

“Weyerhaeuser Uruguay” Forest Plantations on Degraded Grasslands under Extensive Grazing

Document Prepared By Carbosur



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1 PROJECT DETAILS

1.1 Summary Description of the Project

The project will comprise a total of 18,191 ha of land previously 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 mainly on *Eucalyptus grandis* and to a lesser extent *Eucalyptus dunnii* and *Pinus taeda* plantations in 16 and 21-year rotations (the former for Eucalyptus and the second for Pinus), managed with pruning (to a height of 9 and 6 m respectively); one thinning operation in Eucalyptus at the age of 11 and two thinnings operations in Pinus at the age of 12 and 16, to obtain knot-free, high-diameter logs suitable for saw-milling and veneering. Plantation will be completed by year 7 of project and forests will be replanted after clear-cut harvest. Practices will be compatible with PEFC standard for sustainable forest management. 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 living above-ground, litter and dead wood pools. Below ground biomass will be estimated indirectly based on above-ground biomass measurements. Non-tree vegetation and harvested wood products will not be accounted as per the methodology applied. The potential non-permanence of stored carbon will be considered by the non-permanence risk analysis and buffer determination, and by the fact that a significant fraction of the sequestered carbon will be stored in long-lived products which will not be accounted.

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 without carbon financing.

The project will result in a significant contribution to sustainable development of Uruguay, mainly through: i) increased employment and quality of employment; ii) rural development (decentralization); iii) increased gross value of production; iv) improved fiscal balance; v) biodiversity preservation and vi) improvement and preservation of soil quality.

Project activity consists in the establishment of forest on land that had previously been under grassland for more than 300 years. It will be developed under the VCS scope 14: "Agriculture, Forestry and Other Land Use" as an "Afforestation, Reforestation and Revegetation project. Weyerhaeuser Uruguay afforestation on degraded grazing land is a single GHG Project.

1.2 Sectoral Scope and Project Type

The activity implemented by the project is the establishment of forests on land that had previously been under grassland for more than 50 years, and therefore corresponds to the VCS category Afforestation, Reforestation and Revegetation (ARR). *Weyerhaeuser Uruguay forest plantations on degraded grasslands under extensive grazing* is a single GHG Project.

1.3 Project Proponent

The project is proposed by Weyerhaeuser Uruguay. Contact details of Weyerhaeuser Uruguay are the following:

- Agustin de la Rosa 765
- Melo, Uruguay
- Phone 464 30081 / 464 29 054

All properties of Weyerhaeuser Uruguay are legally owned and are covered by deeds duly registered with the National Records, registered with the corresponding number for the Registration of Real Estate. There are no conflicts related to tenure or use rights over the land affected to the project or its products.

1.4 Other Entities Involved in the Project

Weyerhaeuser Uruguay is 100% property of Weyerhaeuser Company. It was established in 2004, and started activities in 2005, buying land in the eastern part of the country (Cerro Largo and Treinta y Tres). Since 2010 Weyerhaeuser Uruguay became a REIT (Real Estate Investment Trust) subsidiary of Weyerhaeuser Company (REIT). All sales (related or non-related parties) of Weyerhaeuser Uruguay are done on a PAC (Pay As Cut) basis. Currently, the legal entity sales are split between Weyerhaeuser Productos S.A. (100% property of Weyerhaeuser Company) and 3rd parties customers. From 2005 until 2010 there was no implementing partner. Since Weyerhaeuser Uruguay became a REIT, the implementing partner is Weyerhaeuser Productos S.A.. Weyerhaeuser Productos S.A (Non REIT) is a subsidiary of Weyerhaeuser Company (Non REIT) that owns in Uruguay Timberlands and Industry located in the North region of the country (Tacuarembó and Rivera).

Carbosur has a contractual agreement with Weyerhaeuser Uruguay for the development and management of the carbon component of the project. Carbosur is not a project proponent.

1.5 Project Start Date

The project start date is February 22nd 2006, when the activities that lead to the generation of GHG emission removals (preparing land for planting) were first implemented.

1.6 Project Crediting Period

Project crediting period will be of 100 years, from February 2006 to February 2106.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Weyerhaeuser Uruguay Forest Plantations on Degraded Grasslands under Extensive Grazing is classified as a "project", according to its scale: it will remove a total amount of 5,601,938tCO₂ in a period of 100 years. This means an average of 56,019tCO₂ per year.

Table 1 Estimated GHG emissions removals

Project					X
Large-project					
Years	Estimated GHG emission reductions or removals (tCO ₂ e)	Years	Estimated GHG emission reductions or removals (tCO ₂ e)	Years	Estimated GHG emission reductions or removals (tCO ₂ e)
2006	0	2041	-1.324.600	2076	277.073
2007	37.277	2042	-687.013	2077	699.250
2008	212.894	2043	-1.181.716	2078	767.607
2009	486.207	2044	130.151	2079	757.844
2010	668.227	2045	526.381	2080	760.346
2011	810.604	2046	731.944	2081	581.965
2012	902.422	2047	707.366	2082	24.364
2013	847.996	2048	785.912	2083	-135.735
2014	785.569	2049	539.135	2084	103.229
2015	772.363	2050	-72.278	2085	-168.532
2016	634.177	2051	-200.040	2086	348.679
2017	148.829	2052	148.321	2087	156.326
2018	-57.589	2053	-106.027	2088	-953.569
2019	105.812	2054	505.384	2089	-1.276.999
2020	-84.348	2055	323.188	2090	-634.350
2021	434.356	2056	-900.783	2091	-1.186.886
2022	539.668	2057	-1.209.502	2092	14.313
2023	238.554	2058	-642.734	2093	402.915
2024	-1.017.346	2059	-1.076.447	2094	679.206
2025	-1.245.241	2060	165.800	2095	608.904
2026	-685.268	2061	515.431	2096	775.714
2027	-1.049.216	2062	647.218	2097	664.072
2028	126.156	2063	708.952	2098	161.165
2029	431.572	2064	645.013	2099	1.983
2030	580.272	2065	546.670	2100	175.395
2031	725.770	2066	40.838	2101	-20.970
2032	658.064	2067	-42.543	2102	436.245
2033	699.780	2068	108.929	2103	197.196
2034	176.765	2069	-21.496	2104	-990.208
2035	10.503	2070	351.832	2105	-1.244.660
2036	172.641	2071	42.513	2106	-740.027
2037	-31.333	2072	-1.145.467		
2038	456.810	2073	-1.248.999		
2039	198.399	2074	-690.562		
2040	-1.027.044	2075	-964.668		
Total estimated ERs					5.601.938
Total number of crediting years					100
Average annual ERs					56.019

1.8 Description of the Project Activity

The project comprises a total area of 18,191 ha with a long history of grazing by beef cattle, activity that have caused soil erosion and land degradation. Forest plantation for obtaining pulp and saw wood and removing carbon dioxide from the atmosphere are being established since 2006.

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

Forests consist of *Eucalyptus grandis* and to a lesser extent *Pinus taeda* plantations managed with a rotation length of 16 and 21 years respectively. The plantations are established on land previously used for cattle grazing. The implementation of the project activity will not cause any displacement of cattle.

The main objectives of the project activity are wood production, land restoration and carbon sequestration through afforestation. Forest plantation will be completed by year 7 of project and forest will be replanted after clear-cut harvest. Project crediting period is 100 years. All practices will be compatible with PEFC standard for sustainable forest management.

Planted forests will remove carbon dioxide from the atmosphere and store it in different carbon pools (living above-ground and below-ground biomass, soil organic carbon, litter and dead wood). All these carbon pools will be accounted towards issuance of VCUs. However, due to methodology provisions, only above ground biomass, litter and dead wood will be monitored (this last two pools might be estimated by the use of conservative defaults factors suggested in the methodological tool).

The following description of the main features of plantation and forest management technology is based on the operational manual internal document of Weyerhaeuser Uruguay. This is an overview of activities applied in the project activity, nonetheless Weyerhaeuser Uruguay might have done adjustments according to each site condition.

1.8.1 Site preparation

- The objective is to promote the establishment and initial development of plants. Site preparation favors the aeration, infiltration and nutrient availability of the soil, and contributes to weed control.
- Soil tillage is done on the strips where the trees will be planted, adjusting the criteria according to the risk of erosion and degradation conditions of the soil. The number of passes varies according to site specific conditions following the land contour. In-row deep tillage (sub-soiling) may be required in many cases. A control plot is established every 30ha in order to monitor the distances between rows, etc. Soil disturbance is limited to site preparation before planting and is not repeated in less than one rotation cycle.
- 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). The application is done 7 days before tillage or plantation. In addition, grazing is used as an effective method to control the vegetation before planting. Depending on the site conditions, a second post-planting application might be done. Burning as possible technique for cleaning fields is particularly excluded;

- Ant control over the whole area, using chlorine-free insecticides with reduced permanence in the ecosystem (insecticides are selectively applied on ant paths and nests (this continues for two year after pine plantation, and one year after eucalyptus plantation);

1.8.2 Planting and fertilization

- The site is manually or mechanized planted with 727 plants per hectare in rows spaced every 5,5 m for pine plantations, and with 900 trees per hectare in rows spaced every 5,5 m for eucalyptus plantations.
- Fertilization is manually or mechanized applied around each eucalyptus plant. Fertilization is not applied ion pine plantations;
- Plants establishment, survival control, reposition and quality is monitored within the first few weeks after planting, checks are performed to identify and replace lost plants;
- Planted forests will cover approximately 60% of the total area of land owned by Weyerhaeuser Uruguay, with the rest being used mainly for grazing. Grazing will also occur within the forest stands.

1.8.3 Forest Management and livestock

- Permanent sampling plots are established in the year 4 after planting. A Continuous Forest Inventory will be established in order to monitor forest development, tree growth, forest health, fire risks and other common forest practices. The information is stored in database and process to generate reports.
- In pine plantations, the first pruning will be when the trees reach a medium height of 5 m. A total of 480 trees per ha are pruned, leaving at least 60% of live crown. The second pruning reaches a height of 2.95 m (sawlog plus stump) and it leaves 50% of live crown. The third pruning reaches 4.5 m and leaves 45% of live crown. The final fourth pruning reaches 6 m and leaves 40% of live crown. In eucalyptus plantations, the first pruning occurs when the trees reaches a medium height of 6 m. A total of 450 trees per ha are pruned, and leaves at least 3 m live crown. The second pruning reaches a height of 6 m (sawlog plus stump) and is leaves 3 m of live crown. The third pruning is done over the best 200 trees per ha, reaches 9 m and leaves at least 4m of live crown.
- The first thinning operation will remove less than half of the volume, including those with thinner stems and badly shaped (in both pine and eucalyptus plantations). A relatively reduced volume of low-priced merchantable wood will be obtained due to reduced wood volume of harvested trees. In eucalyptus plantations thinning occurs at the eleventh year after planting and is the only thinning operation within the rotation cycle. In pine, a second thinning will be conducted at the sixteenth year after planting. A relatively important volume of medium-priced merchantable wood will be obtained through totally mechanized operation.
- Grazing takes place before planting and after planting on areas where forest plantation does not occur (lowlands, buffer areas to native forest, firebreaks, etc). A grazing agreement with a neighboring livestock farmer is usually done, including the exportation of the grazing areas, and the care and maintenance of existing assets.

1.8.4 Final harvest

- Clear-cut harvest is planned to occur around the year 16 after planting (*Eucalyptus grandis*) and around the year 21 (*Pinus taeda*); an important volume of high-priced merchantable wood will be obtained.

- Site preparation for re-planting starts within a year after clear-cut harvest; tillage will be performed on the inter-row spaces, where the second-rotation trees will be established.

1.9 Project Location

The following map (**Figure 1**) shows the exact location of the project, and the cadastral units owned by Weyerhaeuser Uruguay, where the project will be located.

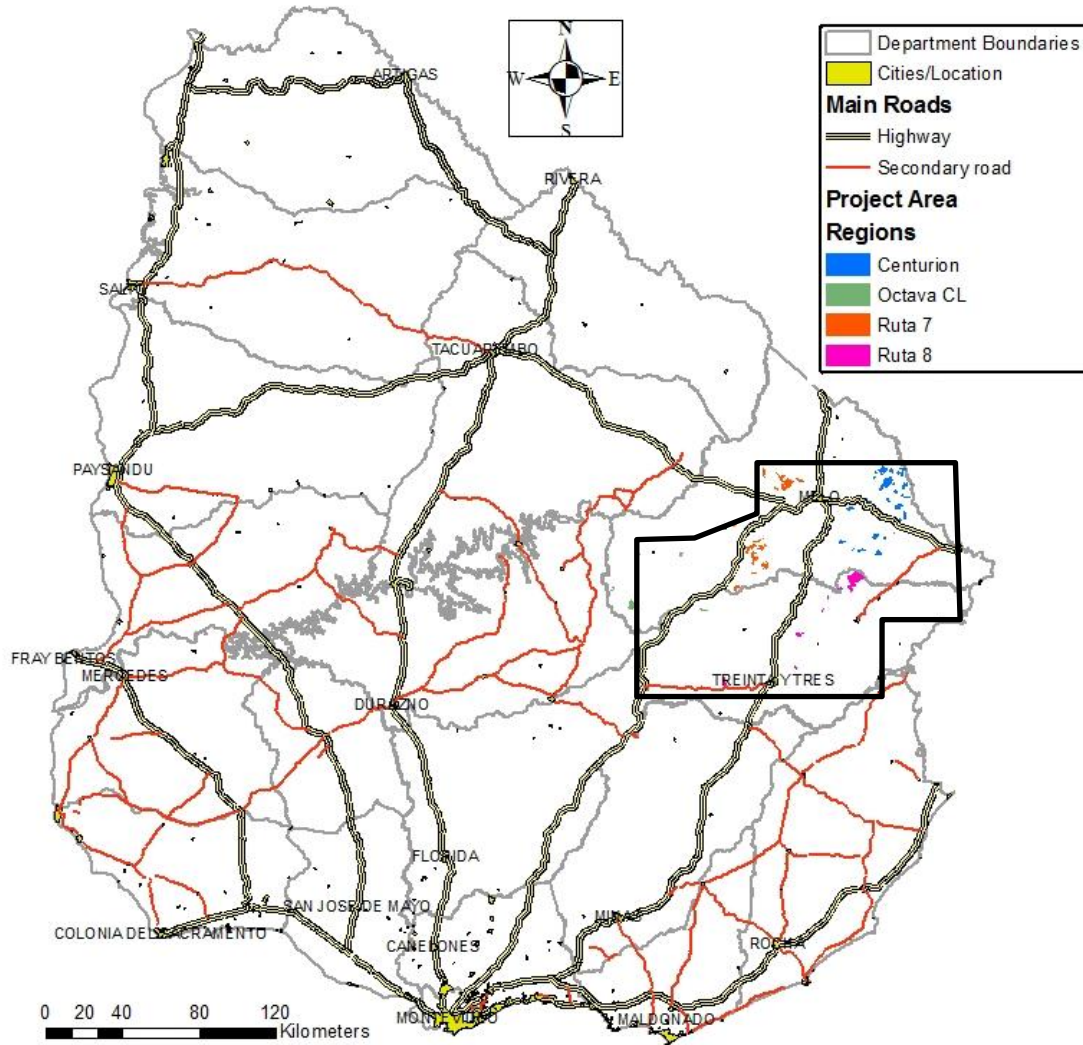


Figure 1. Map of Uruguay showing the location of the areas included in the proposed project activity (black frame).

For the purpose of defining the strata, the project area has been divided into four regions, shown from Figure 2 to Figure 6. The areas are homogeneous in terms of soil types, climate, land use history and socio-economic conditions. The division into four regions is entirely based on geographic location.

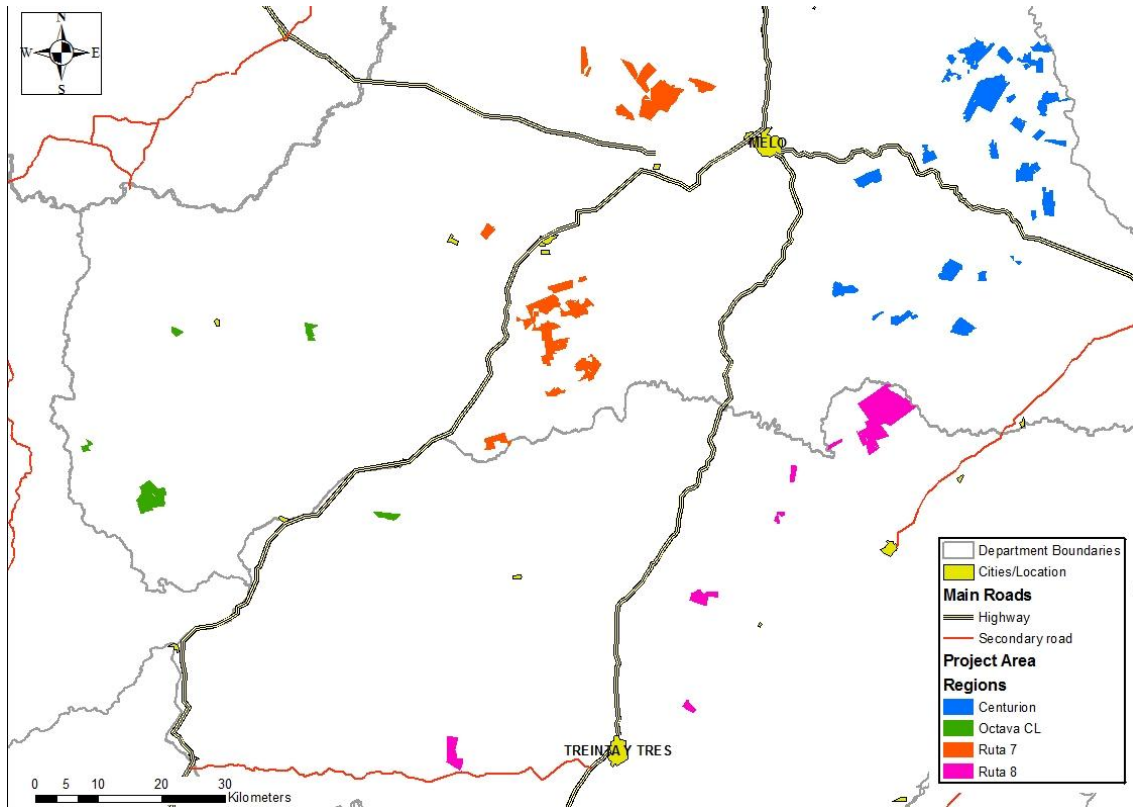


Figure 2. Map indicating the four project regions divided in four different colors.

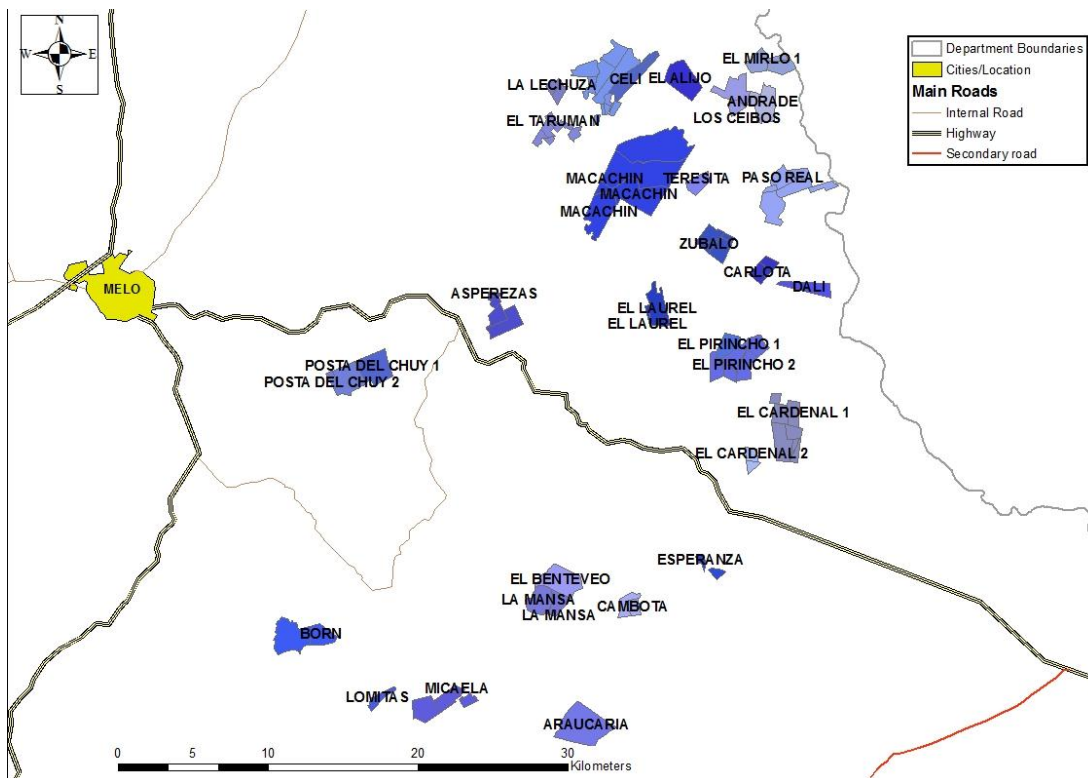


Figure 3. Location of properties which make up the region Centurion

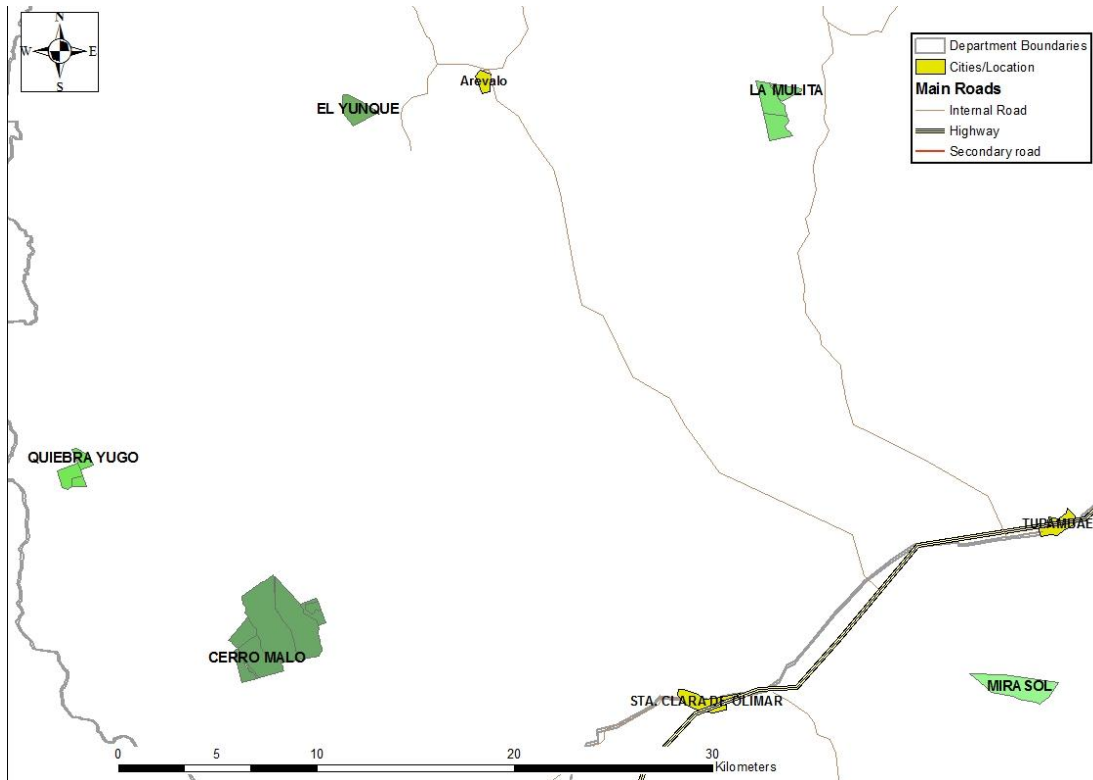


Figure 4. Location of properties which make up the region Octava CL

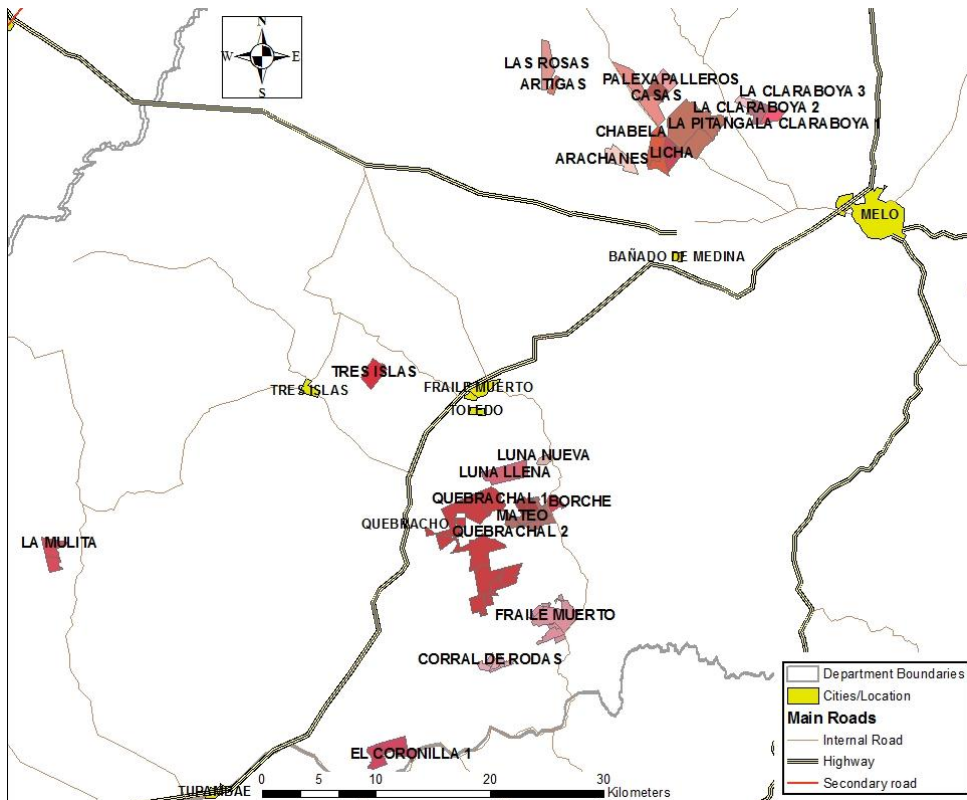


Figure 5. Location of properties which make up the region Ruta 7

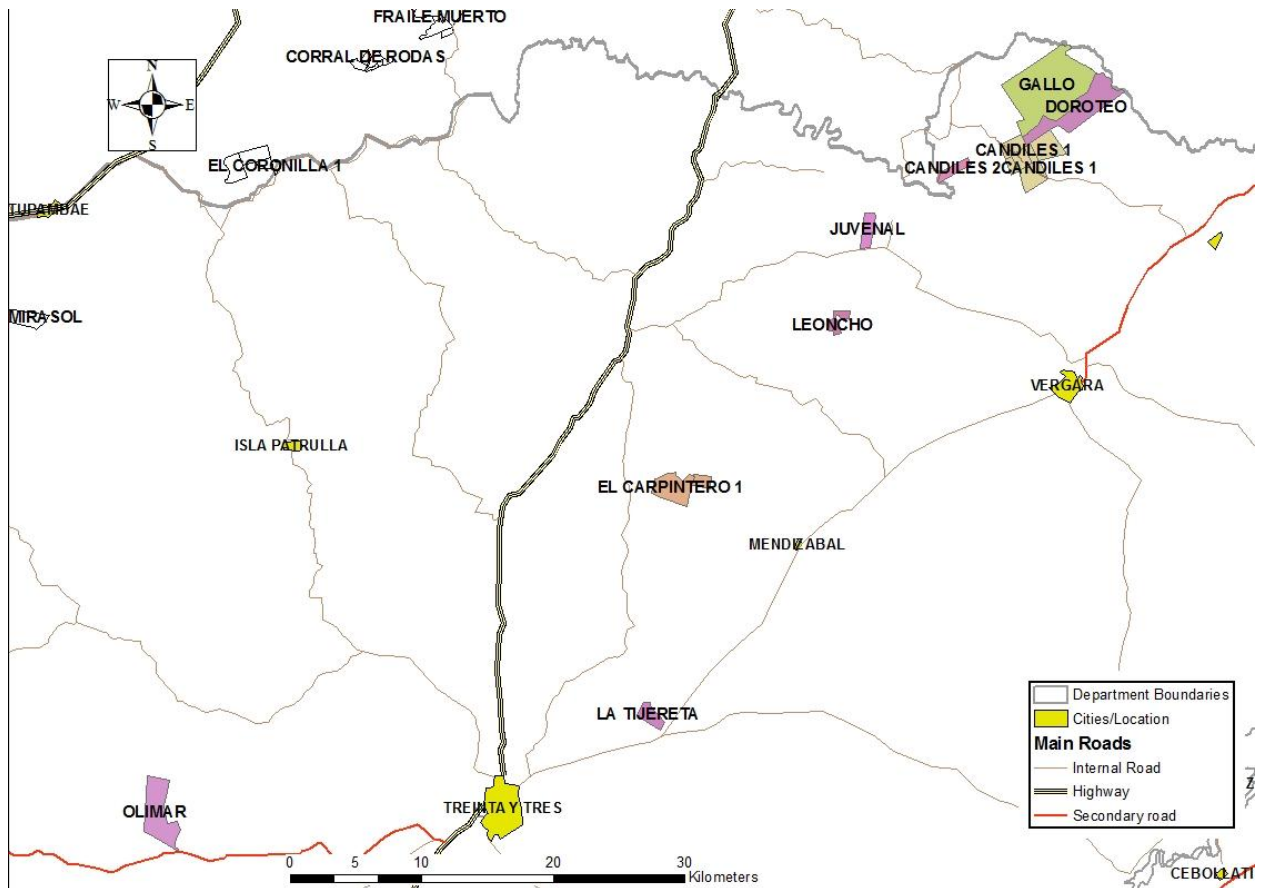


Figure 6. Location of properties which make up the region Ruta 8

The following table shows the distribution of the different species by region and the area covered by them.

Table 2. project boundaries by region and species:

Region	Species			Effective area (ha)
	E. grandis	E. dunnii	Pinus taeda	
Centurion	5.963	673	765	7.400
Octava CL	310	122	376	807
Ruta 7	4.147	716	890	5.753
Ruta 8	3.658	207	366	4.230
Total area (ha)	14.077	1.717	2.397	18.191

From table 3 to table 6 detailed information from each region is presented. From each region, we present:

- Property name: name of the farms that are included on each region
- Latitude/Longitude: property geographic location (coordinates)
- Cadastral units: official number of each cadastral unit of each property
- Area (ha): effective planted area (project boundary) divided by region, property and cadastral unit

Table 3. Indicators for unique identification of project properties in Ruta 8 Region

Region	Property Name	LAT	LONG	Cadastral Unit	Area (ha)
Ruta 8	CANDILES 1	- 32° 47' 1"	- 53° 58' 6"	1811	112
				3953	225
				4715	171
				5397	59
				5398	54
				7721	258
	CANDILES 2	- 32° 47' 36"	- 54° 1' 49"	7079	74
	DOROTEO	- 32° 44' 58"	- 53° 55' 49"	7735	560
	EL CARPINTERO 1	- 33° 0' 57"	- 54° 14' 49"	9352	77
				9357	299
	GALLO	- 32° 44' 9"	- 53° 57' 21"	1805	1.310
	JUVENAL	- 32° 50' 13"	- 54° 5' 57"	2432	159
	LA TIJERETA	- 33° 10' 23"	- 54° 15' 53"	7241	163
	LEONCHO	- 32° 53' 57"	- 54° 7' 16"	2314	41
				2640	45
OLIMAR	- 33° 14' 51"	- 54° 39' 49"	8855	623	

Table 4. Indicators for unique identification of project properties in Octava CL Region

Region	Property Name	LAT	LONG	Cadastral Unit	Area (ha)
Octava CL	CERRO MALO	- 32° 53' 30"	- 55° 11' 6"	652	236
				14719	26
				14720	113
	EL YUNQUE	- 32° 39' 16"	- 55° 8' 48"	10992	51
	LA MULITA	- 32° 39' 1"	- 54° 55' 15"	15120	42
				15127	80
	MIRASOL	- 32° 54' 38"	- 54° 47' 3"	8058	178
	QUIEBRA YUGO	- 32° 49' 14"	- 55° 17' 40"	13164	57
				13165	2
				13166	22

Table 5. Indicators for unique identification of project properties in Ruta 7 Region

Region	Property Name	LAT	LONG	Cadastral Unit	Area (ha)	
Ruta 7	ARACHANES	- 32° 19' 45"	- 54° 23' 58"	14986	196	
	ARTIGAS	- 32° 16' 19"	- 54° 27' 45"	11921	56	
	BORCHE	- 32° 36' 6"	- 54° 27' 8"	1049	84	
	CASAS	- 32° 16' 27"	- 54° 22' 0"	4473	145	
	CHABELA				4934	101
					4935	103
					8976	105
					10932	21
	CORRAL DE RODAS				221	12
					3572	18
					5228	14
					12867	37
					12869	43
	EL CORONILLA 1				12870	34
					482	34
					12247	151
					12391	169
					15826	61
	FRAILE MUERTO				46	40
					107	351
					4717	2
					5751	20
					6050	9
					6052	9
					6098	22
					11946	14
					15781	2
					15782	0
	LA CLARABOYA 1				15783	4
					15504	141
					15545	177
	LA CLARABOYA 2	- 32° 17' 17"	- 54° 16' 20"	15545	177	
	LA CLARABOYA 3	- 32° 16' 53"	- 54° 17' 6"	15856	47	
	LA PITANGA				1169	532
					9078	262
					15853	203
	LAS ROSAS	- 32° 15' 19"	- 54° 28' 11"	15806	267	
	LICHA	- 32° 19' 25"	- 54° 21' 7"	10442	204	
	LUNA LLENA	- 32° 34' 45"	- 54° 29' 53"	6056	211	
	LUNA NUEVA	- 32° 34' 5"	- 54° 27' 47"	12916	55	
	MATEO				71	31
					6028	41
	PALEXA				7586	121
					7587	197
	PALLEROS	- 32° 15' 57"	- 54° 21' 29"	14195	139	
	QUEBRACHAL 1				269	0
					290	15
					4091	8
					7416	70
					11381	4
11382					7	
13962					90	
13963					20	
13964					132	
15859					227	
QUEBRACHAL 2				15890	221	
				15893	53	
				73	66	
				11249	69	
TRES ISLAS				15251	116	
				15745	50	
				15208	116	

Table 6. Indicators for unique identification of project properties in Centurion Region

Region	Property Name	LAT	LONG	Cadastral Unit	Area (ha)
Centurion	ANDRADE	- 32° 14' 43"	- 53° 42' 20"	12764	232
	ARAUCARIA			15600	3
				15601	430
				1884	157
	ASPEREZAS			4309	14
				4310	4
				4311	17
				6532	56
				6238	118
	BORN	- 32° 34' 24"	- 54° 1' 24"	14543	62
	CAMBOTA			14544	58
				12111	65
	CARLOTA	- 32° 20' 41"	- 53° 42' 6"	12112	57
	CELI			6577	100
				15864	29
	DALI	- 32° 21' 17"	- 53° 40' 10"	10940	156
	EL ALLJO	- 32° 13' 56"	- 53° 45' 47"	12739	142
	EL BENTEVEO	- 32° 32' 8"	- 53° 50' 20"	7908	263
	EL CARDENAL 1			5111	28
				7897	108
				9263	203
				9902	32
				11245	96
				14056	59
	EL CARDENAL 2	- 32° 27' 31"	- 53° 42' 23"	11826	31
	EL LAUREL			15325	53
				1818	185
	EL MIRLO 1	- 32° 13' 15"	- 53° 42' 7"	7492	107
	EL MISTO			11077	87
				1836	0
				1910	1
				4074	47
				4686	12
				4943	14
				4987	98
				6567	16
				9271	48
				15352	5
				15353	3
	15354	8			
	EL PIRINCHO 1	- 32° 23' 27"	- 53° 43' 32"	1897	135
	EL PIRINCHO 2			1908	107
				6552	88
				12385	125
				12386	90
				12387	51
	EL TARUMAN			1935	40
				1984	31
				4281	29
				5661	12
				11546	31
	ESPERANZA	- 32° 31' 30"	- 53° 43' 59"	11547	21
	LA LECHUZA			6534	14
				6538	33
	LA MANSANA	- 32° 32' 53"	- 53° 50' 56"	2098	228
	LOMITAS	- 32° 36' 33"	- 53° 57' 56"	15642	59
	LOS CEIBOS			15869	38
				15870	107
	MACACHIN			1793	425
				1811	529
				9243	476
	MICAELA			3755	98
				5597	154
				7287	3
				12032	40
				15178	29
	PASO REAL			5107	100
6576				39	
6580				172	
12108				10	
12445				65	
12446				100	
POSTA DEL CHUY 1	- 32° 24' 37"	- 53° 58' 31"	10285	183	
POSTA DEL CHUY 2	- 32° 25' 5"	- 53° 59' 43"	2276	177	
TERESITA			13392	23	
			15799	102	
ZUBALO			1791	23	
			12117	21	
			12118	93	
			12119	95	

1.10 Conditions Prior to Project Initiation

Topography of the area consists of rolling hills with less than 300 m altitude, with abundant water streams. The mean annual temperature is 18 °C, varying from 12 °C (July) to 25 °C (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 °C. 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 of rivers and the Guaraní Aquifer, one of the largest of the world.

Soils are generally not very deep, of medium-to-coarse texture, with low natural fertility. Dominant land cover in the area is grassland, with predominance of herbaceous vegetation (mainly grass species) with interspersed and not very abundant 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 per cent of the land area. This has been attributed to the natural occurrence of frequent droughts 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. Due to the change in the regime of precipitation observed in recent years, with an increasing trend in both total precipitation and storm intensity, combined with the effects of overgrazing, particularly in dry periods, the soils in the project area would be subjected to increasing erosion and degradation pressures. The removal of vegetation by grazing cattle would also have caused a reduction in the annual inputs of organic carbon into the soil, thus causing a long-term reduction in the soil organic carbon content, which has been estimated at more than 20 per cent of the original soil organic carbon content.

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 within the project boundaries will be planted on grazing-degraded zones, and it was designed with the objective of preserving the most valuable areas outside project boundaries but inside the land owned by Weyerhaeuser Uruguay.

These conservation areas include natural forests alongside 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*, *Sebastiania schottiana*, *Sapium sp.*, *Pouteria salicifolia* and *Erythrina crista galli*. Also, in the most humid areas *Lueha divaricata*, *Quillaja brasiliensis*, *Cupania vernalis*, *Ocotea acutifolia*, *Allophylus edulis*, *Sebastiania klotzschiana* and *Citharexylum 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 *Gochnatia malmei*, *Aloysia gratissima* and *Lithraea molleoides*.

Natural meadows found in this area are developed on hilly landscapes with shallow soils and a topography that determines a good drainage and runoff. Thus, meadows were affected by water deficit so vegetation is dominated by species with summer cycles; such as *Paspalum notatum*, *Setaria geniculata*, *Paspalum dilatatum* and *Axonopus compressus*. It can be found associated species providing forage in the rest of the year (*Stipa papposa*, *Stipa charruana*, *Briza minor*, *Aristida sp.*). Some larger sized species

with more than 30 cm (*Baccharis trimera*, *Baccharis coridifolia*, *Eryngium paniculata* and *Eupatorium buniifolium*) could also be found.

On the other hand, favored by overgrazing, appears *Cynodon dactylon* which has been naturalized and has progressively colonized the soil, occupying the spaces left by species less resistant to trampling. Once established it gives no place, being considered as a noxious weed and as a sign of land degradation (decreased site productivity)

Weyerhaeuser Uruguay project will be established with a long-term perspective, with the ultimate purpose of achieving long-term sustainability and improving soil quality. Sustainable timber and cattle production and climate change mitigation are part of Weyerhaeuser Uruguay's objectives. The selection of forest management practices based on uneven lengths rotation cycles in a region far from timber markets is only possible with the additional carbon financing.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project activity complies with the National law and binding regulations, since forest investment has been approved by the General Forestry Directorate (entity of the Ministry of Agriculture, Livestock and Fishery) and the National Environment Directorate (entity of the Ministry of Housing, Territorial Planning and the Environment). The former ensures that the project activity follows practical and reasonable silvicultural practices, while the second granted the environmental authorization. On the other hand, is important to emphasize that the project will apply to be PEFC certified. This certification ensures that the project complies with all legal, environmental, social and labor regulations.

During the validation, all the approvals from the National Environment Directorate and the General Forestry Directorate were provided to the validation team, along with the proof of payment from the Social Insurance Bank (Banco de Previsión Social) and from the Tax General Authority (Dirección General Impositiva) demonstrating that the Project Proponent complies with all the labor and tax regulations in the country.

1.12 Ownership and Other Programs

1.12.1 Right of use

Notarial certificates stating that the land units within project boundaries are owned by the project developer will be provided to the validation team.

1.12.2 Emissions Trading Programs and Other Binding Limits

GHG removals generated by the project will not be used for compliance with binding limits to GHG emissions since such limits are not enforced in Uruguay, and there is no emissions trading program in place in the country.

1.12.3 Participation under Other GHG Programs

Weyerhaeuser Uruguay is a new afforestation project and is not registered in any other GHG program.

1.12.4 Other Forms of Environmental Credit

The project will only generate credits from the storage of carbon in forest pools, and these are claimed only under the VCS program

1.12.5 Projects Rejected by Other GHG Programs

Weyerhaeuser Uruguay afforestation is a new project and has not been rejected by any other GHG program.

1.13 Additional Information Relevant to the Project

1.13.1 Eligibility Criteria

Weyerhaeuser Uruguay is a single project.

1.13.2 Leakage Management

The methodology selected for the project activity identifies activity displacement as the only potential source of leakage. The project does not cause any displacement of activities. The only activity in the project area prior to the start date is extensive grazing by beef cattle, which continues to occur after project start. Therefore, there is no need for a leakage management plan or for leakage mitigation measures.

1.13.3 Commercially Sensitive Information

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

1.13.4 Further Information

Weyerhaeuser Uruguay project activity consists on the afforestation of degraded lands under extensive grazing in the Northeast of Uruguay. This region is not only characterized for its reduced development in terms of infrastructure and industry, but also for its socio-economic situation. Weyerhaeuser Uruguay project will contribute to the sustainable development of this region through the creation of quality employment and the production of timber that may eventually lead to opportunities for new services and industrial development in the area.

1.13.4.1 Background of forest activity in Uruguay

Uruguay has traditionally been a grassland country. Natural forests cover an area of only 0.8 Mha (4 per cent 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, which 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 years) and pines (25 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, and pulp logs, low-grade timber and firewood were the main products.

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. 15,939. Regulations under this law required that forestry activity be based on projects subject to approval by Forestry Bureau, and forests be located on forest priority soils comprising nearly 4 million ha of low agricultural productivity and/or high susceptibility to erosion or degradation.

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, with an estimated total investment, including a significant amount from foreign sources, of more than US\$ 1 billion in the 1990's.

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. 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, continuously declined thereafter to less than 10,000 ha/year in 2003 and 2004, and increased again between 2005 and 2008 particularly due to the development of large-scale pulp mill plants and to the expectation of carbon finance availability for forests developed on sites with limited access to markets (e.g., in the Northeast of the country). The elimination of plantation subsidies and of tax exemptions occurred in 2005 were factors affecting negatively the investments in new forest plantations.

1.13.4.2 Least Developed Forestry Regions in Uruguay

After the forest promotion policy implemented in 1987, an extensive afforestation process occurred in the West and North regions of Uruguay, making use of the proximity to harbours, excellent soils and the availability of reasonably good infrastructure, services and relatively well-qualified labour force. This development was later followed by investments in forest industries. The Southeast region of Uruguay also saw the establishment of numerous forest plantations, mostly for production of pulpwood in short rotations lured by the proximity to Montevideo harbor. In spite of the availability of large areas with soils declared by the government as of forest priority, the Northeastern region of Uruguay (Departments of Treinta y Tres and Cerro Largo) was not considered as attractive by investors, mainly because of the long distance to harbours or industries, and also due to relatively poor quality of soils and infrastructure. Grassland under extensive grazing continued to be the dominant land use within this region.

According to the current legislation, the total extension of forest priority soils in the NE region of Uruguay is around 1,020,000 ha. This amount represents 45 per cent of the total area of Cerro Largo and Treinta y Tres Departments. However, according to official statistics, during the last 35 years only 6 per cent of that area was actually planted, mostly in the period during which plantation subsidies and soft credits from Banco de la República were available.

1.13.4.3 Lack of industries in the region

Wood primary industries currently in operation in Uruguay include sawmills, chipping plants, pulp and paper mills, wood preservation plants and plywood plants. Some of these industries –small sawmills and pulp/paper plants- were established well before the strong development of forest plantations of the 1990's. According to Pike Consultora Forestal there are more than 200 sawmills in Uruguay. The vast majority of these sawmills are extremely small, very inefficient units, which do not have a significant aggregated

demand for wood. In general, the rest of those sawmills have a reduced scale, with the largest ones being Urufor (Rivera), FYMNSA (Rivera) and Caja Bancaria (Rio Negro). The smaller sawmills are mainly concentrated in Paysandú and Montevideo and their surrounding areas.

In recent years, two new plywood plants have been established in Tacuarembó (Weyerhaeuser Productos and Urupanel). They have a combined capacity to consume more than 600,000 m³ of wood per year.

There are a few wood preservation plants scattered throughout the country, all of them small. The largest ones are UTE (State utility), located in Rincón de Bonete (Tacuarembó) and Matra, located in Trinidad (Flores).

The largest pulp mill currently operating in the country is UPM, established in 2007 (Río Negro), which has a capacity to produce 1.1 million tons of cellulose per year. Montes del Plata (an association of Stora Enso and Arauco) is building a 1.5 million t/year cellulose plant in Colonia, which will start operating in late 2013. In addition, there are two small pulp mills located in the Southwest part of Uruguay: Pamer in Mercedes (Soriano) and Fanapel in Juan Lacaze (Colonia). The combined productive capacity of these two plants is 120,000 t/year of pulp paste. Finally, there are four chipping plants in operation, with a combined capacity for processing 2.1 million m³/year of round wood, located in Fray Bentos (1) and Montevideo (3).

As it can be appreciated in **Figure 7**, all the current industries and mills present in the country that result in a possible market site for Weyerhaeuser Uruguay wood, are located in the North, West and South regions. All of them, as well as the country's ports, are located at more than 300 km by road from the project site, thus imposing high transportation costs to the harvested wood.



Figure 7. Largest pulp mills, chipping plants, sawmills and plywood mills located in Uruguay

1.13.4.4 Social issues related to the project activity

Rural poverty is the origin of the main social problems in Uruguay. The region where Weyerhaeuser Uruguay has developed its project is particularly affected by a lack of development. Rural poverty has caused the internal migration from rural towns to precarious urban settlements in Montevideo and other cities, increasing marginality, criminality, lack of education, drug-addiction and other social problems. The region around the project site has a dominance of an extensive livestock system of production, which is characterized with a very low productivity level, very low employment, and precarious working conditions and reduced opportunities for women and youth, among other problems. Weyerhaeuser Uruguay forest activity is expected to increase the gross value of production per unit area of land by six to eight folds¹ as compared to the previously existing livestock production systems, besides promoting a number of new activities which will multiply this impact.

Creation of employment is one of the main social benefits of the project. Typically, an extensive livestock production system employs half of persons every 1,000 ha. compared with Weyerhaeuser Uruguay

¹ The average production of meat in Uruguay is 65 kg per ha per year. That would correspond to an average productive soil (100 CONEAT- index which measures meat and wool productivity). Forest soils in Uruguay would have an average meat productivity index of 75, so the livestock productivity would be roughly 50 kg of meat per ha per year (corresponding a gross value of 75-100 USD per ha per year). Pine growth (MAI) is 22 m³ per ha per year, multiplied by a price of 40 USD per m³ (placed in sawmill), would represent 880 USD per ha per year.

afforestation activity (Van hoff and Fossati, 2006)². Beyond an increased number of jobs, the project is expected to contribute to the development of the region and the country pursuant the priorities defined by Uruguayan government (promotion of small family businesses, increase in exports, eradication of rural poverty, incorporation of technology, increased nationally added value, development of new productive chains and geographic decentralization of development) as follows:

- Promotion of small family businesses

As it was mentioned above, Weyerhaeuser Uruguay project activity will generate several job opportunities, creating nearly 260 job positions during the agrarian phase, while the amount of workers would increase during the industrial phase to nearly 420 job positions³. The vast majority of employees will be hired by contractors.

- Reduction of rural poverty

The main contribution of Weyerhaeuser Uruguay project activity to the reduction of rural poverty will be through the generation of high quality and stable employment, in a region of Uruguay with elevated levels of poverty. A study by Carámbula and Piñeiro (2006)⁴, demonstrate that forestry projects oriented to the production of high value timber, generates high positive impacts in the eradication of poverty in rural areas and reverting the process of internal migration to big cities.

- Incorporation of technology

The project incorporates the best available and affordable technology for optimizing wood productivity and quality through the selection of seeds, site preparation, plantation, weed and pest control, forest management and wood harvesting and logistics, and achieving sustainability objectives. Weyerhaeuser Uruguay has a program for applied research, continuously testing various practices in order to achieve continuous improvement over time, and collaborates with other companies and public institutions in this regard.

- Increased nationally added value to forestry products

Weyerhaeuser Uruguay project will produce timber that can be used for high-value products. As discussed above, currently there are no wood industries located within a reachable distance from the project site. However, the presence of Weyerhaeuser Uruguay and of other similar initiatives in the area which have already secured (Posco Uruguay and Guanaré) or are also seeking carbon finance (El Arriero, Forteko and others) may induce in the future the establishment of industries in the region. In addition, the forest management adopted by Weyerhaeuser Uruguay would increase the amount of carbon sequestered by trees, thus increasing the carbon embedded value in wood products.

- Development of new productive chains

Weyerhaeuser Uruguay is a REIT, therefore it cannot own any industrial project.. Nevertheless, as mentioned above, Weyerhaeuser Uruguay forest plantation may contribute to promote the establishment of industrial investments in the area.

- Geographic decentralization of development

² Van hoff, E. and Fossati, A. Estrategias y Mecanismos financieros para la conservación y el uso sostenible de los bosques. Available at: <http://www.fao.org/forestry/11623-09df12c118bf235224e78938fea555141.pdf>

³ Forestry activity in Uruguay generates 21,000 jobs during in the industrial phase and 13,000 jobs at the agrarian phase. It was considered the effectively planted area of 'Weyerhaeuser' in order to estimate the job positions generated by Weyerhaeuser project

⁴ Carámbula, M. y Piñeiro, D. La Forestación En Uruguay: Cambio Demográfico y Empleo en Tres Localidades

As it was mentioned above, Weyerhaeuser Uruguay project will bring about a number of socio-economic benefits that will mostly impact on its surrounding area, which is currently one of the less developed ones in the country. This would create a development pole away from Montevideo and other areas which concentrate most of the economic activity in the country

1.13.4.5 Models applied to estimate yields curves

SAG Grandis

The model "SAG grandis" is the only growth model available in Uruguay specific for the species *Eucalyptus grandis* that model or project timber volumes, growth curves or expected future timber returns. This model was created by the National Agricultural Research Institute (INIA) in March 2003 in a Technical Serie Publication No. 131 "SAG grandis: Supporting Management System for *Eucalyptus grandis* plantations". In August 2008, the same institution published a new Technical Serie No. 173 "SAG *Eucalyptus*: Support System management oriented *Eucalyptus* pulp production in Uruguay" that includes a module to model *E. dunnii* but only intended as forest plantation for pulp, not allowing the model of commercial thinning.

In SAG grandis, the simulation model of growth is the main component of the system, allowing estimating future growth of a stand starting from a given initial situation. This is an empirical model, i.e. data that was set with actual growth sampling plots. Unlike mechanistic models, empirical models are not intended to explain the basic physiological processes that determine the growth of trees. Just estimate the likely development of the different variables according to the original terms of the stand, the site and management measures that are simulated (Technical Series No. 131 SAG grandis).

This model is widely used both in private forestry companies in the country as various government institutions for future estimates of forest biomass. The model considers many variables as "inputs required" as initial age, dominant average height, basal area or mean diameter and geographical zones, "optional inputs" and "output" (for more information see Technical Series No. 131, page 15).

Currently, there is one forestry project in Uruguay, registered within the Clean Development Mechanism, "Posco Uruguay afforestation on degraded extensive grazing land" ([click here to access](#)) that recognizes the model as the only available in Uruguay to estimate future growth curve of the species *E. grandis*.

SISPINUS

In Uruguay there are no programs to model or project timber volumes, growth curves or specific expected future returns for *Pinus taeda*. The closest model (because it was developed for conditions for the southern part of Brazil) is the SISPINUS. The simulator SISPINUS growth and yield was based on the NCSU-Managed Growth & Yield Pine Simulator, developed by Hafley, Professor of Forestry at the School of Forest Resources in North Carolina State University, USA. It was calibrated to their circumstances (input parameters and the results of the simulator) by EMBRAPA (Brazilian Agricultural Research Company) with direct supervision of Hafley. Embrapa is linked to the Ministry of Agriculture, and created the model to assist producers in managing forests. It has no cost but it is not freely distributed.

The model is used to calculate when, how much and how to thin each forest, contributing to increase productivity. With this program the user can prepare and implement management plans for sustainable production, required for certification of forest plantations.

It was developed with a basis of several years of research, with data and information provided by forestry companies, allowing rapid response to thinning simulations and presents tables with information growth and annual timber production. It helps the farmer to calculate the annual production and future of forests

(www.portaldoflorestamento.com.br)

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

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

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

- Version 01 of “Procedures to demonstrate the eligibility of lands for afforestation and reforestation CDM project activities”;
- Version 01 of “Combined tool to identify the baseline scenario and demonstrate the additionality in A/R CDM project activities”;
- Version 01 of “Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities”;
- Version 03.1 of “Estimation of non-CO₂ GHG emissions from burning of biomass attributable to a CDM A/R project activity”;
- Version 01 of “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity”;
- Version 01.1 of “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”;
- Version 02.1.0 of “Calculation of the number of sample plots for measurements within A/R CDM project activities”;
- Version 01 of “Guidance on application of the definition of the project boundary to A/R CDM project activities”.
- Version 01 of “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activity”
- Version 01 of “Estimation of carbon stocks and change in carbon stocks in deadwood and litter in A/R CDM project activity”
- Version 02 of “Guidance on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks”

2.2 Applicability of Methodology

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

2.2.1 Applicability conditions

2.2.1.1 Degraded land

“The A/R CDM project activity is implemented on degraded lands, which are expected to remain degraded or to continue to degrade in the absence of the project, and hence the land cannot be expected to revert to a non-degraded state without human intervention”

The “Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities” has been followed. Its procedure states that one of the demonstrations suggested in the tool is enough to deem that the land is degraded and/or degrading. Demonstration (a) has been selected.

(a) Provide documented evidence that the area has been classified as “degraded” under verifiable local, regional, national or international land classification system or peer-review study, participatory rural appraisal, satellite imagery and/or photographic evidence in the last 10 years.

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, with frequent periods of overgrazing, lands have lost the original vegetation and a fraction of the soil organic matter, an essential component determining land productivity, leading to constraints to productivity, particularly in those areas affected by severe erosion. 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.

Grazing practices applied on all the lands included within project boundaries during long periods of time have resulted in significant losses of carbon, nitrogen, phosphorus and other nutrients from the soil, and have also resulted in significant alterations to the vegetation cover and the biological diversity.

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 soils. Some recent studies support this statement. Piñeiro et al (2006)⁵ 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

⁵ 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.

(-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 conditions in which this study was conducted match those of all the sites included in the project activity.

Another peer-review study prepared by Altesor et al. (1998)⁶ arrived to similar conclusions. Five sample plots on grassland sites in North Uruguay were measured in 1935 and revisited in 1990. It was concluded that continued grazing causes an increase in the amount of weedy species and decreasing the palatable forage species. This is an indicator of a presently and continuous degrading process. The findings of this study are applicable to all sites included in the project activity.

The First Report of Uruguay to the UN Convention to Combat Desertification prepared by DINAMA (National Environmental Directorate) in 2000⁷ states in its Section 2.1 that the way in which extensive grazing is practiced deteriorates the natural pasture due to the fact that it is based on the assumption that the natural grassland ecosystem can support mismatches between grazing pressure and forage availability induced by weather and/or market. The report also states that the strong fluctuations in the prices of major agricultural products hinder an adequate planning of the production units, which is essential for the conservation of natural resources. In Section 1.6 of this report, it is stated that the climatic variations frequently produce “forage crises” both in summer and winter times, resulting in overgrazing and a consequent loss of species. The concepts included in this report are valid for all land units included within project boundaries, since previous land use in all sites has been extensive livestock production based on grazing.

According to Zanoniani, R. (1997)⁸ the fundamental feature of Uruguayan grasslands is that in spite of having a good productive stability, due to their species composition diversity, it would be hard to find areas in a steady state, since they evolve continuously towards degradation. In addition, he also suggests that the criteria currently used for selecting the number of grazing animals per hectare grazing, almost purely based on the demand of forage rather than on the loading capacity, is the main cause of degradation of the grasslands in Uruguay, leading to the decrease or extinction of the most valuable species and the survival of those more unproductive or tolerant to unsuitable management practices.

One of the consequences of overgrazing and improper grazing practices is the erosion of the soil, which is more intense in sloppy terrain. Most of the project area, characterized by moderate slopes, is located on the areas affected by various degrees of gully erosion, according to the map of gully process intensity on Uruguayan soils prepared by the Ministry of Livestock, Agriculture and Fisheries (**Figure 8**).

⁶ 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

⁷ First National Report (2000) submitted by DINAMA (acronym in Spanish of Uruguayan National Environment Direction) to UNCCD (United Nations Convention to Combat Desertification)

⁸ Zanoniani, R. (1997). Síntomas de degradación productiva y medidas preventivas para su control. *Cangüe*, vol 4 no.10. p. 22-26

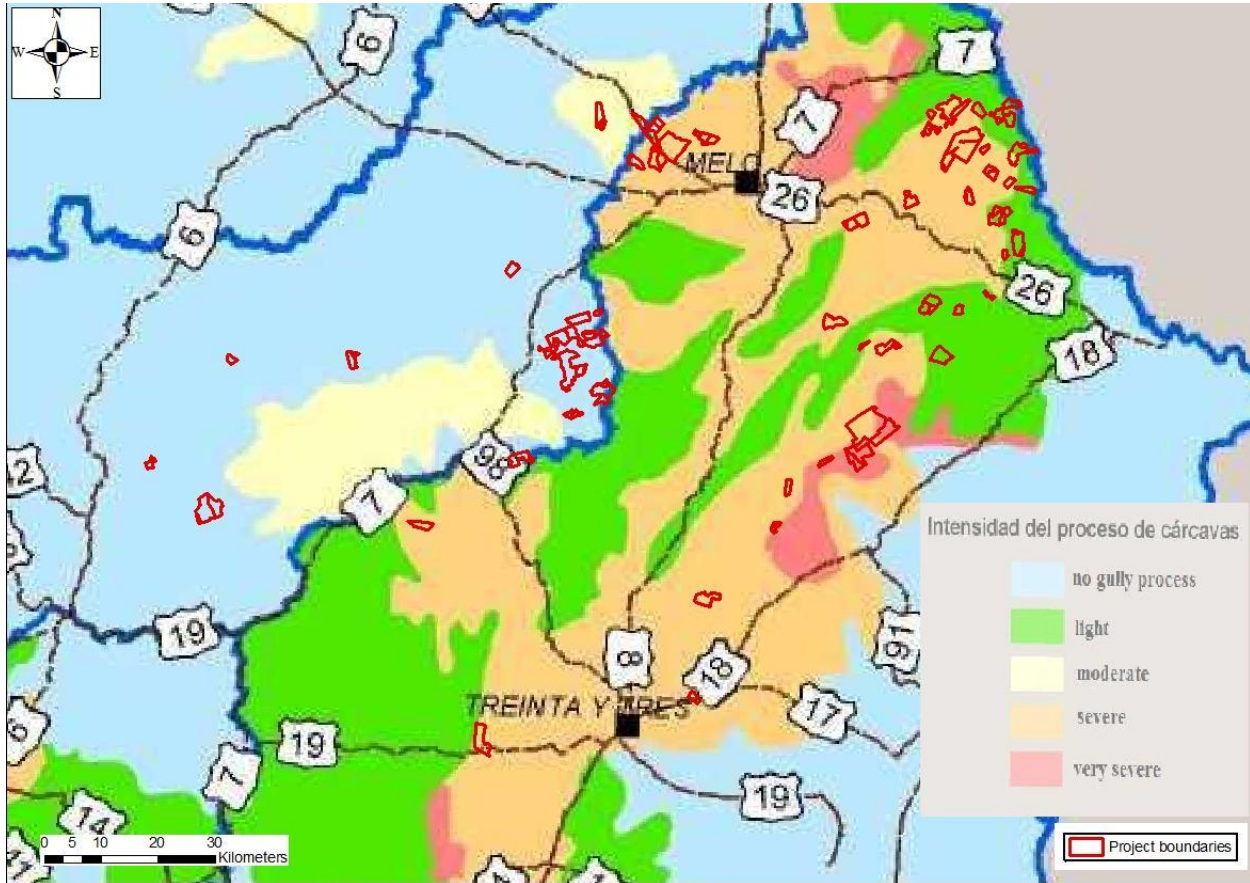


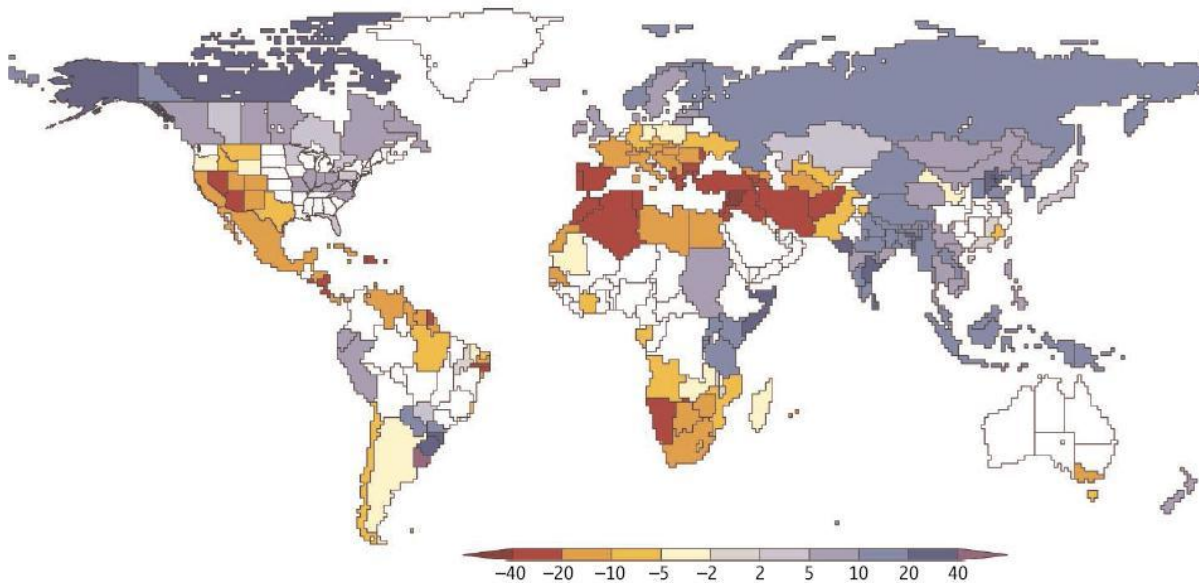
Figure 8. Occurrence of soil erosion gully processes in Uruguay⁹

The main driver of soil degradation is livestock overgrazing, which will continue to be present under the baseline scenario identified below (continuation of extensive grazing by beef cattle). The intensity of soil erosion is expected to increase with time due to climate change. According to the National Institute of Agricultural Research (INIA), the precipitation in the region where the proposed project activity is located has increased by 400 mm yr⁻¹ during the period 1930-2000¹⁰, with a sharp increase during the spring and summer months. This increase is associated with an increase in the intensity of precipitation, thus leading to higher erosion pressure. A global assessment (Milly et al, 2008¹¹) has estimated that Uruguay is the country with the highest expected increase in runoff during the period 2000-2050 (Figure 9). This evidences that the soil erosion pressures are expected to increase in the future.

⁹ Source: 'Ministerio de Ganadería, Agricultura y Pesca' of Uruguay (Ministry of Agriculture). (<http://www.mgap.gub.uy/Renare/SIG/ErosionAntropica/intdelprocesodecárcavas.jpg>) Web site visited 15th February 2011.

¹⁰ Giménez, A. et al. 2006. Cambio climático en Uruguay y la región. Available in www.inia.org.uy/gras

¹¹ Milly, P.C.D, Betancourt, J., Falkenmark, M., Hirsch, R.M., Kundzewicz, Z.W., Lettenmeier, D.P and Stoufler, R.J. 2008. Stationarity is dead. Whither water management? Science 319:573-574



Human influences. Dramatic changes in runoff volume from ice-free land are projected in many parts of the world by the middle of the 21st century (relative to historical conditions from the 1900 to 1970 period). Color denotes percentage change (median value from 12 climate models). Where a country or smaller political unit is colored, 8 or more of 12 models agreed on the direction (increase versus decrease) of runoff change under the Intergovernmental Panel on Climate Change’s “SRES A1B” emissions scenario.

Figure 9. Projected increase in the surface runoff in different regions of the world during the period 2000-2050. Source: Milly et al, 2008 (Science, 329:573-574)

2.2.1.2 Litter removal

The methodology requires that “Litter shall remain on site and not be removed in the project activity”.

Litter will not be removed from the project site

2.2.1.3 Wetland

“The land does not fall into wetland category”.

There are no wetlands in the project area.

2.2.1.4 Drainage of organic soils

“If at least a part of the project activity is implemented on organic soils, drainage of these soils is not allowed and not more than 10% of their area may be disturbed as result of soil preparation for planting”.

There are no organic soils in the project area.

2.2.1.5 Tillage conditions (to account for changes in soil organic carbon pool)

“Ploughing/ripping/scarification attributable to the project activity, if any, is:

- Done in accordance with appropriate soil conservation practices, e.g. follows the land contour; and
- Limited to the five first years from the year of initial site preparation; and
- Not repeated, if at all, within a period of 20 years”.

Soil organic carbon (SOC) will not be accounted in an area of 15,794 ha within project boundaries, on which the rotation length is projected to be of 16 years. That area would not comply with condition 1.5 iii, since tillage would be repeated within a period of less than 20 years. The rest of the project area (*Pinus taeda* plantations) is done in accordance with applicability conditions for accounting soils organic carbon, which will be estimated according to the “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project” activities”.

2.2.2 Justification of the choice of methodology

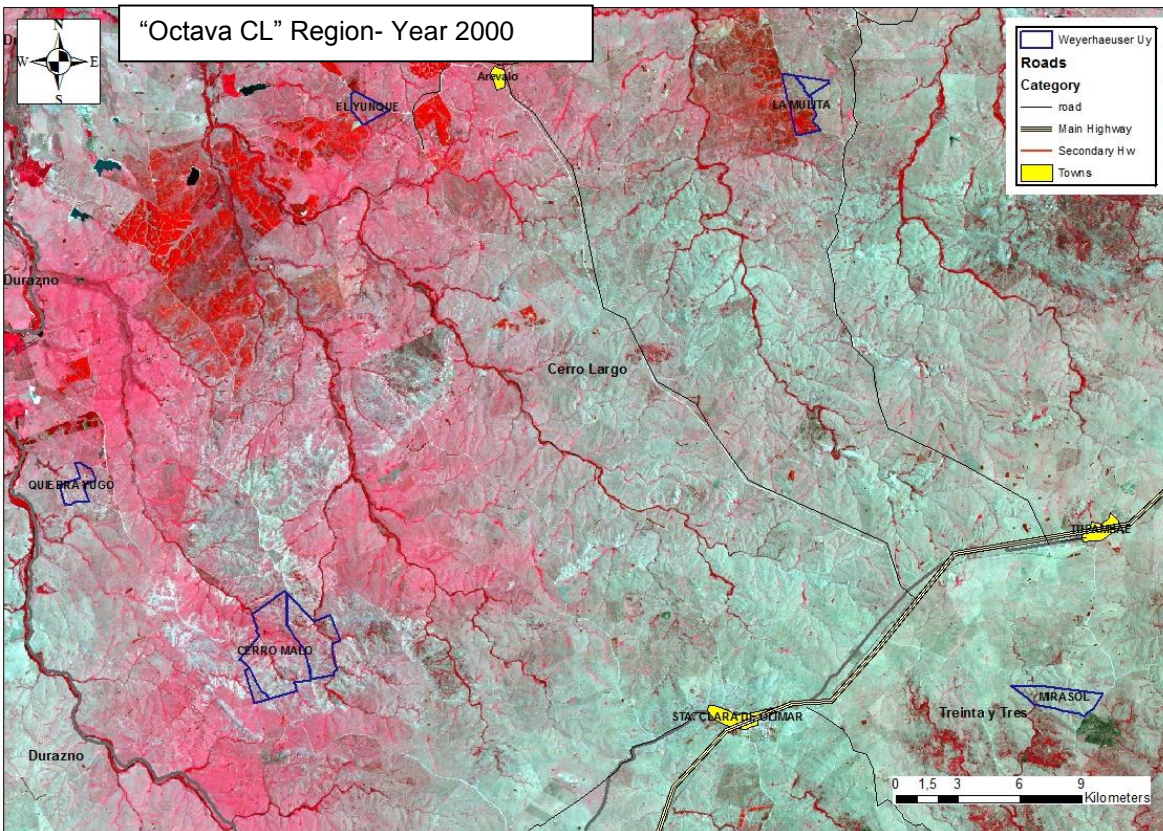
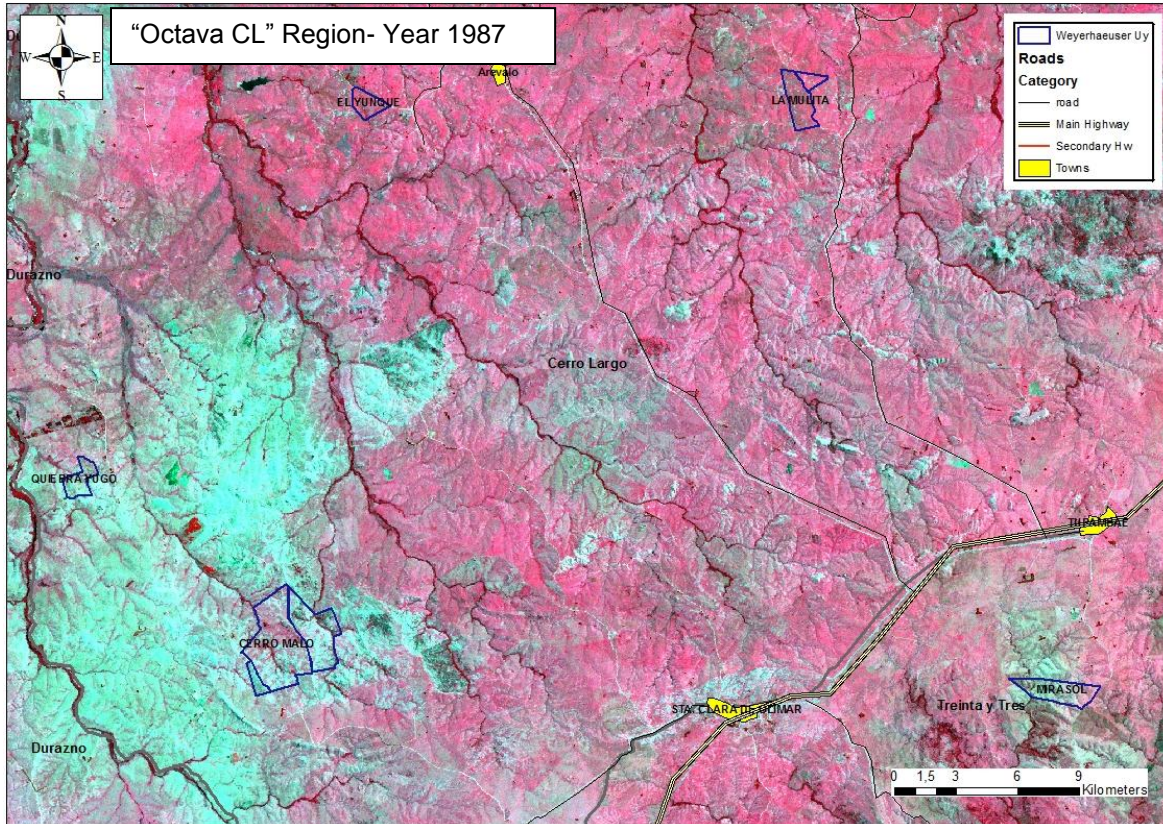
The project activity complies with all applicability conditions of the selected methodology.

2.3 Project Boundary

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

- Forest area effectively planted is delineated by the use of GPS technology and aerial photographs. Project boundaries are organized in GIS-format polygons. Polygons are grouped by property; properties are grouped by region, and the group of all regions comprising the total land area constitutes the project boundaries.
- Only areas complying with land eligibility requirement of the methodology (i.e., areas of land within project boundaries must not have been under forest since at least 1990) and with methodology applicability conditions (e.g., land must be degraded) are included within project boundaries.
- Regarding VCS eligibility requirements (AFOLU requirements 3.3), grassland vegetation dominating before project start is not the native ecosystem of the land within project boundaries. The native condition was modified by the introduction of beef cattle and sheep in the 17th and 19th centuries, respectively, and by the introduction of exotic species during the last three centuries.
- Land eligibility for afforestation under the provisions of the selected methodology: It is demonstrated through application of step 2(a) of the “Procedure to demonstrate the eligibility of lands for afforestation and reforestation CDM project activities” that vegetation on the land has been below the forest threshold since 1987 until the project start date, fulfilling the condition 1. (b).(i) of “Procedures to demonstrate the eligibility of lands for afforestation and reforestation CDM projects activities”: the land had not contain forest on or after 31 December 1989. According to guidance from the A/R Working Group (18th meeting of February 2008) it is not essential to differentiate between afforestation and reforestation for the purpose of demonstrating the eligibility of land in A/R CDM project activities¹². Therefore, even though the proposed project activity is an afforestation case, it is sufficient to demonstrate that vegetation on the land within project boundaries has remained below the thresholds of forest definition since at least 31 December 1989. The result of a remote sensing analysis is shown below. The analysis of satellite images shown in **Figure 10** to **Figure 13** show that afforestation process did not start within project boundaries until 2006. The red coloured areas in these images indicate the presence of forests.

¹² http://cdm.unfccc.int/Panels/ar/ARWG18_Report_Ext



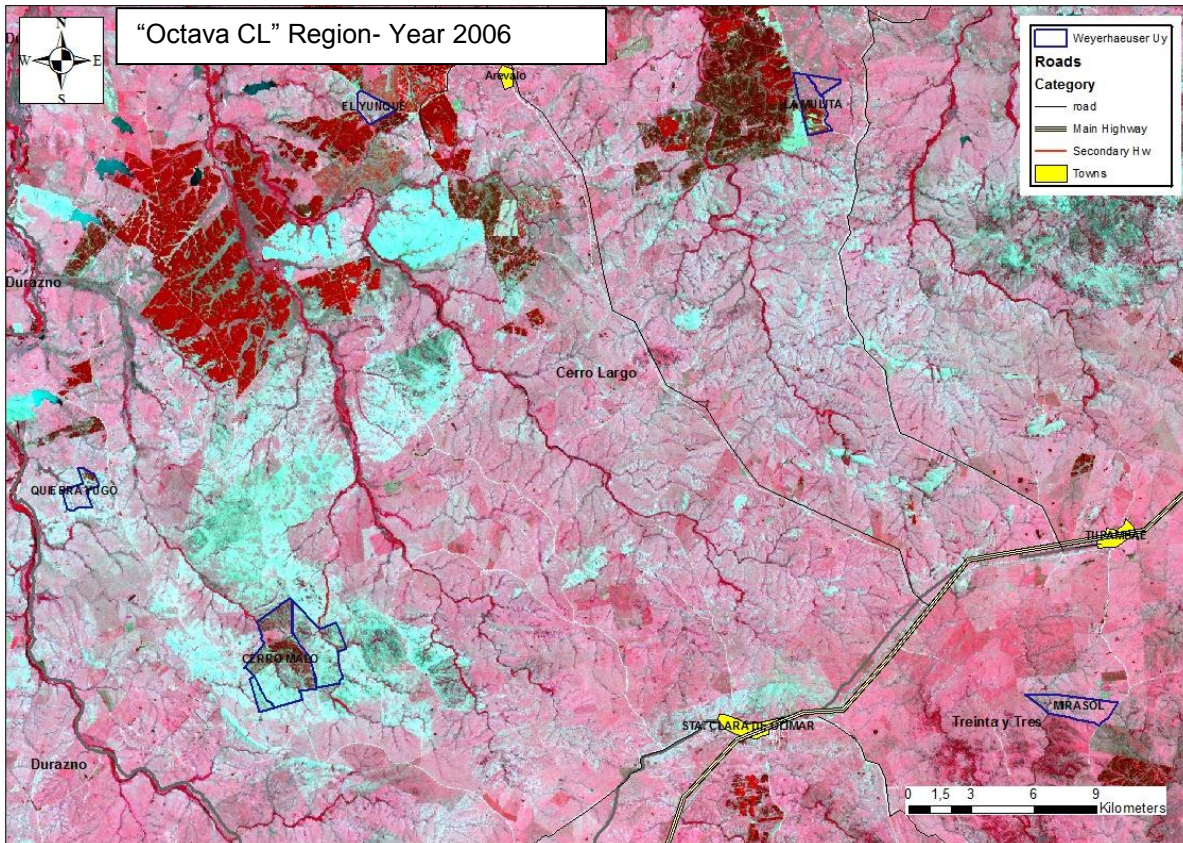
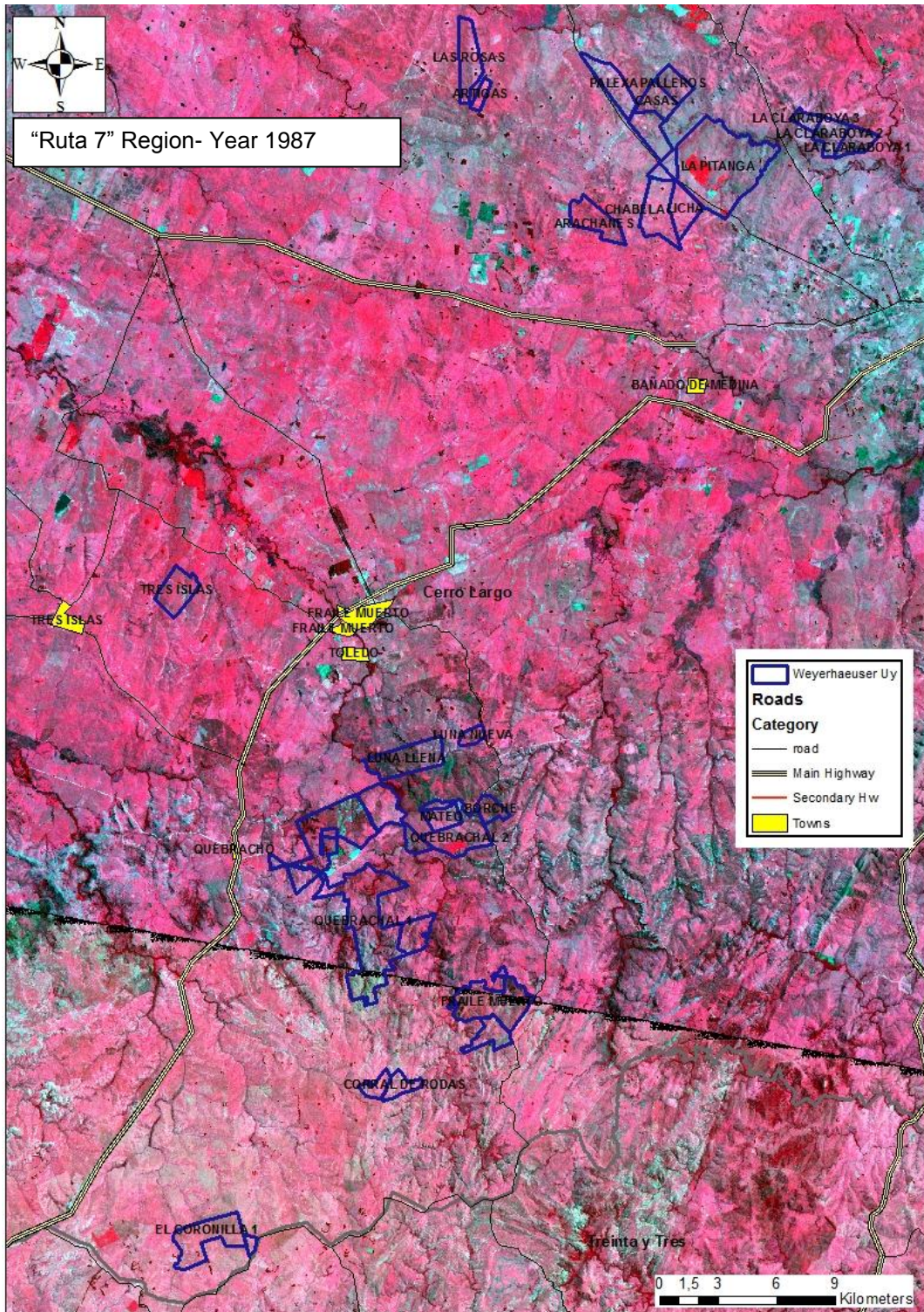
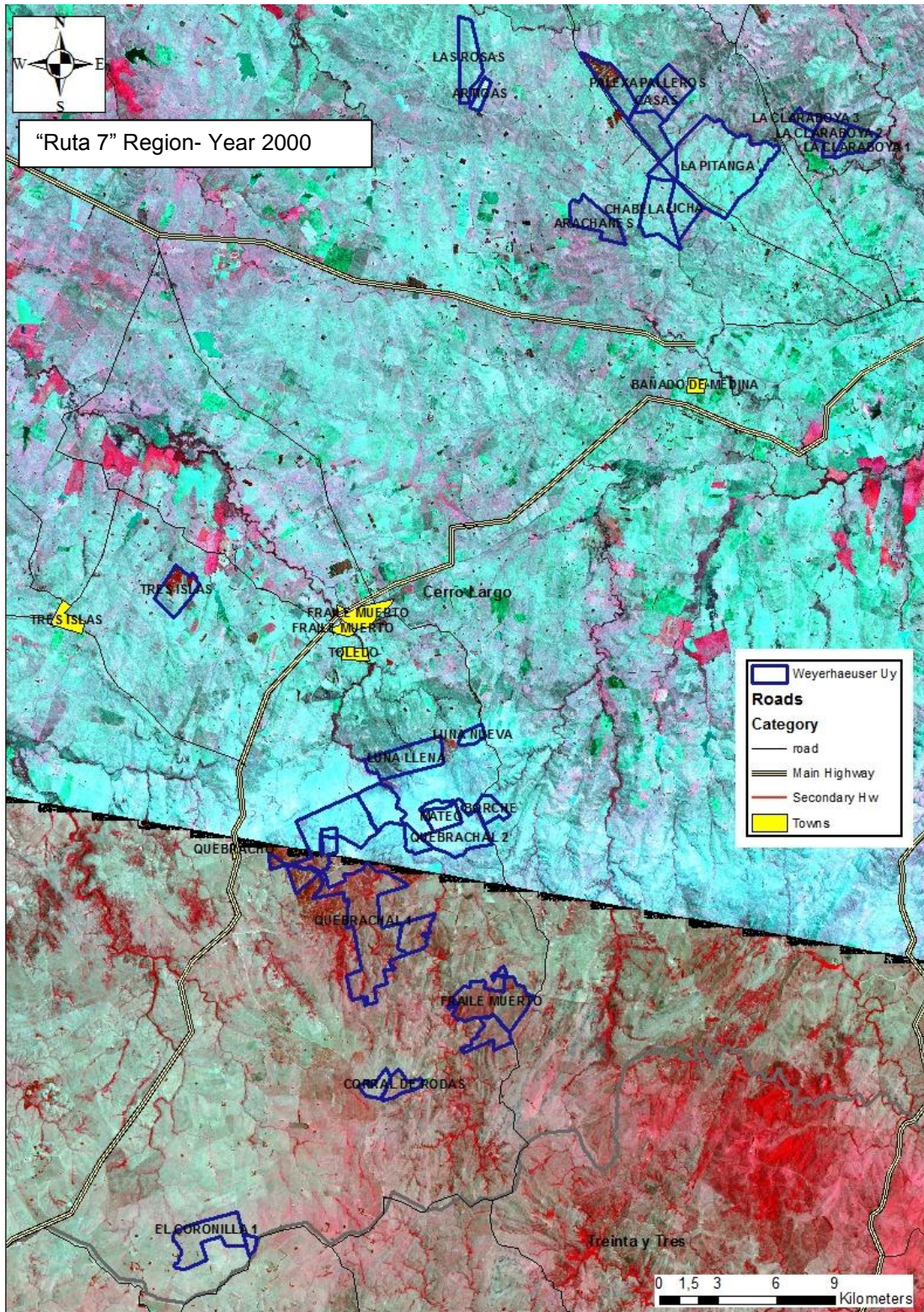


Figure 10. Landsat images of 'Octava CL' region corresponding to March 1987, January 2000 and November 2006.





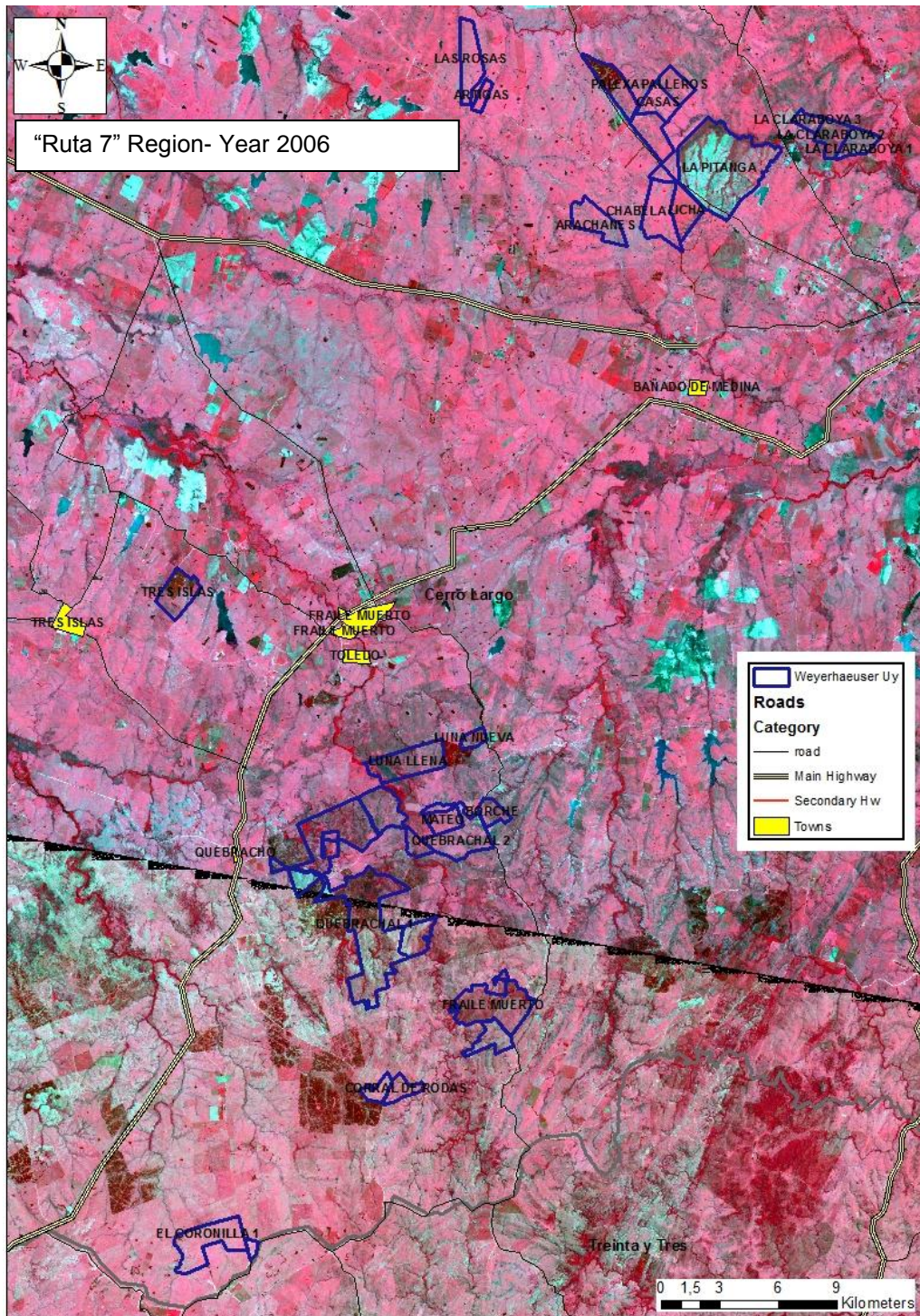
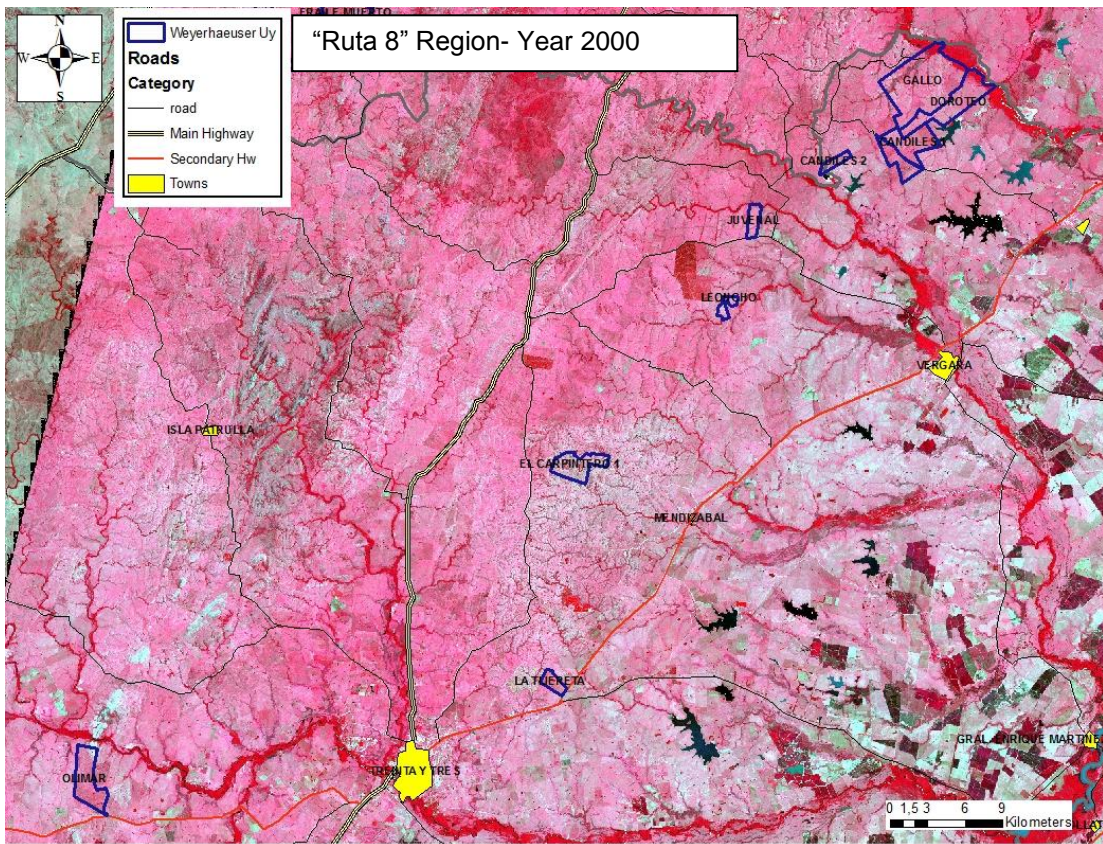
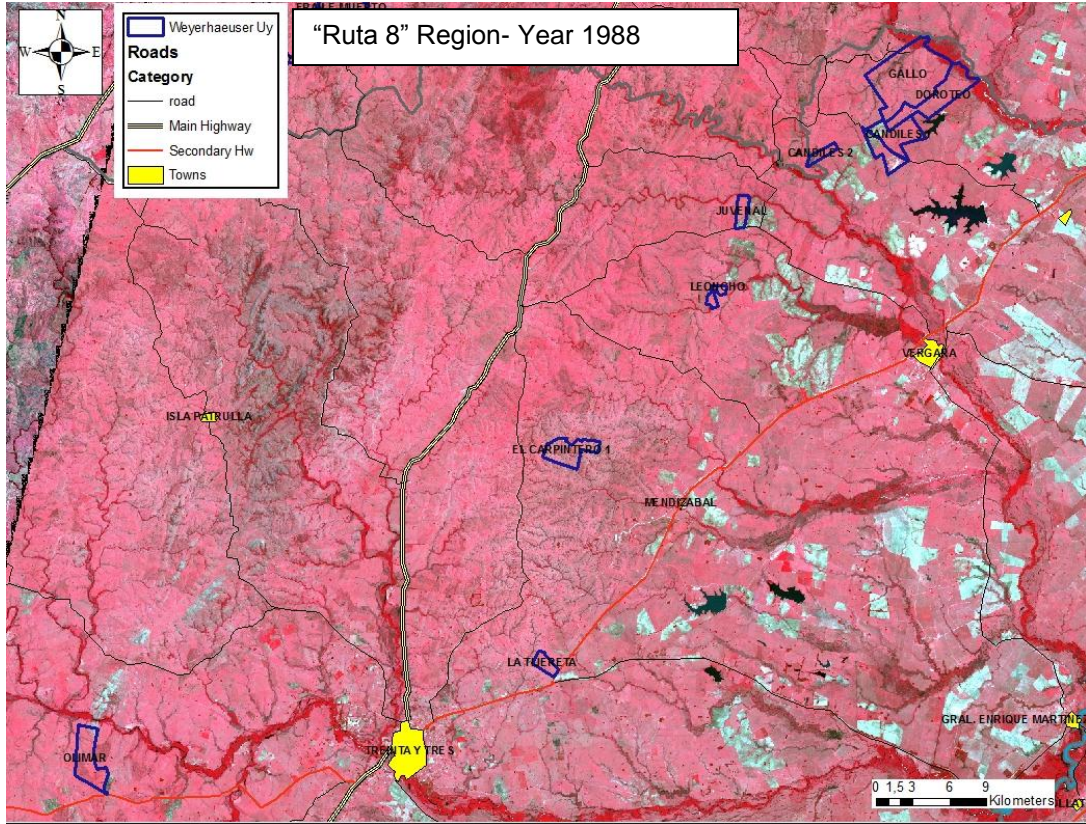


Figure 11. Landsat images of 'Ruta 7' region corresponding to March 1987, January 2000 and November 2006.



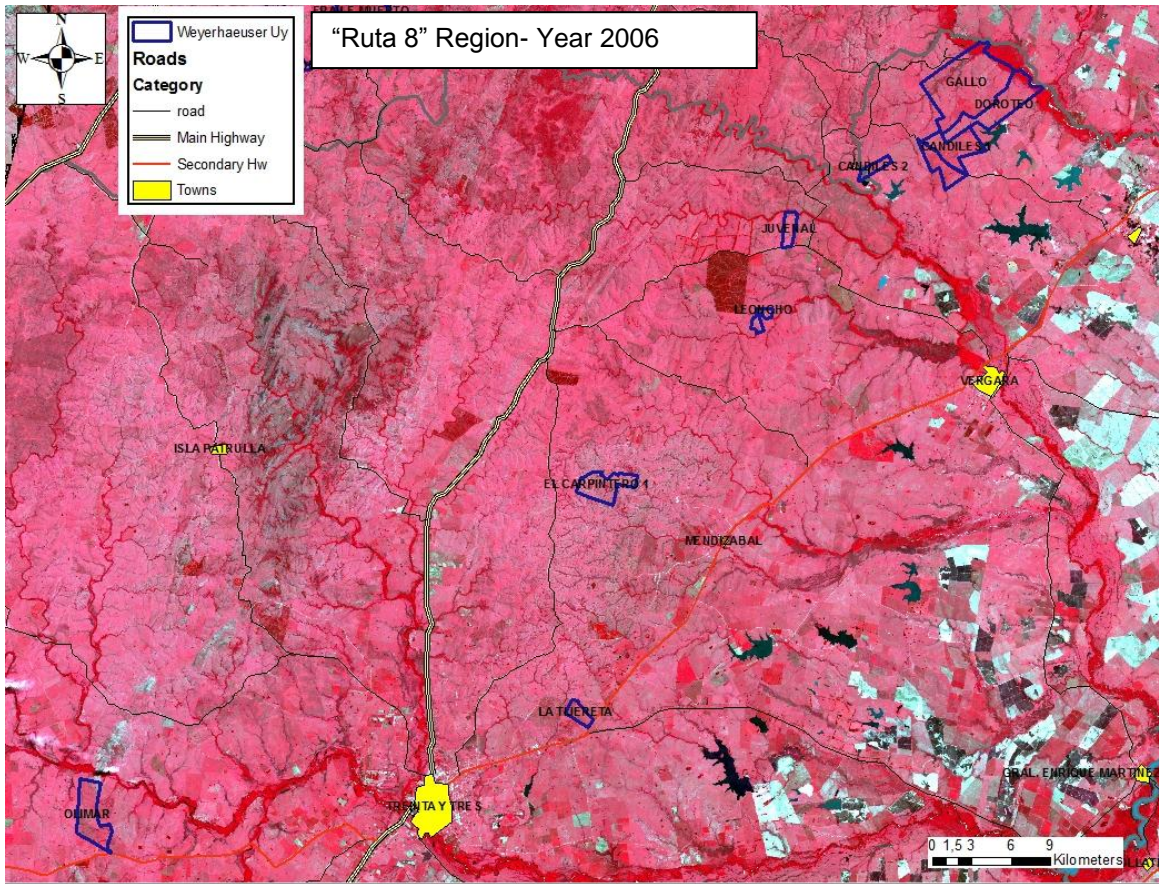
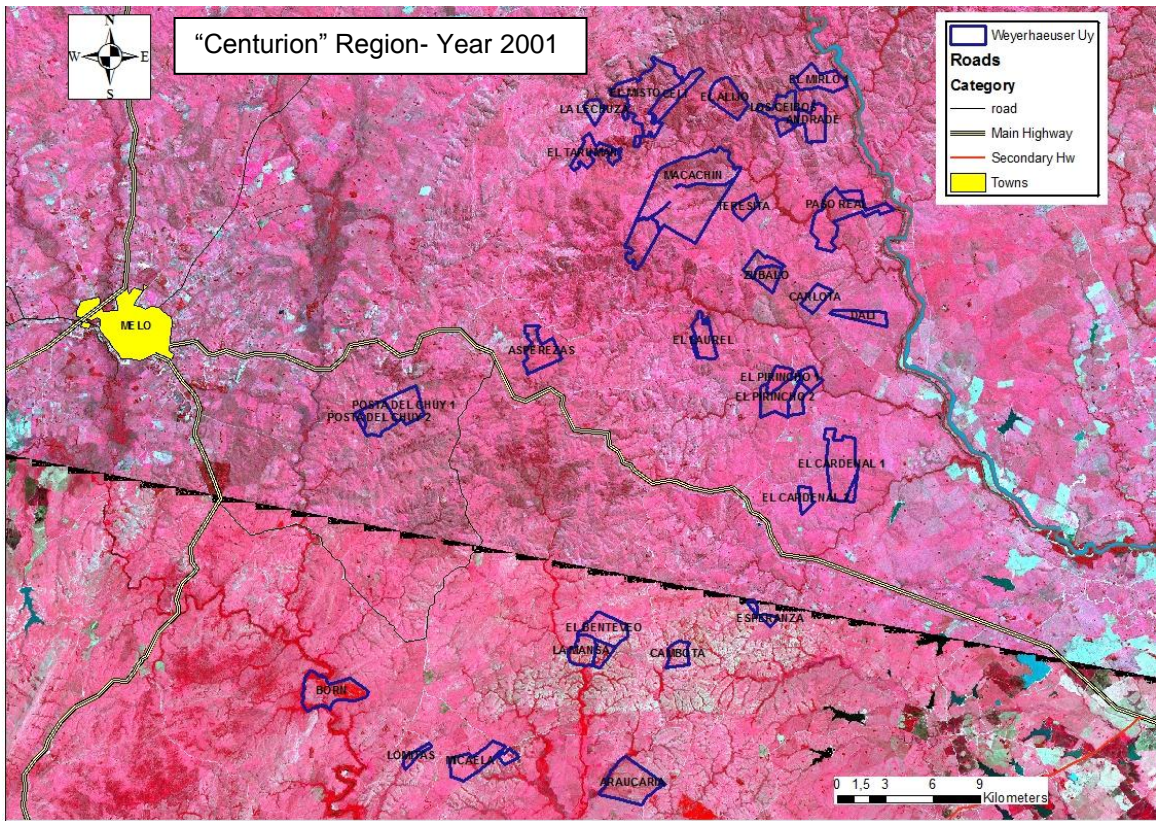
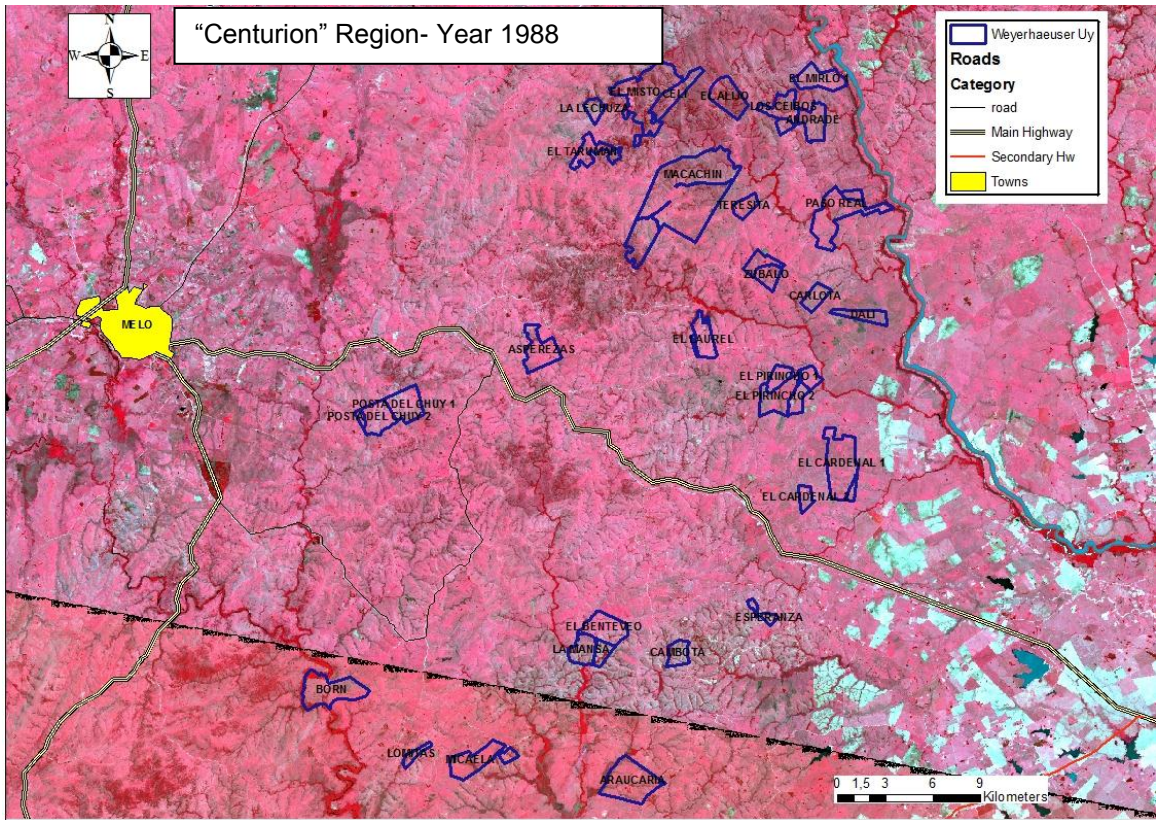


Figure 12. Landsat images of 'Ruta 8' region corresponding to November 1988, December 2000 and November 2006.



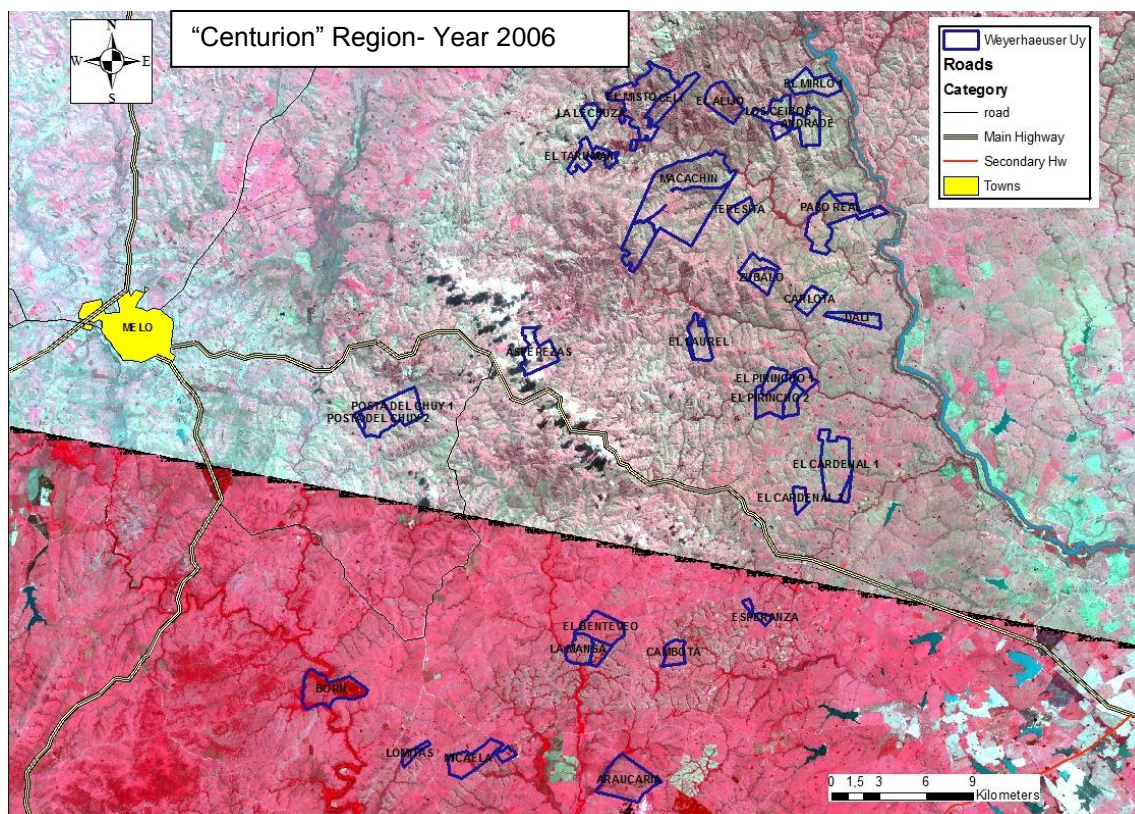


Figure 13. Landsat images of 'Centurion' region corresponding to November 1988, April 2001 and August 2006.

The main source of all Landsat satellite images used for the Land eligibility for afforestation analysis was the INPE web site (<http://www.dgi.inpe.br/CDSR/>). Table 7 shows detailed information and source from the different Landsat satellite images used.

Table 7. Landsat satellite images used for the Land eligibility for afforestation analysis

Landsat Image					
Path	Row	Year	Passage Date	Sceneld	Link to INPE web site
223	83	1996	09/05/1996	L5TM22308319960509	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22308319960509&DONTSHOW=0
223	83	2006	28/10/2006	L5TM22308320061028	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22308320061028&DONTSHOW=0
223	82	1996	10/06/1996	L5TM22308219960610	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22308219960610&DONTSHOW=0
223	82	2006	13/11/2006	L5TM22308220061113	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22308220061113&DONTSHOW=0
222	83	1996	03/06/1996	L5TM22208319960603	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22208319960603&DONTSHOW=0
222	83	2006	22/11/2006	L5TM22208320061122	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22208320061122&DONTSHOW=0
222	82	1996	03/06/1996	L5TM22208219960603	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22208219960603&DONTSHOW=0
222	82	2006	02/08/2006	L5TM22208220060802	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22208220060802&DONTSHOW=0
223	83	1987	14/03/1987	L5TM22308319870704	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22308319870704&DONTSHOW=0
223	83	2000	29/01/2000	L5TM22308320000129	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22308320000129&DONTSHOW=0
223	82	1987	14/03/1987	L5TM22308219870906	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22308219870906&DONTSHOW=0
223	82	2000	25/03/2000	L5TM22308220000402	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22308220000402&DONTSHOW=0
222	83	1988	04/11/1988	L5TM22208319880816	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22208319880816&DONTSHOW=0
222	83	2000	31/12/2000	L5TM22208320000902	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22208320000902&DONTSHOW=0
222	82	1988	01/11/1988	L5TM22208219880816	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22208219880816&DONTSHOW=0
222	82	2001	22/04/2001	L5TM22208220010804	http://www.dgi.inpe.br/CDSR/manage.php?INDICE=L5TM22208220010804&DONTSHOW=0

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 water logging damage; areas with very steep slopes were excluded to prevent serious soil erosion loss.

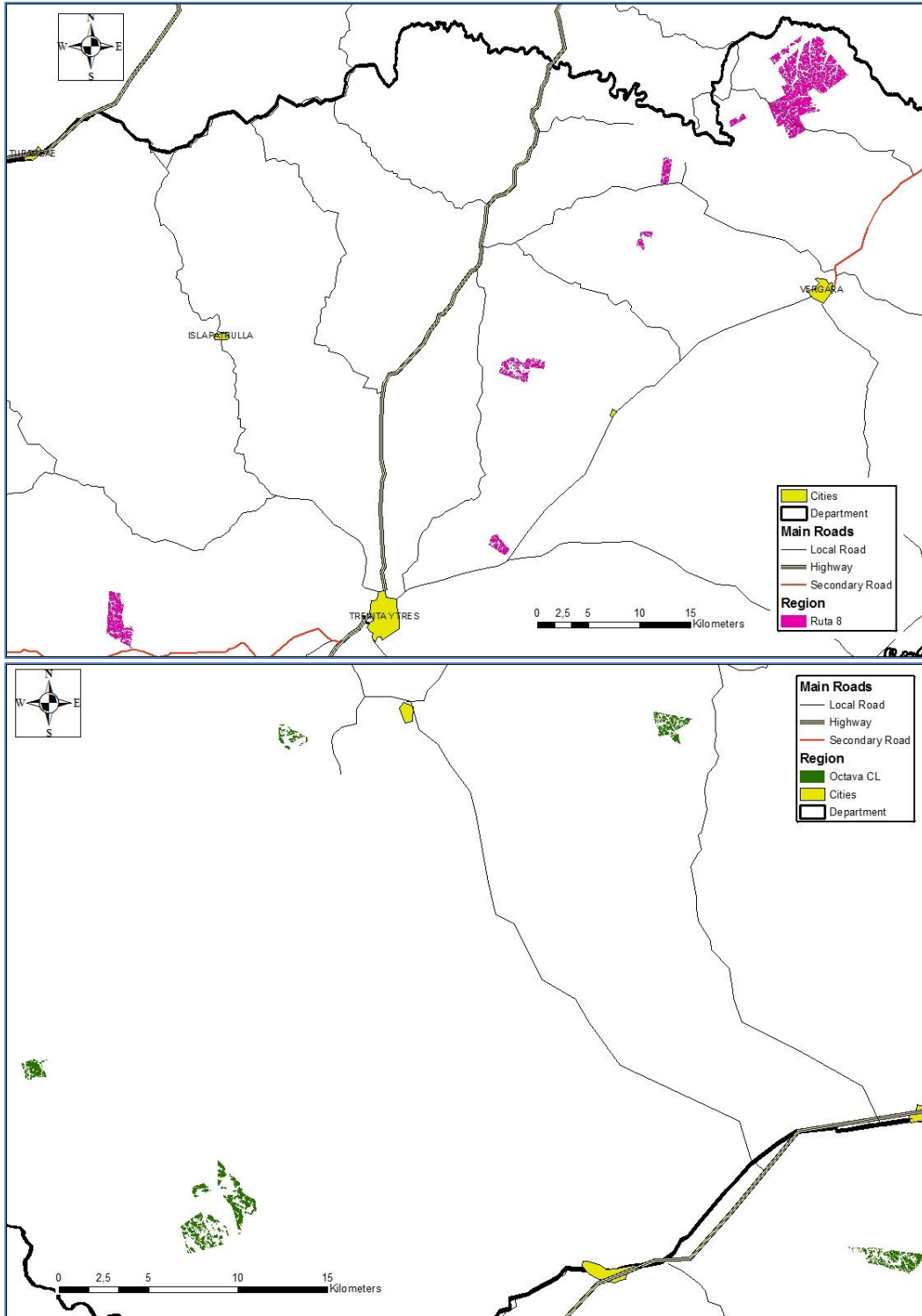
Site aptitude for tree species to be planted: areas suitable for Eucalyptus and Pine trees were included.

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 20-m wide strips on the edge of eucalypt and pine planted areas, where special management and harvest practices will be adopted (e.g., no interventions during nesting periods of certain birds) 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. Cattle could graze these areas.

Firebreaks: a network of 20-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. These areas are not included in the project boundaries.

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 using a 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 **Figure 14**.



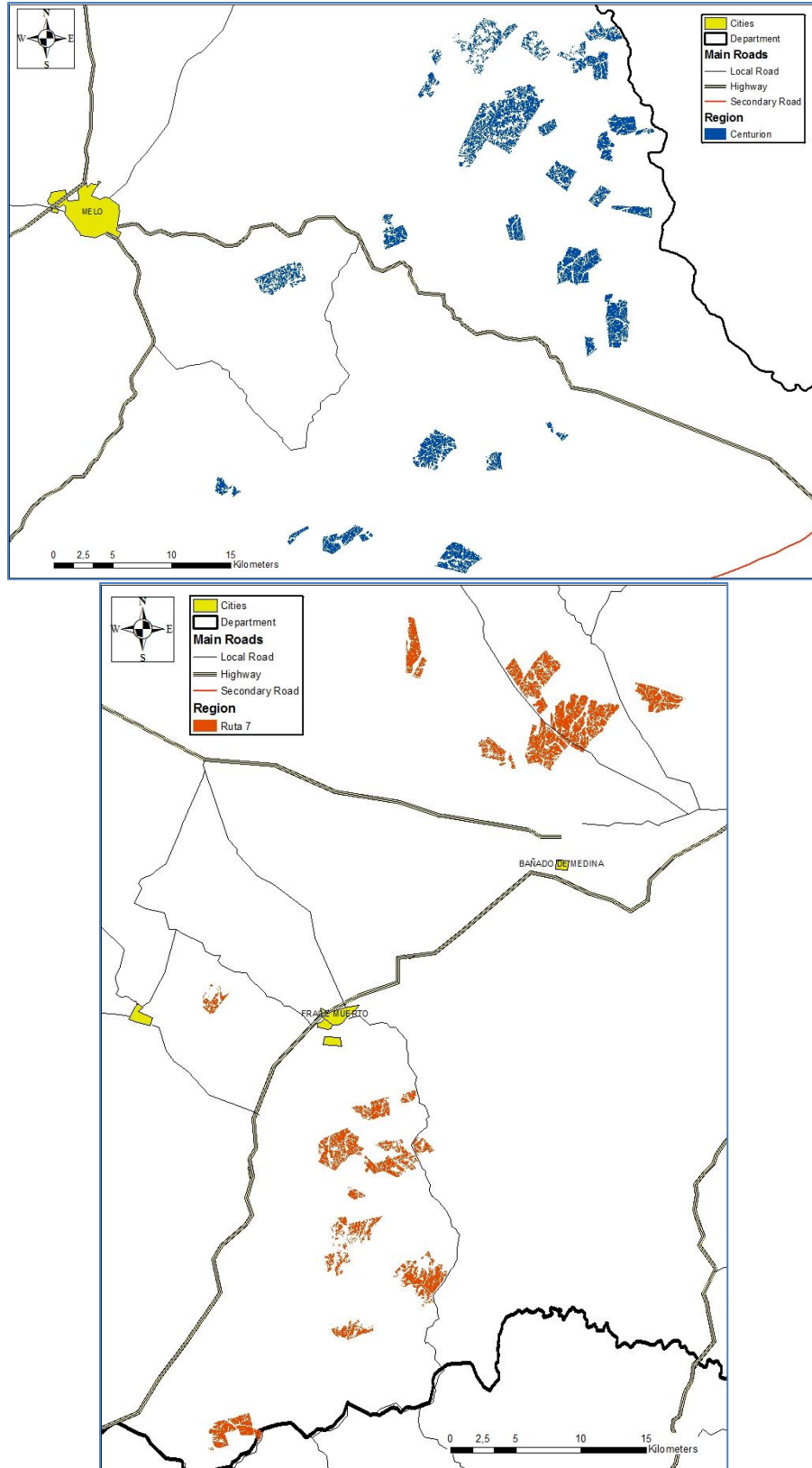


Figure 14. Project boundaries (delimited painted areas) by region: Ruta 8, Octava CL, Centurion and Ruta 7

Five carbon pools are selected: above-ground and below-ground biomass, dead wood, litter and soil organic carbon. Harvested wood products were not selected because it is not eligible under the selected methodology. 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 the implementation of the proposed project activity. It is very clear in the case of dead wood and litter, since these pools do not virtually exist in the pre-project situation, and will appear under forest. In the case of soil organic carbon the situation is more complex. Even though 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.

None of the GHG emission sources mentioned in the methodology from biomass burning of woody biomass was selected.

Table 8. GHG emission sources

Source		Gas	Included?	Justification/Explanation
Project	Burning of woody biomass	CO ₂	No	Carbon stock decreases due to burning are accounted as a change in carbon stock
		CH ₄	No	Fire for site preparation is not part of forest management and will not lead to emissions of methane
		N ₂ O	No	Potential emissions are negligibly small

2.4 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

Weyerhaeuser Uruguay started its afforestation project on February 2006, this is before the registration date and after 31 December 1999. The analysis of satellite images shown in **Figure 10** to **Figure 13** illustrates that afforestation process did not start within project boundaries until 2006.

Step 1. Identification of alternative land use scenario to the proposed ARR project activity

According to the National Agricultural Census done in 2000 (<http://www.mgap.gub.uy>), grassland under extensive grazing (i.e., beef cattle and wool sheep) is the dominant land use in this area, being the main source of income in 79% of the properties present in the region, as shown in Table 9.

Table 9. Land uses prior project initiation, categorized by main source of income per property

Main income source	Cerro Largo	Treinta y Tres	Percentage
Fruit production	24	5	1%
Vineyards	2	0	0%
Horticulture	63	19	1%
Grains	127	90	4%
Dairy	156	67	4%
Beef cattle	2052	1458	64%
Wool sheep	536	272	15%
Forest	42	7	1%
Pigs and birds	128	45	3%
Others	152	58	4%
No income	164	15	3%
TOTAL	3446	2036	100%

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

1. Continuation of pre-project land use (extensive cattle grazing with no pasture improvement)

Cattle and sheep production has been the traditional rural activity in the project area and in all its surrounding region since the 17th century. In soils of low productivity -like the ones in the project area-, the main products obtained are wool to be 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. This production system has remained more or less the same for decades. The main change has been almost the complete displacement of sheep by beef cattle, due to the decline in wool prices during the last 10-15 years. In spite of the relatively low productivity of this system (30-60 kg meat per hectare per year), it has survived due to its very low cost and low risks.

2. Forestation of the land within the project boundary without being registered as the AVR CDM project activity

Afforestation for pulpwood (short rotation) is the most common type in Uruguay. These plantations are normally combined with extensive grazing of forest service areas. The extension of forest plantations in the regions of the project is low.

The type of forest management to be applied in the proposed project activity (long rotation with pruning and thinning) is not widespread in Uruguay.

3. Other alternatives

No other possible alternative scenarios have been identified.

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

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

Step 2. Barrier analysis

Sub-step 2a. List of barriers

Following is a list of all possible barriers that might be identified applicable in the following sub-step2b, for the land-use alternatives identified above:

- Investment barriers
 - -Lack of access to credit (long term)
- Barriers related to land tenure, ownership, inheritance and property rights, inter alia:
 - -Possibilities of large price risks due to the fluctuations in the prices of products over the project period in the absence of efficient markets and insurance mechanisms;
 - -Lack of incentive for land owners to invest in their lands
 - -Remoteness of land area and undeveloped road and infrastructure incur large transportation expenditures, thus eroding the competitiveness and profitability of products from the land use
 - -Land tenure specific features
 - -High land opportunity cost associated with the international high prices of commodities (soybean, wheat, maize, etc.)
 -
- Barriers due to local ecological conditions, inter alia:
 - -Degraded soil
 - -Pervasive opportunistic species prevailing land use
 - -Unfavorable meteorological conditions, *increase of extreme weather events*
 - -High erosion risk (e.g. steep slopes)
 - - Low soil quality
 - -Increase of the incidence of pest and plagues that did not exist in the past
- Technological barriers
 - - Lack of capacity to predict systems productivity (e.g. doubtful growth models)
 - - Lack of capacity to predict the mechanical or physical properties of *E. grandis* species for saw timber production
 - - Uncertainty about the local and international market capacity to absorb high-valued (knot free and large diameters) *E. grandis* logs.
- Barriers related to local tradition, inter alia:
 - -Traditional knowledge or lack thereof, laws and customs, market conditions and practices
 - -Traditional equipment and technology
 - Barriers due to prevailing practice, inter alia:

- -The land use scenario is the “first of its kind”: No activity of this type is currently operational in the host country or region

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

Alternative 1

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

Alternative 2

The alternative 2 “Forestation of the land within the project boundary without being registered as the A/R CDM project activity” is an activity that faces several barriers which finally prevents the activity from being implemented. Following is a summary of the most relevant ones.

Forest plantation with the characteristics applied by Weyerhaeuser Uruguay is not a common practice in the region. In fact, this production system in terms of local tradition is not well known. This activity started to develop in the 1990’s as a result of the forest policy implemented in 1987. In comparison with cattle grazing (more than 300 years from its introduction) is a new form of production. Therefore, knowledge and technology for its implementation is starting to be developed and diffused in the region. There is a noticeable difference between the return periods considered by landowners -who are used to expect a yearly income from their production-, while forestry projects have a period of 10 or more years for return on the investment. In addition, land owners in the region generally lack the capacity and equipment for conducting forestry activities.

This alternative is also prevented by remoteness of land area, which imposes high transportation cost for wood products by very bad roads most of the time (developed in the investment analysis section).

In terms of technology, the adoption of a 16 and 21-year rotation imposes uncertainties about wood productivity and quality; wind damages; and harvesting of thick logs, which are additional to other uncertainties applicable to shorter-rotation plantations (e.g., even longer terms for returns on investment and possible pest and disease outbreaks, among others)..

There are uncertainties related to the productivity that can be reached, particularly considering that the soils in the project area are of lower quality than those soils in the North and West regions in Uruguay where most long-rotation plantations have been developed. The only growth model for *E. grandis* available in Uruguay (INIA SAG-grandis) has been validated for other regions of the country than NE, where the project activity is being implemented. In addition, there are no models available for pine plantations in Uruguay neither for *Eucalyptus dunnii* applying thinning operations.

Also, adopting a long rotation implies sticking to the same genotypes for long periods, thus missing the opportunity of capitalizing on progress through plant breeding, which would be achieved by more frequent replanting. The quality of the wood to be obtained (i.e., whether it would be suitable for the high-price market it is targeted for) is also subjected to uncertainty. The underlying assumption in the design of the project activity is that logs to be obtained at clear-cut harvest will be of a quality at least similar to that of logs that could be obtained in shorter rotations.

Another uncertainty relates to an eventual increase in felling off or damage to trees by wind storms. Intensive thinning of eucalypt and pine plantations is known to increase the risk of wind damages due to the opening of wide spaces within the forest that may channel the wind and increase its speed, aggravated by the vulnerability of tall trees. There is no information on an eventual increase in this

vulnerability in thinned stands with very tall trees such as those with ages 16 or more, but there have been some cases of plantations losses due to strong wind storms.

Risk of erosion within location area is moderate to high, with moderately steep slopes which could reach 30-40%, resulting in high vulnerability of soils. Besides, considering overgrazing history during summers in the region, this alternative is subject to uncertainty about wood productivity due to the degradation process suffered by soils in the project area which, as discussed in the section above about “assessment of applicability conditions”, have lost a fraction of their net primary productivity due to grazing, aggravated by the gully erosion process

Sub-step 2c. List of scenarios that are not prevented by any barrier

Application of the decision tree of sub-step 2c (considering the outcome of sub-step 2b) leads to the following conclusions:

Continuation of pre-project activity has been identified as the most plausible scenario in the absence of the proposed project activity. The pre project activity will continue as it has been shown for the last 20 years.

2.5 Additionality

Additionality has been demonstrated through application of Steps 0 to 2 above and through Common Practice Analysis in Step 4 (in this section below). Despite the fact that sub-step 2c resulted in only one land use scenario and according to the “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities” it is the baseline scenario, the investment analysis was conducted in the afforestation activity to reinforce the conclusion that forest activity in the area was not meant to be developed without being registered in a carbon scheme and generating carbon certifies.

Investment analysis

Sub-step 3a. Determine appropriate analysis method

The Investment analysis will not determine which of the remaining land use scenario is the most economically or financially attractive because there is only one land use scenario remaining. However, it will demonstrate that the IRR for each location does not reach the benchmark IRR.

Option III, benchmark analysis is selected.

Sub-step 3b. Apply benchmark analysis

The benchmark is to represent standard returns in the market, considering the specific risk of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer.

The IRR is selected as the indicator for the benchmark analysis. The Capital Asset Pricing Model (CAPM) is used to estimate the expected internal rate of return on unleveraged project activity that compensates the investor on risk and time value of money (k_e)

Benchmark analysis is done considering the year when the first area to afforest, of each of the regions, was projected. Thus, four benchmarks were estimated (year 2006, 2007, 2008 and 2009).

For a developing country, k_e is determined according to the following equation:

$$k_e = r_f + [E(R_m) - r_f] \beta + prs$$

Where:

k_e = project cost of capital (benchmark project IRR, %)

r_f = risk free rate (%)

$[E(R_m) - r_f]$ = premium for market risk (%)

β = systematic risk of the project activity (dimensionless)

prs = premium for sovereign risk (%)

Determination of the risk free rate r_f

The chosen value for r_f is the yield of 30-year US Treasury bonds.

r_f equals 4.9%, 4.8%, 4.3% and 4.2% in 2006, 2007, 2008 and 2009 respectively in accordance with the US Department of the Treasury

<http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yieldYear&year=2006>

Determination of the premium for market risk $[E(R_m) - rf]$

The arithmetic average annual premium for market risk with respect to US Treasury bonds is selected. It is a conservative value, from a well-documented source (Damodaran, 2011) who calculated the premium for market risk for the period from 1928 to 2011 (a period of 20 years before the project initiation was selected). The following procedure was followed to obtain the selected value for this parameter:

Go to <http://pages.stern.nyu.edu/~adamodar/>

- 1) Click Valuation Icon
- 2) Go to point 3. TOPIC
- 3) Click Datasets icon
- 4) Go to Data sets chart
- 5) Click historical Returns on stocks, Bonds and Bills – United States

Other possible sources for premium for market risk would yield a similar result. These include:

Ibboston Associates (www.ibboston.com)

Barra (www.barra.com)

Bloomberg (www.bloomberg.com)

The estimated values are 5.6% (2006) 4.8%(2007) 4.6% (2008) and 4.2% (2009)

Determination of the systematic risk of the project activity: β

It has to be considered that systematic risk of forestry activities depends greatly on the markets where the industries are located. As an example, average unleveraged β values for paper/wood/forestry sectors for the year 2006 are estimated to be 0.82 (USA), 1.27 (emerging markets), 1.04 (Japan), 0.75 (Europe) and 1.09 (Australia/Canada) by the New York University L.N. Stern School of Business (Damodaran 2011).

Uruguay is an emerging market. The average value of β for these markets (considering Paper & Related Products and Forestry) for the period 2006-2007 was 1.27 (Damodaran 2011). However, for the purpose of this analysis more conservative values of 0.50, 0.57, 0.69 and 0.60 were selected (2006 to 2009 respectively). These are average betas of all emerging markets estimated by Damodaran (only for paper and forest products) without considering location. This value was derived by the following procedure:

- 1) Go to <http://pages.stern.nyu.edu/~adamodar/>
- 2) Click Valuation Icon
- 3) Go to point 3. TOPIC
- 4) Click Datasets icon
- 5) Chart Dataset

There are other possible sources for obtaining a suitable β value would yield similar results. These include:

Ibboston Associates (www.ibboston.com)

Barra (www.barra.com)

Bloomberg (www.bloomberg.com)

Determination of Premium for Sovereign Risk, prs

Sovereign risk reflects the amount of additional market risk for public bonds from one country as compared to the reference case (in this case, the US). The difference in yield between bonds issued by the US Treasury and those from another country constitutes the Premium for Sovereign Risk. Average premium for sovereign risk for Uruguay for year 2006 was calculated at 3.81, in 2007 was 3.67, in 2008 as 3.65 and 2009 as 3.68 percentage points. Reputable and public sources of information were used¹³.

Calculation of benchmark Internal Rate of Return for the afforestation activity

$$k_e = r_f + [E(R_m) - r_f] \beta + prs$$

$$2006 \text{ Values: } k_e = 4.9 + [(5.6) \cdot 0.50] + 3.81 = 11.53\%$$

$$2007 \text{ Values: } k_e = 4.8 + [(4.8) \cdot 0.57] + 3.67 = 11.26\%$$

$$2008 \text{ Values: } k_e = 4.3 + [(4.7) \cdot 0.69] + 3.65 = 11.12\%$$

$$2009 \text{ Values: } k_e = 4.2 + [(4.1) \cdot 0.60] + 3.68 = 10.33\%$$

Since the estimated benchmark is in nominal terms, it was discounted by the US CPI in order to make it comparable with the Internal Rate of Return. CPI data was taken from the US Department of Labor (<ftp://ftp.bls.gov/pub/special.requests/cpi/cpi.ai.txt>). Average of the last 10 years prior to project start was selected for the calculation, which resulted in 2.3%, 2.4%, 2.6% and 2.2% for the years 2006, 2007, 2008 and 2009 respectively.

In conclusion, the benchmark IRR in real terms for an afforestation activity without carbon finance in the project area is estimated to be 9.23% (2006), 8.86% (2007), 8.52% (2008) and 8.13% (2009).

Sub-step 3c. Calculation and comparison of IRR

The cash flow estimated for an afforestation activity in the project site without the financial benefits from the carbon credits will be available for the validation team as part of the PD documentation. The cash flow included all relevant costs and revenues along the crediting period.

Eight IRRs were estimated, corresponding to each of the regions consistent with forest regions delineated before (Centurion, Octava CL, Ruta 7 and Ruta 8) and the specie planted. The estimated IRRs for afforestation without carbon finance in the project area are shown in table 10.

¹³ www.rafap.com.uy

Table 10 Benchmarks and IRR comparison for each specie and region.

<i>Specie</i>	<i>Region</i>	<i>Year</i>	<i>Benchmark %</i>	<i>IRR (%)</i>
Eucalyptus	Centurion	2007	8,8	6,5
Eucalyptus	Octava CL	2008	8,5	5,4
Eucalyptus	Ruta 7	2006	9,2	7,3
Eucalyptus	Ruta 8	2007	8,8	6,4
Pine	Centurion	2007	8,8	3,3
Pine	Octava CL	2009	8,1	2,0
Pine	Ruta 7	2006	9,2	3,7
Pine	Ruta 8	2006	9,2	2,9

The estimated IRRs for afforestation in the project area without profits from carbon credits are therefore lower than the estimated benchmark IRR, for all regions and starting dates.

It is again concluded that the continuation of the pre-project land use is the baseline scenario. A sensitivity analysis was made to make the conclusion that the project activity does not meet the benchmark more robust.

Sub-step 3d. Sensitivity analysis

The sensitivity analysis was performed by using the Montecarlo simulation method (Fischman 1996). Probability density functions for several parameters used for estimation of the cash flow were defined, and 1,000 estimates of the IRR were made for random combinations of those parameters. The analysis showed that the probability of the IRR of being lower than the benchmark for the three locations where the project activity is being held is 100%. Thus, the conclusion above is again highly robust.

Following is the summary (table and graph showing the distribution of the simulated IRR values for the 1,000 runs) of the results obtained by the Montecarlo simulation for each location (assumptions made for the simulation can be found at annex):

Summary:	
Entire range is from 1,7% to 3,2%	
Base case is 2,0%	
Statistics:	Forecast values
Trials	1,000
Base Case	2.0%
Mean	2.5%
Median	2.5%
Mode	---
Standard Deviation	0.3%
Variance	0.0%
Skewness	0.1479
Kurtosis	2.77
Coeff. of Variability	0.1055
Minimum	1.7%
Maximum	3.2%
Range Width	1.5%

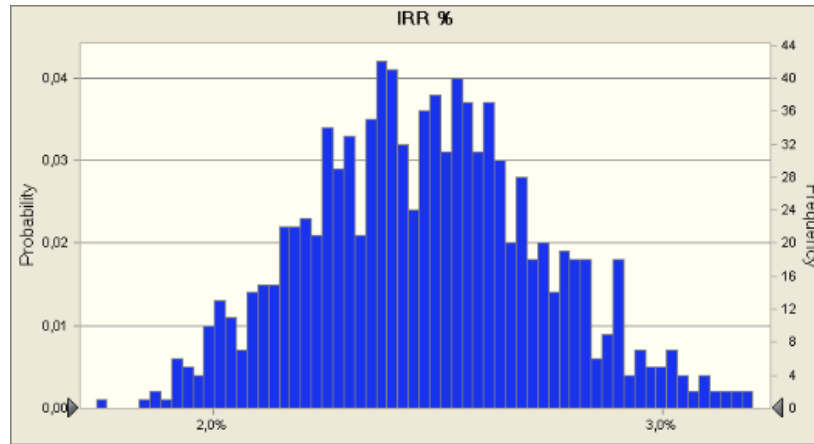


Figure 15. Outcomes of the sensitivity analysis for Pine in Octava CL region

Summary:

Entire range is from 1,5% to 4,2%

Base case is 2,9%

Statistics:

Statistics:	Forecast values
Trials	1,000
Base Case	2,9%
Mean	2,9%
Median	3,0%
Mode	---
Standard Deviation	0,5%
Variance	0,0%
Skewness	-0,1148
Kurtosis	2,86
Coeff. of Variability	0,1579
Minimum	1,5%
Maximum	4,2%
Range Width	2,7%

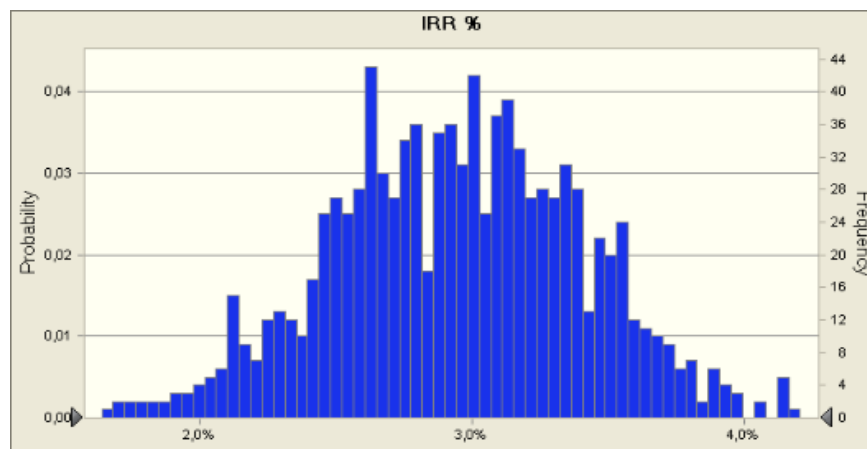


Figure 16. Outcomes of the sensitivity analysis for Pine in Ruta 8 region

Summary:

Entire range is from 2,3% to 5,0%

Base case is 3,7%

Statistics:	Forecast values
Trials	1,000
Base Case	3.7%
Mean	3.8%
Median	3.8%
Mode	---
Standard Deviation	0.4%
Variance	0.0%
Skewness	-0.0561
Kurtosis	2.76
Coeff. of Variability	0.1100
Minimum	2.3%
Maximum	5.0%
Range Width	2.7%

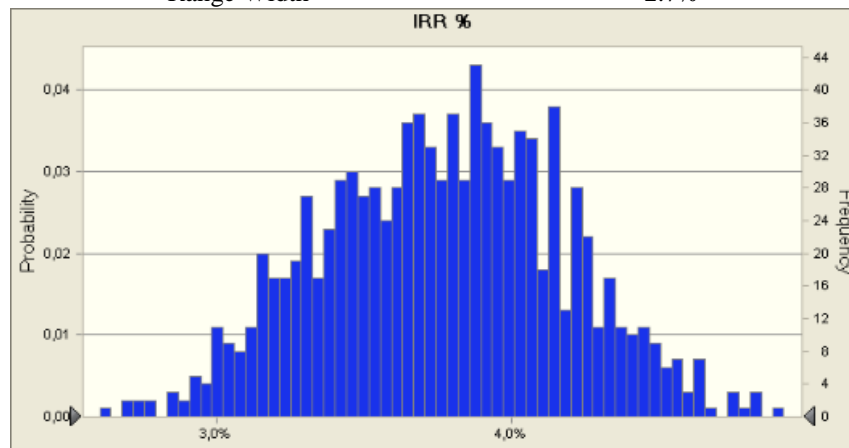


Figure 17. Outcomes of the sensitivity analysis for Pine in Ruta 7 region

Summary:

Entire range is from 1,9% to 4,4%

Base case is 3,3%

Statistics:	Forecast values
Trials	1,000
Base Case	3.3%
Mean	3.3%
Median	3.3%
Mode	---
Standard Deviation	0.4%
Variance	0.0%
Skewness	-0.1434
Kurtosis	2.91
Coeff. of Variability	0.1293
Minimum	1.9%
Maximum	4.4%
Range Width	2.5%

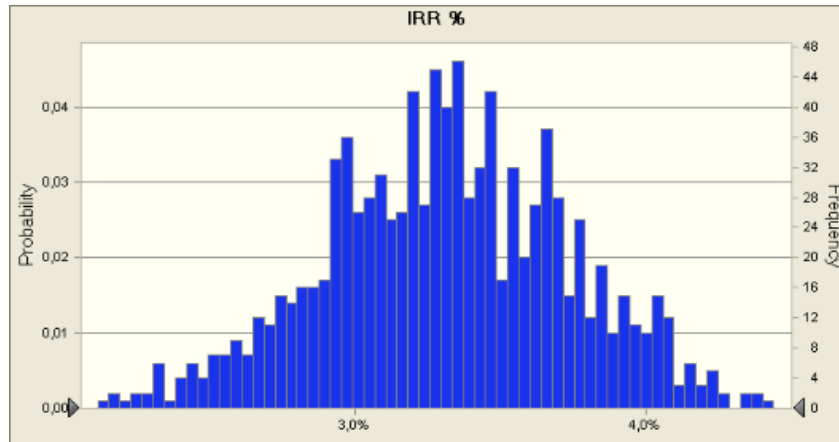


Figure 18. Outcomes of the sensitivity analysis for Pine in Centurion region

Summary:

Entire range is from 4,1% to 8,1%

Base case is 6,4%

Statistics:

	Forecast values
Trials	1.000
Base Case	6,4%
Mean	6,4%
Median	6,4%
Mode	---
Standard Deviation	0,6%
Variance	0,0%
Skewness	-0,2267
Kurtosis	3,19
Coeff. of Variability	0,0936
Minimum	4,1%
Maximum	8,1%
Range Width	4,0%

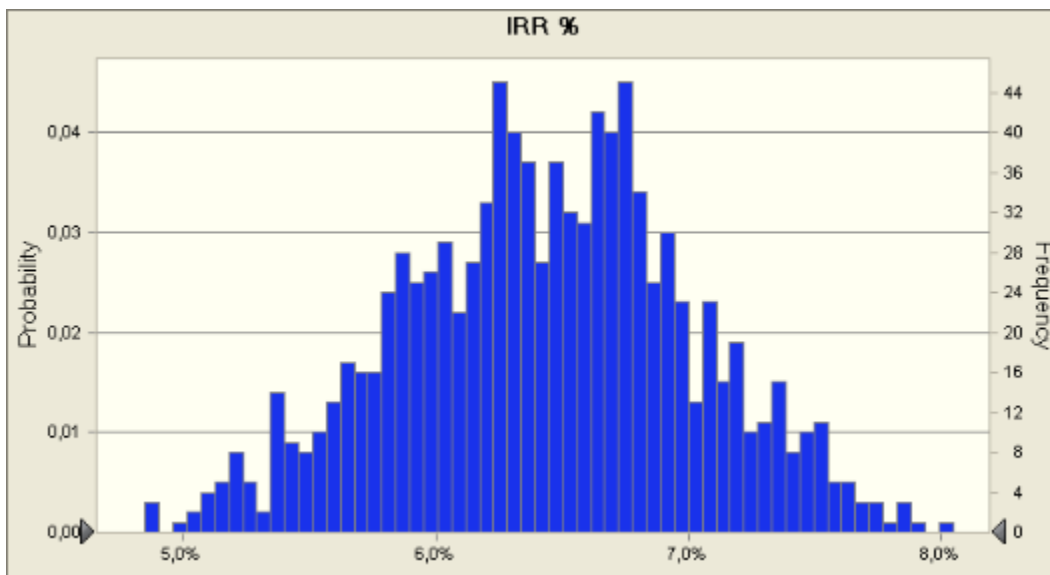


Figure 19. Outcomes of the sensitivity analysis for Eucalyptus in Ruta 8 region

Summary:

Entire range is from 3,6% to 7,4%

Base case is 5,4%

Statistics:	Forecast values
Trials	1.000
Base Case	5,4%
Mean	5,4%
Median	5,4%
Mode	---
Standard Deviation	0,6%
Variance	0,0%
Skewness	-0,0835
Kurtosis	2,88
Coeff. of Variability	0,1142
Minimum	3,6%
Maximum	7,4%
Range Width	3,8%

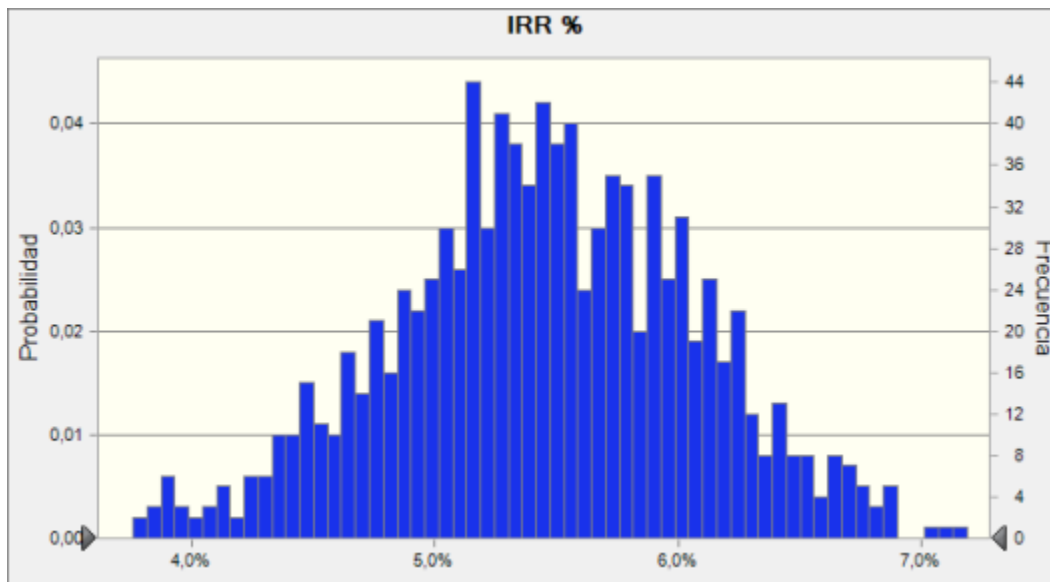


Figure 20. Outcomes of the sensitivity analysis for Eucalyptus in OctavaCL region

Summary:

Entire range is from 4,6% to 8,1%

Base case is 6,5%

Statistics:	Forecast values
Trials	1.000
Base Case	6,5%
Mean	6,5%
Median	6,5%
Mode	---
Standard Deviation	0,6%
Variance	0,0%
Skewness	-0,0195

Kurtosis	2,57
Coeff. of Variability	0,0952
Minimum	4,6%
Maximum	8,1%
Range Width	3,4%

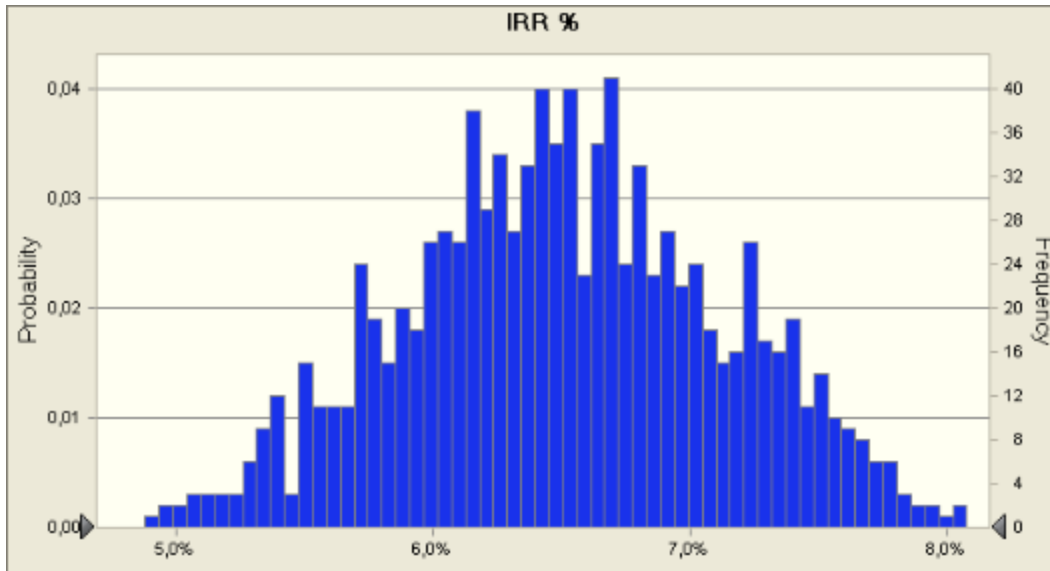


Figure 21. Outcomes of the sensitivity analysis for Eucalyptus in Centurion region

Summary:

Entire range is from 5,4% to 8,9%

Base case is 7,3%

Statistics:

	Forecast values
Trials	1.000
Base Case	7,3%
Mean	7,3%
Median	7,3%
Mode	---
Standard Deviation	0,6%
Variance	0,0%
Skewness	-0,0819
Kurtosis	2,88
Coeff. of Variability	0,0802
Minimum	5,4%
Maximum	8,9%
Range Width	3,6%

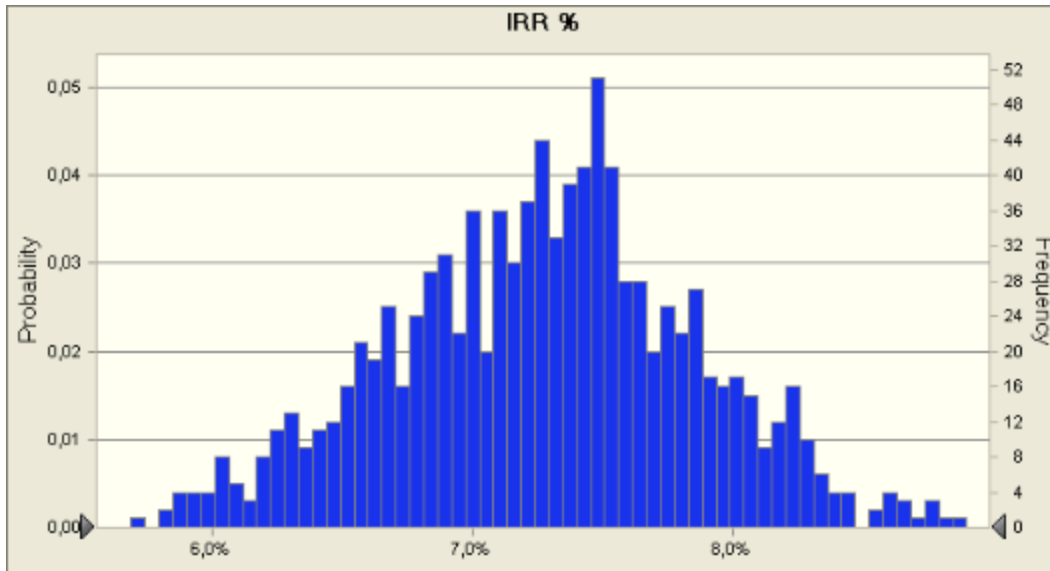


Figure 22. Outcomes of the sensitivity analysis for Eucalyptus Ruta 7 region

Step 4. Common practice analyses

In spite of a large extension of forest priority soils in the Departments of Treinta y Tres and Cerro Largo, the forest promotion policy implemented in 1987 resulted in only a limited extent of afforestation. Approximately only 10% of “forest priority soils” area established in the regulatory framework has been afforested (according to the *Ministry of Livestock, Agriculture and Fisheries*, the total area of “forest priority soils” in the department of Cerro Largo and Treinta y Tres is 1,014,066 ha¹⁴). This represented a very different scenario from that in the other forest regions of the country. As it was explained above, the reasons for this lack of response are to be found in the long distances to wood delivery points (industries or ports) and in the poorer quality of the soils as compared to the North and West regions.

The relatively small area that was forested in the NE region (Cerro Largo and Treinta y Tres) during the period 1987-2005 was in response to the existence of a plantation subsidy, the availability of soft credits from Banco de la República and the exemption of all income and land taxes. As the subsidies were gradually decreased since 2002 until their complete suppression in 2005, the rate of plantation also declined (**Figure 23**). The soft credits and several of the tax exemptions were also eliminated between 2003 and 2005.

The subsidies, depending on the year, had a value of up to US\$ 200 per hectare affected to the plantations (including plantations and servicing areas, which normally amount to 50 to 60 per cent of the effectively planted areas). The value of the subsidy was equivalent to more than 50 per cent of the price of the land.

The soft credits for forest planting provided by Banco de la República had low interest rates (LIBOR plus 1.5 to 2.0 per cent per year) and a grace period of 10 years for both principal and interests. They were conceived for short rotation cycles (i.e., 10 years), clearly not appropriate for the NE region of Uruguay due to the relatively low value of pulpwood (the only product that can be obtained in such a short period). And when the time of repayment came for plantations made in the early 1990's, forest owners were

¹⁴ <http://www.cebra.com.uy/renare/mapa/cartas-tematicas/>

forced to renegotiate their debts with the bank because they just could not sell their wood. Many were even forced to sell their properties later. It must be also noted that, after the sharp decline in the LIBOR occurred in 2001, the Banco de la República unilaterally decided to change the rules and applied a value higher than LIBOR for calculating the interest rates. This aggravated the situation of debtors. This line of soft credits was gradually modified after 2002 and was later phased out.

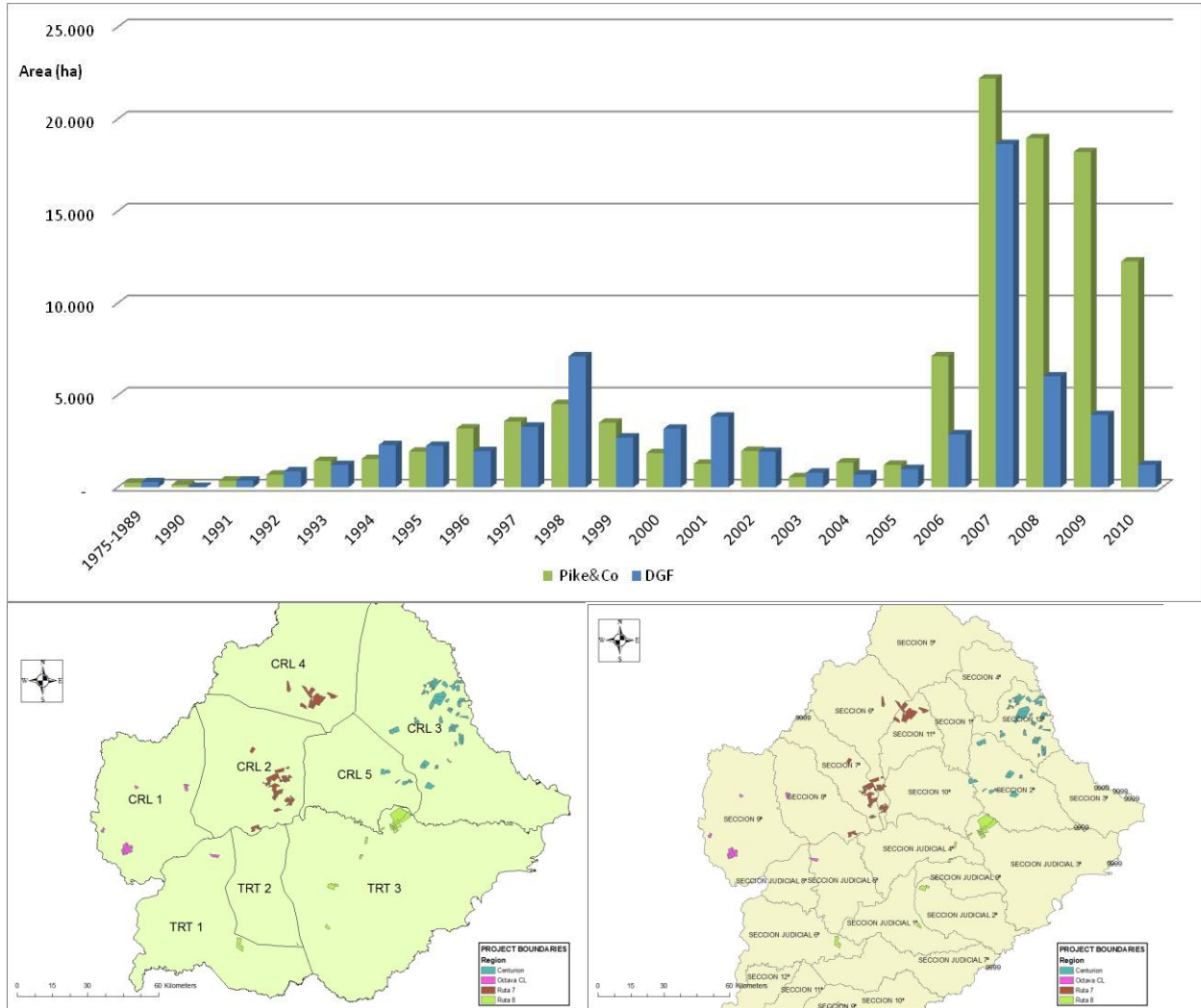


Figure 23. Above: historical annual forest plantation rates in the region of the project according to two sources of information (private data from Pike & Co. and official statistic from Forest General Directorate); Lower left: map with a detail of project area and the geographic units (“foricenters”) included in Pike & Co’s statistics reported in the graph above; Lower right: map with a detail of project area and the geographic units (“Judicial sections”) included in DGF’s statistics reported in the graph above

The situation after 2005 corresponded to a completely different scenario. The rate of plantation in the region increased sharply, in spite of a lack of policy incentives. This increase is highly associated to the consideration of carbon finance by investors. As shown in Table 11, 91 per cent of the forests planted during the period 2006-2011 corresponding to a total of more than 77,000 ha, are either procuring or have already achieved registration under carbon programs (CDM, CCX and VCS).

Table 11. Forest area planted between 2006 and 2011, by owner, in Weyerhaeuser Uruguay project region.

Company	Genus		Effective	Seeking Carbon
	Eucalyptus	Pinus	Area (ha)	Finance
Weyerhaeuser Uruguay SA	19.741	2.887	22.628	Yes (VCS)
Guanare	22.605		22.605	Yes (VCS)
GFP		21.497	21.497	Yes (VCS)
RMK	4.415		4.415	Yes (VCS)
Pradera Roja	3.826		3.826	Yes (VCS)
CJPPU	3.274		3.274	Not known
POSCO	2.076		2.076	Yes (CDM)
Others	1.937		1.937	Not known
ITAA	1.186		1.186	Yes (VCS)
BULGUERONI	906		906	Not known
Antonio Arocena	850		850	Yes (VCS)
Forestal Oriental	603		603	Not known
Tierras Forestales	501		501	Not known
FERNÁNDEZ	300		300	Not known
Yandian	107		107	Not known
Agrosocio Brasileiro	72		72	Not known
SAPS KRAZEMBLUM	53		53	Not known
Total Area (ha)	62.451	24.384	86.835	

Yes (VCS or CDM)	79.082	91%
Not Known	7.753	9%

The common practice analysis was done following the requirements set in the Step 4 of the “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities”. It was analyzed in it, to which extent similar forestation activities to the one proposed have been implemented previously or are currently underway. Similar forestation activities are defined as that which are of similar scale, take place in a comparable environment, inter alia, with respect to the regulatory framework and are undertaken in the relevant geographical area.

Throughout the analysis is concluded that there are similar forest activities (in terms of scale, species, etc) in the area (table 11). However, 91% of those companies established in the area are seeking carbon finance. There was not identification of similar forest activities without requiring carbon finance (paragraph 33 of the tool). Therefore, there is no need to compare the proposed project activities to others (paragraph 34 of the tool). In conclusion, similar activities cannot be observed, then the project activity is not the baseline scenario, and hence it is additional.

2.6 Methodology Deviations

No deviations from the procedures indicated by the methodology have been made.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

Assumptions were taken in accordance with the “Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks”. This guideline is used to ensure that application of default data in estimation of the net anthropogenic GHG removals by sinks results in conservative, but not overly conservative, estimates.

3.1 Baseline Emissions

Under the applicability conditions of the methodology AR/ACM-001, it is assumed that changes in carbon stock of above-ground and below-ground biomass of non-tree vegetation may be conservatively assumed to be zero for all strata in the baseline scenario, also it is expected that the baseline dead wood and litter carbon pools will not show a permanent net increase. It is therefore conservative to assume that the sum of the changes in the carbon stocks of dead wood and litter carbon pools is zero for all strata in the baseline scenario. Moreover, since carbon stock in SOC is unlikely to increase in the baseline, the change in carbon stock in SOC may be conservatively assumed to be zero for all strata in the baseline scenario.

As it is demonstrated, baseline is the continuation of extensive grazing (previous activity). The entire area within the project boundaries were and would have been covered by pastures. Thus, it is not applicable to account for tree and shrubs baseline biomass.

Overall, 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.

3.2 Project Emissions

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

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

Where:

C_{AR-CDM}	Net anthropogenic GHG removals by sinks; t CO ₂ -e
ΔC_{ACTUAL}	Actual net GHG removals by sinks; t CO ₂ -e
ΔC_{BSL}	Baseline net GHG removals by sinks; t CO ₂ -e
LK	Total GHG emissions due to leakage; t CO ₂ -e

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

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

Where:

ΔC_{ACTUAL}	Actual net greenhouse gas removals by sinks; t CO ₂ -e
ΔC_P	Sum of the changes in above-ground and below-ground tree biomass, dead wood, litter and soil organic carbon stocks in the project scenario; t CO ₂ -e
GHG _E	Increase in GHG emissions as a result of the implementation of the proposed A/R CDM project activity within the project boundary; t CO ₂ -e

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

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

Where:

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

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

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

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

Carbon stock changes

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

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

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

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

ΔC_{SHRUB} Change in carbon stock in shrub biomass in project, in year t. Under the applicability conditions of the methodology changes in carbon stock of above-ground and below-ground biomass of shrubs will be conservatively assumed to be zero for all strata in the project scenario

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

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

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

Biomass carbon pools

Above and below ground biomass have been estimated according to the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activity”. A summary of the main factors used and each source of data are presented in the table 12 below. Estimations are archived as part of the project documentation and will be available for the validation team. The following equations were used in order to estimate above and below ground biomass, and biomass carbon stock:

$$B_{TREE} = V_{TREE} * D_j * BEF_{2,j} * (1 + R_j)$$

- B_{TREE} Biomass of trees within the project boundaries at a given point in time
- V_{TREE} Stem volume of tree species estimated by using the tree dimension(s) as entry data into a volume table; m³
- D_j Basic wood density of tree species j; t d.m. /m³
- $BEF_{2,j}$ Biomass expansion factor for conversion of stem biomass to above-ground tree biomass, for tree species j; dimensionless
- R_j Root-shoot ratio for tree species j; dimensionless

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

- C_{TREE} Carbon stock in tree biomass in tree biomass within the project boundary at a given point of time; t CO₂-e
- B_{TREE} Biomass of trees within the project boundaries at a given point in time
- CF_{TREE} Carbon fraction of tree biomass; t C t d.m⁻¹

Table 12. Assumed parameters used for estimation of tree biomass carbon stocks

Parameter	Symbol	E. grandis, E dunnii and P. taeda	Source
Mean Annual Increment (m ³ .ha ⁻¹ .yr ⁻¹)	MAI _j	From 18 to 30	Growth model: SAG grandis and SISPINUS)
Wood basic density (Mg.m ⁻³)	D _j	0.44, 0,482 and 0.46 respectively	Country-specific values
Biomass expansion factor (dimensionless)	BEF _{1j}	From 1.15 to 3.4	IPCC Good Practice Guidance for LULUCF (2003), Table 3A.1.10
Carbon fraction (dimensionless)	CF	0.5	Tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs"
Root-to-shoot ratio (dimensionless)	R _j	From 0.2 to 0.4	Tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs"

Soil organic carbon

Estimations of soil organic carbon (SOC) stocks were done in accordance to the “Tool for the estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activity”. As suggested by the tool, it is assumed that the implementation of the project activity increases the SOC content of the lands from the pre-project level to the level that is equal to the steady-state SOC content under native vegetation. The increase in SOC content in the project scenario takes place at a constant rate over a period of 20 years from the year of planting. The project meets the applicability conditions of this tool in the area managed with Pine plantations:

- the areas of land to which the tool is applied do not fall into wetland category, do not contain organic soils and are not subject to any of the land management practices and application of inputs listed in Tables 1 and 2 of the tool;
- Since the land use prior to project start was grassland, only Table 2 applies. For the temperate warm moist climate region corresponding to the project activity, none of the three combinations included in Table 2 are applicable;
- litter remains on site and is not removed and soil disturbance is in accordance with appropriate conservation practices, limited to site preparation and not repeated within 20 years.

Table 13. Parameters used for estimation of SOC

Parameter	Symbol	Value	Source (SOC estimation tool, V01.1.0)
Reference SOC (tC/ha)	SOC _{REF,i}	88	Table 3 HAC soils, warm temperate
Land use factor	f _{LU,i}	1	Table 6 All permanent grassland
Management factor	f _{MG,i}	0.95	Table 6 Moderately degraded grassland Overgrazed or moderately degraded grassland, with somewhat reduced productivity (relative to the native or nominally managed grassland) and receiving no management inputs
Input factor	f _{IN,i}	1	Table 6 Grassland without input of fertilizer

SOC at the beginning of the project (SOC_{INITIAL,i}) is estimated by multiplying the factors in Table 11 by the reference SOC. As per the tool, a loss in SOC (SOC_{LOSS,i}) is applied in the case that soil disturbance occurs on more than 10 per cent of the land area, which is the case of Weyerhaeuser Uruguay project.

The following methodological formula is used for calculating the annual change in SOC stock:

$$dSOC_{t,i} = \frac{SOC_{REF,i} - (SOC_{INITIAL,i} - SOC_{LOSS,i})}{20}$$

Where:

dSOC_{t,i} The rate of change in SOC stock in stratum i of the area of land, in year t; t C/ha/yr

SOC_{REF,i} Reference SOC stock corresponding to the reference condition in native lands by climate region and soil types applicable to stratum i of the area of land; tC/ha

SOC_{INITIAL,i} SOC stock at the beginning of the A/R CDM project activity in stratum i of the areas of land

SOC_{LOSS,i} Loss of SOC caused by soil disturbance attributable the A/R CDM project activity, in stratum i of the areas of land ; tC/ha

Application of the equation results in an estimated increase of 0.64 t C/ha/year in soil organic carbon.

Litter and Dead Wood

Estimations were done in accordance with the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”. Values of the conservative default-factors expressing carbon stock in litter and dead wood as a percentage of carbon stock in tree biomass was selected according to the guidance provided in the methodological tool (8% in the case of dead wood and 4% for litter).

$$C_{DW} = C_{TREE} * DF_{DW}$$

- C_{DW} Carbon stock in dead wood at a given point in time; t CO₂-e
- C_{TREE} Carbon stock in trees biomass at a point in time, as calculated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activity”; t CO₂-e
- DF_{DW} Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass; percent

$$C_{LI} = C_{TREE} * DF_{LI}$$

- C_{LI} Carbon stock in litter at a given point in time; t CO₂-e
- C_{TREE} Carbon stock in trees biomass at a point in time, as calculated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activity”; t CO₂-e
- DF_{LI} Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass; percent

3.3 Leakage

The methodology requires the assessment of sources of leakage due to activity displacement (conversion from grazing land to forestry). Application of the tool “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” led to the conclusion that this source can be neglected. The application of the “Guidelines on conditions under which increase in GHG emissions related to displacement of pre-project grazing activities in A/R CDM project activity is insignificant”, which is one of the applicability conditions of the tool, resulted in the conclusion that the project will not cause any displacement of the activity occurring before project implementation.

Beef cattle breeding (cow-calf) was the dominant activity in the pre-project land (Eastern hilly areas of Uruguay). Cattle were based on a breeding herd where heifers are mostly placed with bulls at the age of 3 years. Sales include culling cows to be fattened, surplus heifers, and calves (at weaning). Average production is 33 kg per ha per year¹⁵. Existing cattle in the pre-project situation it is commonly sold to the market. (calves and surplus heifers are normally sold in the market for fattening on other grazing areas, while cows, heifers and a reduced number of bulls are sold to slaughterhouses).

Furthermore, according to data gathered from governmental Livestock Controller Division (DICOSE)¹⁶ there has been a smooth increase in the beef cattle and sheep stock in the departments of Cerro Largo and Treinta y Tres (where the project activity occurs) in the last decade (from 1.75 million livestock units, LSU, in 2003 to 1.92 million LSU in 2009). On the other hand, according to data taken from National Forest Directorate (DGF)¹⁷ forest plantations have also been increasing for the same period of time (from 37 thousand hectares in 2003 to 72 thousand hectares in 2009) in the same departments. In addition, native forest has been also increasing in terms of area in the last 43 years at the National level. According to National Forest Inventory (2010)¹⁸ and to the forest maps based on aerial photographs of 1967¹⁹ native forests have increased 21% in terms of area. The fact that total forest area and amount of livestock have been increasing, analyzing Cerro Largo and Treinta y Tres official data, is an evidence that project activity does not result in displacement of the previous productive system. Therefore, leakage is assumed to be zero.

3.4 Summary of GHG Emission Reductions and Removals

Baseline net GHG removals and total GHG emissions due to leakage are zero, thus ex-ante estimation of C AR-CDM equals ΔC ACTUAL.

According to VCS version 3.1 AFOLU requirements, the amount of carbon credits must not exceed the long term GHG benefit of the project. The period over which the long term average GHG benefit is calculated is 116 years (to include the harvest in the last rotation cycle started before the end of the crediting period). The total GHG benefit, calculated as the sum of stock changes along the 116 year period, is 5,601,938 tCO₂ (Table 14).

¹⁵ INIA., 2001. Tecnologías forrajeras para sistemas ganaderos de Uruguay. Boletín de Divulgación 76.

¹⁶ <http://www.mgap.gub.uy/DGSG/DICOSE/dicose.htm>

¹⁷ <http://www.mgap.gub.uy/portal/hgxpp001.aspx?7,20,442,O,S,0,,>

¹⁸ <http://www.mgap.gub.uy/portal/hgxpp001.aspx?7,20,440,O,S,0,,>

¹⁹ URUGUAY MAP. Forest Directorate.- First Forest Chart. Montevideo: MAP, 1979 ([http://www.mgap.gub.uy/portal/hgxpp001.aspx?7,20,410,O,S,0,MNU;E;2;15;125;1;MNU;,"](http://www.mgap.gub.uy/portal/hgxpp001.aspx?7,20,410,O,S,0,MNU;E;2;15;125;1;MNU;,))

Table 14. Estimated net GHG removals

Year s	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)	Year s	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
	0	0	0	0	2057	0	-1.209.502	0	-1.209.502
2007	0	37.277	0	37.277	2058	0	-642.734	0	-642.734
2008	0	212.894	0	212.894	2059	0	-1.076.447	0	-1.076.447
2009	0	486.207	0	486.207	2060	0	165.800	0	165.800
2010	0	668.227	0	668.227	2061	0	515.431	0	515.431
2011	0	810.604	0	810.604	2062	0	647.218	0	647.218
2012	0	902.422	0	902.422	2063	0	708.952	0	708.952
2013	0	847.996	0	847.996	2064	0	645.013	0	645.013
2014	0	785.569	0	785.569	2065	0	546.670	0	546.670
2015	0	772.363	0	772.363	2066	0	40.838	0	40.838
2016	0	634.177	0	634.177	2067	0	-42.543	0	-42.543
2017	0	148.829	0	148.829	2068	0	108.929	0	108.929
2018	0	-57.589	0	-57.589	2069	0	-21.496	0	-21.496
2019	0	105.812	0	105.812	2070	0	351.832	0	351.832
2020	0	-84.348	0	-84.348	2071	0	42.513	0	42.513
2021	0	434.356	0	434.356	2072	0	-1.145.467	0	-1.145.467
2022	0	539.668	0	539.668	2073	0	-1.248.999	0	-1.248.999
2023	0	238.554	0	238.554	2074	0	-690.562	0	-690.562
2024	0	-1.017.346	0	-1.017.346	2075	0	-964.668	0	-964.668
2025	0	-1.245.241	0	-1.245.241	2076	0	277.073	0	277.073
2026	0	-685.268	0	-685.268	2077	0	699.250	0	699.250
2027	0	-1.049.216	0	-1.049.216	2078	0	767.607	0	767.607
2028	0	126.156	0	126.156	2079	0	757.844	0	757.844
2029	0	431.572	0	431.572	2080	0	760.346	0	760.346
2030	0	580.272	0	580.272	2081	0	581.965	0	581.965
2031	0	725.770	0	725.770	2082	0	24.364	0	24.364
2032	0	658.064	0	658.064	2083	0	-135.735	0	-135.735
2033	0	699.780	0	699.780	2084	0	103.229	0	103.229
2034	0	176.765	0	176.765	2085	0	-168.532	0	-168.532
2035	0	10.503	0	10.503	2086	0	348.679	0	348.679
2036	0	172.641	0	172.641	2087	0	156.326	0	156.326
2037	0	-31.333	0	-31.333	2088	0	-953.569	0	-953.569
2038	0	456.810	0	456.810	2089	0	-1.276.999	0	-1.276.999
2039	0	198.399	0	198.399	2090	0	-634.350	0	-634.350
2040	0	-1.027.044	0	-1.027.044	2091	0	-1.186.886	0	-1.186.886
2041	0	-1.324.600	0	-1.324.600	2092	1	14.313	0	14.313
2042	0	-687.013	0	-687.013	2093	2	402.915	0	402.915
2043	0	-1.181.716	0	-1.181.716	2094	3	679.206	0	679.206

2044	0	130.151	0	130.151	2095	4	608.904	0	608.904	
2045	0	526.381	0	526.381	2096	5	775.714	0	775.714	
2046	0	731.944	0	731.944	2097	6	664.072	0	664.072	
2047	0	707.366	0	707.366	2098	7	161.165	0	161.165	
2048	0	785.912	0	785.912	2099	8	1.983	0	1.983	
2049	0	539.135	0	539.135	2100	9	175.395	0	175.395	
2050	0	-72.278	0	-72.278	2101	10	-20.970	0	-20.970	
2051	0	-200.040	0	-200.040	2102	11	436.245	0	436.245	
2052	0	148.321	0	148.321	2103	12	197.196	0	197.196	
2053	0	-106.027	0	-106.027	2104	13	-990.208	0	-990.208	
2054	0	505.384	0	505.384	2105	14	-1.244.660	0	-1.244.660	
2055	0	323.188	0	323.188	2106	15	-740.027	0	-740.027	
2056	0	-900.783	0	-900.783						
TOTAL							0	5.601.938	0	5.601.938

4 MONITORING

4.1 Data and Parameters Available at Validation

Table 15. Parameters available at validation

Data Unit / Parameter:	A_i
Data unit:	ha
Description:	Area of stratum i
Source of data:	Monitoring of strata and stand boundaries is done using a Geographical Information System (GIS) which allows for integrating data from different sources (including GPS coordinates and Remote Sensing data)
Value applied:	Variable according to stratum
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	N/A

Data Unit / Parameter:	$BEF_{2,i}$
Data unit:	Dimensionless
Description:	Biomass expansion factor for conversion of stem biomass to above-ground biomass for tree species or group of species j
Source of data:	IPCC default values (e.g. Table 3A.1.10 of IPCC GPG-LULUCF 2003)
Value applied:	From 1.15 to 3.4, depending on the tree age
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	BEFs in IPCC reports and national forest inventories are usually applicable to closed canopy forests. If applied to individual trees growing in open field.

Data Unit / Parameter:	CF_j
Data unit:	$t\ C\ t^{-1}\ d.m.$
Description:	Carbon fraction of tree biomass for species or group of species j
Source of data:	The IPCC default value of $0.5\ t\ C\ t^{-1}\ d.m.$
Value applied:	0.5
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	N/A

Data Unit / Parameter:	D_j
Data unit:	t d.m. m ⁻³
Description:	Basic wood density for species or group of species j
Source of data:	National species-specific data from LATU: "Evaluación de parámetros de calidad de Eucalyptus globulus y E. maidenii de plantaciones uruguayas para pulpa de celulosa." and "Densidad, Dureza y Color de Eucalyptus grandis de Uruguay Ing. Quím. Silvia Böthig Informe de Investigación N° 5, Julio 2001"
Value applied:	0.46 and 0.52
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	N/A

Data Unit / Parameter:	R_j
Data unit:	Dimensionless
Description:	Root-shoot ratio for species or group of species j
Source of data:	Calculated as B/A where $B = \exp[-1.085 + 0.9256 \cdot \ln(A)]$, where A is aboveground biomass (t d.m. ha ⁻¹) and B is below-ground biomass (t d.m. ha ⁻¹) [Source: Table 4.A.4 of IPCC GPG-LULUCF 2003]
Value applied:	0.23 to 0.29 depending on the tree age
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	N/A

Data Unit / Parameter:	$V_{TREE\ j\ p\ i}$
Data unit:	m ³
Description:	Stem volume of trees of species or group of species j in plot p in stratum i
Source of data:	Existing local species-specific tree growth models. (SAG globulus and SAG grandis)
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	In case of ex ante calculation, growth was estimated based on average growth according to specific site conditions presented in the project site.

Data Unit / Parameter:	Bark volume
Data unit:	m ³ /ha
Description:	Bark volume of trees of species
Source of data:	Methodological tool "Estimation of carbon stocks

	and change in carbon stocks of trees and shrubs"
Value applied:	15% of total stem volume
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	Stem volume estimations of local growth models are under bark, thus this factor is applied

Data Unit / Parameter:	$f_{N,i}$
Data unit:	Dimensionless
Description:	Relative stock change factor for baseline input regime (e.g. crop residue returns, manure) in stratum i of the areas of land
Source of data:	Tables 6 of "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project" activities.
Value applied:	0.7
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	N/A

Data Unit / Parameter:	SOC_{REF}
Data unit:	$t\ C\ ha^{-1}$
Description:	Reference SOC stock corresponding to the reference condition in native lands (i.e. non-degraded, unimproved lands under native vegetation . normally forest) by climate region and soil type applicable to stratum i of the areas of land
Source of data:	Table 3 of "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project" activities.
Value applied:	88
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	NA

Data Unit / Parameter:	$f_{MG,i}$
Data unit:	Dimensionless
Description:	Relative stock change factor for baseline management regime in stratum <i>i</i> of the areas of land; dimensionless
Source of data:	Table 6 of "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project" activities.
Value applied:	0.95
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	N/A

Data Unit / Parameter:	$f_{LU,i}$
Data unit:	Dimensionless
Description:	Relative stock change factor for baseline land-use in stratum <i>i</i> of the areas of land; dimensionless
Source of data:	Tables 6 of "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM Project" activities.
Value applied:	1
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	N/A

4.2 Data and Parameters Monitored

Table 16. Parameters monitored

Data Unit / Parameter:	D _n
Data unit:	cm
Description:	Diameter of the n th piece of lying dead wood intersecting a transect line
Source of data:	Field measurements along transect lines in sample plots
Description of measurement methods and procedures to be applied:	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied
Frequency of monitoring/recording:	Before every verification event
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures prescribed under National forest inventory are applied. In absence of these, QA/QC procedures from published handbooks or from IPCC GPG LULUCF 2003, may be applied.
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	DBH
Data unit:	cm
Description:	Diameter at breast height of tree
Source of data:	Field measurements in sample plots
Description of measurement methods and procedures to be applied:	Usually the diameter at breast height of the tree, but it could be any other diameter or dimensional measurement (e.g. basal diameter, root-collar diameter, basal area, etc.) applicable for the model or data source used. Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Frequency of monitoring/recording:	Before every verification event
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	H
Data unit:	m
Description:	Height of trees
Source of data:	Field measurements in sample plots
Description of measurement methods and procedures to be applied:	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Frequency of monitoring/recording:	Before every verification event
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	DWR _{L,p,i}
Data unit:	Dimensionless
Description:	Dry-to-wet weight ratio of the litter sub-sample collected from plots
Source of data:	Laboratory measurement of field samples
Description of measurement methods and procedures to be applied:	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. A subsample from the composite sample of litter is taken, oven dried and weighed to determine the dry weight.
Frequency of monitoring/recording:	Before every verification event
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	N/A
Any comment:	It is acceptable to determine this ratio for three randomly selected sample plots in a stratum and then apply the average ratio to all plots in that stratum

Data Unit / Parameter:	N
Data unit:	Dimensionless
Description:	Total number of wood pieces intersecting the transect
Source of data:	Field measurements
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	N/A
Value applied:	N/A
Monitoring equipment:	N/A

QA/QC procedures to be applied:	N/A
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	T
Data unit:	Year
Description:	Time period elapsed between two successive estimations of carbon stock in trees and shrubs
Source of data:	Recorded time
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	N/A
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	N/A
Any comment:	If the two successive estimations of carbon stock in trees are carried out at different points of time in year t_2 and t_1 , (e.g. in the month of April in year t_1 and in the month of September in year t_2), then a fractional value is assigned to T

Data Unit / Parameter:	$a_{p,i}$
Data unit:	m^2
Description:	Area of sampling frame
Source of data:	Area of litter sampling frame used in plot p in stratum i
Description of measurement methods and procedures to be applied:	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied
Frequency of monitoring/recording:	N/A
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied
Calculation method:	N/A
Any comment:	Often a litter sampling frame of $0.50 m^2$ is used

Data Unit / Parameter:	$A_{p,i}$
Data unit:	ha
Description:	Area of sample plot
Source of data:	Field measurement
Description of measurement methods and procedures to be applied:	Standard operating procedures (SOPs) prescribed under national forest inventory are

	applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Frequency of monitoring/recording:	Every five years since the year of the initial verification
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Calculation method:	N/A
Any comment:	Sample plot location is registered with a GPS and marked on the project map

Data Unit / Parameter:	$B_{LI_WET,p,i}$
Data unit:	kg
Description:	Wet weight of the composite litter sample collected from plot p of stratum i; kg
Source of data:	Field measurements in sample plots
Description of measurement methods and procedures to be applied:	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied
Frequency of monitoring/recording:	Every verification
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied
Calculation method:	N/A
Any comment:	N/A

4.3 Description of the Monitoring Plan

Monitoring will be done according to the consolidated methodology AR-ACM0001 “Afforestation and reforestation of degraded land” (version 05,2, EB 65), Analysis of its applicability conditions have been developed in section 2,2 of this PD,

Monitoring comprises gathering information, performing calculations and making estimations of GHG emissions and removals, It ensures that commonly established principles of forest inventory and management are put into practice, All data gathered as part of the monitoring plan are archived electronically and kept at least for two years after the end of the last crediting period,

Physical limits will be calculated and checked periodically, The project boundary and the boundaries of pre-defined strata will be adjusted after plantations are established, This is done by aerial photo interpretation and 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,

Sampling design and stratification

Project boundaries are defined at the beginning of project activity and updated along the crediting period, Boundaries may vary or new strata may be created after disturbances effects (pests, droughts, fire) and boundaries will be redefined, Geographic coordinates are established, recorded and archived, A Geographic Information System will be implemented with the following basic layers:

- project boundaries
- aerial photographs
- soils map
- roads, fences, firebreaks, , etc,
- permanent sampling plots

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

With the purpose of developing the monitoring plan, Weyerhaeuser Uruguay area will be divided into 45 strata, Stratification was done considering region (as described in section 2,3); age class (plantation date); and species planted, Current stratification could suffer subdivisions or merges in the case unexpected disturbances occur or insignificant intra-stratum variability is detected in the annual variation in carbon pools (e.g, forest fires), The size of the sample plot is a trade-off between accuracy, precision, and time (cost) of measurement, The size of the plot is also related to the number of trees, their diameter, and the carbon stock variance among plots, The plot should be large enough to contain an adequate number of trees per plot to be measured, IPCC Good Practice Guidance for LULUCF, chapter 4,3, recommends using a single plot varying between 100 m² to 600m², increasing the size from densely planted stands of 1000 trees per hectare to sparsely planted stands of multi-purpose trees, Because of application of thinning, forest stands in this project, have a low number of trees per hectare, tending to have a few large trees per hectare as the stands get older, and uniformly distributed, Taking into consideration the guidance by IPCC and the project-specific conditions, circular plots of 500 m² have been selected for monitoring, Permanent sampling plots are selected, since these are considered to be more efficient for estimating changes in carbon stocks by filtering out any variance due to plot effect,

Estimation of the number of sample plots was done in accordance with the methodological tool “Calculation of the number of sample plots for measurements within A/R CDM project activities”, Calculations are archived as part of project documentation, The monitoring plan will aim at an estimation of the mean carbon stocks with a precision level of 10% with 90% confidence, These are the values suggested by the selected methodology, and have also been 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), The outcome of the estimation from the tool was a total of 158 plots for the whole project area,

The location of the plots will follow the guidance given by the corresponding methodological tool, as well as IPCC Good Practice Guidance for LULUCF (2002), chapter 4.3, An Arc-Map software (NAPA) developed by Pike & Co, will be used to randomly locate the permanent sampling plots (location is systematic, with random start), This software has a feature to enable the location of all plots on forest areas (i.e., it avoids plots from being located in firebreaks and other non-planted areas), The map with the location of the sampling plots is loaded on the GPS receptors used by forest inventory crews, so that they can reach the plots accurately, An example of the software output for two contiguous strata is shown in **Figure 24**.

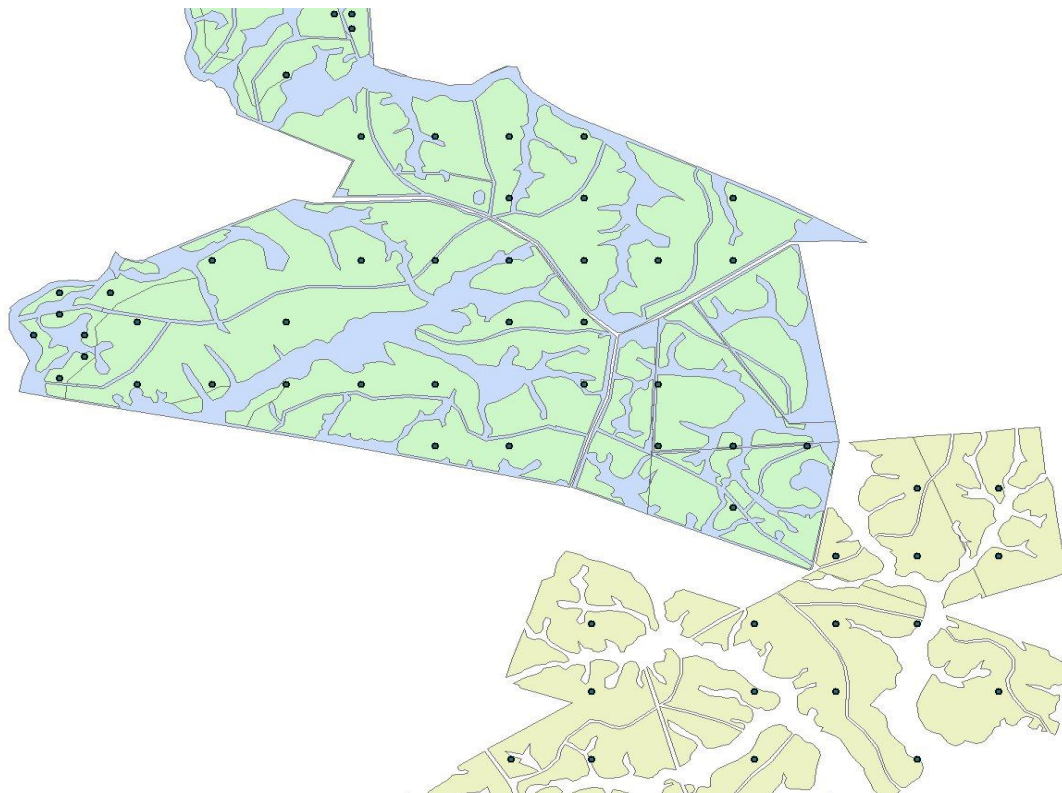


Figure 24. Example of location of permanent sampling plots.

Data Collection

Each pool will be measured following the methodology procedures and IPCC Good Practice Guidance for LULUCF (2003), Carbon stocks in above and below ground biomass of trees are estimated by applying the BEF method, Stem volume, will be calculated applying a manual of procedures developed for local conditions, based on DBH and height measurement in each plot, Stem volume of trees is converted to above-ground and below-ground tree biomass using basic wood density (D), biomass expansion factor (BEF) and root-to-shoot ratio (R), Default carbon fraction (CF) value will be used in order to estimate the carbon stock.

Deadwood will be calculated according to the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities", The conservative default approach might be selected, Otherwise, two types of dead wood will be measured in the field: standing dead wood and lying dead wood, The former will be measured in the same sample plots used for estimating biomass stocks, and will be sub-divided into three categories, The carbon stock for the first two categories (dead standing trees and dead standing trees with fewer leaves and twigs) will be estimated in the same way as for living trees applying a reduction factor to account for lost biomass, The third category, which are standing trees with no leaves and branches, will be also divided into three types according to the rottenness level of the wood (a specific method will be applied in order to define rottenness), Each category will have a specific reduction factor, Laying dead wood will be estimated with the transect method, Two transect lines, intersecting and bisecting orthogonally each other in the center of the plot will be set, The length of the line should be of 100 meters in total, The diameter of wood pieces with diameter larger than 10 cm that are touched by the transect line are measured, The rottenness category is estimated as for standing dead wood, Then the methodological formula is applied.

The conservative default approach might be selected to estimate litter pool, If not, samples for measuring litter carbon stock shall be collected from the same plots used for living biomass estimations, using a sample frame to be laid on the ground on random locations, All litter on the area within the frame will be collected, A sub-sample shall be extracted and weighed, It shall be further oven-dried and weighed again, Dry to wet weight ratio shall be estimated, and the resulting value shall be applied to all samples in the plot, Then the methodological formula is applied.

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

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

Managing data quality

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 on 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.
- development of electronic worksheets for data processing; special software may 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 output and other data shall 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 be 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.

Operational and management structure

The monitoring will be coordinated by the project proponent

Entity applying monitoring plan

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5 ENVIRONMENTAL IMPACT

An Environmental Impact Assessment of the project has been prepared for some of the properties involved in the carbon sequestration project, since not all the properties are required to present the assessment to DINAMA –Environmental Government Entity-. In addition, all properties will be certified under the PEFC certification assesses the environmental impacts of the project, Following is an analysis of possible environmental impacts of the proposed project activity:

Climate change mitigation

This is achieved mainly through carbon sequestration as shown in this PD.

Biodiversity preservation

The 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 independent scientists on behalf of 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 finding 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. The project activity would produce similar impacts.

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 might cause some competition for water with other users (e.g, cattle farms located downstream in the watersheds, hydroelectric power generation, and water for human consumption), Some studies (e.g., Silveira et al., 2006²⁰) 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 (e.g, by limiting the extent of forest plantations in a watershed), The proposed project will leave at least 35% to 40% of the land area unplanted, 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,

Any potential negative impacts on the hydrological cycle processes will be minimized by:

- the design of plantations, which will occupy only approximately 60% of the land area owned by Weyerhaeuser Uruguay , avoiding sensitive areas; and
- the fact that the annual rainfall, and in particular during the spring-summer period, when usually water deficits occur, has been increasing over recent decades, and is expected to continue in the future, thus offsetting the expected decrease in runoff,

On the other hand, given the fact that climate change in Uruguay has been causing, and is expected to continue causing an increased frequency of extreme precipitation events associated with flooding causing severe infrastructure damage and displacement of people from their homes, the establishment of forests acts as a factor attenuating such negative impacts, by moderating the runoff, This is in fact a positive environmental service of the project,

²⁰ Silveira, L., Alonso, J., y Martínez, L. 2006. Efecto de las plantaciones forestales sobre el recurso agua en el Uruguay. Agrocienca (2006) Vol. X N°2 pág. 75-93

No negative impacts on water quality is expected given the fact that soil erosion will be controlled and that a minimal amount of agro chemicals will be used every 16 to 21 years; Soils

The area where the project will be implemented has an incipient process of soil erosion caused by overgrazing. This process may be accelerated due to climate change through the effects of an increased frequency of both droughts (and, in consequence, of overgrazing) and intense rainfall (leading to higher water erosion). In addition, the site has suffered from degradation due to nearly 300 years of extensive grazing by beef cattle and sheep, evidenced by a decrease in the content of organic carbon in the soils.

The implementation of the project activity will result in an effective protection of the soil against erosion and in a reversion of the degradation by building up soil organic carbon. Soils will be disrupted only once each rotation cycle and site preparation will be based on strip tillage, with strips oriented perpendicularly to slope direction, and use of glyphosate herbicide to minimize the exposure the soil to erosion agents. The tree vegetation will completely protect the soil and at harvest, bark, leaves and branches will be left on the ground, thus minimizing any negative impacts of erosion by rainfall and soil degradation by harvesting machinery.

Use of chemicals

The project will use a limited amount of certain chemicals during site preparation for plantation; this is, only once every 16 to 21 years. These products include:

- herbicides for site preparation. Including glyphosate, oxifluorfen and others, all of them properly registered and allowed by 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 to obtain a successful plantation. The project will use fipronil and eventually other products recommended by the Ministry of Agriculture (MGAP). These products are used in localized applications (e.g. they are not overcast) and in small rates, and only during site preparation and the 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 in eucalyptus plantations (not applied in pine). Phosphorus is highly deficient in the project site soils, and application of phosphate localized at one side of each plant ensures proper establishment.

Risk of forest fires

In compliance with national regulations, Weyerhaeuser Uruguay has implemented an extensive plan to prevent forest fires. There are many preventive activities such as: i) establishment of a network of firebreaks surrounding forests blocks with an area not larger than 50 ha; ii) the introduction of cattle in early stages of the forestation for maintaining pastures short and green, thus reducing the volumes of fuel; iii) permanent surveillance of the project area, particularly at times of medium to high risk of fire; iv) burning as possible technique for cleaning fields is particularly excluded; vi) warning signs with risk of fire are placed next to forest sites; vii) transit of non-authorized hunters, hikers or campers is forbidden; viii) fire extinguishers must set in vehicles (including tractors) that circulate in the property.

The risk of fires in commercial forests plantations in Uruguay is very low due to reduced population density and a very humid climate. Normally forest fires in Uruguay only occur in summer in the coastal areas of the South and Southeast of the country, associated with the tourism activity.

In spite of prevention activities, fires can happen. In that case, equipment and staff (own and contracted) is ready and trained for fire fighting.

Socio-economic impacts

As a result of the project activity there would be an increase in the creation of jobs in an area with high unemployment and high poverty rates, The forest activity in Uruguay causes an increase in the number of jobs standing 8 to 10 times compared to extensive farming activity, Job quality is also improved, since forestry wages are typically higher than other activities rural areas, There is a contribution to attenuation or reversal of the phenomenon of population migration from the project zone to urban and other areas of the country, This phenomenon migration from rural areas is the base of the main social problems affecting the country, In addition, increases the baseline of job opportunities for women in activities such as nurseries, planting, pruning and others, in relation to cattle breeding production, This would help improve the stability of rural families, There is a tendency in the country that forestry workers return home after each workday, which is a big improvement respect to livestock, which strongly depends on the residence workers on farms, far from their families, The development of services in the towns next to project area is boosted due to project activity, On the other hand, the gross value of production per unit land area will increase between 6 to 8 times compared to extensive livestock farming, Forestry produces an increase in tax revenue, Biomass production and energy resource is of high strategic value for Uruguay, the project will increase supply of forest residues, which is considered a security for the country in terms of energy sources.

Conclusion

There are no significant negative impacts detected as a result of project activities, On the top of this, plantations will be certified by PEFC standard, Certification ensures achieving positive socio-economic impacts and the application of sustainable forest management.

6 STAKEHOLDER COMMENTS

There are no stakeholder's comments.