurement will be run. If the difference is higher than 10%, the data or the plot will be eliminated;
- *establish procedures to ensure representativeness of PSPs (i.e., to avoid biased estimates due to differential management of PSPs);* The allocation of samples in the field will be systematic with random start, so, the differences between population and sample mean and variance will tend to neutralized, as the sample fraction is wide enough; identification of plots in the field should be coded and apparent only to the monitoring team; periodical checks will be performed on simple measurements (e.g., DBH) outside PSPs, in order to correlate these values with plot measurements;
- *development of allometric equations and emission/C-stock-change factors ;*project-specific equations and stock change factors would minimize errors, as compared to the use of default factors.
- *check project data with benchmarks*; this will help detecting possible inconsistencies in data collection or processing.

## E.2. Sampling design and stratification

>> The predefined project strata will be subdivided into more strata defined by the combination of soil types, tree species, plantation age and forest management. Strata are specific individual land blocks which constitute the basic units for monitoring.

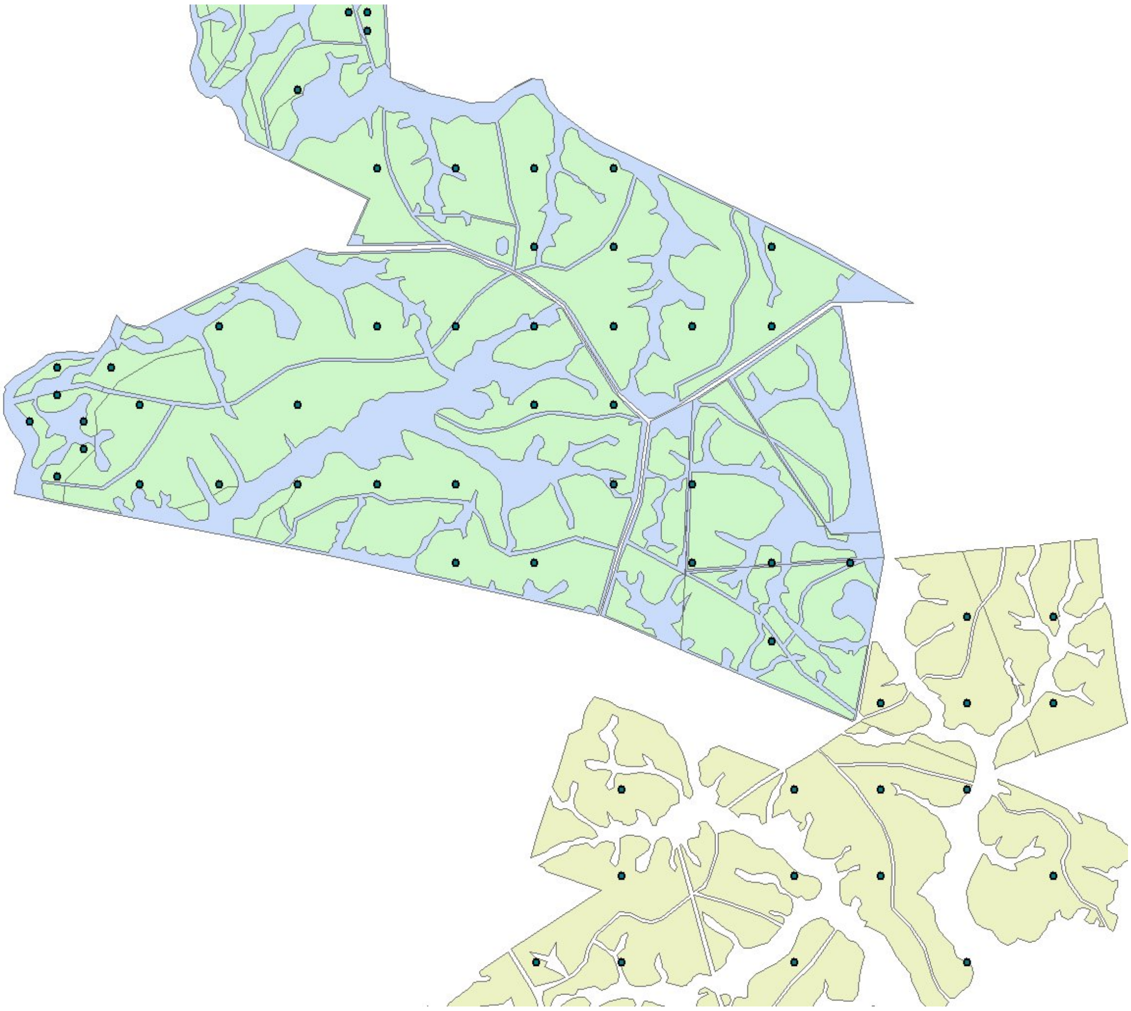
The project area has six soil types (CONEAT soils 2.11a, 2.11b, 2.12a, 2.12b, 2.13 and 2.14). There will be five plantation age classes for *E. grandis* and *E. globulus*. The number of strata for *E. grandis* will be 30 (full combination of five age classes and three soil types, whereas for *E. globulus* the number will be more reduced (13) since there will be only four soil types and four age classes, and not all combinations of these two parameters will exist. The total number of strata will initially be 43. The total number of sub-strata will be 53. These strata will be subdivided in the future when differential management practices are applied to a fraction of one stratum, or when disturbances occur.

A GIS will be implemented with the following basic layers:

- project boundaries
- aerial photographs for 1966, 1987 and 2006 and Landsat images for 1987-1989, 2006 and other years in the future.
- 1:20,000 scale soils map
- CONEAT soils map (Uruguayan system)
- 5-m contour curves (altitude)
- Pre-project land use map
- projected land-use map, with forest plantation strata and sub-strata
- roads, fences, firebreaks, wood stocking areas, buildings, etc.
- permanent sampling plots (see below)

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

Sampling plots will be defined and established according to guidance given by the corresponding methodological tool. It is estimated that approximately 50 plots will be established for each stratum. An Arc-Map Program developed by Carbosur will be used to randomly locate the permanent sampling plots. Following is an example of the program output for two contiguous strata.



**E.3. Monitoring of the baseline net GHG removals by sinks, if required by the selected approved methodology:**

>> Baseline is set to zero and is not monitored under selected baseline approach *a*.

| ID number | Data variable | Data unit | Measured (m), calculated (c) estimated (e) or default (d) | Recording frequency | Number of sample plots at which the data will be monitored | Comment |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |

**E.4. Monitoring of the actual net GHG removals by sinks:**

>>

**E.4.1. Data to be collected in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary resulting from the proposed A/R CDM project activity:**

>> Following is the list of parameters to be monitored:

| **Data / Parameter:** | $A_i$ |
|---|---|
| Data unit: | ha |
| Used in equations: | 23,31,37 |
| Description: | Area of stratum *i* |
| Source of data: | Monitoring of strata and stand boundaries shall be done using a Geographical Information System (GIS) which allows for integrating data from different sources (including GPS coordinates and Remote Sensing data) |
| Measurement procedures (if any): | |
| Monitoring frequency: | Once after plantations are established, and every time a stratum is sub-divided |
| QA/QC procedures: | |
| Any comment: | |

| **Data / Parameter:** | $a_{i,sp}$ |
|---|---|
| Data unit: | $m^2$ |
| Used in equations: | 32 |
| Description: | Area of sampling frame |
| Source of data: | Simple measurement of manufacturers data |
| Measurement procedures (if any): | Two sides of the squared frame will be measured and the area estimated. The same frame size will be fixed until the end of the last crediting period. |
| Monitoring frequency: | Once at the time of the first measurement, and every time the frame is changed for a new one. |
| QA/QC procedures: | |
| Any comment: | Sampling frame will be used to collect litter samples |

| **Data / Parameter:** | $A_{sp}$ |
|---|---|
| Data unit: | ha |
| Used in equations: | 23 |
| Description: | Area of sample plot *sp* |
| Source of data: | Field measurement |
| Measurement procedures (if any): | |
| Monitoring frequency: | |
| QA/QC procedures: | |
| Any comment: | |

| **Data / Parameter:** | $BD_{i,p,t}$ |
|---|---|
| Data unit: | t m$^{-3}$ |
| Used in equations: | 34 |
| Description: | Bulk density (soil mass/volume of sample) of plot *p* in stratum *i*, time *t* |
| Source of data: | Determined in laboratory |
| Measurement procedures (if any): | For bulk density analysis, a single core shall be taken next to one of the carbon analysis cores. The samples are oven dried and weighed for bulk density determination and the oven dry weight of the soil samples shall be used to estimate the soil organic carbon |
| Monitoring frequency: | Every 5 years |
| QA/QC procedures: | |
| Any comment: | |

| **Data / Parameter:** | $B_{LI\_wet,i,sp}$ |
|---|---|
| Data unit: | kg m$^{-2}$ |
| Used in equations: | 32 |
| Description: | Humid weight (field) of the litter in plot *sp* of stratum *i* |
| Source of data: | Field measurements in sample plots |
| Measurement procedures (if any): | **Step 1**: Litter shall be sampled using a sampling frame. The frame is placed at four locations within the sample plot.<br>**Step 2**: At each location, all litter (leaves, fruits, small wood, etc.) falling inside the frame shall be collected and the litter from four locations is mixed to get a representative sample for measuring the wet weight of the biomass. |
| Monitoring frequency: | Every five years or more frequently |
| QA/QC procedures: | |
| Any comment: | |

| **Data / Parameter:** | $C_{SOC_{Sample,i,p,t}}$ |
|---|---|
| Data unit: | g C/100 g soil |
| Used in equations: | 34 |
| Description: | Soil organic carbon of the sample in plot *p* in stratum *i*, time *t* |
| Source of data: | Determined in laboratory |
| Measurement procedures (if any): | ***Step 1:*** The sample plots for soil sampling are selected taking into account the soil type, depth, and bulk density in the estimates.<br><br>***Step 2:*** Soil organic carbon shall be measured to a fixed depth (e.g. 30 cm) by collecting soil samples with a soil corer. The samples shall be collected from five locations within the plot.<br>***Step 3:*** Soil samples collected are aggregated to reduce the variability and sieved through 2 mm sieve, mixed and analyzed in the laboratory. |
| Monitoring frequency: | Every five years |
| QA/QC procedures: | |

| | |
|---|---|
| Any comment: | |

| **Data / Parameter:** | $D_{n,i,t}$ |
|---|---|
| Data unit: | cm |
| Used in equations: | 30 |
| Description: | Diameter of piece *n* of dead wood along the transect in stratum *i*, at time *t* |
| Source of data: | Field measurements in sample plots |
| Measurement procedures (if any): | Lying deadwood should be sampled using the line intersect method. Two 50-meter lines are established bisecting each plot and the diameters of the lying dead wood (≥5 cm diameter) intersecting the lines are measured. |
| Monitoring frequency: | Every five years or more frequently |
| QA/QC procedures: | |
| Any comment: | |

| **Data / parameter:** | *DBH* |
|---|---|
| Data unit: | cm |
| Used in following equations | |
| Description: | Diameter breast height of tree |
| Source of data: | Field measurements in sample plots |
| Measurement procedures (if any): | Typically measured 1.3 m aboveground. All the trees above some a minimum *DBH* of 5 cm in the permanent sample plots will be measured |
| Monitoring frequency: | Every five years or more frequently |
| QA/QC procedures: | |
| Any comment: | |

| **Data / parameter:** | $Depth_{i,p,t}$ |
|---|---|
| Data unit: | m |
| Used in equations: | 34 |
| Description: | Soil depth to which soil sample is collected for plot *p* in stratum *i*, time *t* |
| Source of data: | Field measurement |
| Measurement procedures (if any): | |
| Monitoring frequency: | Every five years |
| QA/QC procedures: | |
| Any comment: | Samples will regularly have 30 cm depth. This parameter will be determined only in those cases where due to, e.g., a rocky layer, samples cannot be taken at 30 cm depth |

| **Data / Parameter:** | $FC_{i,p,t}$ |
|---|---|

| | |
|---|---|
| Data unit: | Dimensionless. |
| Used in equations: | 34 |
| Description: | 1 – (% volume of coarse fragments/100) to adjust the fraction of sample occupied by coarse fragments > 2mm at plot *p* in stratum *i*, time *t* |
| Source of data: | Determined in laboratory |
| Measurement procedures (if any): | The fraction of coarse fragments is to be determined by standard particle size analysis performed in most soil laboratories. |
| Monitoring frequency: | Every five years |
| QA/QC procedures: | |
| Any comment: | |

| **Data / parameter:** | *H* |
|---|---|
| Data unit: | m |
| Used in equations: | |
| Description: | Height of tree |
| Source of data: | Field measurements in sample plots |
| Measurement procedures (if any): | |
| Monitoring frequency: | Every five years or more frequently |
| QA/QC procedures: | |
| Any comment: | |

| **Data / Parameter:** | *L* |
|---|---|
| Data unit: | m |
| Used in equations: | 30 |
| Description: | Length of the transect to determine volume of lying deadwood |
| Source of data: | Field measurements |
| Measurement procedures (if any): | |
| Monitoring frequency: | Every five years or more frequently |
| QA/QC procedures: | |
| Any comment: | |

| **Data / Parameter:** | $MP_{LI}$ |
|---|---|
| Data unit: | Dimensionless |
| Used in equations: | 32 |
| Description: | Dry-to-wet weight ratio of the litter (dry weight/wet weight); |
| Source of data: | Laboratory measurement of field samples |
| Measurement procedures (if any): | Litter samples shall be collected and well mixed into one composite sample at the same time of the year in order to account for natural and anthropogenic influences on the litter accumulation and to eliminate seasonal effects.<br>A subsample from the composite sample of litter is taken, oven dried and weighed to determine the dry weight. |

| | |
|---|---|
| Monitoring frequency: | Every five years or more frequently |
| QA/QC procedures: | |
| Any comment: | |

| **Data / Parameter:** | *N* |
|---|---|
| Data unit: | Dimensionless |
| Used in equations: | 30 |
| Description: | Total number of wood pieces intersecting the transect |
| Source of data: | Field measurements |
| Measurement procedures (if any): | |
| Monitoring frequency: | Every five years or more frequently |
| QA/QC procedures: | |
| Any comment: | |

| **Data / Parameter:** | *T* |
|---|---|
| Data unit: | yr |
| Used in equations: | 7, 27, 28, 33, 35 |
| Description: | Number of years between monitoring time $t_2$ and $t_1$ ($T = t2 – t1$) |
| Source of data: | |
| Measurement procedures (if any): | |
| Monitoring frequency: | |
| QA/QC procedures: | |
| Any comment: | |

**E.4.2. Data to be collected in order to monitor the GHG emissions by the sources, measured in units of $CO_2$ equivalent, that are increased as a result of the implementation of the proposed A/R CDM project activity within the project boundary:**

>> In the following table, variables 4 to 12 are from the methodological tool to estimate GHG emissions from fossil fuel use. Variable 13 is from the tool to estimate N2O emissions from use of fertilizers.

| **ID number** | **Data variable** | **Data unit** | **Measured (m), calculated (c) estimated (e) or default (d)** | **Recording frequency** | **Number of sample plots at which the data will be monitored** | **Comment** |
|---|---|---|---|---|---|---|
| *4* | $FC_{i,j,y}$ | *kL* | *m* | *annually* | | *Fuel purchase data* |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | *will be used for cross-checking* |
| *5* | *j* | *dimensionless* | | *Annually* | | |
| *6* | $AD_{j,y}$ | *Km* | | *Annually* | | *Cross-checked with odometer information* |
| *7* | $SECu_{j,I,y}$ | *L/hour* | | *annually* | | |
| *8* | $SECk_{j,I,y}$ | *L/km* | | *annually* | | *Cross-checked with consumption record and total distance trravelled* |
| *9* | $NE_{j,y}$ | *dimensionless* | | *annually* | | |
| *10* | $NV_{j,y}$ | *dimensionless* | | *annually* | | |
| *11* | $TU_{j,y}$ | *Hours* | | *annually* | | |
| *12* | $TD_{j,y}$ | *km* | | *annually* | | |
| *13* | $M_{SFi,t}$ | *t* | | *annually* | | *Cross-checked with fertilizer purchases* |

**E.5. Leakage:**

>>

**E.5.1. If applicable, please describe the data and information that will be collected in order to monitor leakage of the proposed A/R CDM project activity:**

>> The following table shows the variables to be monitored for leakage. Variables 14 to 19 are from the methodological tool to estimate GHG emissions from fossil fuel use. Variable 20 is from the tool to estimate leakage from displacement of grazing.

| ID number | Data variable | Data unit | Measured (m), calculated (c) estimated (e) or default (d) | Recording frequency | Number of data points | Comment |
|---|---|---|---|---|---|---|
| *14* | $FC_{i,j,y}$ | *kL* | *m* | *annually* | | *Fuel purchase data will be used for cross-checking* |
| *15* | *j* | *dimensionless* | | *Annually* | | |
| *16* | $AD_{j,y}$ | *km* | | *Annually* | | *Cross-checked with odometer information* |

| | | | | | | |
|---|---|---|---|---|---|---|
| *17* | $SECk_{j,I,y}$ | *L/km* | | *annually* | | *Cross-checked with consumption record and total distance trravelled* |
| *18* | $NV_{j,y}$ | *dimensionless* | | *annually* | | |
| *19* | $TD_{j,y}$ | *km* | | *annually* | | |
| *20* | $H_{existingg,k,t}$ | *heads* | | *annually* | | |

**E.5.2. Specify the procedures for the periodic review of implementation of activities and measures to minimize leakage, if required by the selected approved methodology:**

>> Leakage is expected to be very small.

**E.6. Provide any additional quality control (QC) and quality assurance (QA) procedures undertaken for data monitored not included in section E.1.3:**

>>No additional procedures are given here.

| **Data** ***(Indicate ID number)*** | **Uncertainty level of data (High/Medium/Low)** | **Explain QA/QC procedures planned for these data, or why such procedures are not necessary.** |
|---|---|---|
| | | |
| | | |

**E.7. Please describe the operational and management structure(s) that the project operator will implement in order to monitor actual GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity:**

>>>> Monitoring plan will be coordinated by Carbosur SRL. For that purpose, a qualified team of experts will be appointed, covering the areas of forest biometrics, statistics, data processing and GIS/remote sensing. In addition, a group of technicians will be permanently hired and trained to execute field measurements and primary data processing. A facility with a basic laboratory (e.g., for weighing and drying samples), office space and storage of samples, field equipment, etc. will be made available at the project site. Arrangements will be made with other parties for laboratory analyses (e.g., soil organic carbon content), for performing independent measurements/samplings, for implementing a GIS and processing satellite images, etc. All data will be stored in the office at the project site, with backups in Carbosur office in Montevideo.

**E.8. Name of person(s)/entity(ies) applying the monitoring plan:**

>>

Daniel Martino and Alvaro Perez del Castillo
Carbosur SRL
Misiones 1372/304
Montevideo 11.100
Uruguay

Contact person:

daniel.martino@carbosur.com.uy

## SECTION F. Environmental impacts of the proposed A/R CDM project activity:

### F.1. Documentation on the analysis of the environmental impacts, including impacts on biodiversity and natural ecosystems, and impacts outside the project boundary of the proposed A/R CDM project activity:

>>>> An analysis of possible environmental impacts of the proposed project activity lead to the following conclusions about each of the issued considered:

- Climate change mitigation: mainly through carbon sequestration as shown in this PDD.

- Biodiversity preservation: establishment of forest plantations designed to preserve high biodiversity value areas (such as native forests, wetlands and low areas under grassland) has proved to be effective in Uruguay. Since large-scale forest planting started in the 1990s, several surveys (mostly conducted by forest companies) have found a proliferation of birds, frogs, and mammals, some of which had been considered as extinct or endangered. These studies also allowed to find at least three new species (two birds and one frog) which had never been reported before in the country. One of them is a case of a completely new species.

- Hydrological cycle: it is well known that planting trees on a grassland site usually causes a reduction in the runoff and an increase in the evapotranspiration. This may cause some competition for water with other users (eg, cattle farms located downstream in the watersheds, hydroelectric power generation, water for human consumption). Some studies (e.g., Silveira et al, 2005) have shown that this effect is not significant in Uruguay at the medium-size watershed scale (due to high precipitation). At the micro-watershed level, there might be some problems, which can be minimized by plantation design (eg, by limiting the extent of forest plantations in a watershed). The proposed project will leave at least 35% of the land area unplanted (40% if the total land area that was purchased is considered), which would greatly reduce the hydrological effects, as compared with a more common 25-30% of unplanted area. In addition, since most of the project area flows into rivers with relatively high flow rate, no significant downstream effects are expected.

- Soils: soils will be disrupted once every 20 years (rotation length). Site preparation will be based on strip tillage, with strips oriented perpendicularly to slope direction, and use of glyphosate herbicide. These practices will minimize the occurrence of soil erosion. Harvesting practices which cause soil damage will be avoided.

- Use of chemicals: the project will use a limited amount of certain chemicals during the plantation year, this is, only once every 20 years. These products include:
    - herbicides for site preparation, including glyphosate, 2,4-D, acetochlor, picloram, oxifluorfen and others, all of them properly registered and allowed by the law in Uruguay. All these products will only be applied selectively (only when and where they are needed) and avoiding excessive rates. Adoption of safety procedures will minimize problems related with herbicide handling and spraying.

- insecticides for ant control: ants are a major problem in newly established plantations in Uruguay, and they must be controlled in order for the plantation to be successful. The project will use sulfuramide and fipronil, which are the ones recommended by the Ministry of Agriculture (MGAP). These products are used in localized applications (ie, they are not overcast) and in small rates, and only during the time of site preparation and first weeks after plantation. Adoption of safety procedures will minimize problems related with insecticide handling.
- fertilizers: only limited amounts of starter fertilizers will be applied. Phosphorus is highly deficient in the project site soils, and application of phosphate localized at one side of each seedling ensures proper establishment. Average rate will be 60 kg P/ha. A small rate of nitrogen (25 kg N/ha) will also be applied simultaneously with P fertilization at planting. In some cases, and according to soil analysis, small reates of potassium may be added.

- Beauty of the landscape: most people would agree in that a landscape with trees is more pleasant than the flat, monotonous landscape produced by grazed grassland. This, combined with the positive impacts on biodiversity will provide a good alternative for the development of tourism services.

**F.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken an environmental impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:**

>> No negative effects were identified

**F.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section F.2. above:**

>> n/a

## SECTION G. Socio-economic impacts of the proposed A/R CDM project activity:

**G.1. Documentation on the analysis of the major socio-economic impacts, including impacts outside the project boundary of the proposed A/R CDM project activity:**

>>

*The Socio-economic impacts should be assessed following the host country's instruction when the implementation of the project as an A/R CDM is decided. Actually, there's no negative impacts envisioned. The proposed project would contribute to the sustainable development of the rural local society with creation of new industries and employment opportunity.*

**G.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken a socio-economic impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to supporting documentation:**

>> n/a

**G.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section G.2 above:**

>> n/a

## SECTION H. Stakeholders' comments:

**H.1. Brief description of how comments by local stakeholders have been invited and compiled:**

>> n/a

**H.2. Summary of the comments received:**

>> n/a

**H.3. Report on how due account was taken of any comments received:**

>> n/a

## Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROPOSED A/R CDM PROJECT ACTIVITY

| | |
|---|---|
| Organization: | Carbosur SRL |
| Street/P.O.Box: | Misiones 1372/303 |
| Building: | --- |
| City: | Montevideo |
| State/Region: | --- |
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| Represented by: | Daniel Martino |
| Title: | Executive Director |
| Salutation: | Dr. |
| Last Name: | Martino |
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## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

There will be no public funding for this project

## Annex 3

### BASELINE INFORMATION.

**General Information on Land Use in Uruguay**

Land ownership in Uruguay is completely private. Nearly two thirds of the land surface is used for extensive livestock production (beef and sheep cattle), with an average annual output of 60 kg of meat, or its equivalent in other products, per hectare. Average gross income in this area is determined by market prices and climate, two highly variable factors, and ranges between US$ 20 and US$ 60 per hectare per year. This high variability in climate (mainly in rainfall) and prices has been a major barrier to adoption of more intensive production systems. And this is so, in spite of the fact that intensification somehow reduces the vulnerability to climate extremes.

This extensive agriculture area has farms ranging in size from 200 to several thousand hectares. According to government statistics, farms with sizes between 200 and 2,000 ha (650 ha on average) number 9,781 and cover an area of 6.4 million ha (about one third of Uruguay's territory). The segment of farms higher than 2,000 ha (3,789 ha on average) is composed by 1,156 farms extending over 4.4 million ha. The former provide one permanent job every 233 ha (including the farmer and his/her family), whereas the latter has one permanent job every 448 ha. In both cases, 85% of employees are males and poorly qualified. Landowners in this extensive agriculture area are highly educated, (in the largest-farm segment, 46% are university graduates), and relatively old-aged (36% are over 60). Most of them (71 %) live off farm and have other sources of income.

According to 1996 Population Census, 89% of Uruguayans live in urban areas. Most of the rural population is in the intensive agriculture areas of the West and South of the country. Large areas under extensive agriculture, where population densities are extremely low, have shown a persistent decline in population over the last 30 to 40 years, due to an internal migration process to Montevideo (capital city) and tourism areas, where there are more employment opportunities. A large part of this migrants end up in city slums, living in very precarious conditions, without access to proper housing, education, health and sanitation. Whereas population grows at a modest 0.5 % per year in Uruguay, the number of people living in city slums has increased at a yearly rate of 15 % during the last 15 years. This is widely recognized as the most serious social problem of Uruguay.

**Forestry in Uruguay**

Uruguay has traditionally been a grassland country. Natural forests cover an area of only 0.8 Mha (4 % of total land area), and are mostly located on the margins of rivers. Tree planting was first introduced in the country in late 19th century. Small areas of *Eucalyptus sp*. were established in ranch farms, with the objectives of providing shade and shelter for the cattle, and obtaining wood for building fences and for cooking. Today, thousands of these small patches of trees are found all over the country. At the same time, pine trees, and to a lesser extent eucalypts, were established on coastal areas in the south to stabilize sand dunes. These coastal forests are not harvested, but are frequently disrupted by summer fires mainly caused by tourists. Together, forests planted in ranch farms and in coastal dunes add up to an area of 80,000 ha.

Commercial forest did not start until mid-20th century, when the first large scale plantations were established. These first investors included pension funds, small pulp mills, other private investors, and the National utility company (UTE). The first regulation that provided incentives for commercial forest plantations was a law passed in 1967 (Law No. 13723). The mechanism was a partial exemption on income tax proportional to annually planted area, that resulted in a doubling of annual planting rate to 2,750 ha/yr during the period from 1968 to 1979, when the incentive was abolished.
By 1988, commercial forests covered 31,000 ha of plantations distributed all over the country. Most of this area consisted in short rotation eucalypts (10-12 years) and pines (25-30 years), planted with very precarious technology, based on poor genetic materials, intensive soil tillage, mechanical weeding, and lack of use of fertilizers. Frequently, these plantations suffered from damage caused by cattle grazing on young stands. Growth rates were relatively low, with mean annual increments ranging between 10 and 25 $m^3$/ha/yr for eucalypts and from 10 to 20 $m^3$/ha/yr for pines. A large proportion of low-grade timber was usually obtained, and firewood and pulplogs were the main products.

After the oil crises of the 1970's and 1980's, most industries in the country switched from fossil fuels to firewood, exerting a large pressure on native forests. Demand for firewood increased from 1.3 million $m^3$/year in 1973 to 3.0 million $m^3$/year in 1987[5]. About one third of the demand was supplied from native forests[6].

A major breakthrough in the history of Uruguayan forestry was the adoption in 1987 of a forestry promotion policy based on a set of instruments contained in Law No. 15939. The central objectives of this policy were to create a new source of exports and a sustainable supply of firewood while protecting natural forests. This policy was highly successful, and resulted in a remarkable growth of forested area (see figure below), with an estimated total investment, including a significant amount from foreign sources, of more than US$ 1 billion in the 1990's.

This policy adopted in 1987 had the following main features:

- Forestry activity to be based on projects subject to approval by Forestry Bureau (*Dirección Forestal*), designated as the National Forestry Authority. Eligibility criteria include location, tree species and planting density, among others.
- The regulation promotes forests to be established on “Forestry Priority Soils” (location criterion). These soils include 3.6 million ha of low agricultural productivity and/or high susceptibility to erosion or degradation, located in certain areas of the country with potential to develop timber production, transport and manufacturing centers.
- A package of financial incentives was offered to prospect investors, including:
    - investors allowed to deduct up to 30% of their income tax payments from other activities for investments made in forestry projects; similar benefit is provided to buyers of Uruguay’s external debt bonds.
    - a cash subsidy equivalent to 50% of estimated plantation cost;
    - land property tax exemption for all planted areas;
    - permanent exemption of income tax and other taxes and levies;

[5] FAO, 1988. Forest Products Yearbook 1987. Rome.

[6] Uruguay, 1992. National Environmental Study. Environmental Action Plan. OAS/IDB, Washington DC.

- 12-year exemption of any new taxes or levies to be created;
- duty free imports of goods to be applied to approved projects;
- soft credits for planting, with a grace period of 10 years for both principal and interests;
- corporations allowed to buy land if forestry is their main activity (otherwise, land property is nominative in Uruguay);
- forest ownership is separated from land ownership, which provides flexibility for using financial mechanisms; a later regulation allowed land rental contracts for up to 30 years for forestry activity (for other purposes, maximum legal is 15 years);

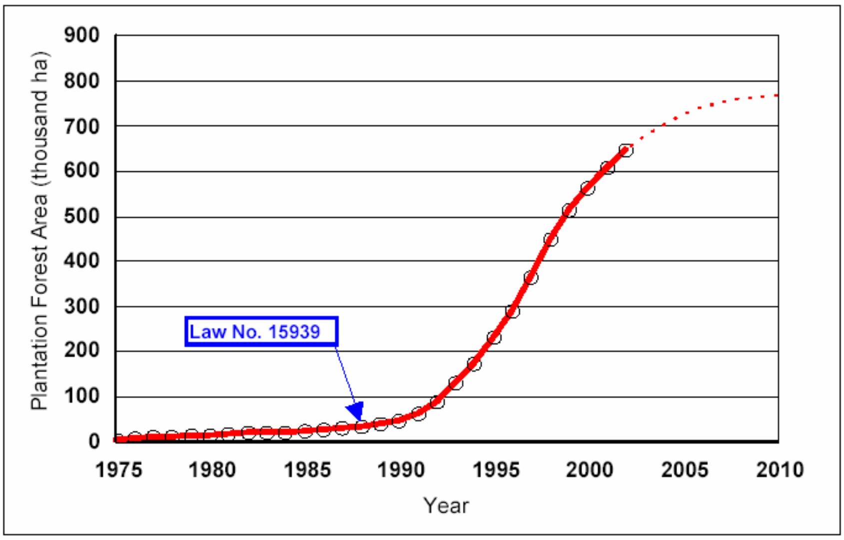
❖ Prohibition of harvesting native forests, with the exception of wood supply for farms, and properly justified cases, subject to approval by Forestry Bureau.

❖ Enforcement of a number of fire and pest prevention measures.

This new policy also marked a sharp change in the characteristics of Uruguayan forestry. New technological practices were adopted, resulting in better quality, more vigorous, and more homogeneous tree stands. However, since rotation length - a major factor governing productivity - did not change significantly, mean annual increments were only slightly raised as compared to pre-1987 forestry. Modern concepts, such as long-term planning, environmental management systems and social responsibility, were introduced in forest company management. Good sustainability standards were achieved, and several companies have obtained, or are in the process of obtaining, FSC or ISO 14,000 certification.

Annual plantation rate reached its maximum in 1998, with ca. 60,000 ha/year, and continuously declined thereafter to ca. 10,000 ha/year in 2003. Forests planted in the last few years were basically for completion of projects initiated in the late 1990's. New projects accounted for only 10 % of the area planted in 2003 and 2004.

Among the reasons for the decline in plantation rate, two major factors were the expiration of the benefit of purchasing government debt at a market (discounted) price, and the delay in payment, followed by complete elimination in 2002, of plantation subsidy. The elimination of the soft credits by *Banco de la República*, and the failure of several projects, particularly those implemented by small investors, to achieve expected returns were also important factors.




Current forest area (0.6 million ha) covers only about one sixth of total area of soils designated as of forestry priority (3.6 million ha). These soils have relatively low agricultural productivity, and to some extent have been subjected to management practices, such as overgrazing or tillage, leading to degradation and erosion processes. Most of the prime-quality land for forestry purposes (i.e., land with deep, good-texture soil, located near harbors or industrial facilities, with good road access) has already been planted. There is currently a large imbalance between timber production and demand by manufacturing industry, and, in consequence, most wood is exported as pulp-logs, with almost no added value and short residence time of carbon in products. Pulp-log exports reached a historical maximum in 2003, with a total of 1.1 million solid cubic meters, which, excluding firewood, accounts for two thirds of wood harvested in that year.

The baseline scenario for CDM afforestation projects in Uruguay can thus be characterized as one with low plantation rates, on land that can be typified as "second class" in terms of their production potential and cost of production, and relatively low timber prices.

**Points of delivery of wood products**

There are four main points for delivery of wood products in Uruguay: Fray Bentos, Nueva Palimira, Montevideo and La Paloma. The latter, consisting in a chipping facility and an oceanic port, is still not operating, but has already had an impact on establishment of short-rotation eucalypt plantations in the SE region of Uruguay. Information on the other three points of delivery is given below[7]:

1. Fray Bentos
The city of Fray Bentos, located on the left bank of the Uruguay River, on W Uruguay, has two port terminals, one of public nature, belonging to the National Port Authority, and a private one (M'Bopicua), belonging to ENCE, a Spanish firm. The latter has a chipping plant, and a project for building a cellulose plant, with capacity to produce 0.5 million tonnes of pulp per year. A Finnish company, Botnia, has begun the construction of another pulp mill, which will be operative in 2007, and will have a production capacity of 2 million tonnes of pulp per year.

Fray Bentos ports have a draft limitation given by two passes (Marquez and Barrizal) on the Uruguay River, allowing for only 6.4 m draft fresh water, depending on river and wind conditions.

2. Nueva Palmira
This small town located on the left bank of de la Plata River, has two port terminals, one of public nature (National Port Authority) and one private (Navios), which together handle more than 2.5 million tonnes of agricultural products per year , including an important volume of loads originating in Paraguay and Bolivia, which are trans-shipped there. Pulp logs are the second most important cargo handled in Nueva Palmira.

Access to Nueva Palmira ports has a draft limitation given by the depth of Martin Garcia channel, which is 9.75 m fresh water.

3. Montevideo
Montevideo, located on the de la Plata River, on S Uruguay, has the largest port of Uruguay, with 14 berthing places. The port handles 250,000 boxes per year plus several other bulk cargoes, including fertilizers, rice, sawn timber and pulpwood.

Acces channel is dredged to 11 m, and draft alonside most quays is 10.5 m. Considering the normal water level over zero level and keel clearance, permissible draft in Montevideo is 10.5 m brackish water.

[7] Source for port information: Agencia Maritima Schandy, www.ams.com.uy

**Table A3.1** Pulpwood exports handled during the past two years in Uruguayan ports

| | Fray Bentos | Nueva Palmira | Montevideo | Total |
|---|---|---|---|---|
| **2003** | | | | |
| Eucalyptus logs ($m^3$) | 579,100 | 249,560 | 558,900 | 1,387,560 |
| Wood chips (green t) | | --- | 148,730 | 148,730 |
| **2004** | | | | |
| Eucalyptus logs ($m^3$) | 547,300 | 354,590 | 674,300 | 1,576,190 |
| Wood chips (green t) | 147,100 | --- | 352,900 | 500,000 |

## Annex 4

## MONITORING PLAN

### 1. General Schedule

- Layout of permanent plots: As explained in the monitoring methodology, the forest area will be divided in strata and sub-strata. The basic statistical unit will be the sub-stratum (homogeneous and contiguous group of trees of the same species and age, planted on the same soils types). In each sub-stratum, permanent sampling plots will be established, aiming to cover maximum variability. The number, sampling design, shape an allocation criteria on the field in explained below.
- Biomass, SOC, and soil density determination: Before starting the preparation of lands for plantations, aboveground and belowground biomass, and soil organic carbon content, will be determined as follows:
    - Aboveground biomass: A 0.5-$m^2$ square frame will be lay on the floor, and all the vegetation growing in the frame and over-hanging outside it, will be clipped at ground level and weighed in the field. A sub sample will be kept to measure moisture content for further extrapolation to the sample and sub-stratum. The number of plots and sampling design will be implemented according to general statistical procedures described below.
    - Belowground biomass, SOC, and soil density determination: As described in the methodology, the soil samples will be used to measure belowground biomass, SOC, and soil density determination. A mechanical soil corer will be used to take undisturbed soil samples. Some of the samples will be used to first determine bulk density by weighing the soil contained in a known volume, and then taking a sub-sample for soil moisture content determination, and another sub-sample for soil organic carbon analysis. The rest of the samples will be used for measuring root biomass by drying, sieving and washing the soil. The number of plots and sampling design will be implemented according to general statistically procedures described below.
    - Plot measuring, data processing, quality control and archiving: Procedures described in the methodology will be implemented. Most measurements will be made with a frequency of three years. Protocols for sampling, data processing, quality control and archiving will be established and all personnel will be adequately trained.

- Validation of factors: By using routine measurements and also by performing special determinations (such as destructive sampling of 30+ trees to adjust allometric equations for aboveground biomass, or destructive sampling to determine tree-shape factors), project-specific factors will be developed.

**2. Statistical procedures**

2.1 Confidence and precision levels:

The monitoring methodology will aim at an estimation of the mean carbon stocks with a precision level of ± 10% with 95% confidence. This ranges where chosen because they reach a compromise between precision in estimation of the population parameters and costs of the measurement and processing (section 4.3.3.4.1 IPCC GPG).

$$p\ (x \pm tSx) = 95\%$$

Where:
x= estimation of the mean
t= tabular value of Student for n-1 freedom degrees and 95% confidence level.
Sx = square root of the variance in the sample.

2.2 Sampling design

The project will use a systematic sampling with random start. The systematic allocation of samples allow to cover most of the field variability and the random start guarantee the random allocation of the samples, which eliminate any biases by the field teams.

The project will use permanent sampling plots on which measurements will be made periodically, at least every three years. Permanent sampling plots are considered more efficient to estimate changes in carbon stocks because they filter out any variance due to plot effect.

Annual estimates will be produced, and this requires using interpolation and trend extrapolation techniques. When data are available at the beginning or the end of the time series, lineal interpolation will be chosen. When there is no data at the end of the time series, then trend extrapolation will be used if the trend remains constant, or surrogate method if the trend changes.

2.3 Shape, size, number, and timing of plots:

*Sample shape*: Considering that the trees will be planted in rows, and that their spatial distribution will be relatively homogeneous, a rectangular or square shape will be chosen. Plot size will be 400 $m^2$ (common size used for commercial forest inventories).

*Sampling frequency:* Plots will be generally visited every three years, preferrably in the same time of the year every time. Visual checks will be performed to all plots between these visits, in order to detect and document any possible anomalies due to fires, pests attacks, nutrient deficiencies, etc.

*Number of plots and sampling error* : As each carbon pool has its own variance, a pre-sampling will be made for each pool individually. The pre sampling will consist in 100 samples per pool, distributed taking into account stratum definition, and trying to represent all the forest sites. To determine the number of plots for each carbon pool, the following equation will be used:

$$n = (t^2 \times CV^2)/ Er^2$$

Where:
n= minimum number of plots to achieve the desired confidence level
t= tabular value of Student for n-1 degrees of freedom and desired confidence level
CV= Coefficient of variation
Er= Standard error around the mean (the project will choose Er= 10%)

The n number of samples will be increased by 10%, to cover any future losses (due to fire, pest, loss of location, etc.) and elimination of PSPs due to measurement errors or inconsistencies.

2.4 <u>Managing sampling uncertainties</u>:

The project will manage the sampling uncertainties evaluating and trying to reduce the type of errors. For that, the project will:

- produce a Measurement Protocol (MP) and run courses for all field personnel.
- rechecking 10% sampling measurements with independent party team. If the difference between measurements is higher than 5%, a third definitive measurement will be run. If the difference is higher than 10% the sample plot will be eliminated.

*Measurement errors*: special attention will be paid to systematic errors that could scale up to the total estimations and multiply the uncertainty. A number of quality assurance and quality control measures will be implemented, as explained elsewhere.

*Model in errors or static factors*: These errors were minimized in the design of the monitoring methodology, which makes minimal use of default values, and uses widely accepted equations or models.

*Sampling errors:* The allocation of samples in the field will be random, so the differences between population and sample mean and variance will tend to neutralized, if the sample fraction is wide enough.

*Data recording and calculation errors:* Usually hard to detect, they can be checked by controlling the range and variance of data of different measurement teams. Use of data loggers, software, automatic data recording field equipment, etc., will minimize errors in data handling.

**PROJECT DESIGN DOCUMENT FORM**
**FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 04**

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**History of the document**

| Version | Date | Nature of revision |
|---|---|---|
| 04 | EB35, Annex 20<br>19 October 2007 | • Restructuring of section A;<br>• Section "Monitoring of forest establishment and management" replaces sections: "Monitoring of the project boundary", and "Monitoring of forest management";<br>• Introduced a new section allowing for explicit description of SOPs and quality control/quality assurance (QA/QC) procedures if required by the selected approved methodology;<br>• Change in design of the section "Monitoring of the baseline net GHG removals by sinks" allowing for more efficient presentation of data. |
| 03 | EB26, Annex 19<br>29 September 2006 | Revisions in different sections to reflect equivalent forms used by the Meth Panel and assist in making more transparent the selection of an approved methodology for a proposed A/R CDM project activity. |
| 02 | EB23, Annex 15a/b<br>24 February 2006 | Inclusion of a section on the assessment of the eligibility of land and the Sampling design and stratification during monitoring |
| 01 | EB15, Annex 6<br>03 September 2004 | Initial adoption |