CDM – Executive Board

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

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

CONTENTS

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

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

>> **Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil**
Version: 03a
Date: February 16th 2009.

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

>> The establishment of plantations as a renewable source of energy for industrial needs is expected to result in a twofold benefit to the climate: (i) generation of carbon stocks and GHG removals by sinks additional to those that would occur in the absence of such plantations, and (ii) use of sustainable sources of biomass in place of fossil fuels and non-renewable biomass to reduce GHG emission in one of Brazil's major industrial sector, i.e. the iron and steel industry. Whereas 98.55% of the world's iron ore reduction in blast furnaces was undertaken using coal coke, only 0.73% of the global iron production in 2005 used charcoal from renewable biomass from planted forests supplies as the reducing agent (Research on IISI 2006; SINDIFER, 2006 and AMS, 2006)[1].

Both of the above mentioned benefits have been integrated into a single and first-of-a-kind project under implementation by the project entity, i.e. the establishment of plantations to supply all of its iron production with charcoal from renewable wood supplies instead of GHG intensive reducing agents. The project's integrated activities are implemented in response to the CDM incentive, which will allow the project entity to overcome the constraints to the supplies of sustainably produced biomass[2]. As the harvesting of the project plantations established in 2000 commences in 2007/2008, the project entity will be the first of its kind to have 100% of its iron production based on renewable charcoal.

The establishment of plantations to supply renewable biomass within the scope of this A/R project activity started in 2000. They cover an area of 11 711.37 hectares[3] and the first harvests will take place after 7 years, followed by successive coppicing-periods of 7 years, as per the species' rotation. The project is expected to last for approximately 30 years (2000-2029). A single 30-year crediting period is adopted, under the tCER approach.

[1] The production of iron and steel requires thermal energy and reducing agents to convert iron ore into primary iron through a reduction process using blast furnace technology. Whereas the decisions on the type of reducing agents do not determine the quantity of iron produced or demanded, the choice of reducing agents significantly influences GHG emissions. Thus, marginal incentives like the CDM can play a major role in the choice of reducing agents for iron manufacturing, and as such in the creation of net GHG removals by sinks through additional plantations as a source of renewable energy.

[2] As the projects are integrated, common data, information and analyses that relate the components are used to establish and corroborate the baseline scenarios, and to fulfill additionality criteria transparently, in spite of different calculation, accounting and monitoring methods.

[3] Within the Plantar Projects an additional area of approximately the same size of the one within the proposed A/R activity is planted in response to the CDM, in order to ensure the supply of renewable charcoal for the integrated project's iron production. These lands were previously stocked with Eucalyptus plantations in 1989 and were already expected to revert to grassland/pastureland in the absence of the project. By definition, they would be exhausted after the rotation cycles of the species. Given special circumstances of Brazil, the project entity in conjunction with organizations in the forestry-based industry, the NGO community and research organizations in Brazil have prepared a discussion paper on how to proceed with the issue in the future. However, such areas are not currently included in this proposed A/R PDD, although they will observe the guidance provided by Annex 8 EB 20, given their connections with the project's iron production project under Decision 17/CP.7 (see Section A7). Available evidences were provided to the DOE.

In compliance with the baseline and monitoring methodologies, the baseline and actual net changes in carbon stocks in above and below-ground biomass pools, and net anthropogenic GHG removals by sinks are conservatively and transparently calculated, monitored and registered in the Tool for Afforestation and Reforestation Approved Methodologies (TARAM[4] V.1.2.Plantar). TARAM is an integrated set of MSExcel spreadsheets developed by the World Bank and CATIE (Tropical Agricultural Research and Higher Education Center). The model has been customized for this A/R project activity. A detailed description and methods of assessment and monitoring of the two carbon pools included in the proposed A/R activity (above and below-ground biomass) are presented in Section E and in the Monitoring Plan (Annex 4). The deadwood, litter, and soil carbon pools are likely to increase under the project. However, for the sake of conservativeness and cost effectiveness, this project activity does not monitor nor claims tCERs for these pools.

All monitoring data collected from the monitoring and forest inventory follow strict quality assurance procedures, which cover data handling, organization and storage. The project entity adopts management practices based on the ISO quality management system. GHG emissions inside and outside the project boundary are also conservatively addressed.

The project is expected to result in various social and environmental benefits, as per its sound Monitoring Plan. As detailed in the Annex 6 of this PDD the project activity contributes to the generation of more than one thousand direct jobs. There is a significant gender component, with a larger participation of women in the production of cloned sprouts. In addition, several indicators on biodiversity (fauna and flora), soil conservation, water and social aspects have been incorporated and will be subject to monitoring throughout the project's lifetime (see Annex 4). One third of the total areas involved in the project entity farms are devoted to the preservation and regeneration of native *cerrado* vegetation. This is the second largest biome of the country and many environmental and scientific groups considers the *cerrado* as one of the most important Brazilian "hot spots" once only 20% of its original area is conserved in its natural state[5]. The multiple benefits of the project arise from long-term backward and forward linkages within the iron industry supply chain. It integrates rural and industrial development through the production and use of renewable biomass, in an industry locked in fossil fuels (see Unruh, 2000).

The proposed project is a pioneer activity within its sectoral scope and it possesses a substantial potential to be replicated by other organizations in Brazil, in Latin America and the Caribbean as well as in many African and Asian developing countries. The project and its sustainability indicators are a first-of-a-kind experience in the Brazilian iron industry, clearly contributing to the CDM's sustainable development dividend at an industrial scale.

A.3. Project participants:

>> ***Project sponsor***: The project sponsor, Plantar is a private company incorporated under Brazilian law on February 27th, 1967. Headquarters are located at Av. Raja Gabáglia 1380, Belo Horizonte, Minas Gerais, Brazil.

[4] This tool has been prepared by: Lucio Pedroni - World Bank and CATIE, Pablo Rodríguez-Noriega - CATIE, and has been tailored to the AR-AM0005. The tool version applied was adapted to the Plantar project activity conditions.

[5] In the *cerrado*, or Brazilian Savanah, more that 10 000 vegetal species are identified. Whereas it is estimated that the Brazilian Amazon rainforest has approximately 80% of its original cover, the *cerrado*, reaches only 20% of its primary 204 million hectares according to the Conservação Internacional do Brasil. Available at: http://www.conservation.org.br

CDM Assistance: The Prototype Carbon Fund of the World Bank supports the Clean Development Mechanism (Art.12) of the Kyoto Protocol. The PCF promotes market in emissions reductions through the purchases of high quality Certified Emission Reductions from the Project Sponsors under the Emission Reduction Purchase Agreements.

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Indicate if the Party involved wishes to be considered as a project participant (Yes/No)
Federative Republic of Brazil (host)	• Private entity: Plantar S/A Planejamento, Técnica e Administração de Reflorestamentos	No
The Netherlands	• International Bank for Reconstruction and Development as a Trustee of the Prototype Carbon Fund	Yes
(*) In accordance with the CDM A/R modalities and procedures, at the time of making the CDM-AR-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		
Note: When the CDM-AR-PDD is prepared to support a proposed new baseline and monitoring methodology (form CDM-AR-NM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

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

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

A.4.1.1. Host Party(ies):

>> The host party is the Federative Republic of Brazil, which has ratified the Kyoto Protocol on August 21, 2002. The date of entry into force of the Kyoto Protocol in Brazil is February 16th, 2005.

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

>> State of Minas Gerais located in the Southern East region of Brazil.

A.4.1.3. City/Town/Community etc:

>> Municipality of Belo Horizonte (headquarters), Municipalities of Curvelo[6], Felixlândia, Morada Nova de Minas, all in the State of Minas Gerais.

[6] Forestry unit where the field management and the clone gardens are located.

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

>> In compliance with the baseline methodology, the spatial boundaries of the project are totally identified by land use maps, GPS coordinates and cartographic information on the project area. Satellite images are also used to complement the project level data. All information on the area and limits of project plantations are recorded in the project entity's forestry inventory system and confirm to the official land tenure documents. Information on biomass accumulation is estimated and registered for stands ("talhão"), strata and sub-strata. The documentation was provided to the DOE and used for monitoring and verification purposes. The detailed procedures on monitoring of the project boundary are outlined in Section E and in the Monitoring Plan, as per AR-AM0005.

The current project boundary delineates the plantation areas to be established under this A/R project activity[7]. The project activity is located in the center-north region of the State of Minas Gerais. The plantations currently included in the project boundaries are distributed in the municipalities of Felixlândia and Morada Nova de Minas, which are about 200km from Belo Horizonte (the capital of Minas Gerais).

For management and organizational purposes, the project entity operates different plantation units, respectively located at each of the municipalities and regions below. These units are included in the current project boundaries and are identified by a number and the associated plantation farm name. Thus, the sum of every plantation stand included in this A/R PDD expresses the project boundaries. Official land records and geo-referenced information are available and will be presented to the DOE. **Figure 01** presents the details on the geographical location of the plantation management units.

Figure 01: Geographic information on the project area

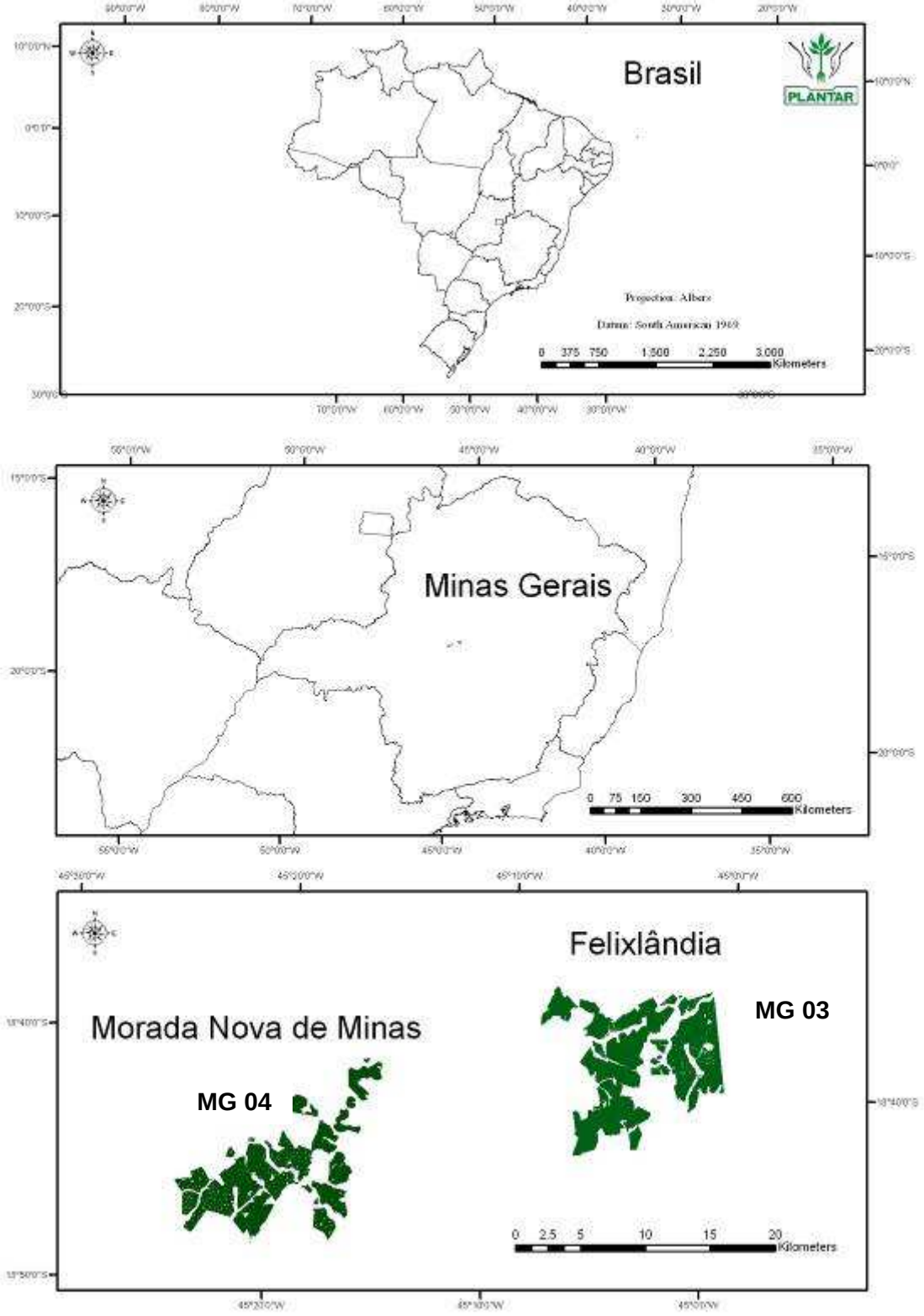
Region	Unit Number	Plantation Farm Name	Overall geo-referenced points
Felixlândia	MG 03[8]	Jacaré/Riachão	- Northeast extreme point: 18º36'19S/ 45º00'38W - Southeast extreme point: 18º40'15S/ 44º59'41W - Northwest extreme point: 18º35'30S/ 45º07'07W - Southwest extreme point: 18º43'19S/ 45º06'22W
Morada Nova de Minas	MG 04[9]	Buriti Grande	- West extreme point: 18º47'52S/ 45º23'32W - Northeast extreme point: 18º41'07S/ 45º14'35W - Southeast extreme point: 18º47'48S/ 45º17'07W

[7] As explained in Section A.2 an additional area of approximately the same size of the area under this A/R PDD is also being planted with the purposes of supplying the integrated project's iron production, but is excluded from the current project activity boundaries. These areas are located both in the region of Curvelo and in the region of Itacambira, in northern Minas Gerais. Further information is provided in Section A7.

[8] Project Boundary Area: 6388,19

[9] Project Boundary Area: 5323,18

Figure 02: Project areas location maps in the State of Minas Gerais and in Brazil[10].



[10] Details about each discrete area of the project boundary are provided in Annex 5.

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

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

>> **Climate:**

The project's region is located within a tropical climate zone. The dry period usually lasts from 4 to 5 months. The average temperature throughout the year is above 18ºC. The winter is mild and the thermal sensation only falls upon the occurrence of the polar anticyclone. The summer is warm and long and lasts from September/October to March.

To characterize the region's climate, data from the official climate registry from the Curvelo Climatological Station for the period 1961-1990 was used. This data respectively refer to the region of Felixlândia and Morada Nova de Minas. Total annual rainfall in the region varies from 800mm to 1300mm.

The highest temperature averages normally occur from September to April. June and July are the coldest months. The temperature is above 35ºC in several months of the year. The temperature in the region ranges from 22ºC to 26ºC and shows the high temperature in the valleys and low temperature on higher altitudes.

The annual average relative humidity is above 70%. The highest average humidity occurs during the rain season and variations in humidity are not significant throughout the year. The lowest temperatures occur in the dry season. Data from Curvelo's Climatologic Station shows that the highest annual insolation occurs in August, with 221.9 hours of sunshine, while January presents the lowest monthly value, with 129.1 hours of sunshine. In general, the incidence of solar radiation is characterized within its sub-region which is located on the extreme East on the border of the São Francisco valley.

The highest monthly values of evapotranspiration occur from October through January. The annual evapotranspiration is 1 675.6 mm. As for the variation throughout the year, the minimum value is 101.2 mm in June and the maximum is 166.8 mm, in January. The potential evapotranspiration follows the solar radiation, showing high values on southern regions and low values on central regions.

Hydrology:

The project areas belong to the São Francisco basin. the main sub-basins are Paraopeba and Três Marias reservoir.

The Jacaré/Riachão farm belongs to São Francisco basin, within the Três Marias sub-basin. The major streams of the area are Jacaré, Retiro, Buritis and Brejo. The Buriti Grande farm is located in the municipality of Morada Nova de Minas, in the Três Marias sub-basin. The main watercourses are Mutuca and Campo Alegre streams.

Soils and Relief:

The terrains of the project area, specifically the ones of Jacaré/Riachão and Buriti Grande farms, range from plain to slightly undulating, with an altitude of 600 to 750 meters, all accessible by the road. In the Buriti Grande farm there are elevations and isolated hills (Picada, Povoação and Tamanduá) of up to 750 meters.

The Jacaré/Riachão farm shows lithology corresponding to the Três Marias formation represented by siliclastic sedimentation and is composed by arcosic arenites, siltites, and conglomeratic intercalation, including detritic covers of the Tertiary/Quaternary periods on plain surfaces.

The predominance of highly permeable Oxisols (*Latossolos* in the Brazilian taxonomy) on slightly undulated terrain favours the infiltration of pluvial water and refilling of the aquifers. The soil types include *Yellow Red Oxisols, Dark Red Oxisols, Cambisols, Humic Oxisols*, and *Litholic soils.*

Ecosystems:

The Jacaré/Riachão and Buriti Grande farms are located in the savannah region (*cerrado*), which is defined as a *xeromorphic* vegetation type, mostly occurring in seasonal climate (circa six months dry).

The predominant form is the *cerrado* on *Cambisol* include the "campo cerrado", "campo limpo", "veredas", "campo rupestre". The "vereda" formation occurring in the region does not present the "Buriti" tree species (*Mauritia flexuosa*), probably because of the local altitude limitations.

The conversion of native vegetation to grasslands and other land-uses took place in the region decades ago. The spatial configuration of the *cerrado* protected and conserved through ecological corridors served to reduce the isolation of the landscape.

The eucalyptus plantations in Jacaré/Riachão and Buriti Grande farms are on pastureland that is dominated by the *brachiaria* forage crop. When establishing the pastureland, the land owners kept some small islands of native vegetation (locally called "*moelas*"). These areas are preserved under the plantation activity and around them the project entity established fire breaks.

The *cerrado* vegetation is located alongside the natural drainages, whose soils have high physical and chemical limitations. However, these areas are important for preservation purposes because of their landscape diversity. The project entity, Plantar, intends to preserve the areas of high diversity under the preservation areas. A program for interconnecting preservation areas is being implemented under the project, and will form the basis for biodiversity conservation in the region. While implementing the ecological corridors project there is a possibility to eradicate eucalyptus trees that were established by the project activity and are currently located within the project boundary. Those eucalyptus areas could be removed to give room to the establishment of ecological corridors. When these cases occur, the area automatically monitored will be excluded from the A/R CDM project boundary. The project comprises the following steps:

- Indicate in map the places where planting areas and/or pasture areas will give room to the establishment of ecological corridors, that shall have minimum width of 50m;

- Eradication of eucalyptus occurring in the defined places, the closest possible to the ground in order to restrain the regeneration of stumps;

- The resultant wood will be removed as soon as harvesting ends, avoiding damages in native vegetation sprouting in process of assisted regeneration;

- Once eucalyptus is eradicated the bark of the stump shall be removed, in order to make regeneration difficult. Other measures could be taken to impede the eucalyptus regeneration process;

Even adopting the measures defined above, it is normal that eucalyptus regeneration occurs to some stumps due to the start of rainy season. These eucalyptus sprouts shall be mechanically removed whenever they reach 1.5m height.

After removing the eucalyptus from the area, protection measures will be applied in order to facilitate natural regeneration of the species, which may occur via seedbank and propagating material from other areas. This process easily occurs within *cerrado* areas previously occupied with eucalyptus plantings.

It is highly improbable to occur natural regeneration process in pasture areas, however, in a first stage; measures to protect the area will be undertaken in way to facilitate the natural regeneration.

Monitoring: After one year of the eucalyptus eradication and/or the attempt of natural regeneration promotion of the old pasture areas, a floristic assessment shall take place in the recent formed corridor indicating the presence of native species and their frequencies. This assessment will allow in a correct environmental and technical way if it will be necessary to promote the enrichment's planting activities. The enrichment's planting activities normally are required in pasture areas, mainly due to soil compaction caused by the cattle activity.

The enrichment's planting activities will be undertaken every time that the floristic assessment results point in this direction. The changes observed in the local fauna that could be addressed to the formation of the ecological corridors will be part of the monitoring work regularly made by Plantar in the region of the project.

Figure 03 presents the land use and vegetation in the preservation areas associated with the project.

Figure 03: Land use and vegetation in the preservation areas associated with the project plantations

Plantar S/A Reflorestamentos - Enrivonmental Licencing and Management Departament

UNISE MG03 (Jacaré/Riachão Farm - Felixlândia/MG) - Tres Marias basin

FRAGMENT	LEGAL RESERVE (HA)	PERMANENT PRESERVATION AREAS (HA)	CONSERVATION AREA (HA)	TOTAL (HA)	IDENTIFIED PHYSIOGNOMIES (CERRADO BIOME)	POSITION - UTM SAD 69
1	29.08	3.35	-	32.43	Riparian Forest and Cerrado	23K 499953.21 e 7935649.20
2	32.11	-	-	32.11	Riparian Forest and Cerrado	23K 498830.81 e 7935013.62
3	18.93	14.54	-	33.47	Riparian Forest Vereda and Cerrado	23K 498145.87 e 7936482.40
4	814.74	29.67	-	844.41	Cerrado, Cerradão, Riparian Forest, Vereda, Campo de Várzea and Campo Cerrado	23K 494224.29 e 7934984.06
5	-	-	58.09	58.09	Cerrado, Cerradão, Riparian Forest and Vereda	23K 496529.60 e 7935120.50
6	-	2.25	4.88	7.13	Vereda, Hidromophic field and Cerrado	23K 493646.13 e 7932487.49
7	-	1.52	5.30	6.82	Vereda and Cerrado	23K 493194.92 e 7932132.62
8	-	0.38	16.81	17.19	Cerradão and Vereda	23K 492518.18 e 7932716.87
9	-	1.90	3.69	5.59	Vereda, Hidromophic field and Cerrado	23K 493138.37 e 7931261.01
10	-	2.19	2.46	4.65	Vereda and Cerrado	23K 492289.17 e 7931706.00
11	-	5.86	31.58	37.44	Vereda and Cerrado	23K 491230.81 e 7931418.69
12	-	-	10.34	10.34	Cerrado	23K 491017.34 e 7933856.15
13	339.45	6.64	-	346.09	Riparian Forest, Cerrado and Cerradão	23K 489799.37 e 7934571.46
14	-	2.09	38.29	40.38	Cerrado and Vereda	23K 490024.34 e 7937499.02
15	-	-	4.51	4.51	Cerrado	23K 490904.42 e 7937191.16
16	-	-	2.63	2.63	Cerrado e Cerradão	23K 480232.22 e 7939239.69
17	-	4.23	3.76	7.99	Cerrado e Vereda	23K 489384.79 e 7938268.47
18	-	-	2.42	2.42	Cerrado e Vereda	23K 489593.84 e 7938469.62
19	-	-	6.32	6.32	Cerrado e Campo Cerrado	23K 489914.90 e 7941053.04
20	-	-	68.90	68.90	Cerrado	23K 491692.22 e 7940667.06
21	198.24	27.32	-	225.56	Cerrado, Cerradão and Vereda	23K 491341.89 e 7939040.48
22	-	3.98	162.90	166.88	Campo Cerrado, Cerrado and Riparian Forest	23K 488637.21 e 7939889.29
23	-	19.77	74.89	94.66	Cerrado and Cerradão	23K 485073.99 e 7939344.64
24	631.94	-	-	631.94	Campo Cerrado, Cerrado, Cerradão and Riparian Forest	23K 494454.07 e 7937669.01
25	-	-	23.39	23.39	Cerrado and Riparian Forest	23K 495286.97 e 7937541.95
26	84.43	47.56	-	131.99	Cerrado and Riparian Forest	23K 495646.08 e 7939151.11
27	-	-	4.45	4.45	Cerrado	23K 495538.23 e 7938451.33
28	-	-	3.49	3.49	Cerrado	23K 495253.48 e 7938615.02
29	-	13.72	61.68	75.40	Cerrado, Vereda and Riparian Forest	23K 495139.77 e 7941633.30
30	-	-	56.92	56.92	Riparian Forest and Cerrado	23K 497309.75 e 7941346.22
31	-	17.66	126.22	143.88	Cerradão, Cerrado e Campo Cerrado, Vereda and Riparian Forest	23K 497714.90 e 7937713.30
32	-	-	7.29	7.29	Cerrado and Campo Cerrado	23K 498819.58 e 7949642.38
33	-	-	1.45	1.45	Cerrado and Cerradão	23K 498482.41 e 7936586.42
34	-	-	2.81	2.81	Cerrado and Cerradão	23K 495445.78 e 7936602.06
35	-	-	51.00	51.00	Cerrado, Cerradão, Cerrado in regeneration	23K 488115.19 e 7941446.31
36	-	13.37	-	13.37	Cerradão and Hidromórphic Field	23K 488566.88 e 7942682.05
37	-	11.40	58.50	69.90	Riparian Forest, Decidual Forest and Campo Cerrado	23K 488781.76 e 7943873.29
	2,148.92	**229.40**	**894.98**	**3,273.30**		

UNISE MG04 (Buriti Grande/Vitória e Guariba Farm- Morada Nova de Minas/MG) - Tres Marias basin

FRAGMENT	LEGAL RESERVE (HA)	PERMANENT PRESERVATION AREAS (HA)	CONSERVATION AREA (HA)	TOTAL (HA)	IDENTIFIED PHYSIOGNOMIES (CERRADO BIOME)	POSITION - UTM SAD 69
01 (A a L)	-	51.80	31.41	83.21	Cerrado, Vereda and Riparian Forest	23K 459293.93 e 7924669.17
02 (A e B)	32.26	-	-	32.26	Riparian Forest, Vereda and Cerrado	23K 460605.46 e 7925614.32
03 (A e B)	11.91	9.74	-	21.65	Cerrado, Vereda and Riparian Forest	23K 461751.44 e 7927570.61
4	3.50	3.72	-	7.22	Cerrado and Riparian Forest	23K 462543.27 e 7928146.93
05 (A a D)	18.76	42.61	-	61.37	Cerrado, Decidual forest and Vereda	23K 462019.72 e 7924224.40
06 (A a B)	9.32	60.31	-	69.63	Cerrado, Hidromophic field and Riparian Forest	23K 463102.60 e 7924801.87
07 (A e B)	-	-	47.67	47.67	Cerrado and Hidromophic field	23K 463434.23 e 7925884.51
08 (A a G)	46.57	83.15	9.51	139.23	Cerrado, Decidual forest and Vereda	23K 466775.71 e 7926310.06
9	-	-	30.39	30.39	Cerrado and Hidromophic field	23K 465079.60 e 7928292.17
10	-	3.43	30.34	33.77	Cerrado and Decidual forest	23K 465950.33 e 7929156.84
11	407.11	139.01	1.77	547.89	Cerrado, Campo Cerrado, Decidual forest and Riparian Forest	23K 468584.41 e 7927318.94
12	-	86.50	-	86.50	Cerradão and Decidual forest	23K 469269.35 e 7924420.14
13	-	-	11.79	11.79	Hidromophic field	23K 470639.35 e 7924991.45
14 (A e B)	8.41	38.21	-	46.62	Riparian Forest and Cerrado	23K 469465.93 e 7926102.14
15	-	8.63	5.42	14.05	Cerrado, Campo Cerrado and Riparian Forest	23K 469803.69 e 7927485.55
16 (A a D)	26.46	15.67	-	42.13	Cerrado, Campo Cerrado and Riparian Forest	23K 469696.81 e 7928479.75
17 (A a C)	6.97	16.05	-	23.02	Cerrado, and Riparian Forest and Decidual forest	23K 469268.45 e 7929193.35
18 (A a C)	37.11	19.08	-	56.19	Cerrado, Decidual forest and Riparian Forest	23K 469121.51 e 7930455.44
19 (A a F)	549.06	158.78	-	707.84	Campo Cerrado, Cerrado and Riparian Forest	23K 468466.13 e 7932177.56
20	34.20	-	-	34.20	Cerrado, Campo Cerrado and Riparian Forest	23K 470289.75 e 7930716.39
21	3.43	-	-	3.43	Cerrado	23K 470913.65 e 7931883.10
22	6.86	-	-	6.86	Cerrado and Riparian Forest	23K 466723.52 e 7932337.56
23	90.17	3.90	-	94.07	Cerrado, Riparian Forest and Vereda	23K 471177.85 e 7935087.68
24 (A a C)	37.74	-	-	37.74	Riparian Forest, Cerrado and Campo Cerrado	23K 470464.84 e 7932937.34
25	365.93	78.88	-	444.81	Campo Cerrado, Cerrado, Cerradão and Riparian Forest	23K 473374.91 e 7934242.35
26	-	-	3.78	3.78	Cerrado	23K 472531.75 e 7935000.92
27	13.16	-	-	13.16	Cerrado and Hidromophic field	23K 464273.16 e 7925321.17
28	35.83	-	-	35.83	Cerrado	23K 464903.15 e 7924456.20
29	26.18	-	-	26.18	Cerrado	23K 463266.47 e 7921739.81
	1,770.92	**819.47**	**172.08**	**2,762.47**		

Source: Social and Environmental Development Administration, Plantar S/A

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

>> **Flora and Fauna:**

The survey of flora and fauna in the project area indicates the representation of several protected species. The areas with protected species are preserved to improve the biodiversity of the region. **Figure 04** presents the categories of protected species of flora in the project area. These species are monitored as part of the project.

Figure 04: Flora protected by law identified in the project activity farms area

SPECIES	PRESERVATION STATUS			Vegetation type
	Endangered	Presumed Endangered	Restriction on harvests	
Anacardiaceae				
Myracrodruon urundeuva	Vulnerable	-	-	Deciduous Forest
Annonaceae				
Duguetia furfuracea	-	X	-	Cerrado, Campo Cerrado
Duguetia lanceolata	-	X	-	Gallery Forest
Arecaceae				
Euterpe edulis	Vulnerable	X	-	Gallery Forest
Bignoniaceae				
Tabebuia aurea	-	-	X	Cerrado
Tabebuia impetiginosa	-	-	X	Deciduous Forest
Tabebuia ochracea	-	-	X	Cerrado, Campo Cerrado
Tabebuia roseo-alba	-	-	X	Deciduous Forest
Tabebuia serratifolia	-	-	X	Gallery Forest and Semi-deciduous
Caryocaraceae				
Caryocar brasiliense	-	-	X	Cerrado, Campo Cerrado, Cerradão
Lauraceae				
Rollinea laurifolia	-	X	-	Semi-deciduous Forest
Opiliaceae				
Agonandra brasiliensis	-	X	-	Cerrado
Orchidaceae				
Cattleya walkeriana	-	X	-	Deciduous Forest
Flora Characterization: (MG02 Unit): 302 species registered, distributed into 201 genders and 80 botanical families. (MG03 Unit): 182 species registered, distributed into 126 genders and 61 botanical families. (MG04 Unit): 227 species registered, distributed into 159 genders and 69 botanical families.				

Source: Social and Environmental Development Administration, Plantar S/A

Figure 05 presents information on the avifauna and mammal species found in the project area. The project seeks to protect and enhance the flora and faunal species of the project area. Special initiatives implemented as part of the biodiversity conservation are presented in Annex 6.

Figure 05: Number of avifauna and mammal species reported in the region of project area

Group	n.º of species		
	MG02 Unit	MG03 Unit	MG04 Unit
Avifauna	159	172	174
Mammals	29	36	38
Relevant species (endemic, endangered, etc.)	8	19	15

Avifauna and mammals – Buenos Aires Farm MG02 Unit

Avifauna: 159 bird species registered, distributed into 43 families. Among them, six are endangered species in Minas Gerais State: Rhea (*Rhea americana*), *Platalea ajaja*, *Mycteria americana*, *Ara ararauna*, *Culicivora caudacuta* and *Sicalis flaveola*. Moreover, 4 Cerrado endemisms were found (SILVA, 1995c): (*Antilophia galeata*), (*Cyanocorax cristatellus*), (*Charitospiza eucosma*) and (*Saltator atricollis*).
Mammals: 29 mammal species registered, including 2 endangered species: the *Tamandua tetradactyla* and the lobo-guará (*Chrysocyon brachyurus*).

Avifauna and mammals – Jacaré/Riachão Farm MG03 Unit

Avifauna: 172 bird species registered, distributed into 40 families. Among the 172 birds, 6 are endangered species: Rhea (*Rhea americana*), *Platalea ajaja*, *Mycteria americana*, *Ara ararauna*, *Culicivora caudacuta* and *Sicalis flaveola*. Among the endemic birds, it is mentioned: *Antilophia galeata*, *Cyanocorax cristatellus*, *Charitospiza eucosma* and *Saltator atricollis*
Mammals: 36 mammal species registered, including 9 at some level of risk or relevancy in Minas Gerais or Brazil: *Myrmecophaga tridactyla*; *Tamandua tetradactyla*, *Cabassous* sp.; *Chrysocyon brachyurus*; *Leopardus pardalis*; *Puma concolor*; *Tapirus terrestris*; *Tayassu* pecari; *Phyllomys brasiliensis*.

Avifauna and mammals – Buriti Grande Farm MG04 Unit

Avifauna: 174 bird species registered, distributed into 39 families. Important to note that the *Platalea ajaja* and *Ara ararauna are* endangered species in Minas Gerais. The *Hylocryptus rectirostris*, *Antilophia galeata*, *Cyanocorax cristatellus*, *Charitospiza eucosma* and the *Saltator atricollis* are endemic birds of the *cerrado* region.
Mammals: 38 mammal species registered, including 9 species at some level of risk or relevancy: *Myrmecophaga tridactyla*; *Tamandua tetradactyla*, *Cabassous* sp.; *Chrysocyon brachyurus*; *Leopardus pardalis*; *Puma concolor*; *Tapirus terrestris; Tayassu* pecari; *Phyllomys brasiliensis*.

Source: Social and Environmental Development Administration, Plantar S/A

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

>> *Eucalyptus spp*: The project plantations are implemented with hybrid clones of *Eucalyptus urophyla, Eucalyptus Grandis* and *Eucalyptus camaldulensis.*

The choice of species is aimed at achieving the highest productivity of sustainable biomass in order to accomplish self-sufficiency of charcoal consumption in the project's pig iron mill demanding the smaller land possible. Therefore, mainly *Eucalyptus Urograndis* hybrid cloned sprouts are used in the establishment of the project plantations.

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

>> The proposed A/R CDM project activity relies on sustainable production practices and advanced plantation technology developed by the project entity. The plantations are managed using sustainable management practices under the Forestry Stewardship Council certification or

other certified quality management systems. The production of cloned sprouts in large-scale nurseries and localized irrigation systems are designed to make the use of water and other inputs more efficient. The fire protection policies and infra-structure and the setting aside of preservation areas enhance the biodiversity of the project area (more than 8 000 hectares are set aside for conservation purposes). The following features illustrate the technology employed by the proposed A/R project activity:

- *Research and Development*: The project entity has established a research and development program aimed at providing high-yielding eucalyptus clones. With the objective of producing quality and productive sprouts, empirical field experiments are conducted using advanced scientific protocols. The rigorous selection process and propagation methods assure the production of quality cloned sprouts for plantation purposes**. Figure 06** and **Figure 07** illustrate the large-scale greenhouses and scientific nursery management processes.

Figure 06: Clonal garden used in the selection and propagation of Eucalyptus clones.

- *Reproduction of cloned sprouts*: Mini-sprouts are selected from sprout matrices, developed in the field experiments, and propagated in a plantation nursery that is fully equipped with clone gardens, water recycling devices and greenhouses with electronic controls for temperature and moisture. The production process of one sprout takes approximately 100 days. After this period of time, the sprouts are taken to the field for planting.

- *Planting process*: The planting process involves minimum cultivation techniques, which minimizes soil impacts and optimizes the use of water. Fertilizers, herbicides and pest control substances are used as per recommended silviculture practices. A summary of the planting process and its basic activities are listed below:

  a) The selection of the area to be planted;
  b) Division of stands and fire breaks;
  c) Area cleaning;
  d) Ant prevention;
  e) Soil preparation;
  - Fertilization
  - Definition and digging of planting lines

  f) Planting

- *Harvesting Process:* Plantar adopts the full harvesting for its harvesting activities, which is completely mechanized. The harvesting process occurs with the use of a tractor called feller.

Dragging of the cut trees out of the stand is executed with a skidder. Slashing of trees, which consists of the slashing the merchantable volume of the tree, is executed with a machine called "Garra Traçadora" (Slasher Claw). These three harvesting operation activities occur in the following order:

1) Harvesting;
2) Dragging;
3) Slashing

There's a specific SOP for harvesting and it doesn't consider any pre-harvest thinning.

Figure 07: Greenhouse for the project activity

Figure 08: Fire watch-tower model

- *Productivity management practices* is implemented to ensure that the expected production results are monitored since the first planting months in a scientifically devised inventory system. The survival rates of plantings are monitored. Whenever early results indicate lower survival rates, the affected areas are replanted. To minimize the risk of fires, the project entity maintains ongoing vigilance at strategically located fire-watch towers. Fire monitoring is conducted in conjunction with fire-fighting brigades (**Figure 08**).

- *Quality management system:* Operations are fully integrated into the project entity's quality management system, which follows ISO 9001 standards. Each operational procedure is registered, described and monitored as per norms and standard operational procedures. Social and environmental aspects are managed by a specific department within the project entity in order to ensure compliance with legislation, corporate principles, and forestry certification schemes (details on social and environmental management outlined in Sections F, G and in Annex 6).

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

>> Since the proposed A/R activity relies on the know-how and technology developed by the project entity in Brazil, it has not required transfer of technology from Annex 1 countries to Brazil. However, the project may result in the transfer of the applied technology for non-Annex 1 countries with a substantial potential of implementing similar CDM project activities, especially in Africa, other parts of Latin America and Southeast Asia.

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

>> In this project activity, leakage is assumed to occur as a result of increased emissions measurable and attributable to the project activity from fossil fuel combustion (mobile combustion) outside the project boundary. The project entity has made all efforts to minimize

the leakage associated with the transportation of personnel. Transportation policy is based on the use of large buses in order to keep the number of smaller vehicles to the minimum. In addition, the project proponent does not own live stocks and the lands acquired to establish the project activity were already on sale. All theses measures adopted by the Plantar Carbon team and the World Bank Carbon Finance Unit followed the good practices on CDM project design and implementation in order to minimize leakage. As a result, there is no leakage due to activity displacement once there were no households or livestock displacement attributable to the establishment of the project activity.

Following the leakage provisions of the approved methodology AR-AM0005, below it is presented the results of the leakage assessment.

Increase in emissions from fossil fuel combustion

The forms of leakage from the project are due to travel of project personnel and transportation of cloned sprouts, fertilizers, labor, staff and harvested wood outside the project area. This leakage is accounted in the project while estimating the net GHG removals by sinks from the project (see below for the parameters used for calculating leakage).

Leakage calculations consider emissions from transport of cloned sprouts from the clone gardens to the project sites, transport of harvested wood products to wood processing facility, transport of fertilizers from the sale point to the project sites and transport of labor force to the A/R site. The emissions from field inspections and monitoring were also considered.

Emissions due to travel of project personnel and transportation of fertilizers outside the project are estimated following the procedures similar to GHG emissions from fossil fuel sources by taking into account the distance traveled and fuel consumed by the project personnel for travel outside the project. The IPCC default emission factors for diesel and gasoline were also taken into account. The ex ante calculation details are provided, following the methodology in section D.2 of this PDD.

Activity Displacement

Since its project implementation Plantar has adopted an internal policy to prevent leakage due to the displacement of economic activities/household displacement. This policy restricts the purchase of lands to those that were already for sale in the market. Therefore, the decision to sell the land it is not attributable to the project activity establishment. Evidences provided by the previous owners demonstrate that they had placed their land for sale independently and prior to this project entity's interest for the land[11]. The project proponent's policy was revised by the World Bank's Prototype Carbon Fund and accepted by SGS's initial verification as a leakage prevention activity.

Aiming to evaluate and confirm leakage prevention policy effectiveness, the project entity have recently prepared and applied a structured questionnaire among the previous owners of the

[11] All previous landowners have confirmed in writing that the land was already for sale and the value of land would not be used for deforestation anywhere else.

project lands. The answers confirmed that there is no leakage measurable and attributable to the implementation of the project activity[12].

The table below shows summary results on the main points related to the leakage assessment based on the items provided in the approved methodology AR-AM0005 and also based on the EB 39, Annex 12, version 02 of A/R Tool of "Estimation of GHG emissions related to displacement of grazing activities in A/R CDM project activity":

[12] The answers were confirmed and signed by the previous landowners.

Figure 09: Survey results for leakage prevention.

Questions	Answers				
	Area 1	**Area 2**	**Area 3**	**Area 4**	**Area 5**
Acquisition date	07/08/2000	26/03/2001	15/03/2003	09/05/2002	24/05/2005
Area (ha)	10,141.23	654.48	67.76	7,754.87	703.45
Farm name	Jacaré (MG03)	Riachão (MG03)	Paiol (MG03)	Burity Grande (MG04)	Vitória e Guariba
Sale reason	business change	owner disease	give and take	financial needs	interested in another area
Was the previous owner interested in selling the land before the project entity's offer?	yes	yes	yes	yes	yes
How many people lived in the land?	56	4	7	40	12
Was there fuel wood collection for cooking or energy demand?	yes	yes	yes	yes	yes
What was the fuel wood consumption? (m^3/year)	25	10	12	10	50
What was the source of the fuel wood?	not identified	residues, dead wood	gathered in the area	not identified	residues, dead wood
Where the households moved to?	urban and rural areas	urban area	rural area	rural area	rural area
What is the fuel wood consumption in the new residence? (m^3/year)	20	0	12	10	30
What is the source of the fuel wood?	not identified	N/A	gathered in the area	not identified	residues, dead wood
Were there grazing animals in the land at the time of transaction?	yes	yes	yes	yes	yes
How many?	6,500	17	80	8,000	500
What was done with the grazing animals?	sold	sold	displaced	sold (60%) displaced (40%)	slaughtered 30% displaced (70%)
In case of displacement of the grazing animals, what is the land category where the animals were displaced to?	N/A	N/A	pasture land	native (40%) pasture land (60%)	native(20%) pasture land (80)
What is the area (ha) where the animals were displaced to?	N/A	N/A	64	8,000	500
Was there any kind of deforestation caused by animals' displacement?	N/A	N/A	no	no	no
Were there grazing animals in the area where the animals were displaced	N/A	N/A	no	yes	no

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

to?					
How many?	N/A	N/A	N/A	4,000	NA

Based on the answers stated in the questionnaires, all acquisitions were initially motivated by the previous owners' intention to sell the land before the project entity offers, thus there is no leakage measurable and attributable to the project activity. This reconfirms the evidences revised by the World Bank and verified by SGS previously, and as per the approved methodology that no leakage activity due to the activity displacement shall be considered to the project activity if leakage prevention activities are implemented as part of the project implementation and evidences are provided.

Furthermore, even if it was required to identify emissions from the activity displacement, as per the evidences no deforestation took place on the lands where the animals were displaced to and the consumption of fuel wood decreased after the project establishment.

In addition, the above mentioned A/R tool is not mandatory to the chosen methodology. However, if the project entity had applied this tool, based on the questionnaire answers it is concluded the following:

- Total number of head animal before the project establishment: 15 097[13]
- Total number of head animal sold: 11 317 (no leakage)
- Total number of head animal slaughtered: 150 (no leakage)
- Total number of head animal displaced:
  (3 200 + 350 + 80) = 3 630
- Number of head animal in the area where the cattle were displacement to: 4 000
- Specific original land area occupied by the displaced animals:
  (3 101.95 + 492.42 + 67.76) = 3 662.12
- Total area where the animals were displaced to: 8 564
- Quantity of animals per hectare (grazing intensity) before displacement:
  (3 630 / 3 662.12) = 0.99
- Quantity of animals per hectare (grazing intensity) after displacement:
  (4 000 + 3 630/ 8 564) = 0.89

Considering that the quantity of displaced animals per hectare had decreased, thus there is no overgrazing and consequently no leakage from displacement of grazing activities.

Based on the above mentioned leakage prevention procedures, it is not identified any displacement of economic activities nor households attributable to the project activity. Hence, no leakage emissions measurable and attributable to the project activity was identified due to displacement of economic activities to areas outside the project that lead to deforestation and land use change for agriculture/non-agricultural purposes, harvest of fuel wood for meeting domestic energy needs, and use of lands as pastures for grazing/fodder collection.

Market Leakage

According to the guidance related to market leakage (EB 28, paragraph 33, page 1), the Board agreed that "market leakage", which may include the increase in GHG emissions occurring outside the project boundary, attributable to effects of price, supply or demand of goods affected by the market impact of the CDM A/R project activity, shall not be accounted for in A/R baseline and monitoring

[13] Based on the Landsat images the total grassland area of the 5 farms areas is above 12000 hectares. Therefore, the pre-existent conditions of the project areas indicate a grazing intensity of around 1.25 cattle heads per hectare.

methodologies. Also, according to AR-AM0005 the market effects of A/R CDM project activities will be ignored due to its improbable significance even for large-scale project activities[14].

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

>>All project lands are owned by the project entity and are legally registered in accordance with applicable land-tenure and Brazilian legislation. Registries were presented to the DOE.

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

>>The land eligibility assessment of the project area followed the provisions of Annex 18, EB 35 (version 1 of the "**Procedures to demonstrate the eligibility of lands for afforestation and reforestation CDM project activities**") and it was based on data collected and analyzed by a third party forester expert report[15]. In compliance with the Brazilian DNA/UNFCCC regulations, this project activity eligibility assessment adopted the definition of forest as a minimum tree crown cover value of 30 %, a minimum land area value of 1.0 hectare, with trees with the potential to reach a minimum height of 5 meters in maturity.

The goal of the survey was to identify the type of vegetation existing in the years 1989 and 2000, seeking past information through the use of remotely sensed data and data collected from the field. The study assessed and mapped the land use and cover the project boundary, using the decision tree algorithm and a database consisting of Landsat images taken at two different times as well as images derived from information extraction techniques. The main work steps of the study included:

1) Image acquisition - The database used in the study consisted of remote sensing images with medium spatial resolution and field collected data. The type of image chosen was coherent to the Brazilian DNA forest definition requirement of 1 ha minimum. Image information included:

    - Data obtained from appropriate institutions over the Internet.
    - Landsat satellite images taken using Thematic Mapper and Enhanced Thematic Mapper sensors at two different times (1989 and 2000), with spatial resolution of 30 meters for 6 spectral bands.

Figure 10: Images information.

Scene	Image year
219-73 Geocover	2000
219-73	1989

Figure 11: Images database.

Database	Source
Land use map of Minas Gerais	Geominas
Vegetation mapping 1994	IEF
Municipality centers	Geominas
Road system	Geominas
Contours	IBGE

[14] As presented in the section A.2 the amount of iron produced and the respective demand are not influenced by the type of reducing agent adopted.

[15] Oliveira, Adauta C. (March 2008). Land-use survey executive report.

Water courses	ANA

- Field-collected land cover data for locations where no significant change in land use has taken place in the last eighteen years. These areas were selected after searching into databases from institutions such as IEF, Emater and Epamig. Selected areas were located in the image and a field check was then made using points collected by GPS.

2) Determination of the thematic classes - The methodology for the definition of the mapping classes of land use considered the bibliographical research on land use and occupation; economical activities predominant in the study area and; the data and seasonality of the Landsat satellite images.
3) Development of a digital elevation model (DTM) – DTM is a 3D representation of land surface terrain and enables viewing landscape features at a reduced scale and making deeper and more complex landscape analyses.
4) Image processing (geometric correction and radiometric calibration) - Satellite images were recorded using control points acquired in the field with the aid of GPS – Global Positioning System units.
5) Information extraction from the images - It consisted in the application of digital classification algorithms to extract information for use during the digital classification phase.
6) Spectral mixture analysis – Consisted in integrating energy reflected or emitted by all objects, called mixture components, contained in the pixel, due to the variation in and proximity of targets on the earth surface. After delimiting and geo-referencing Landsat-TM data, the linear spectral mixture model was applied to generate three components related to vegetation, soil and shade.
7) Definition of the normalized distance vegetation index (NDVI) - The NDVI was used to convert Landsat's multispectral data to an image with a single band representing vegetation distribution.
8) Digital classification (decision tree method and homogenization of classification results) – The attributes used with this classification technique included Landsat bands 1,2,3,4,5 and 7; fraction image of soil, shade, vegetation and error derived from linear spectral decomposition and NDVI vegetation index.

Following the image interpretation phase, a mask was created based on the boundaries of the service units to enable classification of these areas alone. The classification obtained for the service units was later edited to better adjust vegetation classes to the study area.

Digital image processing and data mining for the decision tree classifier were undertaken using the software applications available at the Image Analysis and Geo-processing Laboratory, Department of Forest Sciences, Federal University of Lavras. Field activity was carried out using the following equipment: GPS (Global Positioning System), digital photographic camera, notebook, measuring tape, field sheets and a vehicle for transportation to selected sites.

Main software applications used in the study:

a) Envi 4.2 (for recording and cutting out images).
b) ArcGis 9.0 (for digitalization and spatial analysis);
c) C5 (Decision tree)

The extraction of information from the images was the preliminary stage of the digital classification algorithms to extract information for use during the digital classification phase. It included generating fraction or synthetic images derived from analysis of spectral mixture and normalized distance vegetation index (NDVI). Through the use of remotely sensed images processing techniques, such as the decision tree algorithm, images were classified in groups or regions, according to a predefined homogeneity criterion. Decision tree algorithm-based classification was performed using first a data mining applications software to generate a set of decision tree rules and subsequently an image processing software for digital classification.

Once the images were processed and interpreted as per procedures mentioned above, the land eligibility assessment focused on the effective plantation areas within the project boundaries of both plantation units. As a result, grasslands were identified in the following status:

- High pasture - Grouped in this class are open pasture areas with high biomass stocks of exotic gramineous plants with more homogeneous texture such as *brachiaria*.
- Low pasture - Low biomass stocks pasture is found in large cattle raising properties, where beef cattle raising and cattle genetic improvement operations are carried out. The most widely cultivated grass types are species of *brachiaria*.
- Degraded areas - This class include small areas of soil managed for maintenance of pasture. It is also found in areas affected by erosion or crossed by paved or unpaved roads. It is characterized by areas recently burnt out for pasture formation. The burn-out practice is common in the region and normally takes place during the driest months.

These three grasslands vegetation status do not fall under the Brazilian DNA's forest definition, since none of them reach a minimum tree crown cover value of 30 % neither have trees with the potential to reach a minimum height of 5 meters in maturity. As per a research report on the dry matter yield of *brachiaria* species[16], they have an average height between 75cm to 120cm.

As mentioned previously, the land eligibility assessment was executed following the procedures of the EB 35, Annex 18, which states that the project participant shall demonstrate that there was no forest on the project activity's land in two specific years: 2000 (project starting year) and 1989. Data from the land eligibility assessment report demonstrates that the pasture areas were significantly more degraded in 2000. In addition, the report concludes that the project area fulfils the EB 35 Annex 18 criteria falling under the category of reforestation, since local vegetation cover was below forest thresholds[17].

Lands included in this project activity did not contain forest-cover in 1989 and were expected to remain as such in the absence of the project. The land eligibility assessment was executed by a third party forester specialist[18]. The list of the images used and their date, as well as the details and tools used on their processing, are well documented in the land eligibility assessment report. The report concluded that at the moment of the start of the project and on December 31st 1989 there were no forests in the project boundary area. In addition, it concluded that the proposed A/R CDM project activity falls under the reforestation category, as per Decision 19/CP.9.

[16] Mello, Dimas et al. Dry Matter Yield of Brachiaria brizantha and Andropogon Gayanus under different types of tillage. July 2008.

[17] As defined by Resolution no 2, of 10 August 2005, by the Interministerial Commission on Global Climate Change.

[18] Oliveira, Adauta C. (March 2008). Land-use survey executive report.

As presented in section A.2, due to the integrated nature of the project entity CDM projects activities, an equivalent amount of areas included in this CDM A/R activity is used to establish new and additional forest plantation in lands not currently included in the boundaries to supply the industrial production of iron with renewable biomass based energy. These lands contained exhausted forest plantations - hence non-spontaneous vegetation - established before December 31st 1989[19]. Considering that this issue highlights special circumstances inherent to Brazil and its forestry sector, the project entity in conjunction with organizations in the forestry-based industry, the NGO community and research organizations have prepared a discussion paper on how to address this issue in the future.[20] The information on these plantations and the net changes in their carbon stocks will be separately recorded and voluntarily monitored in light of the provisions in AR-AM0005. Previous land-use is also explicitly registered for each plantation stand under the project activity. Moreover, in compliance with Annex 8 of EB20 guidance on the use of sustainable biomass, carbon stock changes in these lands will be monitored in order to demonstrate the relationship between carbon stocks of the renewable biomass production and its end use in the project's iron production[21] under Decision 17/CP.7.

A.8. Approach for addressing non-permanence:

>>The project aims at producing sustainable sources of biomass to meet the project entity's long-term energy needs of industrial production. Therefore, the project adopts a fixed 30-year crediting period and uses the **tCER** approach to account for the net anthropogenic GHG removals by sinks. Since the plantations are established and managed for the project entity's own use to serve as the renewable sources of energy to the project entity's industrial project activity, the proposed A/R project activity is expected to bring long-term benefits to the climate.

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

>>

[19] By definition, the harvesting of such forest plantations was foreseen before the existence of the CDM and would occur regardless of the CDM (as per the maximum rotation period of eucalyptus plantations in Brazil). These plantations were under exhaustion at the time the project activity started. As such, the project entity decided to establish new plantations in these lands as part of its integrated CDM project to produce renewable-charcoal-based iron. In as much as these areas would be harvested regardless of the CDM, the establishment of new plantations on them is also subject to the same barriers and incentives applicable to the establishment of new plantations within the current boundaries of this A/R project activity. Thus, they would also follow the same baseline land-use patterns, i.e. grassland. In spite of such facts, these lands are currently excluded of the project boundaries, given the doubts regarding the interpretation of the current eligibility rules. Areas under this land-use category include lands in the region of Itacambira (MG15 Unit) and in the municipality of Curvelo (MG02 Unit).

[20] The inclusion of these lands in the future would allow for the use of lands that were already degraded, without land-use change and without creating perverse incentives in terms of additionality. Since harvesting is determined by the rotation and coppicing practices, it would occur regardless of the CDM. On the other hand, the use of the same areas requires new and significant investments in plantations, i.e. it requires the creation of new carbon stocks that could be addressed within AR-AM0005, which is different from the mere preservation of existing stocks.

[21] Within the pig iron production activity, self-sufficiency in renewable charcoal supply can only be accomplished when new plantations are established in these areas.

Summary of results obtained in Sections C.7., D.1., and D.2.				
Year	**Estimation of baseline net GHG removals by sinks (tonnes of CO_2 e)****	**Estimation of actual net GHG removals by sinks (tonnes of CO_2 e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of net anthropogenic GHG removals by sinks (tonnes of CO_2 e)**
2000	4 054	5 402	18	1 330
2001	17 973	47 705	85	29 648
2002	46 241	220 257	265	173 751
2003	87 554	660 743	391	572 798
2004	135 630	1 406 299	514	1 270 155
2005	193 137	2 348 749	589	2 155 024
2006	193 137	3 173 960	725	2 980 099
2007	196 786	3 611 331	1 140	3 413 405
2008	209 313	3 191 764	2 283	2 980 169
2009	234 753	2 679 173	3 453	2 440 967
2010	271 935	2 270 981	4 514	1 994 532
2011	315 204	2 506 410	4 949	2 186 258
2012	366 960	3 128 509	5 017	2 756 532
2013	366 960	3 638 696	5 153	3 266 583
2014	371 014	3 779 569	5 570	3 402 985
2015	384 933	3 072 944	6 725	2 681 286
2016	413 201	2 100 426	7 892	1 679 333
2017	454 514	1 392 563	8 888	929 161
2018	502 590	1 501 730	9 311	989 829
2019	560 097	2 316 715	9 386	1 747 232
2020	560 097	3 141 926	9 522	2 572 307
2021	563 746	3 579 296	9 937	3 005 613
2022	576 273	3 159 730	11 080	2 572 377
2023	601 714	2 647 139	12250	2 033 175
2024	638 895	2 238 946	13 311	1 586 739
2025	682 164	2 474 376	13 746	1 778 466
2026	733 920	3 096 475	13 814	2 348 740
2027	733 920	3 606 661	13 950	2 858 791
2028	737 974	3 747 534	14 367	2 995 193
2029	751 894	3 040 909	15 522	2 273 493
Total (tonnes of CO_2e)	751 894	3 040 909,1	15 522	2 273 493

**** As explained in the section C.5.1 and based on the most plausible baseline scenario of this project activity the "baseline net GHG removals by sinks" are considered as zero. However, in order to strengthen the conservativeness of the project's net anthropogenic GHG removals by sinks, the historical annual A/R rate of the iron sector since the end of the fiscal incentives (8,2%) will be discounted throughout the project lifetime. The discounted amount is expressed in this column.**

Source: Plantar/TARAM

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

>>The project does not involve Official Development Assistance (ODA) and nor other sources of public funding from Annex 1 countries.

SECTION B. Duration of the project activity / crediting period

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

>> Starting date of the project: 10 November 2000.

The start date of this A/R activity complies with the period in which the project entity started the establishment of plantations (planting activities in the field) in response to the CDM incentive. In response to the CDM, the project entity commenced implementation of this A/R project activity on 10 November 2000, which is adopted as the starting date for this proposed A/R project activity. The related documentation and publicly available documents and agreements signed with the World Bank's Prototype Carbon Fund, as well as communications with the Brazilian DNA were presented to the DOE. In addition, the forest inventory system provided hard evidences on the exact date of the starting date of the planting activities within the project boundaries, as 10 November 2000.

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

>>The expected operational life time of the project activity extends for a period of 30 years (from November 10th, 2000 to November 9th, 2029).

B.3 Choice of crediting period:

>> This project will use a **fixed crediting period**.

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

>> N/A

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

>> The 30-year fixed crediting period would cover the duration between 10 November 2000 and 09 November 2029 and uses tCER approach to account for the net GHG removals by sinks from the project.

SECTION C. Application of an approved baseline and monitoring methodology

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

>> The proposed A/R CDM project activity is based on Version 01 of the approved methodology AR-AM0005 "**Afforestation and reforestation project activities implemented for industrial and/or commercial uses**". In addition, this project activity adopts the procedures and guidance of the version 02 of the "**Tool for the Demonstration and Assessment of Additionality in A/R CDM Project Activities**"[22].

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

>> The proposed A/R CDM project activity meets the applicability conditions of the AR-AM0005 methodology, as outlined below:

[22] Annex 17, EB 35.

- The project activity falls under the category of reforestation as renewable source of wood supplies for industrial use. It occurs through the establishment of eucalyptus plantations on grasslands, with low soil carbon content;

    - As per evidences provided in the land eligibility assessment report with satellite images of the project's area both in 1989 and 2000[23], the project's area consisted of pastureland, i.e. grasslands[24], prior to the project entity's land acquisition.
    - The project entity acquired the land for this project activity that was already on sale. Therefore, there was no activity or household displacement attributable to this A/R CDM proposed project activity.

- The baseline scenario is the maintenance of the present land use as grassland. As per the applicability condition, the second possible baseline scenario option (*A/R activity undertaken in small amounts in the periods prior to the A/R CDM project activity*[25]) was considered as one of the three alternatives under the baseline selection in this PDD. The areas in the proposed project A/R activity were specifically purchased for the project and were not subject to any A/R activities[26]. Thus an historical A/R rate is not applicable to this specific project activity. Also, if the baseline for the land-use is assessed for the region, one comes to the conclusion that eventual A/R activities conducted in the surroundings of the project and the historical sectoral A/R rates do not reflect sectoral conditions and the land-use trends, in line with the methodology. They are part of a very minor offer of A/R activities for iron and steel manufacturing, which results in a large deficit of A/R activities for the industry in Brazil, as widely documented in Section C5.1. Although there are small rates of A/R in the immediate surroundings of the project area, such A/R activities are not consistent with the land-uses that reflect the sectoral conditions[27] (land-use associated with the iron industry baseline). In fact, the trends in land uses that reflect sectoral conditions do not result in an applicable A/R rate

[23] Oliveira, Adauta C (March 2008): Land-use survey: executive report.

[24] The grasslands prior to the implementation of the project consisted of degraded, unmanaged and extensively managed land-uses. For conservativeness, the calculations in this A/R project activity assume that the whole project area consisted of extensively managed grasslands and that the carbon stocks referred to such a type of non-tree biomass at its peak (high pastureland) and in steady state are discounted in the estimation of net GHG removals by sinks.

[25] See details in Scenario 2 in Step 5 and Step 6 in section C.5.1. below.

[26] Based on a historical approach, the pre-project A/R rate is zero once the company has not established plantations in eligible areas prior to the establishment of this A/R project activity.

[27] Since this specific methodology is designed for A/R activities for industrial/commercial uses, land-use trends must reflect sectoral conditions (see methodology quote below). One can not assume that in the absence of the project activity, the eligible lands purchased by the project entity would be converted from pastureland to A/R activities for iron manufacturing, even at small rates. Two main arguments are advanced: (i) the baseline in terms of the industrial use associated with the methodology is the use of coal coke. Thus it is not consistent to assume that the land-use baseline reflect any A/R rate. Rather the baseline land-use is the prevailing land-use in the region (pastureland) and (ii) even if the regional A/R rate is considered (below 2% as per the most comprehensive study - IEF, UFLA, 2006 – the national rate is even lower), this would still not be a likely land-use baseline scenario. Since there is no availability of plantations in the market, it can not be assumed that one would purchase new portions of land (pastureland) to reforest only a minor part of it for the industrial use at stake, i.e. iron making. This is applicable both to the baseline (absence of the project) and to the project. The following quotations illustrate the consistency of the rationale presented above with the methodology: "*If regional data is not available or* ***not reflecting sectoral conditions****, [average annual rate of pre-project A/R undertaken at the national level should be selected and adequate evidence be provided to justify this choice …* "*The analysis shall focus on the* ***rate of A/R activities that is likely to occur in the absence of the A/R CDM project activity****; the determination of such an average annual A/R rate must be established by means of verifiable data and* ***supported by the reasons for the trends in the land uses***".

for the baseline for the eligible areas within this project activity[28]. However, in order to increase the conservativeness of the estimation of net anthropogenic GHG emission removals, the amount equivalent to the past A/R rate for the iron sector since the end of the fiscal incentives will be discounted in the calculation of net anthropogenic GHG emission removals.

- Land cover within the project boundary is conservatively adopted as high grassland in steady state and therefore considered to be at its carbon stock peak. As per the land eligibility assessment report above mentioned, satellite images and remote sensing methods were used to verify and classify the land cover within the project activity's area. The outcomes of this assessment are presented in the maps in Section C.4. The graphs below show the changes in vegetation cover occurred within the project boundary in years 1989 and 2000. Identified as hard evidences that the approach adopted by the project proponent is conservative once that most of grassland status identified in the project area were in degrading and low carbon stocks levels (56% of the land cover within the project boundary in 2000 was classified to be degraded and only 20% was characterized as high pasture).

Figure 12: Project's area vegetation cover in 1989 (%)

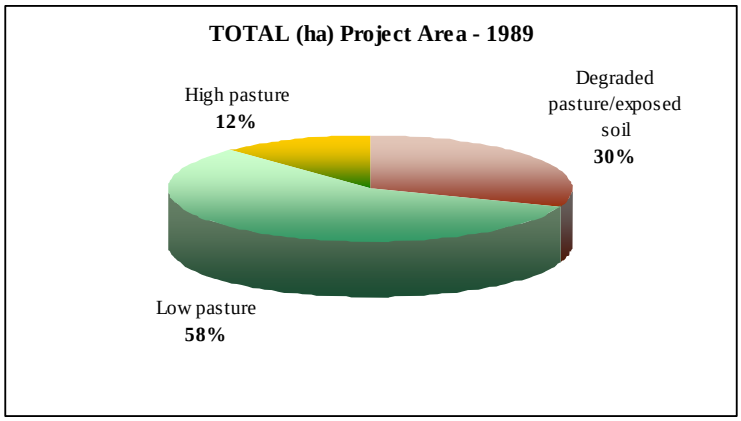
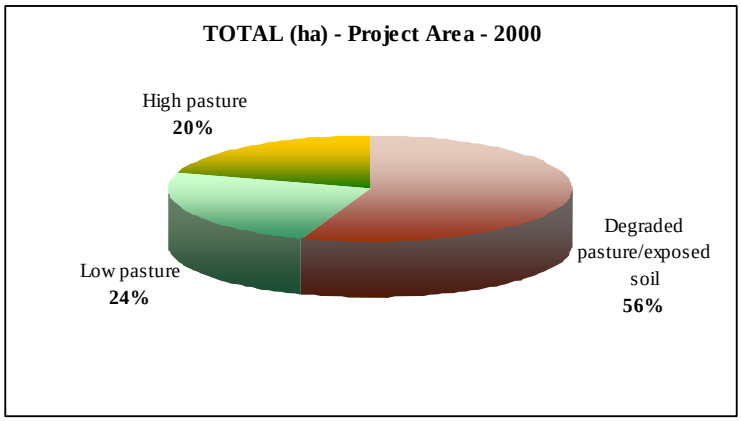


Figure 13: Project's area vegetation cover in 2000 (%)



[28] (Coal coke baseline → no A/R activities for iron making → baseline land-use = prevailing land use in the region (which, in this case, is not consistent with the adoption of a small A/R rate).

- Lands under this A/R project activity have been reforested through direct planting, based on sustainable production practices and advanced plantation technology.

- Basically the grazing activity in Brazil and in the project region adopts exotic grasslands species such as *Brachiaria* that is characterized as invasive specie. It is also public known that cattle grazing farmers in Brazil and in the project region use biomass fire burns and field weeding techniques as common grassland management practices. In addition, the pre-existent conditions of project areas reached around 20% to 25% higher grazing intensity (number of cattle head per unit of area) comparing to national and regional grazing intensities[29]. Therefore, natural regeneration is not expected to occur in the project area due to the prevailing land use, as per the common practice adopted in the region, which does not permit the establishment of tree vegetation. Scientific literature present empirical evidences that under the pre-existing conditions of the project area (land use reflecting extensively managed grazing activities under pastureland, including degraded ones) natural regeneration is avoided or faces a great difficulty to happen due to the facts that grazing practices can cause a decrease in quantity and quality of the natural seed sources[30]; and that without human intervention[31] the chances that natural regeneration take place are remote.

- Carbon stocks in soil are expected to decrease more or increase less in the absence of the project activity, relative to the baseline scenario. Lower soil carbon under grassland compared to plantations or secondary forests can be expected under tropical conditions. This approach is conservative, since soil carbon may actually increase with long-term plantations, as indicated by the scientific literature[32].

- Grazing did not occur within the project boundary since the project's implementation;

- Flooding irrigation is not practiced by the project entity. Instead, as per its forest management plan, the project entity adopts local irrigation only during the planting activity, and only during dry weather conditions;

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[29] As per data provided from the previous land owners, around 15 097 cattle heads used to be raised within the project area (a grazing intensity of more than 1.25 cattle heads per hectare). According to IBGE (2006) Brazil's grazing intensity reaches around 1 cattle head per hectare of grassland and the regional (State of Minas Gerais) intensity it is slightly high than the national levels, around 1.02 cattle head per hectare.

[30] Degrading and degraded pasture are closely related to the inappropriate grassland management that according to the scientific literature can cause intensive erosion, "transforming them into punctual sediments emissions sources. According to GASPARINO et al. (2006) in pasturelands, the cattle cause soil compaction, avoiding or creating difficulties to natural regeneration and causing soil seed sources impoverishment in quantity and in quality." (BOCHNER, J. 2007, p. 8)

[31] "In areas occupied with grasslands for long periods of time, the natural regeneration of the *cerrado* is reduced specially in diversity, but also density and tree cover (…) all experimental attempts in order to accelerate the natural regeneration in grassland areas, it was found that Brachiaria control with the use of wide spectrum herbicides (*glifosato*) was the only technique which provided superior results to natural regeneration in areas with no treatment at all. (…) seed rain is less important than underground structure coppicing in the process of recovery of *cerrado* areas. (...) Naturally, the proportion among the different processes in the recovery of an area will rely on the availability of structures which can coppice, the existence of seed sources nearby and favorable light and humidity conditions for the establishment of seedlings. In other words, this proportion depends on the type of intensity of the disturbance to which the ecosystem was or is been submitted." (BORDINI, 2007 *apud.* DURIGAN, 2003, p. 22).

[32] Desjardins T, Andreux F, Vokoff B, Cerri CC (1994): Organic carbon and 13 C contents in soils and soil size-fractions, and their changes due to deforestation and pasture installation in eastern Amazonia. Geoderma 61, 103-118; Detwile RP (1986): Land use change and the global carbon cycle: the role of tropical soils. Biogeochemistry 2, 67 -93; Fearnside PM, Barbosa RI (1998): Soil carbon changes from conservation of forest to pasture in Brazilian Amazonia. Forest Ecology and Management 108, 147-166

- The planting process follows the minimum cultivation technique, which minimizes soil impacts and optimizes the use of water. Fertilizers, herbicides and pest control substances are used as per good practices in silviculture. These procedures are in conformance with the FSC's requirements to sustainable development, which also include:

  - adoption of soil conservation techniques;
  - monitoring of water quality and quantity;
  - preservation of legal reserve areas and reduction of natural areas fragmentation.

  A complete list of requirements and the details on the principles and criteria required by the FSC – Forest Stewardship Council can be found in the Annex 6 of this PDD. As such, soil drainage and disturbance are insignificant. Therefore, non-CO_2 emissions from this activity can be neglected;

- The project plantations include hybrid clones of different *Eucalyptus* varieties, which are not nitrogen-fixing species (NFS); thus GHG emissions from denitrification can be neglected in the estimation of actual net GHG removals by sinks.

- The whole project area is georeferenced and the project entity is implementing Geographical Information System (GIS) for the management of spatial data.

- No activity or household displacement is attributable to the project activity.

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

>> As per the approved methodology, this project activity selects the carbon pools and the emissions sources presented in the table below:

Figure 14: Selected carbon pools

Carbon pools	Selected (answer with Yes or No)	Justification / Explanation of choice
Above ground	Yes	Major carbon pool subjected to the project activity
Below ground	Yes	Major carbon pool subjected to the project activity
Dead wood	No	Conservative approach under applicability condition
Litter	No	Conservative approach under applicability condition
Soil organic carbon	No	Conservative approach under applicability condition

Figure 15: Emissions sources included in or excluded from the project boundary

Sources	Gas	Included/ excluded	Justification / Explanation of choice
Combustion of fossil fuels by machinery & vehicles	CO_2	Included	
	CH_4	Excluded	Potential emission is negligibly small
	N_2O	Excluded	Potential emission is negligibly small
Biomass burning from fires	CO_2	Excluded	Not applicable
	CH_4	Included	
	N_2O	Included	

Use of fertilizers	CO_2	Excluded	Not applicable
	CH_4	Excluded	Not applicable
	N_2O	Included	
Removal of pre-existing non-tree vegetation	CO_2	Included	
	CH_4	Excluded	Not applicable
	N_2O	Excluded	Not applicable

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

>>**Stratification of the project area**

Step 1: Stratification taking into account pre-existing conditions and likely evolution of baseline.

The first step of the stratification was based on a third party land eligibility assessment report[33]. The following procedures and findings were considered in order to identify the baseline strata:

- In the study the type of local vegetation cover was the main variable influencing carbon stock changes in above-ground and below-ground biomass pools within the project area. The project's area is located in a region of same climate, soil and topography regional conditions. Hence, climate and soil variables were considered to influence carbon stock changes under the same pattern to the whole project activity area. Landsat images were taken during the dry season, during times of little cloudiness, and scenes are further divided and reduced in size to cover an area encompassing both municipalities.
- The baseline information was collected from Landsat satellite images (Scene 219-73 Geocover from 2000 and Scene 219-73 from 1989) taken using Thematic Mapper and Enhanced Thematic Mapper sensors with spatial resolution of 30 meters for 6 spectral bands, field collected data through GPS coordinates points, and soil, vegetation maps and local studies (see table below). This information reflects the status of grassland within the project area based on official and reliable sources.

Figure 16: Images Information Sources

Database	Source
Land use map of Minas Gerais	Geominas (Minas Gerais State Program on Geoprocessing Technology)
Vegetation mapping 1994	IEF (Minas Gerais State Forests Institute)
Municipality centers	Geominas (Minas Gerais State Program on Geoprocessing Technology)
Road system	Geominas (Minas Gerais State Program on Geoprocessing Technology)
Contours	IBGE (Brazilian Institute of Geography and Statistics)
Water courses	ANA (National Water Agency)

- The data collected from Landsat satellite images taken in 1989 and 2000, land tenure documentation, and information collected from previous land owners **(as per Figure 16**: Survey results for leakage prevention in Section A.5.6) clearly demonstrates the degradation process of the pre-existing conditions of the grassland (vegetation and composition). Based on

[33] Oliveira, Adauta C. (March 2008). Land-use survey executive report.

the assessed results it is conservative to adopt as baseline scenario the maintenance of a high pasture in its peak carbon stock in the absence of implementation of the A/R project[34].

- As presented on the table above, Landsat satellite images, field survey and official data publications were the information sources used to identify the pre-project status of grassland. The status of the area, managed as extensive grassland, was demonstrated through the use of reflectance spectral patterns of the images and field collected data. In addition, the fact that the three grasslands status (high pastureland, low pastureland, and degraded areas) were identified in the same area, and considering that the most common activity in the region is grazing, demonstrates that the pre-project grassland status was managed as extensive grassland.
- The data project area's pre-existing conditions were selected after searching into databases from government institutions such as IEF, Emater and Epamig and corroborated with Landsat satellite images and field land cover data collection.. Selected areas were located in the image and a field check was then made using points collected by GPS. These data was used to identify the preliminary strata of the grassland.
- The information on the strata identified under preliminary stratification were complemented with data from the specific features of the stratum levels, which included:
    - The grasslands consisted of three different grasslands status: high pasture, low pasture and degraded areas.
    - Small islands of native vegetation and isolated trees, locally called *reboleiras*, were preserved as natural protected areas but were not included in the project's boundaries. Since they contribute to the maintenance of the local biodiversity, they are expected to remain in the same status.
    - Past changes in the grassland vegetation were assessed through Landsat satellite images, field collected data, land tenure documentation and information collected from previous land owners (as per **Figure 9**: Survey results for leakage prevention in Section A.5.6.
- It was demonstrated by Landsat images, field collected data, and information collected from previous land owners (as per **Figure 9**: Survey results for leakage prevention in Section A.5.6 that different status of grasslands (high, low and degrade pasture) were identified within the project area before the establishment of the project activity. Based on the same evidences it was inferred that the pre-existent conditions signalized a degrading process of the grassland. However, the project proponent adopted a conservative approach, applying one single baseline stratum as high grassland areas under extensive management and that were expected to remain in such state in the absence of the project activity.
- The analysis of preliminary strata did not reflect significant variation within the strata, since the project's grasslands are under the same region (same regional characteristics – climate, soil, topography) of the Minas Gerais State.
- The strata were identified, based on Landsat images and field surveys for both forestry service units are presented in maps below. Since the three grasslands status identified were under the same regional characteristics (e.g. soil, climate, topography), for conservativeness purposes only one stratum was adopted. Thus, the dominant species of grassland, *brachiaria spp,* was considered in its peak and steady state as the basis to estimate carbon stock changes under the baseline.

[34] The land eligibility report issued by a third party in regards to the project activity area's vegetation cover presents a decreasing trend of the total high pasture and an increasing trend of degraded pasture in the comparison of years 1989 and 2000 (a period of 11 years), see Figures 17 and 18 below

Figure 17: Project area vegetation cover in 1989.

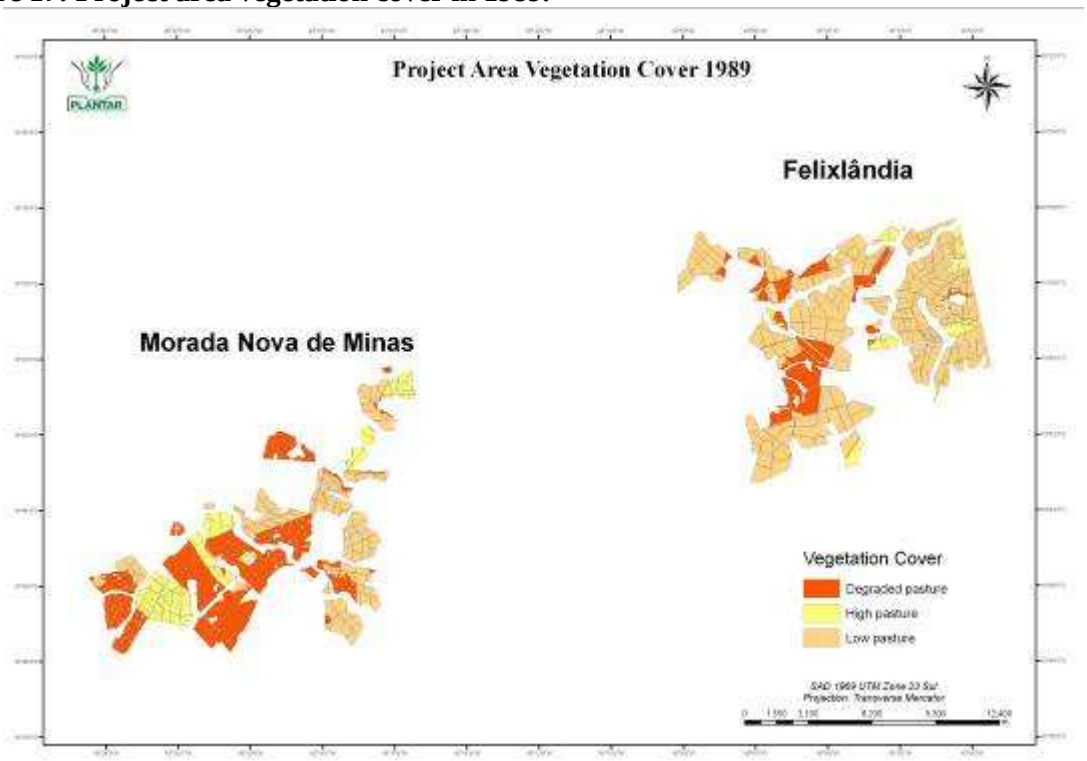
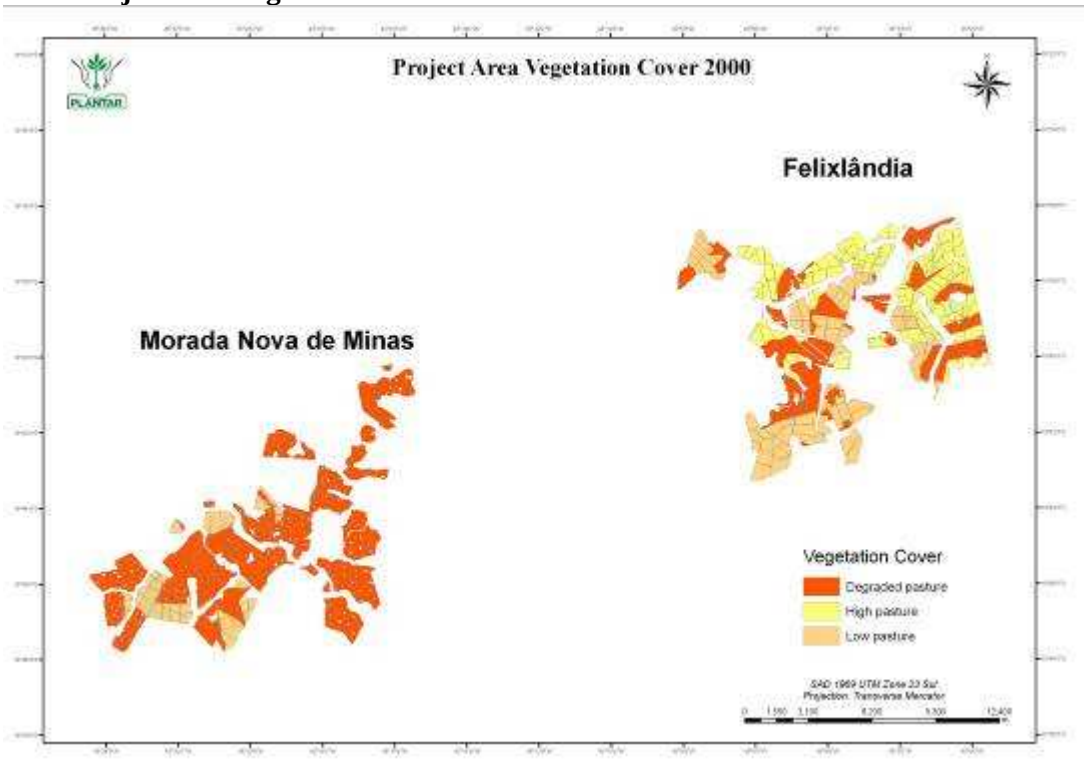


Figure 18: Project area vegetation cover in 2000.



Within the project boundary the maintenance of grasslands is the most plausible and common land use, as per the eligibility assessment, land use maps and the land tenure documentation. In a comparison between the project area's vegetation status in year 1989 and in year 2000, the data shows that the pasture areas were significantly degraded during the period. As such, the likely evolution of the baseline would be the continuing degradation of the pasture, as per data on the land eligibility assessment report mentioned above.

In conclusion, the study identified grasslands as the most plausible baseline in the pre-project area[35]. For conservativeness purposes, the different status of grasslands was classified as *brachiaria spp* in its higher carbon stock (peak) and in steady state, which formed the baseline strata (see Section C.7. Estimation of the *ex-ante* Baseline Net GHG Removals by Sinks and Section D.1 *Ex ante* actual net GHG removals by sinks calculation.

Step 2: Criteria of stratification considered in the proposed CDM A/R project activity

i) Specification of the species and stand level characteristics of the project:

Since each clone planted in the project has a different basic wood density, the major ten clones were identified and analyzed. For the determination of the basic wood density, four trees of each clone were harvested, and identified according to its clone code, tree number, stand number and collection date. The trees were cut in 2.5 cm discs at specific heights of the commercial part of the tree. These discs were then transformed into woodchips, which were carefully selected, mixed and sent to laboratorial analysis, where the dry matter weight and consequently the basic wood density are determined. The respective basic densities, as per table below, were determined based on the ten major clones selected, on the wood collected and on the analysis of the woody material.

Figure 19: Densities by clones

CLONE	Db (kg/m³)
3486	470
3336	495
3335	506
3281	510
PL 40	510
3487	520
1591	530
2486	530
3334	550
1288	580

Following the classification of each stand, with their respective basic wood densities, a weighted average of the densities was calculated resulting in a 503.07 Kg/m^3 average basic density.

A single stratum was defined for the project areas of the MG-03 and MG-04 units. This was based on the consideration that the cloned sprouts used in the project activity has the same growth trend and

35 The vegetation classes semidecidual stational forest, *cerrado* (Brazilian savannah), wetlands and regeneration areas, were identified outside the project's boundaries. This vegetation remains preserved by the project entity as natural protected areas.

morphological characteristics, and that the plantations were established under similar soil, relief, climate, and forestry management conditions and adopting a weighted average of clone densities.

Based on the Forestry Continuous Inventory (FCI) data, each stand annual production was calculated. A weighted average of each stand's annual productivity and their total area were calculated in order to build a growth curve according to the age of the stratum. The stratum was then divided into sub-strata, which were defined based on the planting dates (age class of the plantations).

ii) Specification of the silvicultural regime of species:

The project's stratification considered the following variables under the project entity's silviculture regime: age class, the type and quantity of fertilizer applied, the wood volume to be harvested, and the rotation cycle adopted. Age class is taken into account for the sub-strata determination. The other variables were taken into account considering that there is only one stratum determined for the project area and that the same silviculture regime is applied for all types of clones.

Approximately a total of 8.35kg of nitrogen per hectare is applied during the first three years after the planting date. The wood volume to be harvested in each cycle is approximately 250-270m^3 of wood per hectare. The forests are planted in accordance with the eucalyptus seven-year rotation up to a 28-year-period.The planting density is 1 111 trees per hectare for all clones, which is equivalent to a 9 square meters spacing per individual tree. Due to highly similar soil formations, same production capacity and growth is assumed. Clones have similar growth parameters. Harvesting occurs after seven years of the forest's implementation in 100% of the stand.

iii) Specification of the temporal and spatial information on the plantation establishment:

The project entity relies on a Geographic Information System (GIS). Topographical information on the area of the MG03 and MG04 units, plot data, age class, and ex-ante stratification data have been already included in the GIS. Project plot areas are all larger than the Brazilian DNA forest definition. Age class and other factors are also recorded in the TARAM tool for calculating emissions and removals of GHG. All stands within the project's boundary are georeferenced.

iv) Factors affecting actual net GHG removals by sinks:

The project activity relies on sustainable production practices and advanced plantation technology. Since the same silviculture regime and forest management procedures are used for the whole project's area, management factors such as harvesting and replanting were not considered for the stratification criteria.

Step 3: Ex-ante stratification taking into account the stratification criteria and land use within the project boundary

All stands within the project's boundary are georeferenced. One single stratum was defined for the project area. The project boundaries are consistent with the boundaries of the stratum of each forestry service unit (MG-03 and MG-04).

Step 4: Preparation of ex-ante stratification map

Georeferenced maps with ex-ante stratification including sub-strata information were prepared with the defined strata and are presented below.

Figure 20: Sub-strata of MG03 unit.

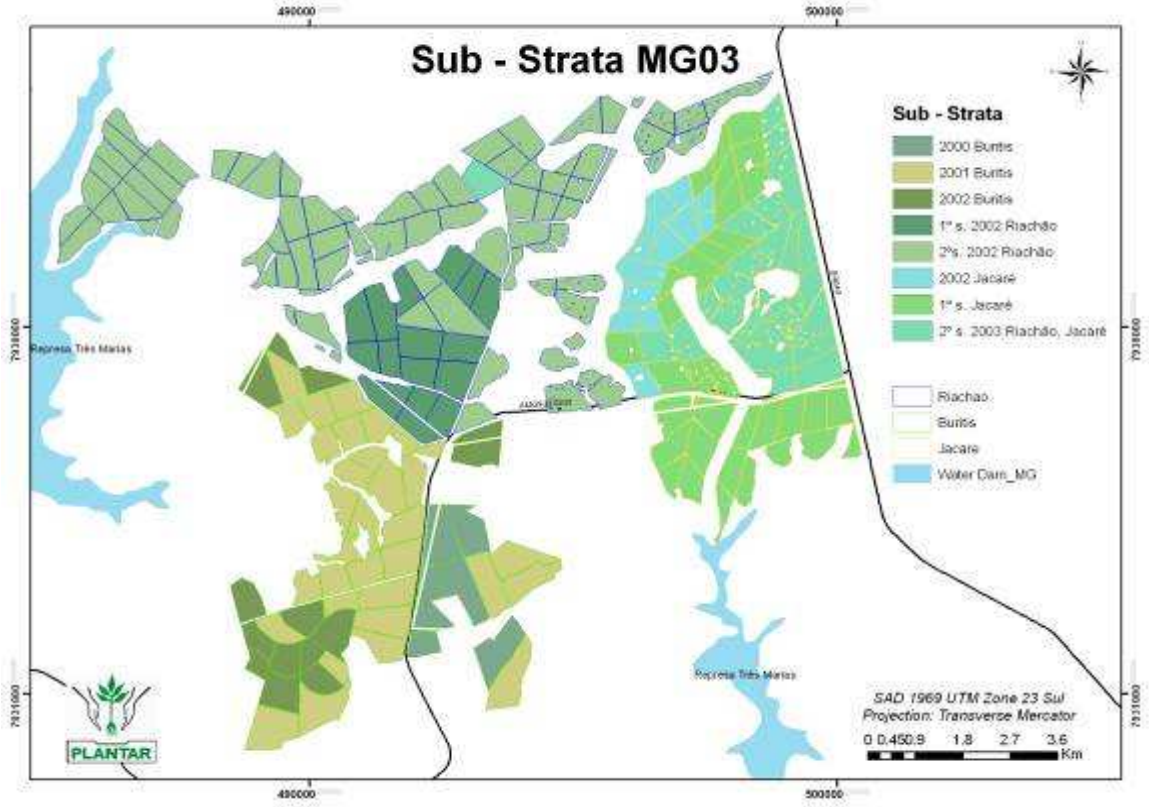
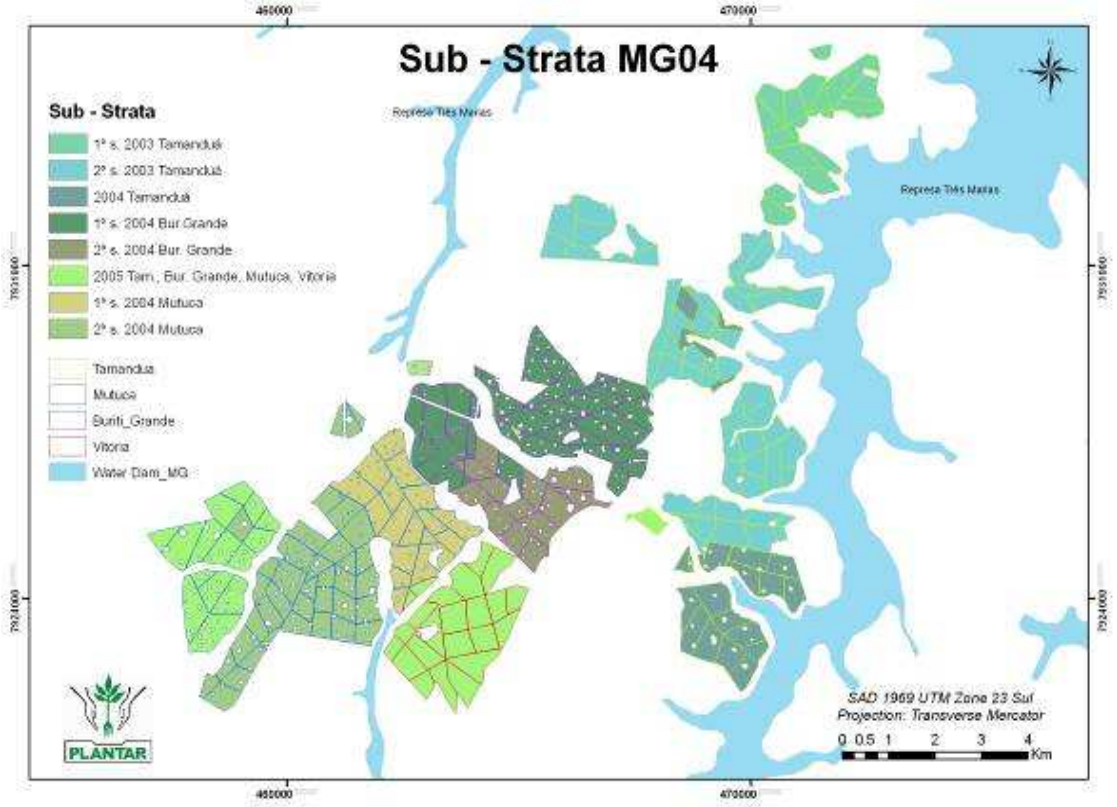


Figure 21: Sub-strata of MG04 unit.



Step 5: The changes to the A/R project after the adoption of ex-ante stratification
All the relevant changes will be recorded in the TARAM tool for calculating emissions and removals of GHG. Changes on the geographical delimitations of the stands occurring after the ex-ante stratification will be monitored as per the approved methodology. See item E.2 for monitoring provisions.

C.5. Identification of the baseline scenario:

C.5.1. Description of the application of the procedure to identify the most plausible baseline scenario (separately for each stratum defined in C.4.):

>> In accordance with the provisions of the approved methodology (AR-AM0005), the following steps and sub-steps are adopted to determine the baseline scenario in a transparent manner. The analysis aims at identifying the most likely land-use and its related GHG impacts in the absence of the establishment of new dedicated plantations to supply the production of iron with renewable charcoal.

Step 1: Demonstration of the most likely land use at the time the project starts

In compliance with the Brazilian DNA forest definition[36], the lands within the current boundary of this A/R PDD solely refer to areas that did not contain forest on December 31st, 1989 (see Section A7). This is corroborated by a technical report developed by an independent forest engineering expert, which was based on the analysis of remote sense data and satellite images. The public and official land-use satellite images dated *circa* 1989 demonstrate that the project areas were covered with pastureland (*brachiaria* grasslands), hence not forested land as per decisions 11/CP.9 and 19/CP.9. In addition, the report confirms that the area did not contained forests before the project activity's implementation.

The same report presents the project activity area's vegetation physiognomy in years 1989 and 2000. The data shows that the native vegetation in the project's area has not regenerated within the project boundary as per the maps provided in the section C.4 above. On the contrary, a severe pasture degradation process happened over the 11-year-period, reaching more 56% of total areas within the project boundary as presented in the section C.2 above.

In compliance with the methodology, the determination of the most likely land use within the project boundary at the time the project starts is based on the prevailing land use in the region, land use trends and, on the barriers that condition it. An underpinning feature is the deficit of plantations to supply renewable charcoal for the production of iron. By definition it represents the absence of carbon stocks attributable to forest plantations in lands that could be used for such a purpose (see Step 3). The deficit results from major barriers that limit the project entity's capacity to establish forest plantations for charcoal-based iron production as well as the lack of plantations for renewable charcoal in general, which make the project activity implementation unlikely and unattractive in the absence of CDM. Several barriers are identified, and their relative significance is examined in step 3 (barrier analysis). Barriers include the lack of appropriate debt-funding, investment barriers, the lack of policies to stimulate forest plantations for charcoal-based iron, the lack of access to capital markets, risks related to regulatory schemes and the long-term maturity period of the project.

[36] Brazilian Interministerial Commission on Global Climate Change - Resolution n. º2 - August 10, 2005. Available at www.mct.gov.br/clima

Having identified major and specific barriers to forest plantations as an alternative land use, a general analysis on lands in the vicinity and the pressures that prevent the possibility of land being abandoned to natural regrowth is also is also undertaken as to corroborate the most likely land-use in the absence of the project plantations.

As further analyzed in steps 2 and 3, forest plantations cover an area of approximately 5 million hectares, which represents less than 0.5% of the Brazilian territory. According to the Minas Gerais Agriculture Department, Federal University of Lavras (UFLA) and Forest Institute of the State (IEF), 1 167 267 hectares are covered with the forest plantations in the State of Minas Gerais, corresponding to less than 2% of the total territory. On the other hand, 25 348 603 hectares are occupied with pastureland, which corresponds to 81% of rural areas[37]. The total area of pastureland in the municipalities involved in the project activity, Felixlândia and Morada Nova de Minas, is 125 715 hectares, which represents 77% of the total rural properties (IBGE, IEF, UFLA 2006)[38]. At the project level, 47% of lands within the project boundaries were covered with pastureland before the project. The remaining areas consisted of degraded areas with no-vegetation cover. Pastureland is the prevailing practice not only in the project vicinities but also at the state level. This makes explicit the land pressures that prevent the possibility of land being abandoned to natural forest regrowth. Therefore, pastureland is the most common land use category of the region where the project activity is located. This analysis conservatively excludes the degraded status of most of the project areas before the project activity and considers pastureland as the most likely land-use at the time the project started, remaining as such in the absence of the project.

Step 2: Assessment of national and sector policies and legislation

In accordance with the baseline methodology, the policies related to the creation of wood sources, legislation related to A/R activities and wood use, and the role of sectoral incentives and constraints and the macroeconomic policies are addressed below:

a) Policies related to the creation of wood sources

Brazil holds the largest concentration of forests proportionally to its territory, covering 64.3% (544 million hectares) of the land area. Tree plantations or silviculture practices represent only 0.9% of the country's total forested area, the remaining 99.1% refers to native vegetation (LEITE, 2003). In addition, the total forest plantation areas, including those for other industries represent 0.5% of the national territory. Historically, natural forests have supplied the country's demand for wood, which resulted in the large-scale degradation of several of the country's original biomes, specially the Atlantic Rainforest, the *Cerrado* (Brazilian savanna) and a significant proportion of the Amazon Rainforest[39]. The development of forest plantations in Brazil has only started in 1967, in response to a federally subsidized reforestation program, enacted by the national government under law 5.106, on September 2, 1966. In response to the growing demand for wood-based industries and to limit deforestation practices, a fiscal incentives program (which was later referred to as FISET) was

[37] Net of degraded areas and native vegetation (including areas under legal constraints). It is important to recall that approximately 30% of the land-use of rural proprieties in the State of Minas Gerais must be legally set aside for the preservation of native vegetation, hence the exclusion of these areas. The area within the project boundaries is net of such areas. More than 8 thousand hectares have been set aside for the preservation of native vegetation as a result of the project activity, corresponding to one third of the total land-use resulting from the project.(Around 23 thousand hectares of plantations and above 9 thousand hectares of native areas)

[38] Net of the project plantations and of legal preservation areas.

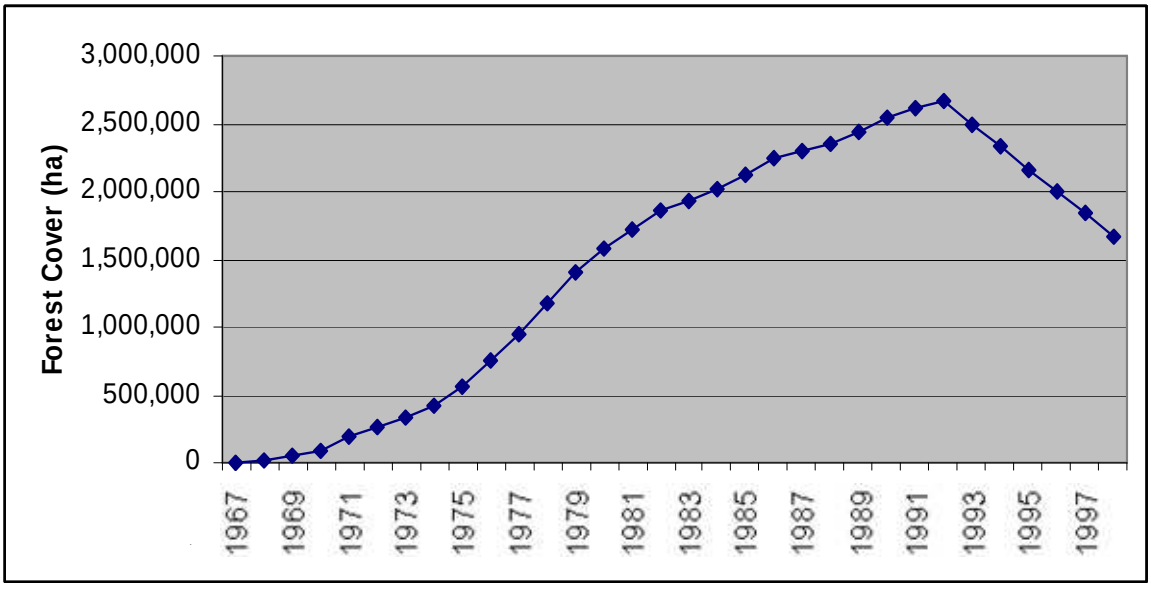
[39] O Estado de S.Paulo, September 16th, 2005.

implemented to stimulate the establishment of plantations. The program lasted until 1988 and the state of Minas Gerais accounted for over 70% of the plantation projects.

The plantation area has grown in response to the program. The total area of plantations in Brazil, almost non-existent before, increased to 6.5 million hectares in 1992 (REIS, 1994 and IPEF, 2000). With the discontinuation of the Program in 1988, plantation establishment decreased, while harvesting of existing plantations continued at a rapid rate. The replacement of the Brazilian Institute for Forestry Development (IBDF) with the Brazilian Institute of Environment and Natural Resources (IBAMA), in 1989, also emphasized a focus away from plantation forest establishment to native forest preservation and its sustainable management. As a result, charcoal consumption remained at rates similar to pre-1989 values and the area of plantations declined from 6.5 millions hectares in 1992 to 4.8 million in 1998 (REIS, 1994 and IPEF, 2000).

The declining trends in plantation activity were strongly observed in the state of Minas Gerais (the project region), as it has historically dominated the Brazilian plantation sector, especially in terms of plantations for charcoal supply. The plantation forestry sector in the state has evolved hand-in-hand with the iron and steel industry. The rich-deposits of iron ore and the need for a thermal reduction agent (carbon) have led to the rapid depletion of the regional native forests. The end of the FISET led to a marked drop in area under plantation establishment in Minas Gerais. This was followed by a reduction in the forest cover in the state, as the harvesting levels continued high, with almost no replanting (**Figure 22**). In 1992, the state was covered with over 2.6 million hectares of forest plantations. By 1998, this figure was reduced to 1.67 million hectares (REIS, 1994 and IPEF, 2000). In 2003 and 2004, the forest plantation stock in Minas Gerais respectively accounted for 1.16 and 1.15 million hectares, 75% of which were established for charcoal supply (AMS, 2004).

Figure 22: Forest plantation stock in Minas Gerais (ha)



Source: IPEF, 2000

Recognizing the threatening deficit of plantations in Brazil, the Federal Government created the National Forestry Program (PNF) in 2000. The program's objective was to expand the forestry plantation base through multi-purpose initiatives, such as increasing funding, removing regulatory

bottlenecks and strengthening governmental institutional capacity. In 2004, the PNF was re-launched by the federal government. However, as per the trends presented below, the recent measures are far from resolving the current and projected wood supply deficits in the long-run due to prevailing barriers, e.g. insufficient funding, the difficulties associated with the high-interest-rates of the Brazilian economy, and the resulting risks and high opportunity costs to long term investments, such as the establishment of dedicated fuel wood plantations with production cycles of up to 28 years in comparison with the use of global commodities such as coal coke. In fact, as the fiscal incentives program put in place by the government in 1967 terminated in 1987, a sectoral trend towards the increasing use of coal coke has been strengthened.

> *"…fiscal incentives to plant forests were removed in the late 1980s, decreasing and even stopping the establishment of new forests. Moreover, the wave of opening of the national market to imports led to the increase in coke production, encouraged by its immediate availability and cost-effectiveness (…) During the 1990s, the privatization of integrated steel and iron industries resulted in the shutdown or conversion of charcoal furnaces into coke furnaces." (BRAZIL, 2007, p.23).*

b) Legislation related to the requirements of A/R activities and wood use

The iron and steel industry in Brazil is not legally required to use non-GHG intensive reducing agents, such as renewable charcoal from dedicated forest plantations instead of coal coke. Given the expected twofold increase in the Brazilian production of iron (see Section C.6, Step 4), the government is actually seeking alternatives to stimulate the national production of coal, as to enable self-sufficiency and ensure thermal-energy security for one of the country's main development drivers[40]. On the other hand, iron producers willing to use renewable charcoal must comply with a series of laws and regulations as to ensure the origin of their sources and to minimize the use of charcoal from non-renewable native forests (a GHG intensive carbon source) due to other environmental concerns.

Since the 1930's, different regulatory mechanisms have affected the establishment of wood plantations for the production of renewable charcoal or the use of non-renewable charcoal in Brazil. The Brazilian Forestry Code, issued in 1934 (Decree 23.973/34) and reedited in 1965 (Law n.4771/65), was an important instrument to regulate the forestry activities, establishing a minimum percentage for the preservation of native forests, and introducing the concept of permanent preservation areas and legal reserves. The transportation of, acceptance and storage of wood, firewood or charcoal originated from native forests, as well as the production of charcoal using first quality native wood without proper licenses have all been qualified as criminal offenses. These contraventions are punished with three months to one-year imprisonment and fines.

In 1989, the Decree 97.628/89, under the Brazilian Forestry Code, required all large-scale wood consuming industries to be responsible for creation of the required plantation sources to supply their production activities. The 1988's Federal Constitution[41] had established a new role for the Federation, States and Municipalities in the preservation and maintenance of forests, fauna and flora. It allowed States to simultaneously legislate on environmental issues. In 1991 Minas Gerais became the first Brazilian State to have its own forestry regulation, with the creation of the State Forestry Law (Law n.10.561/91), revoked and replaced by Law n.14.309/2002, which obliged all organizations that consume or commercialize forest products to use a minimum of 90% of wood coming from planted forests. It allowed a maximum of 10% for native forests consumption, provided a fee is paid. Forestry

[40] Ministry of Mines and Energy (Gazeta Mercantil 04/19/2004)

[41] Chapter VI, Articles 23 and 24 deal with forestry matters.

products coming from other states shall present documentation guaranteeing the origin of the wood. However, there are no mandatory provisions on the use of coal coke.

Whereas, the vast majority of the Brazilian iron production is based on coal coke (see **Figure 23**) the minor part often relied on illegal practices to sustain their production in the past, e.g. illegal logging and falsification of licenses for the production and transportation of charcoal. Approximately 50% of the Minas Gerais *cerrado* (Brazilian savannah) has been depleted for 20 years to supply charcoal for part of the iron industry[42]. Technical and human resources for thorough inspections were not sufficient to cover the national territory. The effects of such a lack of enforcement over public property rights have often lead to a classic common pool resource problem (see Olson, 1971), posed by the availability of native wood and its obvious economic attractiveness *vis-a-vis* any alternatives that require major new investments, i.e. renewable charcoal from forest dedicated plantations. This has resulted in market failures in the sustainable production of renewable charcoal-based iron and most of the iron industry that complied with legal requirements has been basing their activities on the use of coal coke.

Over the past 10 years law enforcement and inspection operations have significantly grown both in terms of frequency and strictness, making the use of non-renewable charcoal increasingly difficult. Criminal and financial penalties have been applied, such as apprehensions, embargoes, fines and imprisonment of the involved people[43]. In the state of Minas Gerais, the culmination of this trend has taken place when the executive branch proposed a new law[44], gradually banning the use of non-renewable sources of charcoal for the production of iron. The same bill explicitly recognizes the role of carbon finance mechanisms, namely the CDM, in stimulating and supporting the use of renewable charcoal from dedicated plantations.[45] Within this context, it would be unrealistic and non-conservative to assume that project entities would plan new and long-term investments in production of iron, based on illegal and unsustainable practices involving the use of non-renewable charcoal.

Step 3: Assessment of demand and supply of wood resources for industrial and commercial purposes

The historical, current and expected forest plantation deficits in Brazil is widely recognized by the local, state and federal governments, universities, research institutes, NGOs' and private sector entities. Several governmental and non-governmental organizations have published reports on the status of plantations as the sources of wood supply and on the specific deficits of plantations for charcoal in Brazil, including the Brazilian Institute of Geography and Statistics (IBGE), Brazilian Bank for Social and Economic Development (BNDES), Ministry of the Environment (MMA), Brazilian Silviculture Society (SBS), Brazilian Institute on Forestry Research (IPEF), Silviculture

[42] Rodrigues apud Loubet 2007 (public prosecution authority)

43 See articles on several of these operations at:

http://www.ibama.gov.br/novo_ibama/paginas/materia.php?id_arq=3299

http://www.ibama.gov.br/novo_ibama/paginas/materia.php?id_arq=4798 ; http://www.ibama.gov.br/novo_ibama/paginas/materia.php?id_arq=3185;
http://www.ibama.gov.br/novo_ibama/paginas/materia.php?id_arq=3572 ; http://www.ibama.gov.br/novo_ibama/paginas/materia.php?id_arq=3502 ;
http://www.ibama.gov.br/novo_ibama/paginas/materia.php?id_arq=4589 ; http://www.ief.mg.gov.br/index.php?option=com_content&task=view&id=310&Itemid=139 ;
http://www.cedefes.org.br/new/index.php?conteudo=materias/index&secao=5&tema=1&materia=2855 ; http://www.pm.sc.gov.br/website/rediranterior.php?site=40&act=1&id=1895

http://www.aaitmg.org.br/pages/1_news_old/2006/07_20_06.html ; http://www.revistareferencia.com.br/index.php?principal=ver_noticia.php&uid=174

[44] SEMAD 2007

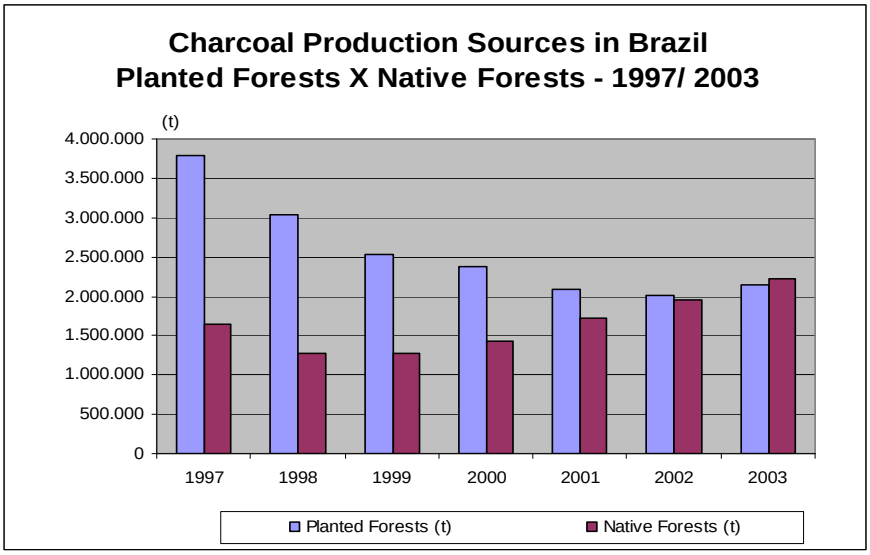
[45] Secretaria de Estado de Meio Ambiente e Desenvolvimento Sustentável (SEMAD/2007).

Association of Minas Gerais (AMS, former ABRACAVE), the University of Viçosa (UFV), the University of São Paulo (ESALQ/USP), STCP Engenharia, the Environment Defense Association of Minas Gerais (AMDA), among others.[46]

Although specific numbers vary, depending on research focus, vintage of data, and end-uses of wood, most researches report a common conclusion, i.e. there is a severe shortage in the supply of wood plantations in Brazil, which is commonly referred to as the "forestry blackout". The most frequent causes are: lack of adequate debt funding, inadequate long-term policy, high interest rates, complex environmental policy and plantation legislation. In most cases, these issues provide the basis for the lack of attractiveness of plantation establishment for iron, which stands out as a common conclusion reached in published reports and literature (see BRAZIL, 2007).

In accordance with the Brazilian National Development Bank (BNDES), the iron and steel charcoal based industry is currently the most affected by the ever increasing demand for wood sources. This has been worsened by the exhaustion of the plantations established under the fiscal incentives, and the lack of new plantations (BNDES, 2002). A published IBGE (2005) research further corroborates such a trend (**Figure 23**). The research highlights that the decreasing rate[47] of plantation-based charcoal is attributable to a decline in the establishment of plantations aimed at supplying the iron and steel industry.

Figure 23: Charcoal production sources in Brazil



Source: IBGE, 2005

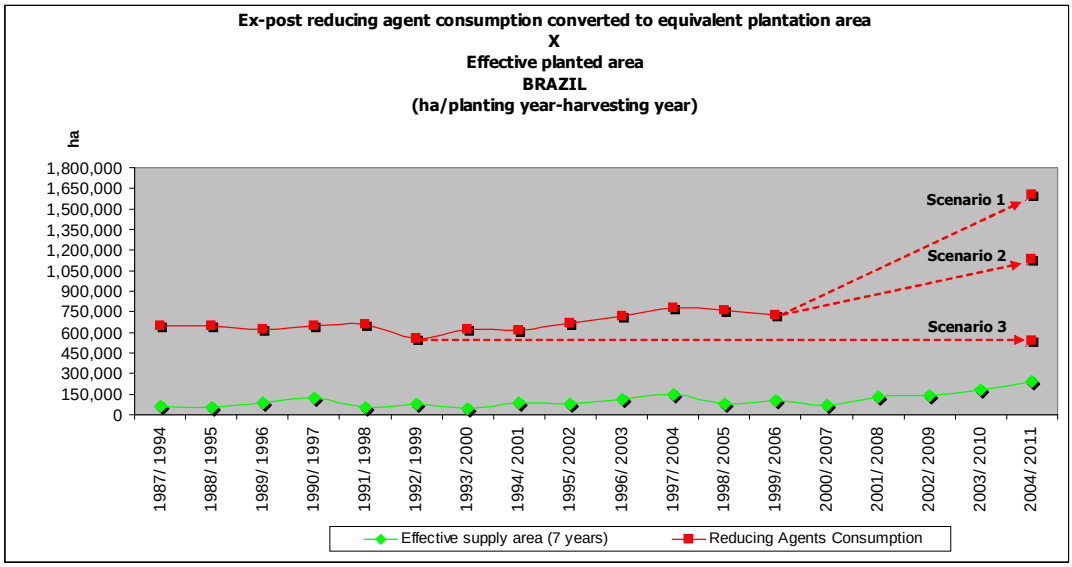
The impacts of barriers on the plantation establishment for charcoal-based iron production can be more clearly identified by a comparative analysis of the reducing agents consumed (effective demand) and the amount of plantations established - for such an end-use - seven years before (available supply). These plantations include those implemented in the project region by other companies. **Figure 23** and **Figure 24** demonstrate the demand-supply gap. Even though the absolute amount of

[46] Some publications call attention to the increase in plantations for charcoal supply as well as for other purposes. However, most of these sources often look at the absolute number at the supply side and overlook the increase on the demand side, which results on increasing deficits in spite of an absolute increase in the supply of plantations (see **Figures 23 and 24**).

[47] From 73% in 1998 to less than 50% in 2002.

plantations has increased since 2001, the consumption of reducing agents has increased significantly more, resulting in an increase of the *ex post* plantation deficit. Historical data demonstrates that in spite of cyclical fluctuations in the consumption of reducing agents by the iron industry plantation deficits have always been observed. The projected consumption of reducing agents for the following years results in a substantial deficit of more than 300 000 hectares in 2011. This is the case even when the most conservative scenario of the time series analyzed (i.e. Scenario 3, representing the lowest consumption of reducing agents over the past 10 years). Scenarios 1 and 2 are based on projected data grouped by the Brazilian National Development Bank and by the Brazilian Iron and Steel Institute, and respectively result in a deficit of 890 000 and 1 376 000 hectares of forest plantations.

Figure 24: Comparison between (i) the *ex post* consumption of reducing agents expressed in equivalent plantation area and (ii) effective planted area, as per the seven year rotation of eucalyptus (Brazil):

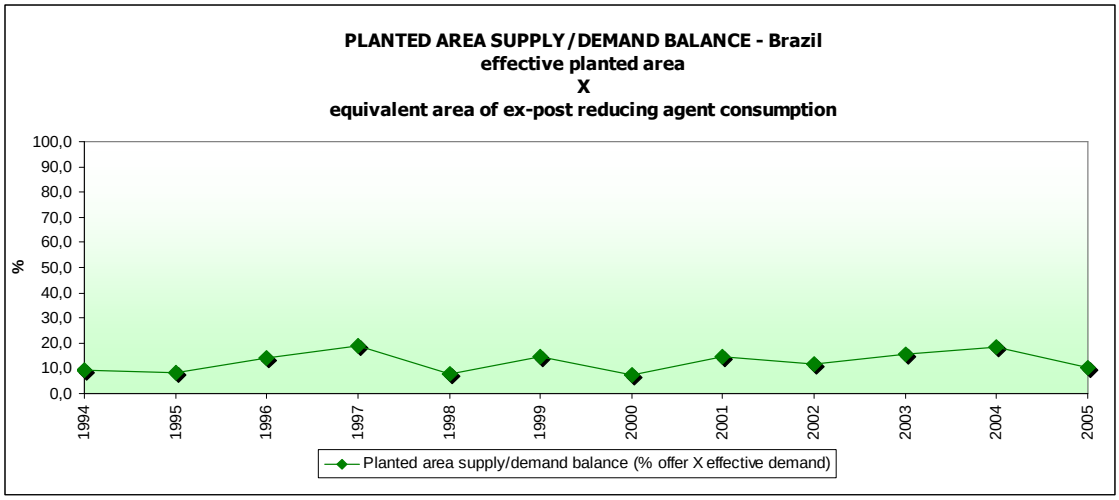


Souce: Research on AMS ; SINDIFER, 2006

Had it not been for the substantial technological improvements in plantation development, the situation would have been worse in the past and in the current days. Forestry productivity has almost doubled in Brazil over the past 20 years. The data above incorporate these productivity gains[48]. The worsening of the wood deficit in Brazil, in spite of substantial productivity gains, is a clear indication of the impacts of the prevailing barriers and of insufficient policies.

Figure 25: Planted area balance in terms of the gap between the plantation area available and requirement to meet iron and steel industry demands

[48] The productivity gains have been discounted on the conversion of charcoal consumption in the stacked cubic meters (mdc) to the equivalent plantation area required for such an amount (2 mdc/stere of wood). It was conservatively assumed that plantation productivity doubled during the harvesting period between 1970 until the year 2004. Four different productivity rates were considered, ranging from 123 to 231 st/ha. These numbers are deemed conservative for the state of Minas Gerais, since they partially include productivity rates of eucalyptus clones, which were planted by a few companies until 1999.



Souce: Research on AMS; SINDIFER, 2006

Figure 25 shows that on average only 12.6% of the total iron and steel demand of reducing agents has been supplied with renewable charcoal from dedicated plantations, from 1994 to 2005 (proportion of the equivalent area of reducing agents consumption). This supply percentage reached 7.5% of the total demand in 2000, the year which this A/R project activity started its implementation.

Step 4. Assessment of land-use practices and prevailing land uses in the project region

In accordance with the approved methodology and EB guidance (Annex 19, EB 23), project participants must assess land-use practices in the project region and, if appropriate, adopt a pre-project A/R rate, applicable to the project boundaries in the baseline scenario. If an A/R rate is adopted, it should be estimated based on historical and verifiable data, based on the project entity's previous A/R activities and the sectoral level A/R activities, which in this case is taken at the national level (production of iron). The analysis should reflect trends and impacts associated with the relevant regulatory constrains and policy incentives.

The project entity itself was founded in 1967 in response to the fiscal incentives provided by the federal government. As a forestry management company (service provider to third parties) the project entity has managed plantation consortia based on fiscal incentives. By rendering forestry management services, the project entity has been able to acquire quotas of some consortia, which allowed for the establishment of its own plantations stocks. It is important to note that the project entity had established its own plantation stocks before starting the production of pig iron, an exception in its industry. This illustrates the project entity's policy, aimed at prevent supply shortages associated with the unsustainable practices commonly observed in the iron industry.

Nevertheless, the project entity's plantations have, in general, followed the trend of the Brazilian iron and steel charcoal based sector. From 1988 to the end of the 1990's the project entity's annual plantations have varied from zero to irrelevant figures. The impacts of the cessation of the fiscal incentives in 1988 led to the interruption of plantation establishment, for the first time in the project entity's history. However, it needed wood supply more than ever, since it had established a pig iron mill in 1984 based on the stocks made available by its own plantations.

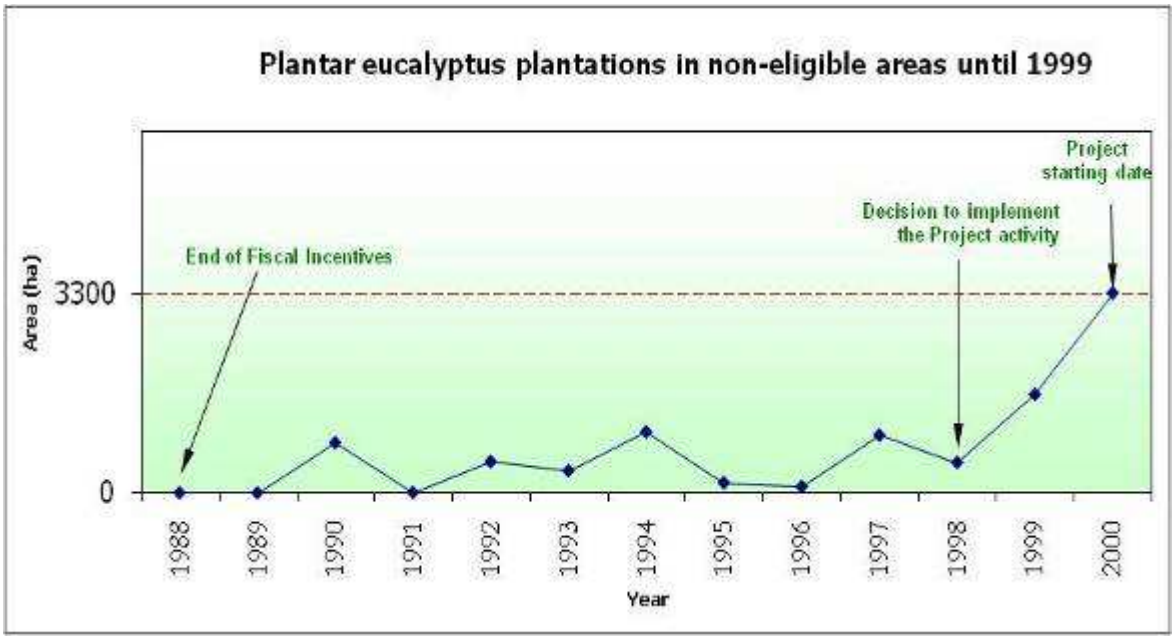
Thus, the suspension of the fiscal incentives and the prevailing barriers such as lack of debt financing, and of appropriate governmental policies (see step 3 Section C.6), have critically prevented the

project entity from establishing dedicated plantations for the production of iron and its previous plantation stocks terminated.

The significant establishment of plantations has only been resumed in 2000, as part of this proposed project activity. The decision to establish new plantations has been strongly supported by the already advanced and publicly known negotiations with other project participants and investors, including the World Bank's Prototype Carbon Fund[49]. **Figure 26** presents the plantations activities undertaken by the project entity since the end of fiscal incentives.

[49] Letters of Intent and official correspondence are available and were presented to the DOE.

Figure 26: Plantar's plantations in non-eligible areas before the project (until 1999).



Source: Project entity's records

The CDM incentives applied to the integrated Plantar project (net GHG removal accounted for in this A/R PDD and emission reductions accounted for the industrial component[50]), will allow the project entity to curb the deficit of charcoal from renewable plantations and improve the opportunity costs of manufacturing iron based on renewable charcoal, instead of GHG intensive reducing agents. As a result, when the plantations established within the project reach their first maturity/harvesting period (2007/2008), the project entity is expected to become the first of its kind capable of producing pig iron 100% based on renewable charcoal.

As presented in Steps 2 and 3 and further discussed above, Plantar's A/R activities followed the same path of the regional and national A/R activities for iron production, since the end of the fiscal incentives in 1988. Since then, the company has not established plantations in CDM eligible areas for this A/R project activity. Thus, based on a historical approach, the pre-project A/R rate is zero[51].

Figure 27: Industry historic rate of reforestation for the production of charcoal for iron production, since the end of the fiscal incentives

Year	Total planted area (ha) energy Brazil	A/R activities to supply the iron industry (%)
1988	54 352	8

[50] As outlined in Section 1, the methodology and the draft PDD for the industrial component are still under approval process.

[51] Considering Plantar's average plantations activities from 1988 to 1999 (year before the CDM Project implementation) the rate of A/R activities before the project reached only 15.34% of the total plantation establishment needs for the project's iron manufacturing, 3 300 hectares per year on average (see **Figure 26**). However, these minor A/R establishments were undertaken in old and exhausted plantation areas in non-eligible areas outside the project boundaries, which would be harvested regardless of the project. As explained in Section C.2, such a pre-project A/R rate is not considered as a plausible baseline scenario (see Section A7).

1989	88 357	14
1990	125 000	19
1991	51 305	8
1992	80 067	14
1993	46 653	7
1994	37 026	6
1995	30 351	5
1996	32 752	5
1997	30 756	4
1998	30 000	4
1999	30 000	4
Average Area	**53 052**	
Average Rate(%)	***8.20***	

Source: Plantar Inventory records, AMS and Sindifer (several years)

Thus, considering that:

- The analysis and trends presented above reveal that (i) the exhaustion of the forest plantations stocks developed with fiscal incentives and (ii) the lack of new plantations would lead the project entity to rely on GHG intensive reducing agents, e.g. coal coke, in order to produce iron.
- …the low A/R rate identified at the sectoral level and the trends pointing to an ongoing deficit of plantations lead to a scenario in which the project entity could not rely on the market to supply it iron production with renewable charcoal from forest plantations.
- …the project entity purchased the grassland areas (non-forested in 1989) within the current project boundaries for the project activity and that, by definition, such lands would not be subject to the project entity's A/R rate.
- …the prevailing land-use in the region is grasslands for pastureland or no-vegetation cover, the areas acquired to establish the new forest plantations would remain under the same land-use since it is the most common pattern in the project's region (see Step 1).
- …it is unrealistic to assume that a new investment to produce charcoal-based iron on a non-stop and sustainable basis would be made if the supply of reducing agents (i.e. renewable charcoal from plantations) were limited to only 8.20% or even 15.34% of the required supply.

Conclusion of Step 4: it is not appropriate to adopt an A/R rate in the baseline scenario, since it is not coherent with the project entity's and sectoral conditions, as well as the associated land-use prevailing practices.

Step 5: Identification of plausible and credible alternative land-uses

Plausible and credible land use scenarios are outlined in light of national and sectoral policies and the project entity's land-use practices. The scenarios focus on the availability of plantation stocks and on the associated carbon stock changes in line with the decision 19/CP.9. As noted earlier, it is important to emphasize that the GHG impacts related to the end-use of the plantations (iron manufacturing) are considered within an associated but separately designed project activity in compliance with Decisions 17/CP.7, and the guidance of the Executive Board (Annex 8 of the EB 20).

Given that the plantations under this project activity are established to supply the production of iron with renewable charcoal, land-use analyses are restricted to carbon stock changes derived from the iron industry. Thus, the potential land-use impacts related to other industries that may use renewable biomass are not considered relevant for this project, since the demand for iron is not related with the demand for other forest-based products such as pulp and paper, furniture, pencils, construction materials, etc. Moreover, the amount of iron produced is not determined by the type of reducing agents adopted.

The land use scenarios are analyzed in Step 6 below. Those that are not likely to occur in the absence of the project activity are eliminated and the *land-use* scenario that is most likely to prevail is identified as the baseline scenario for this A/R project activity. For the selected baseline scenario, the vegetation cover and its likely future development are then further analyzed in Step 6.

The three following alternative land uses are identified and described below:

- *Scenario 1:* Maintenance of the present land-use, reflecting the complete absence of forest plantations to supply the project's iron production.

- *Scenario 2:* A/R activities are expected to occur at intermittent rates to supply the project's iron production, reflecting the substantial lack of forest plantations.

- *Scenario 3:* The project activity undertaken without the CDM incentive, indicating that land-use reflects full-fledged forest plantations to supply the project's iron production.

Step 6: Identification of the most likely land-use in the absence of the project activity

Each of the scenarios outlined in Step 5 are analysed and the most likely land-use in the absence of the proposed project activity is adopted as the baseline scenario.

- *Scenario 1:* Maintenance of the present land-use, reflecting the complete absence of forest plantations to supply the project's iron production.

Considering (i) the historical, current and expected deficits of renewable charcoal in Brazil, (ii) the project entity's plantation stocks (**see Figure 26**), and (iii) the prevailing barriers identified in step 1 above and detailed in Section C.6 and in Annex 3, it is unlikely that net GHG removals from additional plantation stocks established to supply the iron industry would take place in the absence of the project entity's CDM projects. In the absence of such new plantations to supply the project's iron production, it is conservative to assume that the resulting land-use scenario in the project boundaries throughout the crediting period of this A/R project activity would be the prevailing land-use within the regional and sectoral levels. In consistency with the methodology, the analysis below is conducted to determine the prevailing land-use in project boundaries in the baseline scenario.

1.1) Degraded areas/No vegetation cover:

In accordance with the Minas Gerais Agriculture Department, 13.82% of the land-use in the state consists of areas with no vegetation cover. This accounts for the third largest land-use category within the State (the fifth largest State in Brazil in terms of area, equivalent to 10% of the national territory and to the size of the French Republic). At the project level, this land-use also represents a significant baseline alternative, as more than half (56%) of the

lands within the project boundaries fell under this scope before the start of the project activity (see Section C.2).

1.2) Land-use is grasslands/pastureland remaining as such

Within the state of Minas Gerais, pastureland represents 81% of rural areas[52]. At the project level, 47% of the land-use within the project boundaries before the project starting date fell within this land-use category[53] (the other half consisted of degraded lands). Therefore, considering the analysis above and the analyses conducted in Step 1 and in Step 3 (deficit of plantations for renewable charcoal - see **Figure 24**), the prevailing land-use in the project boundaries in the absence of the project is conservatively considered pastureland, in spite of 56% of areas considered as degraded pasture.

Figure 28: Most likely land-use in the absence of the proposed A/R activity.

1.3) Other land-uses including agriculture and other tree vegetation types.

The current degraded status of native vegetation, the prevalence of pastureland in the project region and, the associated land use trends, do not allow for a scenario in which the area within the project boundaries would be subject to spontaneous vegetation growth. In terms of other agricultural practices, official data shows that cropland represents less than 15 % of the total rural areas within the State and 10.9 % of the total project's vicinity[54].

In light of the above, Scenario 1 is conservatively defined as "*the maintenance of the grassland land-use in eligible areas, reflecting the complete absence of forest plantations to supply the project's iron production*".

- *Scenario 2:* A/R activities are expected to occur at intermittent rates to supply the project's iron production, reflecting the substantial lack of forest plantations.

Within this scenario, the project entity would implement a minor area of forest plantations, which would result in the consideration of a pre-project A/R rate in the baseline scenario. However, it is unrealistic to assume that the project entity would make new investments in the production of

[52] Net of degraded areas and native vegetation. It is important to recall that approximately 30% of the land-use of rural proprieties in the State of Minas Gerais must be set aside for the preservation of native vegetation and that the area within the project boundaries is net of such areas.

[53] see OLIVEIRA 2008

[54] Minas Gerais Agriculture Department (2007), IBGE,IEF,UFLA 2006.

charcoal-based iron relying on scarce and unavailable supplies of such a fundamental input (see Step 3 - 8.20% in the case of the previous activities of the project entity or 15.34% of plantations at the sector level which were already in use by other companies and by definition would not be available for the purposes of the project activity). Even if one assumed that the project's iron production would rely on scarce supplies of renewable charcoal, the consideration of an A/R rate within this PDD would still not be applicable. If project entity were to develop partial A/R activities in the absence of the project, as per its historical rate, this would occur in lands that already belonged to the project entity covered with exhausted plantations, which were stocked in 1989 and would be harvested and reverted to non-forested areas regardless of the project (i.e. planted from 1979 to 1985). These areas are currently excluded from the project boundaries in this PDD, as explained in Section A7. The areas currently included in the project boundaries within this PDD (*brachiaria* grasslands) are only those that were specifically purchased for the project entity's proposed CDM activities, and as such they would not be acquired in the baseline scenario.[55]

Thus, considering the abovementioned points, it is not appropriate to adopt an A/R rate within the scope of this PDD and this scenario is not likely to be the baseline scenario.

- *Scenario 3:* The project activity undertaken without the CDM incentive, indicating that land-use reflects full-fledged forest plantations to supply the project's iron production.

In light of the analyses above and of the project entity's and sectoral analyses in Step 2, 3 and 4 as well as the analysis in this section, this is the most unlikely baseline scenario.

Hence, *Scenario 1* as the maintenance of the *grassland land-use* reflecting the complete absence of forest plantations to supply the project's iron production it is conservatively identified as the most likely land use scenario in the absence of the project activity and is henceforth referred to as the baseline scenario[56].

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

As presented in section C.4, Landsat satellite images and field data confirmed the pre-existing conditions of the area within the project's boundaries, which consisted of three different *status* of grasslands. For conservativeness purposes, the three different status of grasslands identified (high pasture, low pasture, and degraded areas) were classified as *brachiaria spp* in its higher carbon stock (peak) and in steady state, which formed the baseline stratum of the project activity.

The maintenance of grasslands is the most plausible and common land use, as per baseline analysis, land eligibility assessment, land use maps and land tenure documentation. In a comparison between the project area's vegetation status in the year 1989 and in the year 2000, the data shows that the pasture areas were under a significant degradation process during the period assessed. This is corroborated by the evidences presented in sections C.2 and C.4. As such, the likely evolution of the baseline scenario would be the continuing degradation of the pasture with no tree vegetation

[55] Registered contracts, publicly available project documents the Emission Reductions Purchased Contract signed with the World Bank's Prototype Carbon Fund demonstrate that the referred areas were specifically purchased for the project and will be made available to the DOE.

[56] However, as a conservative approach in the final calculations of the "Estimation of baseline net GHG removals by sinks" it is applied a discount based on historical annual A/R rates established by the iron sector since the end of the fiscal incentives.

establishment. Therefore, the adoption of one single baseline scenario stratum considered as high grassland in its peak carbon stocks is deemed to be a conservative approach.

C.6. Assessment and demonstration of additionality:

>> In accordance with Section II.5 of the baseline methodology, and as per the most recent version[57] of "Tool for the demonstration and assessment of additionality in A/R CDM project activities", the steps below are used to demonstrate that the project scenario is not part of the baseline and is therefore additional:

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

The project implementation started in 10 November 2000. Documentation such as project design documents, validation and verification reports, and official correspondence with the World Bank's Prototype Carbon Fund and other interested parties, have been made public since the project's conception and starting date. The first project plantations have been established in 10 November 2000, thus this is adopted as the start date of the project.

Moreover, the project entity's integrated project, including the proposed A/R activity, was submitted to independent validation in 2002, under the UNFCCC regulations applicable at that time. However, in spite of validating the industrial project activity, the DOE could not conclude the validation of the A/R activities due to the absence of LULUCF regulations at that time.

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

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

The project scenario is determined from amongst the plausible alternatives analyzed in section C.5, in the context of the baseline scenario. The same baseline alternative scenarios addressed in the previous section are analyzed as project scenarios, according to the procedures of the latest version of the "Additionality Tool". Therefore the scenarios listed in **outcome of Sub-step 1a are presented and analyzed as follows:**

- *Scenario 1:* Maintenance of grassland land-use reflecting the complete absence of forest plantations to supply the project's iron production.

- *Scenario 2:* A/R activities are expected to occur at intermittent rates to supply the project's iron production, reflecting the substantial lack of forest plantations.

- *Scenario 3:* The project activity undertaken without the CDM incentive, indicating that land-use reflects full-fledged forest plantations to supply the project's iron production.

Sub-step 1b. Consistency of credible land use scenarios with enforced mandatory applicable laws and regulations.

All of the scenarios under analysis are consistent with applicable laws and regulations in Brazil, as further discussed in subsection "*b) Legislation related to the requirements of A/R activities and wood use"*of the Step 2, section C.5.1. There are no laws and regulations that obstruct or block the conversion of pastureland into A/R areas.

[57] Annex 17, EB 35.

The wood and charcoal industries in the State of Minas Gerais are regulated by the State law n.14.309/2002 (which replaces Law n.10.561/91). It enforces companies and people commercializing wood products to exclusively consume or use products coming from planted forests, respecting the limits applied (see item C.5.1 Step B, for details). However, considering that the project entity's sustainable charcoal end use is for pig iron production (as explained in item A.2) it is worth to emphasize that there is no legislation, either in Federal or State level, that enforces the use of charcoal as a mandatory reducing agent for the iron ore production. As the coal coke faces fewer barriers to its use, the use of this reducing agent is the common practice in Brazilian iron and steel industry. Therefore, the project activity is not a legally required activity.

Sub-step 1c. Selection of the baseline scenario

As presented in section C.5.1, *Scenario 1*, indicates the maintenance of the present land-use in CDM A/R eligible areas as grasslands, reflecting the complete absence of forest plantations to supply the project's iron production. As such pastureland is adopted as the most likely land use scenario in the absence of the project activity.

Step 2: Investment Analysis

As per the "Tool for the demonstration and assessment of additionality in A/R CDM project activities", it is necessary to undertake at least one of the analysis: either the Investment Analysis or the Barrier Analysis. This project entity chooses to undertake the Barrier Analysis (Step 3).

Step 3: Barrier analysis

Sub-step 3a. Identified barriers that would prevent the implementation of type of the proposed project activity

Significant barriers limit the project entity's capacity to establish plantations for charcoal-based iron manufacturing. The following ones are identified and their relative significance is examined.

i) Investment barriers

- Lack of appropriate debt financing and of access to credit for medium and/or long-term activities.

The establishment of tree plantations requires large amounts of investment. Although the productivity of eucalyptus plantations in Brazil is currently considered one of the best in the world, the first harvesting period for most economic uses, including charcoal, cannot occur before the 7th year, within a plantation cycle of up to 28 years. Thus, industries that can be based on wood plantations, such as the project activity, have no income until the full maturity of the trees, which is reached in 7 years. In order to cope with the intrinsic characteristics of this industry, loans must have at least a 7-year grace period, and a minimum duration of about 10 years, which is almost non-existent in the Brazilian financial market and in most developing countries. The situation is worsened by the fact that these types of loans are not offered by Brazilian private banks. As a result, the entire debt-funding demand relies on governmental bodies, which have competing developmental priorities and limited resources.

At the time the project activity started (2000), the Brazilian National Government was working on

the establishment of the National Forestry Program (PNF[58]), with the objective of alleviating the ongoing forest plantations deficit. Although the current government has launched the program in 2004, no additional large-scale funding has become available. As detailed below, the funding structure is still inappropriate to supply the sector's demand and the project activity.

In 1988, The Minas Gerais Development Bank (BDMG) has created the only applicable funding facility to which the project entity had access (Proflorestas). The fund started its operations in 1994 with limited resources (US$28 million). In addition, most companies are not able to meet the collateral requirements and other governmental restrictions. At the time the project activity started, and in the subsequent years, the total amount of annual resources made available by this facility has only covered a very minor portion of the sector's needs[59]. In 2005, only R$16 million were available and, in 2006 and 2007, R$10 million and R$8 million were available to the entire forestry based sector in the state of Minas Gerais (BDMG, 2008). **Figure 29** presents the Minas Gerais Development Bank's disbursement of Proflorestas loans from 2000 to 2007.

Table 29: Minas Gerais Development Bank (BDMG) Proflorestas Disbursement of loans for the forestry sector during 2000-2007:

Proflorestas Loans - BDMG	
Year	**Total Values (R$)**
2000	1 269 323
2001	10 960 131
2002	17 014 601
2003	11 947 910
2004	4 538 000
2005	16 000 000
2006	10 000 000
2007	8 000 000*
TOTAL	79 729 965
* Estimated value for 2007.	

Based on carbon finance, Plantar was able to obtain loans under the Proflorestas scheme as per the cap within the program[60]. Although these resources were used to implement part of the project activity, they only covered a smaller portion of the total investment required for the project implementation. The acquirement of these loans was also enabled by project entity's CDM projects and by the PCF transaction, which positively influenced the BDMG risk assessment procedures (additional information on Step 5).

Even the Brazilian Development Bank (BNDES), which is the main source of long-term funding in the country - and is a major alternative for these producers - cannot supply the sector's debt financing needs. Four out of the five long-term forestry loans offered by the Bank have duration of five years or less. The other funds that were available to forestry plantations are not applicable to the project activity, as they are exclusively devoted to small-scale enterprises (i.e. BNDES Pronaf - for rural households only, and BNDES Propflora) or are only dedicated to the pulp and

[58] For more information: www.mma.gov.br

[59] See BDMG Official Statement 2008

[60] As explained in Step 5, carbon finance has also enabled the granting of the referred loans to the project entity;.

paper industry. The Propflora facility has been created to support the implementation of plantation activities. However, it is capped at R$150 000, which is negligible considering the investment requirements of large-scale plantations.

Likewise, the location of the plantation activity in the state of Minas Gerais also makes it ineligible for other sources of official funds, including the special funds structured for the less developed regions of Brazil, which also lack sufficient resources (e.g. North, Center-West and Northeast regional funds) and exclude the project region[61].

In addition to the scarcity of funding, most companies, including the project entity, have serious difficulties in providing collaterals and loan warranties. The plantations per se are not accepted as collaterals or permanent real assets, which significantly limits the access to debt resources.

The severe shortage of debt-financing and the prevailing double-digit real interest rates in Brazil also have a dominant role in the risk-aversion for investors in creating long-term assets. In Brazil, investors have struggled with high real interest rates (the highest in the World[62]), sustained by the implementation of a strict monetary policy aimed at curbing inflation since the early 1990's. Integrated activities to supply charcoal-based iron production are particularly affected, since they are mostly dependent on the long-term credit availability. For more than 10 years, the project entity has not been able to make such large investments in the establishment of plantations for the production of iron, following the sectoral trends (see Step 4 below for further analyses). Therefore, structural lack of and the difficulties in the access to appropriate debt-funding are major barriers to the implementation of the project activity.

- No access to international capital markets due to real or perceived risks associated with the nature of the project entity and industry.

The project entity is not a publicly listed company and thus has had no access to international capital markets[63]. This is mostly due to its small size and due to the international investors' risk-aversion to loans for dedicated plantation activities to produce renewable charcoal in developing countries, with a very unstable institutional environment as discussed in Step 1. Thus, no alternative sources of debt or financing, other than the limited domestic resources, were available to the project entity, especially at the time the investment decision was made (year 2000).

ii) Barriers due to prevailing practices

As large international iron and steel groups started controlling several Brazilian industries, the above mentioned barriers became even more relevant. The World's iron production is largely based on coal-

61 http://www.bnb.gov.br/content/aplicacao/Investir_no_Nordeste/Perfil_dos_Estados/gerados/mg_apresentacao.asp (accessed on July 21st, 2008).

62 Folha de S.Paulo (2008) http://www1.folha.uol.com.br/folha/dinheiro/ult91u378775.shtml . The Brazilian annual interest rate in 2000 was approximately 16.5% (SELIC rate - http://www.bcb.gov.br/?COPOMJUROS) and the country's investors risk classification was still far from reaching the investment grade (BB+ by S&P and Fitch - http://dinheirama.com/blog/2007/06/19/o-que-e-o-tal-grau-de-investimento (accessed on July 21st, 2008).

63 The website www.bovespa.com.br lists all Brazilian public companies that have stocks trading in the Bovespa stock exchange. Plantar is a private owned family business not listed in the Bovespa nor in any foreign stock exchange.

coke, a readily available fossil source. 98.55 % of the world primary iron reduction in 2005 was based on coal coke (Research on IISI, 2006; SINDIFER, 2006 and AMS, 2006). Brazil is yet the only country capable to produce charcoal-based iron and steel in the short-run and at a significant scale[64]. However, international investors and their shareholders prefer not to be exposed to the risks associated with long-term forestry investments and operations for charcoal-based iron, especially at smaller scales such as in the projects. Several factors have contributed for such a reality. Implementation, management and non-financial risks associated with the establishment of large-scale plantation stocks are significantly more complex than those related to alternative industrial inputs (e.g. use of readily available coal coke). The necessities of purchasing significant portions of land, and to deal with a large work force in rural areas vis-a-vis the risk aversion of operating a long-term business, have also contributed to the lack of investments in the plantations for charcoal supply. The legal restrictions relating to land-use are also additional barriers in this context, as discussed in the next sub-sections.

Historical, current and expected practices demonstrate a lack of sectoral and corporate capability of establishing sustainable amounts of plantation stocks, and the lack of incentives to change prevailing practices, further enhancing the project entity's vulnerability.

The iron and steel industry in the State of Minas Gerais and in Brazil has never been able to establish the required amount of plantations for charcoal supply. The situation has been worsened with the end of the fiscal incentives (FISET) in 1988. The barriers herein referred have prevented the industry from pursuing self-sufficiency. Alternatively, the prevailing business culture has been one of relying on the readily available and non-scarce fossil global commodities such as coal and on the unsustainable availability of non-renewable charcoal in the spot market, which also boosts corporate vulnerability. Thus, companies are completely exposed to supply shortages of renewable charcoal. In the mid 1990's, as a result of the extreme lack of plantations, the charcoal-based iron's market share was reduced, giving place to an increasing coal based production (SINDIFER, 2000/ BRAZIL, 2007). With the opening of Brazilian market in the early 1990's the access to coal was even more facilitated (BRAZIL 2007). Because of its pioneer project activities,[65] the project entity will become the first of its kind to have 100% of its iron production based on renewable charcoal by 2007/2008 [66].

iii) Management and institutional barriers

- Limited effects of governmental policy to stimulate wood plantations

As demonstrated in Section C.5.1, governmental capacity is still not sufficient to eliminate the plantation stock deficit in Brazil and in the project region. As in most developing countries, Brazilian national and state governments, as well as official banks, experience a serious lack of resources to support the establishment of plantation stocks.

> *"Nevertheless, fiscal incentives to plant forest were removed in the late 1980s, decreasing and even stopping the establishment of new forests. Moreover, the wave of opening of the national market to imports led to the increase in coke production, encouraged by its*

[64] BRAZIL, 2007 (Brazil's Contribution to Prevent Climate Change - White Paper – Brazilian Ministry of Science and Technology)

[65] Such project activities encompass the project activity proposed under this A/R PDD and the one jointly designed to be submitted in a separate PDD, as per Decisions 17/CP.7, 19/CP.9 and EB Guidance on Annex 8 of the EB20 report.

[66] IEF/SEMAD, 2007

immediate availability and cost-effectiveness, which was lower if compared to the cost of implanting and maintaining a forest. During the 1990s, the privatization of integrated steel and iron industries resulted in the shutdown or conversion of charcoal furnaces into coke furnaces. This scenario led many small and independent steel and iron industries to close because of the difficulty finding enough charcoal to keep their blast furnaces working" (Brazil, 2007).

- Risks related to regulatory schemes and changes in government policies or laws

Environmental regulations and tree plantation laws in Brazil are extremely complex. Environmental licensing usually takes no less than six months, in spite of the efforts by the local and federal governments to promote simplicity and cost-effectiveness. Changes to economic, environmental, and plantation policies are still major risks to large-scale plantation activities in Brazil.

Moreover, Brazil is one of the few countries in which landowners are obliged to set aside, without any economic countervailing measure, a relevant portion of rural properties as preservation areas[67]. At the project activity site, at least 20% of the land must be protected as legal environmental reserves. This amount is often increased to 30%, as additional preservation areas, such as the surroundings of water springs and stream margins, are also required. Therefore, companies must purchase 30% to 40% more land than the effective required area for plantation development, increasing significantly the costs of operations, the proportion of permanent assets and opportunity costs of the business, *vis-a-vis* the other options of reducing agents, e.g. coal coke.

- Inherent market risks

The risks of being exposed to volatility in the wood/charcoal spot markets are overwhelmed by the risks associated to lumpy long-term investments required for plantations. Historical and current variations in the consumption of the reducing agent, especially in the charcoal industry, have not resulted in a proportional increase in the plantations establishment, which further reinforces the risk aversion to plantation investments. There is a persistent deficit in the annual establishment of the plantations for charcoal *vis-a-vis* the annual consumption of reducing agents in iron and steel production. Such a deficit points to the inexistence of a spot market for wood for charcoal in Brazil. Therefore, there is no sustainable alternative to the use of renewable charcoal, other than the establishment of dedicated plantations. This is also one of the reasons why the commercial and public banks do not accept forest plantations as a collateral in debt funding agreements[68], which makes the access to credit even more difficult as discussed above.

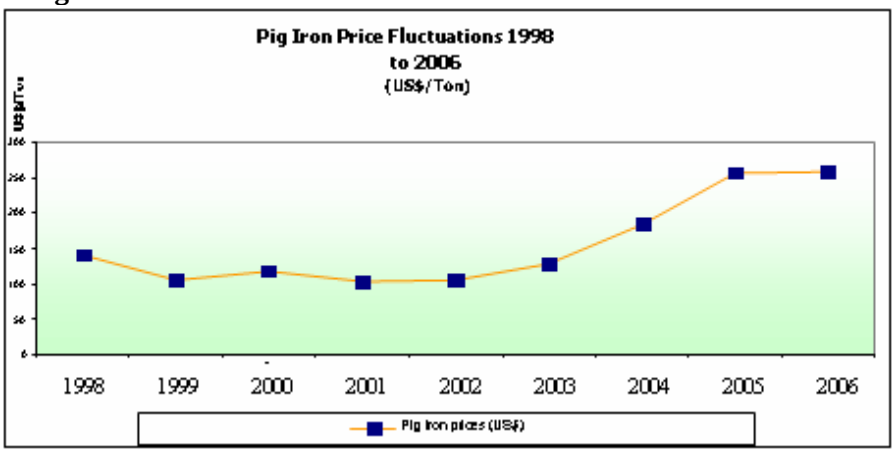
In addition, historical changes in pig iron prices, which, in the financial *stricto-sensu*, could turn plantation establishment attractive, have not resulted in a proportional increase in plantation establishment. On the contrary, the gap in terms of plantation establishment has even worsened. **Figures 30** and **31** below show that price fluctuations of pig iron have not reversed the deficit between the annual establishment of plantations and the effective reducing agent consumption. On the contrary, the deficit has increased. Arguably, this points to the existence of a *quasi*-market

[67] According to the Brazilian Forestry Code, issued in 1934 (Decree 23.973/34) and reedited in 1965 (Law n.4771/65).

[68] As per BDMG Resolution 201-B Annex XII-A. April 2008 and BNDES [personal message/Garantias Florestal]. July 18th 2008.

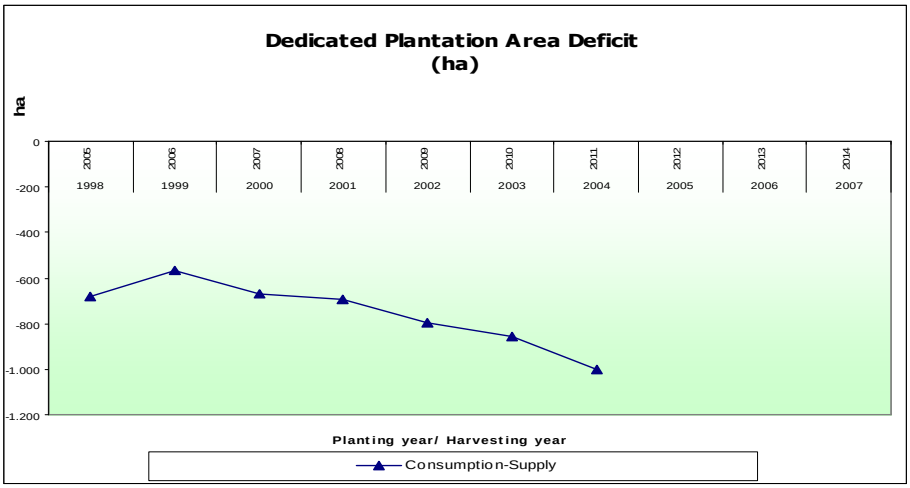
failure in the charcoal-based iron production. This less than elastic relationship between the plantation establishment and its end-use corroborates the large risks perceived in the plantation investment. The volatility of current prices must be weighted against the uncertainty and risks associated with a long-term maturity periods of up to 28 years.

Figure 30: Pig Iron Price Fluctuations



Source: AMS; Brazilian Ministry of Development, Industry and Foreign Trade, AliceWeb

Figure 31: Dedicated Plantation Area Deficit (difference between effective planted area and ex-post reducing agent consumption converted to equivalent plantation area)



Source: AMS; Brazilian Ministry of Development, Industry and Foreign Trade, AliceWeb

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternative land use scenarios (except the proposed project activity)

Figure 32 summarizes the analysis of barriers under each of the alternative baseline scenarios under assessment. Out of the three alternative scenarios only *Scenario 1* "maintenance of *grasslands and the complete absence of plantations in the eligible areas for A/R activities"* is not prevented by the several barriers identified in the sub-step above: (i) investment barriers, (ii) barriers due to prevailing practices and (iii) management and institutional barriers. The analysis confirms the most likely land-

use at the project entity level and at the regional level, taking into account related policies and sectoral circumstances.

- *Scenario 1:* Maintenance of grassland land-use, reflecting the complete absence of forest plantations to supply the project's iron production.

- *Scenario 2:* A/R activities are expected to occur at intermittent rates to supply the project's iron production, reflecting the substantial lack of forest plantations.

- *Scenario 3:* The project activity undertaken without the CDM incentive, indicating that land-use reflects full-fledged forest plantations to supply the project's iron production.

Figure 32: Barriers Assessment

Barriers (prevent the alternative scenario?)	Alternative Scenarios			SUMMARY OF MAIN FACTS	SUMMARY OF LISTED EVIDENCES AND REFERENCES
	Scenario 1	Scenario 2	Scenario 3		
i) INVESTMENT BARRIERS					
• Lack of appropriate debt financing and of access to credit for medium and/or long term activities	NO	YES	YES	Lack of appropriate debt-financing (large amounts of upfront investments that require at least a 7 year grace period, 10yr duration, which is worsened by the fact that Brazil has the highest real interest rate in the World); lack of acess to credit (strict requirements for the type of loan at stake, e.g. forest plantations assts are not acceptable as collaterals and warranties); such loans are not provided by national private banks ; heavy reliance on government financing, which is very limited (PNF, Proflorestas, Pronaf, Propflora).	National Environmental Ministry (www.mma.gov.br); BDMG official statement; BDMG Resolution 201-B Annex XII-A. April 2008; BNDES (www.bndes.gov.br); http://www.bnb.gov.br/content/aplicacao/Investir_no_Nordeste/Perfil_dos_Estados/gerados/mg_apresentacao.asp (accessed on July 21st, 2008); http://www.bcb.gov.br/?COPOMJUROS (accessed on August 6th, 2008).
• No access to international capital markets	NO	YES	YES	Family owned company exposed to international investors risk aversion to investments in forestry plantations in developing countries; no access to international capital markets (not listed in any foreign stock exchange); no access to national capital markets (not listed in the Brazilian Stock Exchange - BOVESPA).	BOVESPA stock exchange (www.bovespa.com.br); http://www1.folha.uol.com.br/folha/dinheiro/ult91u378775.shtml (accessed on August 6th, 2008); http://dinheirama.com/blog/2007/06/19/o-que-e-o-tal-grau-de-investimento (accessed on July 21st, 2008).
ii) BARRIERS DUE TO PREVAILING PRACTICES					
• Barriers due to prevailing practices	NO	YES	YES	World's iron production largely based on coal, a global commodity and a readly available fossil fuel; Brazil is currently the only country technically capable of producing charcoal based iron; the project entity has become the first of its kind capable of producing 100% of iron based on renewable charcoal as a result of the CDM ; international investors and shareholders' aversion to long-term investments in forest plantations: aversion to investments in great portions of land; aversion to deal with a large work force in rural areas; aversion to deal with land-use legal restrictions; prevailing business culture of relying on a readily available and non-scarce global commodity (coal). The opening of the brazilian market to imports has led companies to rely increasingly on the use of coal.	Research on IISI, 2006; SINDIFER, 2006; AMS, 2006; BRAZIL, 2007; SINDIFER, 2000; Ministry of Mines and Energy (Gazeta Mercantil 04/19/2004); BNDES, 2007; Brazilian Iron and Steel Institute-IBS (www.ibs.org.br), IEF/SEMAD 2007.
iii) MANAGEMENT AND INSTITUTIONAL BARRIERS					
• Limited effects of governmental policy to stimulate wood plantations	NO	YES	YES	The increasing deficit of renewable charcoal for iron making make clear that the government policies (regulatory, funding and fiscal policies) have been insufficient to stimulate dedicated plantations for charcoal since the end of the fiscal incentives in the late 80's.	BRAZIL, 2007; LEITE, 2003; REIS, 1994; IPEF, 2000; AMS, 2004; IBGE, 2005; BNDES, 2002; SINDIFER, 2006; Law n.7714, Dezember 29th 1988. Law n.5106, September 2nd 1966; Environmental Defense Association of Minas Gerais-AMDA (www.amda.org.br); Brazilian Silviculture Society-SBS (www.sbs.org.br); Federal University of Viçosa (www.ufv.br); State Forest Institute-IEF (www.ief.mg.gov.br); University of Sao Paulo (www.esalq.usp.br).
• Risks related to regulatory schemes and changes in government policies or laws	NO	YES	YES	Complex federal and state environmental and forestry plantation laws; unstable regulations regarding forestry plantations investments; Brazilian Forestry Code's land appropriation requirement (at least 20% of the land set aside for preservation). These legal requirements place an additional and significant burden on the establihsment of dedicated plantations for iron produciton, increasing its opportunity costs in comparison with the use of coal coke.	Brazilian Forestry Code issued in 1934 (Decree 23.973/34) and reedited in 1965 (Law n.4771/65); Minas Gerais State Forestry Law n.14.309/2002.
• Inherent market risks	NO	YES	YES	In spite of increases in pig iron prices the deficit of dedicated plantations/renewable charcoal has increased, variation in pig iron prices are not proportional to the establishment of new dedicated plantation leading to a quasi-market failure in the charcoal based iron production, there is no spot market for wood for renewable charcoal in Brazil.	BDMG Resolution 201-B Annex XII-A. April 2008; BNDES [personal message/Garantias Florestal], July 18th 2008.

Description of the scenarios:
Scenario 1. Maintenance of grassland land-use, reflecting the complete absence of forest plantations to supply the project's iron production.
Scenario 2. A/R activities are expected to occur at intermittent rates to supply the project's iron production, reflecting the substantial lack of forest plantations.
Scenario 3. The project activity undertaken without the CDM incentive, indicating that land-use reflects full-fledged forest plantations to supply the project's iron production.

Step 4: Common practice analysis

As identified in step 1 and evaluated in the subsequent steps, the project entity and its industry have been undergoing a severe supply shortage of forest plantations to produce renewable charcoal, as a reducing agent for iron manufacturing. **Figures 24 and 25** can be used as a conservative proxy for the assessment of common practices in the project entity market. According to both of them, the use of charcoal from dedicated forest plantations is not a common practice in iron and steel making. In order to further corroborate this aggregate outcome, this section builds upon company-specific data.

Since the early 1990's, major iron and steel companies changed their reducing agents, moving from charcoal into the use of coal coke, in a clear response to the lack of attractiveness of using charcoal from dedicated plantations and its increasing supply constraints.

> *The wave of opening of the national market to imports led to the increase in coal coke production, encouraged by its immediate availability and cost-effectiveness, which was lower if compared to the cost of implanting and maintaining a forest* (BRAZIL, 2007, p. 23).

One of the first companies to follow this trend was the former Brazilian company Belgo Mineira, currently part of the ArcelorMittal Group. Belgo had been using charcoal from forest plantations as a reducing agent since its initial operations in 1937, and it followed the sectoral trend switching to coke in the 1990's. In 2002, a business plan of Companhia Vale do Rio Doce (CVRD) included a plant to run with charcoal in Northern Brazil and with future expansions, but the company changed plans and recently announced an investment in a coke-based plant, in partnership with the Chinese giant BaoSteel. The plant will produce 5 million tons of coke-based steel per year, which, by definition, means that no forest plantations will be established to supply this plant. Other projections are presented in **Figure 33**, showing the expansion plans for the sector. These plans were announced by the Brazilian National Development Bank (BNDES) and Brazilian Iron and Steel Institute (IBS) in 2006 and are 100% based on coal coke. This corroborates the scenario in which the absence of forest plantations is the most likely land-use associated with the industry at stake.

Figure 33: Announced expansion of the iron and steel production capacity in Brazil

Company	Current capacity (t/year)	Expanded capacity (t/year)	Deadline for expansion
Brazil (IBS)	36.6 million	50.4 million	2011
Brazil (BNDES)	36.6 million	72.0 million	2011
Gerdau /Ouro Branco	3.0 million	4.5 million	Concluded
CST/ArcelorMittal	5.0 million	7.5 million	2007
Grupo Gerdau	7.0 million	10.5 million	2008
MMX	(new)	1.5 million	2008
MMX	(new)	not announced	2008
ThyssenKrupp Siderúrgica do Atlântico	(new)	5.0 million	2009
Sumitomo/V&M	(new)	600 thousand	2010
Ceara Steel	(new)	1.5 million	2010
Usiminas/Cosipa	9.0 million	14.5 million	2015
CSN Itaguaí (RJ)	(new)	4.5 million	not announced
CSN Congonhas (MG)	(new)	4.5 million	not announced
CSN Ceará	(new)	4.5 million	not announced
CVRD/ BaoSteel	(new)	5.0 million	not announced

Sources: IBS, BNDES, ALMG, ABM Brasil, companies (several years)

Hence, the iron and steel production is expected to practically double in Brazil (BNDES, 2007). On the other hand, **Figures 24 and 25** show a major deficit of charcoal from dedicated plantations in comparison with the use of GHG intensive reducing agents, such as coal coke. The expansion of the coke based industry points to the worsening of such a deficit in the short and long terms.

Therefore, it is very likely that companies running with charcoal are nowadays in a similar position where Plantar stood back in 2000, prior to the decision of implementing the project activity. This coupled with the absence of new incentives stimulate them to adopt either the legal coal coke option or to enter the unsustainable fields of illegality with the short term use of non-renewable charcoal.

The expected CDM registration of the project activity and the marginal gains accrued from GHG removals by sinks and from emission reductions in the iron ore reduction system are very likely to help these companies overcome some of the investment barriers analyzed in the steps above. In the case of the project entity, the CDM incentive has triggered the establishment of new plantations on a sustainable basis. It will increase the attractiveness of forest plantation charcoal-based iron production, allowing the project entity to curb the plantation supply deficit and to produce iron 100% based on renewable charcoal by 2007/2008 (when the harvesting of the plantations established for the project commences). The project entity will be the first of its kind to succeed in such an achievement[69].

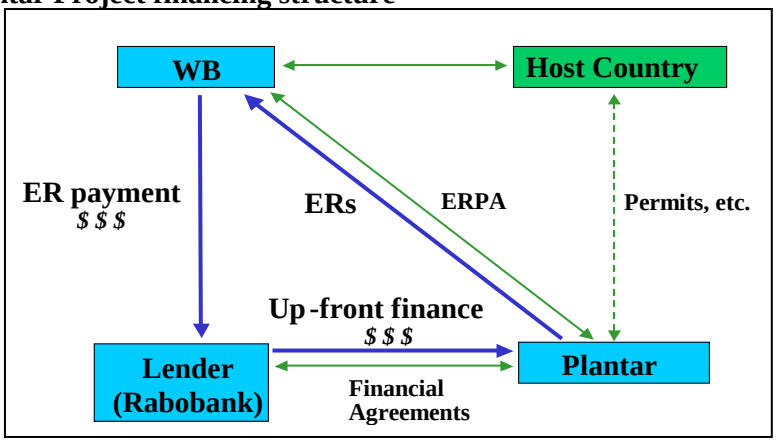
The CDM has already helped reversing a substantial part of the above-mentioned barriers. Besides enhancing shareholder's confidence in equity investment, especially in light of the historically supply-constrained charcoal-based iron industry, the project entity has been able to seek revenues by selling part of the project's emission reductions and removals (a total of US$5.3 million) to the World Bank's Prototype Carbon Fund.

As important as the marginal carbon revenues is the qualitative impact of carbon finance in debt funding structures for the establishment of new plantations to supply charcoal-based iron production in Brazil. The mismatch between the upfront cash requirements for large-scale investments and the *ex-post* payments[70] for the GHG removals and emission reductions were partially solved with a financial engineering scheme, called monetization / securitization of receivables (i.e. a pioneer up-front loan based on the carbon credits structured by a commercial bank matching the payment for the ERs with the loan's repayment schedule). **Figure 34** illustrates the above-mentioned financing structure, as it was applied to the project entity. Within such an arrangement, the World Bank's PCF pays for the ERs directly into the lender's account, amortizing the loan taken by Plantar with the commercial bank, Rabobank International. It was the first time this financial structure was applied in Brazil and in the World.

[69] IEF, SEMAD, 2007

[70] As in most emission reduction/removals transactions, the PCF payments are only made against delivery. In the project activity most of the credits from emission removals will be delivered at the end of the initial 7-year plantation establishment period.

Figure 34: Plantar Project financing structure



This transaction has only been possible and the project only became bankable due to its eligibility to the CDM and carbon credits. The sale of ERs anticipated part of the project's original income from 7 years. Also, the ERs provide a source of hard currency to Plantar, which enabled the company to repay the external loan in hard currency. The support provided by the PCF's ERPA (Emission Reductions Purchase Agreement) allows the payment for the ERs directly in the lender's account and to limit the exchange rate risk. Therefore, the cash convertibility and transferability risks are reduced, and the overall risk and respective interest rates for the loan decrease, making it feasible for the project entity to repay the loan.

The eligibility of the integrated projects to the CDM has also helped the project entity to obtain marginal revenues and part of the debt financing mentioned in Step 3. It provided significant marginal confidence to lenders and shareholders, removing constraints on the long-term financing from local institutions such as the Minas Gerais Development Bank (BDMG). Therefore, in the absence of the carbon finance impacts additional reforestation and net GHG removals (accounted for in this A/R PDD) and emission reductions in the iron ore reduction facility (accounted for in a separate methodology and PDD) would not have occurred.

The CDM registration may have an unprecedented impact on the establishment of forest plantations to supply charcoal to the iron and steel industry - the project entity's sector – and one of Brazil's most important development drivers. Besides, other companies that may use wood resources could be strongly encouraged to establish proper and additional plantations as a source of renewable energy and for other end-uses, depending on the specific circumstances of their industries.

As a matter of fact, other companies in Brazil have already been considering the CDM incentive as a means of accomplishing sustainable plantations supply. Over the past three years, major iron and steel producers, such as Acesita S/A and Belgo (ArcelorMittal Group) have started the development of similar project activities in response to the CDM incentive. Both companies had previously reverted part of their plantation-based industrial operations to alternative fossil fuel-based ones, such as coke-based iron manufacturing. Likewise, in other large and smaller companies, such as Queiroz Galvão, Siderpa, Metalsider and Siderurgica Alterosa have been considering the CDM as an alternative to enable the establishment of new forest plantation to produce charcoal-based iron.

The following table summarizes this section presenting the final results of each of the alternatives analyzed under the provisions of the "Tool for the demonstration of additionality in A/R CDM Project activities" (version 02).

Figure 35: Additionality assessment

Additionality Assessment					
Steps and sub-steps applied using the latest "Additionality Tool"					
Alternatives	**Identify credible alternative land use scenarios**	**Consistency of with enforced mandatory applicable laws and regulations**	**Selection of the baseline scenario**	**Barriers Analysis**	**Common Practice test**
1. Maintenance of the grassland land-use, reflecting the complete absence of forest plantations to supply the project's iron production.	Yes	Yes	Yes	Yes	Yes
2: A/R activities are expected to occur at intermittent rates to supply the project's iron production, reflecting the substantial lack of forest plantations.	Yes	Yes	No	Alternative eliminated	
3: The project activity undertaken without the CDM incentive, indicating that land-use reflects full-fledged forest plantations to supply the project's iron production.	Yes	Yes	No	Alternative eliminated	

Conclusion

There are several barriers at the sector and project entity levels, which prevented the implementation of the project activity until the project entity has been able to take advantage of the CDM incentive in a first-of-a-kind initiative in Brazil. Therefore, the establishment of this A/R project activity is clearly additional under the provisions of the AR-AM0005 and the latest "additionality tool".

Besides the climate benefits associated to the additional carbon stocks in forest plantations, other positive aspects of CDM registration include:

- Opportunities for attracting alternative sources of financing to invest in the establishment of

sustainable plantations, as a renewable and clean source of energy for several purposes.

- Creation and improvement of good-quality employment opportunities in rural areas in developing countries.
- Incorporation of additional monitoring schemes and social and environmental criteria in large-scale tree plantations.
- Encouraging further research and development on the role of tree plantations and biofuels as a source of net GHG removals by sinks and emission reductions.

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

>>As presented in the stratification section and reaffirmed in the Baseline Selection and Additionality Assessment sections above the project proponent applying a conservative approach adopted one single stratum to the whole project activity area accounting the grasslands biomass stocks in its peak[71].

In addition, as described in the section A.5.1. the farms where the project activity is undertaken were pastureland that was dominated by *Brachiaria* forage, a exotic species (native from Africa) which is commonly know as a invasive grassland species and one of Minas Gerais most common species used in cattle grazing activities. When establishing the grasslands the previous land owners kept some small islands of native vegetation and a few isolated trees (*moelas* and *reboleiras*). On establishing the A/R stocks the project proponent had excluded those areas from the project boundary. Isolated tree were maintained in the midst of the eucalyptus plantations and fire breaks were placed around the *moelas* areas.

According to the approved methodology two land uses categories of land uses are foreseen:

- Maintenance of grassland in its state; and
- Implementation of afforestation/reforestation at the pre-project rate, hectares yr^{-1}.

Once it was presented above the most likely baseline scenario of this project activity do not involve the implementation of any A/R pre-project rate in eligible areas the baseline net GHG removals by sinks are assessed as per the procedures of the approved methodology to consider the lands within the project boundary that represent the baseline scenario as *maintenance of grassland in its state*, and represented as below:

$$\Delta C_{BSL,t} = \Delta C_{GLB,t} + \Delta C_{ARB,t} \quad \textbf{(01)}$$

where:

$\Delta C_{BSL,t}$ = baseline net GHG removals by sinks for year *t*; tonnes CO_2

$\Delta C_{GLB,t}$ = baseline net GHG removals by sinks for year *t*, under the baseline scenario *maintenance of grassland in its state*; tonnes CO_2

[71] As it was presented in the eligibility assessment the major part of the area of the project activity baseline were characterized as low pastureland and degraded area. Therefore, assume that the whole project area as high pastureland in its steady state is very conservative.

$\Delta C_{ARB,t}$ = baseline net GHG removals by sinks for year *t*, under the baseline scenario with *A/R activities implemented at the pre-project rate*; tonnes CO_2[72]

t = year for which the baseline net GHG removals by sinks is calculated; year

(1) Maintenance of grassland in its state

The project area in the baseline scenario are conservatively considered in its carbon stock peak expected to be maintained in its prevailing state once the regional trends show the pastureland as the most common use. Hence the *ex ante* stratification of the project area conservatively considered as one single stratum (high pastureland, peak of carbon stock).

As per the methodology under the baseline scenario of *maintenance of grassland in its state*, carbon pools are assumed to remain in a steady state condition (where annual carbon gains and losses cancel each other out). Therefore, sum of carbon stock changes in the living biomass of grassland, for any year *t*, is expected to be zero, as represented in the equation below.

$$\Delta C_{GLB,t} = 0 \quad \textbf{(02)}$$

As per the methodology for areas with grasslands with native vegetation and isolated trees, the changes in carbon stocks of living biomass for isolated trees shall be estimated and the baseline net GHG removals by sinks in such cases shall be represented as follows.

$$\Delta C_{GLB,t} = \Delta C_{ijk,t,\,ETB} \quad \textbf{(03)}$$

where:

$\Delta C_{GLB,t}$ = the sum of the carbon stock changes in the living biomass of grassland (above and belowground biomass) under the baseline scenario - *maintenance of grassland in its state*; tonnes CO_2 yr^{-1} in year *t*

$\Delta C_{ijk,t,\,ETB}$ = sum of annual changes in the carbon stocks of living (above- and belowground) biomass of pre-existing trees in stratum *i* substratum *j* species *k;* t CO2 yr^{-1}.

However, as it was presented above and detailed in the section A.7, the small islands of vegetation and isolated trees of the project area were exclude from the project activity boundaries and were settled as natural protected areas associated with the eucalyptus plantation. Then;

$\Delta C_{ijk,t,\,ETB}$ = 0

[72] $\Delta C_{ARB,t} = 0$

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

Hence applying the formulae above the *ex ante* calculation baseline net GHG removals are zero considering that the baseline scenario is conservatively identified as grassland in its peak and in its steady state. Therefore, it will remain in its existing state[73] throughout the project crediting period.

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

ID number [74]	Data variable	Data unit	Value applied	Data Source	Comment
C.7.01	$\Delta C_{BSL,t}$	tonnes CO_2	*0*	*Project activity*	(d) default value applied as per the assessment presented above
C.7.02	$\Delta C_{GLB,t}$	tonnes CO_2	*0*	*Project activity*	(d) default value applied as per the assessment presented above
C.7.03	$\Delta C_{ijk,t,ETB}$	tonnes CO_2	*0*	*Project activity*	(d) default value applied as per the assessment presented above
C.7.04	$\Delta C_{ARB,t}$	tonnes CO_2	*0*	*Project activity*	(d) default value applied as per the assessment presented above

As explained in the section C.5.1 and based on the most plausible baseline scenario of this project activity the "Baseline net GHG removals by sinks" should be considered as zero. However, in order to strengthen the conservativeness of the project's net anthropogenic GHG removals by sinks, the historical annual A/R rate of the iron sector since the end of the fiscal incentives (8,2%) will be discounted throughout the project lifetime. The discounted amount is expressed in the table below..

[73] As explained in Step 6, Section C.5.1, the historical rate of A/R in the baseline scenario is not applicable to the lands currently included in this A/R project activity.

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

Year	Annual estimation of baseline net anthropogenic GHG removals by sinks in tonnes of CO_2 e
2000	4 054
2001	17 973
2002	46 241
2003	87 554
2004	135 630
2005	193 137
2006	193 137
2007	196 786
2008	209 313
2009	234 753
2010	271 935
2011	315 204
2012	366 960
2013	366 960
2014	371 014
2015	384 933
2016	413 201
2017	454 514
2018	502 590
2019	560 097
2020	560 097
2021	563 746
2022	576 273
2023	601 714
2024	638 895
2025	682 164
2026	733 920
2027	733 920
2028	737 974
2029	751 894
Total estimated baseline net GHG removals by sinks (tonnes of CO_2e)	751 894
Total number of crediting years	30
Annual average over the crediting period of estimated baseline net GHG removals by sinks (tonnes of CO_2e)	25 063

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

>> The project participants have conducted several baseline studies and reports. In response to the CDM incentive, the project entity itself, with the support of the State Forestry Institute of Minas Gerais (IEF)

and IBAMA, conducted a study in June 1999 entitled "The Status of Planted Forests in Minas Gerais[75]". Afterwards, the World Bank's Prototype Carbon Fund carried out the study entitled "Baseline Determination for Plantar: evaluation of the emissions reduction potential of the Plantar Project". This and other project related documents have been available on the PCF's website (www.prototypecarbonfund.org).

Accordingly, this PDD updates using relevant information for the baseline scenario of this project activity. Thus, the date of completion of the baseline study of this project activity was March 4th 2008, which was determined by the Plantar Carbon Team in partnership with the World Bank Carbon Finance Unit (for details see Annex 1).

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

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

>> The estimation of the net anthropogenic greenhouse gas removals by sinks follows the generic equation

$$C_{AR-CDM} = \Delta C_{ACTUAL} - \Delta C_{BSL} - \text{LK} \quad \textbf{(04)}$$

Where:

C_{AR-CDM} = net anthropogenic greenhouse gas removals by sinks; tonnes CO_2-e

ΔC_{ACTUAL} = actual net greenhouse gas removals by sinks (as per equation 1); tonnes CO_2-e

ΔC_{BSL} = baseline net greenhouse gas removals by sinks (as per equation 14); tonnes CO_2-e

LK = leakage (as per equation 41); tonnes CO_2-e

The *ex-ante* estimation of actual net GHG removals involves (1) estimation of the changes in carbon stocks in the living biomass pool; and (2) estimation of the increase in emissions of GHG by the sources that are increased as a result of the implementation of the A/R CDM project activity, i.e.,

$$\Delta C_{ACTUAL,t} = \sum_{i=1}^{I_P} \sum_{j=1}^{J_P} \sum_{k=1}^{K_P} \Delta C_{ijk,t} - GHG_{E,t} \quad \textbf{(05)}$$

where:

$\Delta C_{ACTUAL,t}$ = actual net greenhouse gas removals by sinks; tonnes CO_2-e yr^{-1} in year *t*

$\Delta C_{ijk,t}$ = average annual change in carbon stock in living biomass of trees for stratum *i* species *j* sub-stratum *k* (age class); tonnes CO_2 yr^{-1} in year *t*

[75] Original version in Portuguese.

$GHG_{E,t}$ = annual increases in GHG emissions by sources within the project boundary as a result of the implementation of the A/R CDM project activity; tonnes CO_2-e yr^{-1} in year *t*

i = number of strata of the project, i = 1,2,3…I_P

j = number of species in the project, i = 1,2,3…J_P

k = number of sub-strata of the project, i = 1,2,3…K_P

In the applied methodology, increases in emissions of greenhouse gases by sources are assumed to result from fossil fuel combustion, loss of biomass due to conversion of grassland to forests as a result of A/R CDM project activity, burning of biomass[76], and/or application of nitrogenous fertilizers.

Where:

$$GHG_{E,t} = E_{FuelBurn,t} + E_{BiomassLoss,t} + E_{Non-CO_2,BiomassBurn,t} + N_2O_{direct-N_{fertilizer},t} \quad \textbf{(06)}$$

$GHG_{E,t}$ = annual increase in GHG emissions within the project boundary as a result of implementation of A/R CDM project activity; tonnes CO_2-–e yr^{-1} in year *t*

$E_{FuelBurn,t}$ = annual increase in CO_2 emissions from combustion of fossil fuels within the project boundary; tonnes CO_2-–e yr^{-1} in year *t*

$E_{BiomassLoss,t}$ = annual increase in GHG emissions from the loss of biomass in site preparation and conversion to A/R within the project boundary; tonnes CO_2–e yr^{-1} in year *t*

$E_{Non-CO_2,BiomassBurn,t}$ = annual increase in non-CO_2 emission as a result of biomass burning within the project boundary; tonnes CO_2-–e yr^{-1} in year *t*

$N_2O_{direct-N_{fertilizer},t}$ = annual increase in N_2O emissions as a result of direct nitrogen application within the project boundary; tonnes CO_2-–e yr^{-1} in year *t*

Then:

$GHG_{E,t}$ = 56 507 + 128 396 + 0 + 1 836

$GHG_{E,t}$ = **186 739**

The average annual change in carbon stock in living biomass of trees for stratum was calculated regarding below and above-ground biomass carbon pools only. According to TARAM Tool, the final amount of the average annual change in carbon stock shall be:

$\Delta\Delta C_{ijk,t}$ = **3 227 648**

[76] This practice is not adopted in the project activity implementation.

In order to assure conservativeness and compliance to hierarchical order when choosing data, intense research was conducted and the following values were applied:

Figure 36 –Considered values

Wood Density	Carbon fraction	Biomass Expansion Factor	Root to shoot ratio
D_i	CF_i	BEF_i	R_i
t d.m. m^{-3}	t C (t d.m.)$^{-1}$	dimensionless	dimensionless
0.503	**0.500**	**1.45**	**0.38**
Source: Applicable local data. (Plantar records)	Source: IPCC default	Source: LADEIRA, 1999	Source: LADEIRA 1999

The Wood Density value applied was based in the weighted average of the clone densities which were planted in the areas of the project and it was defined by the Research Department of the project entity.

The Biomass Expansion Factor and the Root-to-Shoot ratio used were based in a *Magister Scientiae* research[77]. The field data was collected in the neighboring municipality of Três Marias, with similar edapho-climatic conditions to the project area. The number of trees per hectare is the same used by the project, which is 1 111 trees/ha.

There were not found neither local nor regional data for the Carbon Fraction variable which could support the characteristics of the clones planted in the project area, thus the IPCC default value was considered.

As explained in the section C.5.1 and based on the most plausible baseline scenario of this project activity the "Baseline net GHG removals by sinks" should be considered as zero. However, in order to strengthen the conservativeness of the project's net anthropogenic GHG removals by sinks, the historical annual A/R rate of the iron sector since the end of the fiscal incentives (8,2%) will be discounted throughout the project lifetime. The ex-ante calculation of the correspondent amount to be discounted is provided below:

ΔC_{BSL} = **751 894 tCO_2e**

The leakage calculations take into account two categories – CO_2 emissions from the use of fossil fuels in the transportation of seedlings, products and personnel; and displacement of economic activities to areas outside the project boundary. As there's no activity displacement in this specific project activity, the leakage shall be the only the CO_2 emissions from the use of fossil fuels.

$$LK_t = LK_{Vehicle,CO_2,t} + LK_{Activity\_Disp,t} \quad \textbf{(07)}$$

where:

[77] LADEIRA, 1999

LK_t = annual increase in GHG emissions outside the project boundary; tonnes CO_2-e yr^{-1} in year *t*

$LK_{Vehicle,CO_2,t}$ = annual increase in CO_2 emissions outside the project boundary due to fossil fuel combustion from vehicles; tonnes CO_2-e yr^{-1} in year *t*

$LK_{Activity\_Disp,t}$ = annual increase in GHG emissions outside the project boundary resulting from displacement of economic activities; tonnes CO_2-e yr^{-1} in year *t*

Then:

$$LK_t = LK_{Vehicle,CO_2,t} + 0$$

Increase in GHG emissions outside the project boundary are caused from fuel combustion in vehicles used for transportation of seedling, labour, staff and harvest products to and/or from the project sites and the markets (while avoiding double-counting with emissions accounted under $E_{FuelBurn}$ above). The CO_2 emissions can be estimated using the bottom-up approach described in GPG 2000.

$$LK_{Vehicle,CO_2,t} = \frac{\sum_v \sum_f \left(EF_{ij} \bullet FuelConsumption_{ij,t}\right)}{1000} \quad \textbf{(08)}$$

where:

$LK_{Vehicle,CO_2,t}$ = annual increase in CO_2 emissions outside the project boundary due to fossil fuel combustion from vehicles; tonnes CO_2-e yr^{-1} in year *t*

EF_{vf} = emission factor for vehicle type *v* with fuel type *f*; kg CO2 $litre^{-1}$

$FuelConsumption_{vf,t}$ = consumption of fuel type *f* of vehicle type litres in year *t*

v = refers to vehicle type

f = refers to fuel type

Then:

$LK_{Vehicle,CO_2,t}$ = **15 522** = LK_t = **15 522** tCO_2-e

As per the result indicated in theTARAM tool, the actual net GHG removals by sinks are 3 040 909 tCO_2e in 2029. Net carbon stock changes will be monitored on an *ex post* basis, and the initial projections are updated at each monitoring interval. The net GHG removals by sinks are dependent on the plantation

establishment and harvesting schedule. The annual, cumulative and total amount of GHG removals by sinks over the project period are summarized in Table 12.

The estimation of the net anthropogenic greenhouse gas removals by sinks follows the generic equation and the respective values:

$$C_{AR-CDM} = \Delta C_{ACTUAL} - \Delta C_{BSL} - \text{LK} \quad \textbf{(09)}$$

Then:

$$C_{AR-CDM} = 3\,040\,909 - 751\,894 - 15\,522$$

$$C_{AR-CDM} = \mathbf{2\,273\,493}$$

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

>> ***Leakage ex ante calculation***

Based on the assessment presented in the section A.5.6 above it is conservative to consider that under the project, leakage is from increased emissions from fossil fuel combustion outside the project boundary (e.g. personnel and supplies transportation etc.) once no displacement of activities occurred as a result of the project. Hence, no leakage emissions associated with the deforestation neither displacement of grazing activities nor fuel wood collection due to households' displacements is applied in this PDD.

However, emissions due to the transit of personnel, cloned sprouts, fertilizers and harvested wood that occurs and that are attributable to the project activity are calculated below according to the specific origin and destination points. The most conservative distances are considered in order to calculate leakage emissions from fossil fuels. As per the provisions of the CDM approved methodology AR-AM0005 the fuel consumption is specific monitored and calculated per measurements of the quantity and amounts of fertilizers, personnel transported and the distances travelled throughout the crediting.

$$LK_t = LK_{Vehicle,CO_2,t} + LK_{Activity\_Disp,t} \quad \textbf{(11)}$$

where:

LK_t = annual increase in GHG emissions outside the project boundary; tonnes CO_2-e yr^{-1} in year *t*

$LK_{Vehicle,CO_2,t}$ = annual increase in CO_2 emissions outside the project boundary due to fossil fuel combustion from vehicles; tonnes CO_2-e yr^{-1} in year *t*

$LK_{Activity\_Disp,t}$ = annual increase in GHG emissions outside the project boundary resulting from displacement of economic activities; tonnes CO_2-e yr^{-1} in year *t*

As previously mentioned, there is no activity displacement in this project activity, then:

$LK_{Activity\_Disp,\ t} = 0$

If the leakage for activity displacement is zero, the leakage of the project should be the leakage related to the increase in CO_2 emissions due to fossil fuel combustion from vehicles.

$LK_t = LK_{Vehicle\ ,CO_2,t}$

Increase in emissions from fossil fuel combustion $\left(LK_{Vehicle\ ,CO_2}\right)$

Increase in GHG emissions outside the project boundary is caused by vehicle fuel combustion due to transportation of clone sprouts, machinery, fertilizers, staff and harvested wood to and/or from project sites (while avoiding double-counting with emission accounted for in $E_{FuelBurn}$ above). The CO_2 emissions can be estimated using bottom-up approach described in GPG 2000.

In order to follow the 03 steps of the methodology related to the emissions from fossil fuels, the information asked, such as vehicle types, distance travelled outside the project boundary, specific emission factors, number of vehicles and fuel consumed are presented in the TARAM model. This tool calculates the project leakage emissions according to AR-AM0005 and it uses the following formula.

$$LK_{Vehicle,CO_2} = \sum_v \sum_f \left(EF_{ij} \bullet FuelConsumption_{ij}\right)/1000 \quad \textbf{(12)}$$

$$FuelConsumption_{vf} = n_{vf} \bullet k_{vf} \bullet e_{vf} \quad \textbf{(13)}$$

where:

EF_{vf}	= Emission Factor for vehicle type v with fuel type f, kg CO_2 litre-1
$FuelConsumption_{vf}$	= consumption of fuel type f of vehicle type v, litres
n_{vf}	= number of vehicles type v with fuel type f
k_{vf}	= kilometers traveled by each of vehicle type v with fuel type f, km
e_{vf}	= average fuel consumption of vehicle type v with fuel type f, litres km-1
v	refers to vehicle type
f	refers to fuel type

Considering the stated above, the leakage is accounted for the increase in emissions from fossil fuel combustion. Accordingly the tables below express the ex-ante calculation TARAM data.

Figure 37: Increased fossil fuel consumption outside the project boundary

Transport activity	Fuel efficiency	CO_2e emission factor	Distance	Capacity of the vehicle performing the transport task	Emissions **tCO_2e**
	e_{xy}	EF_{diesel}	k_{vf}		
	l km^{-1}	dimensionless	km		

Transport of cloned sprouts from the nursery to the project sites	0.500	2.8300	120	60 000	Number of cloned sprouts per transporting vehicle	160
Transport of harvested wood products to wood processing facility	1.270	2.8300	07	44	m^3 per transporting vehicle	12 161
Transport of fertilizers from the sale point to the project sites	1.000	2.8300	800	1.5	t N per transporting vehicle	520
Transport of labour force to the AR site	0.500	2.8300	35	35	Number of persons in one vehicle	2 646

Figure 38: Increased fossil fuel consumption outside the project boundary due to field inspections and monitoring

Transport activity	Distance traveled km	Fuel type ***y***	Fuel efficiency e_{xy} l km^{-1}	CO_2e emission factor EF_{xy} dimensionless	Emissions **tCO_2e**
Annual field inspections	4 880	Gasoline	0.100	2.3300	34
Periodical monitoring	600	Gasoline	0.100	2.3300	1

Considering the information above as input for the TARAM Tool, it is identified:

Figure 39: Total leakage with only the significant sources of leakage

Cumulative leakage	
LK_{t*}	
tCO_2e	
30 year Project	Average per year
15 522	517

The amount of leakage in the project represents 0.51% of the net anthropogenic GHG removals by sinks and represents 8.31% of total project emissions. As a result of that this amount shall be deducted from the actual net GHG removals by sinks as per the approved methodology AR-AM0005.

Therefore, leakage from the project is due to travel of the project personnel (labor and staff) outside the project area and transport of clone sprouts, fertilizers and harvested wood. As presented in Section A.7, the accumulated leakage emission until the last project year is 15 522 t CO_2e and table below provides a summary of that.

Figure 40: Summary of Leakage Emissions

TITLES	INPUT	PROJECT	COMMENTS

		DATA	
Fossil Fuels	Transport of cloned sprouts from the nursery to the project sites	160 tCO_2e	
	Transport of harvested wood to the wood processing facility:	12 161 tCO_2e	Plantar Forestry Planning Department
	Transport of fertilizers from the sale point to the project sites	520 tCO_2e	Plantar Forestry Planning Department
	Transport of labour force to the AR site.	2 646 tCO_2e	Plantar Forestry Planning Department
	Transport of staff due to field inspections and monitoring	35 tCO_2e	Plantar Forestry Planning Department
	Carbon content of Diesel (tons of CO_2/l)	0.00283	Source: IPCC default (TARAM tool)
	Carbon content of gasoline (tons of CO_2/l)	0.00233	Source: IPCC default (TARAM tool)

SECTION E. Monitoring plan

E.1. Monitoring of the project implementation:

E.1.1. Monitoring of forest establishment and management:

>> The plantation establishment activities under this project follow a seven-year-rotation period (up to 28 years) as per the productivity parameters and production practices for eucalyptus in Brazil. The plantations initiated in 2000 are expected to continue for a seven-year period (2000-06), followed by two harvesting cycles at 7-year intervals from the planting. The first rotation harvests are expected to continue from 2007 to 2013. The second harvesting rotation (from 2014 to 2020) is expected to result from coppicing. As the second and last harvesting occurs, new plantations would need to be established to replace the exhausted stock.

The productivity rate of the coppice phase is expected to decline in relation to the planting phase. **Figure 41** illustrates the expected planting and harvesting schedule.

Figure 41: Planting and harvesting schedule under the project

Calendar Year	Project Year	Planting/Coppicing	Expected Productivity (%)	Expected Harvesting Schedule
2000	**1**	**First Rotation (Planting)**	**100**	**-**
2001	**2**	**First Rotation (Planting)**	**100**	**-**
2002	**3**	**First Rotation (Planting)**	**100**	**-**
2003	**4**	**First Rotation (Planting)**	**100**	**-**
2004	**5**	**First Rotation (Planting)**	**100**	**-**
2005	**6**	**First Rotation (Planting)**	**100**	**-**
2006	**7**	**First Rotation (Planting)**	**100**	**-**
2007	**8**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2008	**9**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2009	**10**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2010	**11**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2011	**12**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2012	**13**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2013	**14**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2014	**15**	**First Rotation (Planting)**	**100**	**Second Rotation Harvest**
2015	**16**	**First Rotation (Planting)**	**100**	**Second Rotation Harvest**
2016	**17**	**First Rotation (Planting)**	**100**	**Second Rotation Harvest**
2017	**18**	**First Rotation (Planting)**	**100**	**Second Rotation Harvest**
2018	**19**	**First Rotation (Planting)**	**100**	**Second Rotation Harvest**
2019	**20**	**First Rotation (Planting)**	**100**	**Second Rotation Harvest**

2020	**21**	**First Rotation (Planting)**	**100**	**Second Rotation Harvest**
2021	**22**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2022	**23**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2023	**24**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2024	**25**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2025	**26**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2026	**27**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2027	**28**	**Second Rotation (Coppice)**	**90**	**First Rotation Harvest**
2028	**29**	**First Rotation (Planting)**	**100**	**Second Rotation Harvest**
2029	**30**	**First Rotation (Planting)**	**100**	**Second Rotation Harvest**

Monitoring of project boundary, forest establishment and management activities

a. Monitoring of the project boundary

• The validation dates of the project entity's operating licenses will be annually monitored, according to provisions presented in item F.3, Section F.

• Field surveys will be undertaken to verify that the delineated project boundary is congruent with the ex-ante description presented in the AR-CDM-PDD. Any significant changes shall be recorded and integrated in the Forest Inventory System; Based on the standard operational procedures field surveys will be done by the inventory team in order to delineate project boundary and increase measurement accuracy, following the best practices of forestry management techniques and cost-effectiveness;

• As presented in the step C.4 above, the spatial extent and location of each stand's characteristics (e.g. type of the clone/density) of the project activity are recorded and monitored throughout the crediting period. Therefore, the confirmation and/or specifics changes in the reforested sites within the project boundary in relation to the ex ante list of sites presented in the AR-CDM-PDD are recorded and monitored as per the forest management SOP's (standard operational procedures).

• According to Plantar's internal quality assurance and quality control system the forestry management maps shall contain: spatial extent, location of the plots, and number of the stands. The Geographic Information System is readily available for consultation of all issues related to the plantations. Hence, the spatial extent and location of the species planted under this A/R project activity, in each stratum, will be recorded and monitored as per the approved methodology.

• The actual net removals by sinks are estimated by monitoring the permanent sample plots in order to estimate the changes in biomass increment within the project boundaries following the good practices and cost-effectiveness of forest inventory management. The net anthropogenic GHG removals by sinks calculation in this A/R CDM PDD takes into account the following items[78] (see **Figure 42** below for the parameters to calculate GHG removals by sinks[79]).

Figure 42: Assumptions and parameters used in the calculations of the actual net GHG removals by sinks

[78] Relevant changes will be monitored and recorded; updates will be presented to the DOE at time of verification.

[79] LADEIRA, 1999

D_j	0.503 t d.m. m-3		Wood density - see *TARAM Tool,* worksheet "Species"
BEF_j	1.450 dimensionless		Biomass expansion factor - see *TARAM Tool,* worksheet "Species"
R_j	0.38 dimensionless		Root to shoot ratio - see *TARAM Tool,* worksheet "Species"

• Following the best practices of the forestry management techniques in case sub-strata inventory discrepancy is above 10%, for a 95% confidence level, more plots should be established in order to reduce the sampling error. Then, any discrepancies between the area reported and the area estimated under the proposed A/R CDM project activity in any part of the strata or sub-strata along with the species planted, including the areas of mortality due to natural factors (e.g. fire and pests) and anthropogenic factors will be recorded and reported.

b. Monitoring of the forest establishment

• The project proponent has a Quality Management Department in place which documents and records the significant activities related to forest establishment, including activities related to site preparation and vegetation affected as part of site preparation. The monitoring intervals and specific activities/ staff responsibilities are provided in the Standard Operational Procedures which are based on ISO rationale and are constantly updated based on the continuous improvement approach, including compliance with safety and quality regulations.

• The forestry inventory process consists of a series of field monitoring procedures executed by a project entity's forestry technical team, starting 2.5 years after the plantation establishment year. These procedures establish the required conditions for measuring the trees, collecting[80] and processing data, allowing for the quantification of the forests' wood volume, taking into account the provisions of the approved methodology AR-AM0005 and the company's quality assurance and quality control system, which are based on ISO standards.

Inventory data processing is currently conducted by SPP EUCALYPTUS – *Sistema para Prognose de Crescimento e Produção de Eucalyptus sp.* Version 1.0.0 (NEMAF/UFLA). This system was developed by Professor José Roberto Soares Scolforo,[81] from the Forest Engineering Department of the Federal University of Lavras, and may be revised[82] throughout the crediting period based on the quality assurance and quality control system.

• Deviations or any significant changes in the implementation of the ex ante forest management plan are justified and recorded in the forest inventory system, following the monitoring provisions of the approved methodology.

• The monitoring of the forest establishment data such as information on planting layout, forestry management plan, and mortality rate are integrated into the forestry inventory system and the detailed data collection parameters in the table below (following monitoring sections).

[80] Including information on the number of planted clones, area of stratum, and planting layout as per the management plan and approved methodology.

[81] Dr. Scolforo's curriculum vitae accessed on November 23rd, 2007 at http://buscatextual.cnpq.br/buscatextual/visualizacv.jsp?id=K4788018A0

[82] Relevant changes in the systems will be recorded and updated to the DOE at time of verifications.

• The planted areas affected by natural and anthropogenic disturbances will be recorded and the collected data will be recorded in the forestry inventory system.

c. Monitoring of the forest management activities

• Fertilizers application occurs in years 1, 2 and 3 of planting and replanting stages. The fertilization used is an N type (NPK), a total amount of 0.008358 tons per hectare for each rotation period;

• Harvesting instructions are provide in a specific SOP, thinning activities are not expected to occur in the project activity once forestry management techniques do not indicate these procedures are not required to produce charcoal[83].

• Harvesting starts at year 8 and continues throughout the project years (see **Figure 41**);
The first planting cycle is followed by a 7-year cycle of coppicing. At the end of this second cycle a new planting (replanting) shall be implemented (see **Figure 41**);

• Diesel consumption monitoring is either per unit of area (planted area; standard yield hour/hectare; standard yield liters/hour) for site preparation, planting and maintenance, or per unit volume logged (volume logged; standard yield hour/m^3; standard yield liters/hour). Therefore, the quantity of fossil fuels used in the forest management and operations during each year of the project collected and recorded, and details about the monitoring frequency are presented in the table below.

• The occurrence of natural or anthropogenic disturbances such as forest wild fires are closely monitored by the project entity, which maintains continuous vigilance at strategically located fire-watch towers (see **Figure 8**). All stands and natural preservation areas of the forestry services units are surrounded by fire breaks. Forest fires are combated in conjunction with special trained fire-fighting brigade. Location and area data of stratum, stands and permanent sample plots are managed and recorded integrally as per the quality assurance and control systems of the project activity forestry inventory.

• The project proponent does not carry out any biomass burning practice.

• During the process of establishment of the stands, fire breaks are carefully built respecting SOP's related and also procedures for fire prevention including the use of a fire truck and fire brigades. There's a specific SOP for forest protection in which procedures for avoidance of insect infestation is proposed.

[83] In case thinning activities occur due to the management requirements related to natural or anthropogenic disturbances data will be collected and registered as per the monitoring procedures of the approved methodology.

Table 4.1: The following data shall be collected or used in order to monitor verifiable changes in carbon stocks:

ID number [84]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[85]	Recording frequency	Number of data points / Other measure of number of collected data	Comment
MONITORING OF THE PROJECT BOUNDARY						
E.1.01	Stratum ID	Alphanumeric	e	5 years	100%	Stratum takes into consideration similar type of soil, climate, and possibly tree species
E.1.02	Sub-stratum ID	Alphanumeric	e	5 years	100%	Each sub-stratum has a particular age class referring to the planting date under each stratum
E.1.03	Confidence level	%	e	5 years	100%	For the purpose of QA/QC and measuring and monitoring accuracy
E.1.04	Accuracy	%	e	5 years	100%	For the purpose of QA/QC and measuring and monitoring accuracy
E.1.05	Standard deviation of stratum	Alphanumeric	e	5 years	100%	Stratum and substratum, calculated from E.1.03– E.1.04
E.1.06	Number of sample plots	Alphanumeric	c	5 years	100%	Plot ID shall be provided to each permanent sample plot
E.1.07	Sample plot ID	Alphanumeric	e	5 years	100%	Numeric series ID will be assigned to each permanent sample plot
E.1.08	Plot location	GPS coordinates	m	5 years	100%	Using GPS
MONITORING OF THE FOREST ESTABLISHMENT						

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

[85] Please provide full reference to data source.

E.1.09	Tree species	Species names		5 years	100%	Arranged in CDM-AR PDD
E.1.10	Age of plantation	Alphanumeric	m	5 years	100%sampling plot	Counted since the planting date
E.1.11	Number of trees	Alphanumeric	m	5 years	100% of trees on plots	Counted in plot measurement
MONITORING OF THE FOREST MANAGEMENT ACTIVITIES						
E.1.12	Diameter at Breast Height (DBH)	m	m	5 years	100% trees on plots	Measured at each monitoring interval
E.1.13	Mean DBH	m	c	5 years	100% of sampling plots	Calculated from E.11 and E.12
E.1.14	Tree height	m	m	5 years	100% trees on plots	Monitoring at each monitoring time per sampling method
E.1.15	Mean tree height	m	m	5 years	100% trees on plots	Calculated from E.1.11 and E.1.14
E.1.16	Merchantable volume	m^3/ha	c/m	5 years	100% trees on plots	Calculated from E.1.13 and possibly E.1.15 using local-derived equations, or directly measured by field instrument
E.1.17	Wood density	t d.m. m^3	e	5 years	100% trees on plots	Local-derived and species-specific value have the priority
E.1.18	Biomass expansion factor (BEF)	dimensionless	e	5 years	100% of plots	Local-derived and species-specific value have the priority
E.1.19	Carbon fraction	t C $(t\ d.m)^{-1}$	e	5 years	100% of plots	Local-derived and species-specific value have the priority
E.1.20	Root-shoot ratio	dimensionless	e	5 years	100% of plots	Locally-derived and species-specific value have the priority
E.1.21	Carbon stock in above-ground biomass of tree	kg C $tree^{-1}$	c	5 years	100% sampling plot	Calculated
E.1.22	Carbon stock in below-ground biomass of tree	kg C $tree^{-1}$	c	5 years	100% sampling plot	Calculated

E.1.23	Carbon stock in above-ground biomass of plots	t C ha^{-1}	c	5 years	100% sampling plot	Calculated
E.1.24	Carbon stock in below-ground biomass of plots	t C ha^{-1}	c	5 years	100% sampling plot	Calculated
E.1.25	Mean carbon stock in above-ground biomass per unit area per stratum per species	t C ha^{-1}	c	5 years	100% of stratum and sub-stratum	Calculated from E.1.06 to E.1.23
E.1.26	Mean carbon stock in below-ground biomass per unit area per stratum per species	t C ha^{-1}	c	5 years	100% of stratum and sub-stratum	Calculated from E.1.06 to E.1.20
E.1.27	Area of stratum and substratum	ha	m	5 years	100%	Actual area of each stratum and sub-stratum
E.1.28	Carbon stock in above-ground biomass of stratum per species	t C	c	5 years	100% of stratum and sub-stratum	Calculated
E.1.29	Carbon stock in below-ground biomass of stratum per species	t C	c	5 years	100% of stratum and sub-stratum	Calculated
E.1.30	Carbon stock change in above-ground biomass per stratum per species	t C yr^{1}	c	5 years	100% strata and sub-strata	Calculated
E.1.31	Carbon stock change in below-	t C yr^{1}	c	5 years	100% strata and	Calculated

	ground biomass per stratum per species				sub-strata	
E.1.32	Total carbon stock change	t CO_2-e yr^{-1}	c	5 years	100% project area	Summing up carbon stock change in E.1.30 and E.1.31 for all stratum, sub-stratum and tree species
E.1.33	Amount of diesel consumed in machinery use for site preparation, thinning or loggings	litre	m	Annually	100%	Monitoring either diesel consumption per unit area (planted area; standard yield hour/hectare; standard yield liters/hour) for site preparation, planting and maintenance, or per unit volume logged (volume logged; standard yield hour/m^3; standard yield liters/hour)
E.1.34	Emission factor for diesel	kg/litre	e	5 years	100%	GPG 2000, IPCC Guidelines, national GHG inventory. National inventory value should have priority
E.1.35	Emission from fossil fuel use within project boundary	t CO_2-e yr^{-1}	e	Annually	100%	Calculated using equations
E.1.36	Area affected by biomass burning	ha	m	Annually	100%	Measured for different sub-stratum
E.1.37	Mean above-ground biomass stock before burning	t d.m. ha^{-1}	e	At the beginning of the project	100%	Sampling survey for different sub-strata before burning
E.1.38	Proportion of biomass	dimensionless	m	Annually	100%	Sampling survey for different sub-strata after burning

	burned					
E.1.39	Biomass combustion efficiency	dimensionless	e	Before the start of the project	100%	IPCC default value (IPCC default: 0.05) should be used if no appropriate value available
E.1.40	Carbon fraction	t C (t d.m.) $^{-1}$	e	5 years	100%	
E.1.41	Loss of above-ground biomass carbon due to biomass burning	t C yr^{-1}	c	5 years	100%	Calculated from equation
E.1.42	N/C ratio	kg N/kg C	e	Before the start of the project	100%	IPCC default value (IPCC default: 0.01) should be used if no appropriate value is available
E.1.43	N_2O emission from biomass burning	t CO_2-e yr^{-1}	c	5 years	100%	Calculated using equation
E.1.44	CH_4 emission from biomass burning	t CO_2-e yr^{-1}	c	5 years	100%	Calculated using equation
E.1.45	Increase in non-CO_2 emission as a result of biomass burning	t CO_2-e yr^{-1}	c	5 years	100%	Calculated using equation
E.1.46	Amount of synthetic fertilizer N applied per unit area	kg N ha^{-1} yr^{-1}	m	Annually	100%	The amount of fertilizer N is the same for all sites and the application occurs in years 1, 2 and 3 of each rotation.
E.1.47	Area of land with N fertilized	ha yr^{-1}	m	Annually	100%	For different tree species and management
E.1.48	Amount of synthetic fertilizer N applied	t N yr^{-1}	c	Annually	100%	Calculated using equation
E.1.49	Fraction that	Dimensionless	e	At the time of	100%	IPCC default value (IPCC default:

	volatilizes as NH_3 and NO_X for synthetic fertilizers			validation		0.1) should be used if no appropriate data is available
E.1.50	Emission factor for emission from N input	N_2O N-input^{-1}	e	At the time of validation	100%	IPCC default value (1.25%) should be used if no appropriate data is available
E.1.51	Direct N_2O emission of N input	t CO_2-e yr^{-1}	c	Annually	100%	Calculated using equation
E.1.52	Total increase in GHG emission	t CO_2-e yr^{-1}	c	Annually	100%	Calculated using equation
E.1.53	Number of vehicle type used	number	e	Annually	100%	Monitoring number of each vehicle type used
E.1.54	Emission factor for road transportation	kg CO_2-e t^{-1}	e	Annually	100%	National or local value has the priority
E.1.55	Kilometers traveled by vehicles	km	m	Annually	100%	Monitoring kilometers for each vehicle type and fuel type used
E.1.56	Fuel consumption per km	litre km^{-1}	e	5 years	100%	Estimated for each vehicle type and fuel type used
E.1.57	Fuel consumption for road transportation	litre	c	Annual	100%	Calculated using equation

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

>> The QA/QC procedures under the project aim to implement standard procedures for monitoring and collection of reliable field measurements. To ensure that the net anthropogenic GHG removals by sinks are estimated and monitored accurately, the quality assurance and quality control (QA/QC) procedures such as (1) quality assurance of field monitoring; (2) collection of field data; (3) verification of the data collected; and (4) data entry and analysis, are implemented. According to a quality system based on ISO 9001 standards.

Quality assurance of field monitoring

The personnel involved in the project monitoring are carefully trained in data collection and analyses. The data collection and organization is based on the Standard Operating Procedures (SOPs) developed for the purpose. These SOPs contain provisions for documentation and verification so that continuity in the field monitoring is maintained and measurements can be verified. In order to ensure consistency in field monitoring and measurements, the team members are trained in all procedures of data collection. The monitoring and data collection unit is organized and the team's responsibilities are clearly outlined.

Data collection

The field data collection is verified by undertaking random checks of plots, including their re-measurement by a senior member of the monitoring team. In case of errors, these is corrected and recorded for each stratum. The errors identified are recorded as a percentage of errors on all the verified plots to estimate the measurement error.

Verification of field data

Each team re-measures the standing above ground biomass in at least one plot measured by another team. During the re-measurement, key items such as location of trees and measurement of diameters of each tree in the plot. The results of re-measurements are compared and problems identified are resolved. This procedure is repeated during the field data collection to minimize the errors in the field data.

Data entry and analysis

The data entry process is reviewed by a senior member of the monitoring team and compared with independent data sources to ensure consistency. Regular meetings between the monitoring and data entry personnel during data analysis is undertaken in order to resolve any anomalies in the field data before its analysis.

ID number[86]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[87]	Recording frequency	Number of data points / Other measure of number of collected data.	Comment
E.1.2.01	Confidence level	%	c	5 years	100%	For the purpose of QA/QC and measuring

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

[87] Please provide full reference to data source.

						and monitoring accuracy
E.1.2.02	Accuracy	%	c	5 years	100%	For the purpose of QA/QC and measuring and monitoring accuracy

E.2. Sampling design and stratification

>> The stratification process adopted by Plantar considered the similarities that reflect in the results of net actual GHG removal by sinks. Nevertheless, any changes in the number and area of strata will be recorded accordingly. Few aspects, such as accidental fires, caterpillar plague and others that may especially interfere in the volume of wood to be harvested and even in the definition of sub-strata (age class) in case of anticipating harvesting or replanting an area, are considered for the ex-post stratification.

The forests stocks established under this project activity are very homogeneous, once they've been implemented in similar conditions of soil, climate, landscape and forestry management procedures. Thus, they have the same growth tendency and similar morphologic features for the planted genetic sprouts

In this sense, it's possible to apply a system of random definition of plot centers for sampling plots, as it has a low variability in the forest for the characteristics of interest. The system is a procedure in which there's no restriction to casualness, which means, all suitable plots of the population have the same chance to be randomized in order to compose the inventory sample.

Considering that the plantings occurred in different dates, the substrata were subdivided by planting year. Therefore, to increase conservativeness of carbon removals measurements each substratum was considered as an independent population and the inventories were carried out for each one of them, generating distinct sampling intensity and sampling errors, increasing its conservativeness.

The forestry management system adopted is supported by SOPs and QA/QC measures that can assure that changes in the stratification due to influence of grassland vegetation in the growth of young stands will hardly occur. For that purpose, procedures such as manual weed control and product application are executed. The adequate product concentration needs to be determined according to a pre-assessment of the area and its phenological stage, as per most recent SOP. Local aspects that may lead to changes in the adopted silvicultural regime and any changes in site characteristics or other variables not considered in the ex-ante stratification will be accordingly recorded and considered in the ex-post stratification.

Taking into account the provisions of the approved methodology AR-AM0005 the project adopts more conservative approach on sampling design patterns, plots distribution and stratification. For example, in case the sub-strata inventory has an error above 10%, considering a 95% confidence level, more plots shall be added in the sub-strata in order to lower the sampling error, strictly following the approved methodology provisions.

As presented in the section C.4 above the total project activity area has one single stratum and the sampling plot design and distribution follow the good practices of forest science methods and techniques and were available to the DOE at the time of validation. The project activity forest inventory adopts, by definition, that a sample plot shall be located at an interval of approximately 10 hectares and that each stand shall have at least one sample plot, regardless of the stand size, which are geo-referenced (centre of the plot) increasing conservativeness of measurement. The location of sample plots is randomly defined. All the original maps with the sample plots information are filed for future measurements.

The strata are divided into sub-strata sorted by the date of planting (age class). There is no differentiation in the management system adopted for all sample plots, as defined by the SOPs and QA/QC procedures.

Strata and sub-strata will be verified in the first verification and changes will be monitored each five years. The monitoring will be carried out through Forestry Continuous Inventory (FCI) data and maps. Any changes will be recorded and presented to the DOE at the time of verification.

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

>> Since the baseline scenario is the maintenance of grassland in its peak and steady state and the sum of the carbon stock changes of the living biomass in the grassland is considered to be zero, this project activity does not require monitoring of the baseline as per the CDM approved methodology AM-AR0005.

ID number[88]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[89]	Recording frequency	Number of sample plots at which the data will be monitored	Comment
N/A	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

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

>> The monitoring of the actual net GHG removals by sinks covers the monitoring of the changes to the project boundary and the assessment of changes in the carbon pools under consideration within the project boundary. The monitoring procedures are designed based on the stratification, sample frame, and monitoring frequency. The monitoring of the actual net GHG removals by sinks includes:

- Monitoring the changes in the above-ground and below-ground biomass pools of the A/R project.
- Monitoring of GHG emissions within the project boundary that result from the implementation of the A/R project activities such as site preparation, planting, maintenance, fertilization, harvesting, and accidental fires, etc.

The following equation provided by the AR-AM0005, Section III. 5.c is used to calculated net greenhouse gas removals by sinks. The ex-post calculations will be provided to the DOE at time of verification (the ex-ante results are available in section D.1 above).

$$\Delta C_{ACTUAL,t} = \sum_{i=1}^{I} \sum_{j=1}^{J} \sum_{k=1}^{K} \Delta C_{ijk,t} - GHG_{E,t} \qquad \textbf{(14)}$$

where:

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

[89] Please provide full reference to data source.

$\Delta C_{ACTUAL,t}$	= net greenhouse gas removals by sinks; tonnes CO2-e yr^{-1} for year *t*
i	= stratum *i* (*I* = total number of strata)
j	= species *j* (*J* = total number of species)
k	= substratum *k* (*K* = total number of substrata)
$GHG_{E,t}$	= annual GHG emissions as a result of the implementation of the A/R CDM project activity within the project boundary; tonnes CO2-e yr^{-1} for year *t*

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

>> This section presents, based on the provisions of the CDM approved methodology AR-AM0005 the basic variables that affect the changes in carbon stock in the above-ground and below-ground biomass pools and report the same at the time of verification. The following steps are followed in the monitoring process.

Monitoring frequency

Monitoring interval may depend on the growth rate and variability observed in the above-ground carbon pool. Depending upon the rate of carbon accumulation in the living biomass, the first monitoring interval is between second and third years, as per the QA/QC system, after which the monitoring interval coincides with the verification interval, which is expected to occur at 5-year intervals, until the end of the crediting period.

Monitoring of GHG emissions within the project boundary

The following *three* major sources of GHG emissions are identified in the implementation of the CDM A/R project activity. These emissions are recorded, reported and accounted in the calculation of actual net GHG removals by sinks from the project.

- GHG emissions from fossil fuel consumption;
- GHG emissions from nitrogenous fertilizer application;
- The biomass burning in the project area as a result of fire from accidental natural causes or due to anthropogenic activities outside the project activities. Biomass burning is not considered for ex-ante estimates once this is not silviculture practice adopted in this CDM A/R project activity.

Monitoring of the carbon stock changes

The above-ground tree component standing on the permanent sample plots is measured at each monitoring interval. The approved methodology does not account for non-tree biomass carbon pools. This is due to the fact that the non-tree component in the project scenario is likely to be greater than in the baseline scenario. This is conservative once the non-tree biomass carbon pools and forms less than 5 percent of the total project biomass. The changes in carbon stock in the above- and below-ground biomass are estimated as the difference of the carbon stocks measured obtained at the beginning and at the end of a monitoring interval. Carbon stocks are estimated using biomass expansion factor that results out of the weighted average from all sub-strata within the project boundary detailed in the section C.4.

Changes in carbon stock in the above-ground biomass pool are estimated taking into account the increases and decreases in the carbon pools, under the project scenario. The major changes contributing to the changes in the carbon pools result from the following:

- Changes in the area reforested over the project period;
- Increases in carbon stock in the above-ground biomass pool due to growth.
- Loss of carbon stock due to clearance of grassland biomass to implement the A/R project activity; and
- Losses in carbon stock due to natural or anthropogenic disturbances, such as accidental fire and harvesting cycles.

The changes in the carbon stocks of above-ground and below-ground biomass are estimated as follows.

$$\Delta C_{ijk,t} = (\Delta C_{AB,ijk,t} + \Delta C_{BB,ijk,t}) \bullet \frac{44}{12} \quad \textbf{(15)}$$

$$\frac{\Delta C_{AB,ijk,t} = (C_{AB,ijk,m_2} - C_{AB,ijk,m_1})}{T} \quad \textbf{(16)}$$

$$\Delta C_{BB,ijk,t} = \frac{(C_{BB,ijk,m_2} - C_{BB,ijk,m_1})}{T} \quad \textbf{(17)}$$

where:

$\Delta C_{ijk,t}$ = verifiable changes in carbon stock in living biomass of trees for stratum *i* species *j* sub-stratum *k*; tonnes CO_2 yr^{-1} in year *t*

$\Delta C_{AB,ijk,t}$ = changes in carbon stock in above-ground biomass of trees for stratum *i* species *j* sub-stratum *k*; tonnes CO_2 yr^{-1} in year *t*

$\Delta C_{BB,ijk,t}$ = changes in carbon stock in below-ground biomass of trees for stratum *i* species *j* sub-stratum *k*; tonnes CO_2 yr^{-1} in year *t*

C_{AB,ijk,m_2} = carbon stock in above-ground biomass of trees for stratum *i* species *j* sub-stratum *k* calculated at monitoring point m_2; tonnes C

C_{AB,ijk,m_1} = carbon stock in above-ground biomass of trees for stratum *i* species *j* sub-stratum *k* calculated at monitoring point m_1; tonnes C

C_{BB,ijk,m_2} = carbon stock in below-ground biomass of trees for stratum *i* species *j* sub-stratum *k* calculated at monitoring point m_2; tonnes C

C_{BB,ijk,m_1} = carbon stock in below-ground biomass of trees for stratum *i* species *j* sub-stratum *k*, calculated at monitoring year m_1; tonnes C

T = number of years between monitoring point m_2 and m_1, is 5 years, as per approved methodology AM-AR0005.

$\frac{44}{12}$ = ratio of molecular weights of CO_2 and carbon; dimensionless

Destructive sampling methods

Destructive sampling is used at the time of monitoring. The randomly selected trees of different sizes are selected and their diameter at breast height (dbh) and height are measured. The trees are harvested and sampled to estimate the volume of the tree above-ground biomass through using destructive sampling methods.

Use of BEF method and use of local/national published data

The changes in above-ground biomass are assessed using biomass expansion factor method (BEF method) and data from local measurements and publications, as prescribed by Section III.5.a.2 of the AR-AM0005 methodology. The changes that are related to below-ground biomass and root-shoot ratio calculation are assessed based on scientific experiments and public available data that were assessed through measurement in eucalyptus plantations sites in the same region with similar climate and soil conditions. In addition, the BEF and the root-shoot ratio applied are age and density dependent based on scientific based local publication; nevertheless, the calculations are volume based per area (i.e. volume per hectare). Therefore, the following step-wised procedures are applied in the project activity stratum using plot level data, available local yield data and expansion factors, taking into account sub-stratum (age class) per unit of area (hectare).

The source of the BEF used in this project activity is an academic research study (LADEIRA, 1999) developed in the same region and river basin of the project activity, the Paraopeba river basin. The species used in the research was the *Eucalyptus Urophylla*, which is a component of the project entity's hybrid clone of *Urograndis*. The eucalyptus were planted using an equivalent (9 square meters) spacing planting, the same used by the project entity. Since the research considered all of the forest lifecycle stages (ages), the BEF was calculated as an average of the age classes applied in the research.

Step 1*:* Estimation of living biomass of trees using BEF

$$TB_{AB,ijk,tree,m} = V_{ijk,m} \bullet D_j \bullet BEF_{jk} \quad \textbf{(18)}$$

$$TB_{BB,ijk,tree,m} = TB_{AB,ijk,tree,m} \bullet R_j \quad \textbf{(19)}$$

$TB_{AB,ijk,tree,m}$ = above-ground biomass per tree of stratum *i* species j and sub-stratum *k*; tonnes d.m. tree^{-1} at monitoring year *m*

$TB_{BB,ijk,tree,m}$ = below-ground biomass per tree of stratum *i* species j and sub-stratum *k*; tonnes d.m. tree^{-1} at monitoring year *m*

$V_{ijk,m}$ = merchantable volume per tree (diameter DBH and height H) in stratum *i* species j and sub-stratum *k* (age class); m^3 tree^{-1} at monitoring year *m*

D_j = basic wood density for species *j*; tonnes d.m. m^{-3} merchantable volume

BEF_{jk} = biomass expansion factor for conversion of merchantable volume to above-ground tree biomass for species j sub-stratum k; dimensionless

R_j = root-to-shoot ratio appropriate for species *j (eucalyptus)***;** dimensionless

Step 2: Estimation of the carbon stock living biomass of trees in one permanent sample plot

$$PC_{AB,ijk,plot,m} = \sum_{tr=1}^{TR} TB_{AB,ijk,tree,m} \bullet CF_j \quad \textbf{(20)}$$

$$PC_{BB,ijk,plot,m} = \sum_{tr=1}^{TR} TB_{BB,ijk,tree,m} \bullet CF_j \quad \textbf{(21)}$$

where:

$PC_{AB,ijk,plot,m}$ = plot level carbon stock in above-ground biomass for stratum *i* species *j* sub-stratum *k* per unit area; tonnes C ha^{-1} at monitoring year *m*

$PC_{BB,ijk,plot,m}$ = plot level carbon stock in below-ground biomass for stratum *i* species *j* sub-stratum *k* per unit area; tonnes C ha^{-1} at monitoring year *m*

$TB_{AB,ijk,tree,m}$ = above-ground biomass per tree of stratum *i* species j and sub-stratum *k*; tonnes d.m. $tree^{-1}$ at monitoring year *m*

$TB_{BB,ijk,tree,m}$ = below-ground biomass per tree of stratum *i* species j and sub-stratum *k*; tonnes d.m. $tree^{-1}$ at monitoring year *m*

CF_j = carbon fraction of dry matter for species *j*, tonnes C (tonne d.m.)$^{-1}$;

The basic wood density applied is 0.503 t d.m. m^{-3}, as details are presented in the stratification section.

Step 3*:* Mean carbon stock within each stratum calculated by averaging the carbon stock across plots in a stratum.

$$MC_{AB,ijk,m} = \frac{\sum_{p=1}^{P_{ijk}} PC_{AB,ijk,plot,m}}{P_{ijk}} \quad \textbf{(22)}$$

$$MC_{BB,ijk,m} = \frac{\sum_{p=1}^{P_{ijk}} PC_{BB,ijk,plot,m}}{P_{ijk}} \quad \textbf{(23)}$$

where:

$MC_{AB,ijk,m}$ = mean carbon stock in above-ground biomass for stratum *i* species *j* sub-stratum *k*; tonnes C ha^{-1} at monitoring year *m*

$MC_{BB,ijk,m}$ = mean carbon stock in below-ground biomass for stratum *i* species *j* sub-stratum *k*; tonnes C ha^{-1} at monitoring year *m*

$PC_{AB,ijk,plot,m}$ = plot level carbon stock in above-ground biomass for stratum *i* species *j* sub-stratum *k*; tonnes C ha^{-1} at monitoring year *m*

$PC_{BB,ijk,plot,m}$ = plot level carbon stock in below-ground biomass for stratum *i* species *j* sub-stratum *k*; tonnes C ha^{-1} at monitoring year *m*

P_{ijk} = plot in stratum *i*, species *j*, sub-stratum *k* (P_{ijk} = total number of plots in stratum *i* species *j sub-stratum k)*; dimensionless

Step 4*:* The carbon stock in living biomass is calculated from the area of each stratum *i*, species *j* and substratum *k* at monitoring year *t* and the mean carbon stock in above-ground biomass and below-ground biomass per unit area, given by:

$$C_{AB,ijk,m} = A_{ijk,m} \bullet MC_{AB,ijk,m} \quad \textbf{(24)}$$

$$C_{BB,ijk,m} = A_{ijk,m} \bullet MC_{BB,ijk,m} \quad \textbf{(25)}$$

where:

$C_{AB,ijk,m}$ = changes in carbon stock in above-ground biomass for stratum *i* species *j* sub-stratum *k*; tonnes C at monitoring year *m*

$C_{BB,ijk,m}$ = changes in carbon stock in below-ground biomass for stratum *i* species *j* sub-stratum *k*; tonnes C at monitoring year *m*

$A_{ijk,m}$ = area of stratum *i* species *j* sub-stratum *k;* hectare (ha) at monitoring year *m*

$MC_{AB,ijk,m}$ = mean carbon stock in above-ground biomass for stratum *i* species *j* sub-stratum *k*; tonnes C ha^{-1} at monitoring year *m*

$MC_{BB,ijk,m}$ = mean carbon stock in below-ground biomass for stratum *i* species *j* sub-stratum *k*; tonnes C ha^{-1} at monitoring year *m*

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

ID number [90]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[91]	Recording frequency	Number of data points / Other measure of number of collected data.	Comment
E.1.01	Stratum ID	Alphanumeric	See comment.	See comment.	See comment.	**See Table at item E.1.1 above**
E.1.02	Sub-stratum ID	Alphanumeric	See comment.	See comment.	See comment.	**See Table at item E.1.1 above**
E.1.03	Confidence level	%	e	5 years	100%	**95%**
E.1.04	Accuracy	%	e	5 years	100%	**10% sampling error**
E.1.05	Standard deviation of each stratum	Alphanumeric	e	5 years	100%	**Estimated based on E.103, E.104 and specific SOP**
E.1.06	Number of sample plots	Alphanumeric	c	5 years	100%	Plot ID shall be provided to each permanent sample plot
E.1.07	Sample plot ID	Alphanumeric	e	5 years	100%	Numeric series ID will be assigned to each permanent sample plot
E.1.08	Plot location	GPScoordinates	m	5 years	100%	Using GPS to locate before start of the project and at time of each field measurement
E.1.09	Tree species	Species names		5 years	100%	Arranged in CDM-AR PDD
E.1.10	Age of plantation	year	m	5 years	100%sampling plot	Counted since the eucalyptus planting date
E.1.11	Number of trees	Alphanumeric	m	5 years	100% of trees on plots	Counted in plot measurement
E.1.12	Diameter at Breast Height (DBH)	m	m	5 years	100% trees on plots	Measured at each monitoring interval
E.1.13	Mean DBH	m	c	5 years	100% of sampling plots	Calculated from E.11 and E.12

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

[91] Please provide full reference to data source.

E.1.14	Tree height	m	m	5 years	100% trees on plots	Monitoring at each monitoring time per sampling method
E.1.15	Mean tree height	m	m	5 years	100% trees on plots	Calculated from E.1.11 and E.1.14
E.1.16	Merchantable volume	m^3/ha	c/m	5 years	100% trees on plots	Calculated from E.1.13 and possibly E.1.15 using local-derived equations, or directly measured by field instrument
E.1.17	Wood density	t d.m. m^3	e	5 years	100% trees on plots	Local-derived and species-specific value have the priority
E.1.18	Biomass expansion factor (BEF)	dimensionless	e	5 years	100% of plots	Local-derived and species-specific value have the priority
E.1.19	Carbon fraction	t C. (t d.m)$^{-1}$	e	5 years	100% of plots	Local-derived and species-specific value have the priority
E.1.20	Root-shoot ratio	dimensionless	e	5 years	100% of plots	Locally-derived and species-specific value have the priority
E.1.21	Carbon stock in above-ground biomass of tree	kg C tree^{-1}	c	5 years	100% sampling plot	Calculated
E.1.22	Carbon stock in below-ground biomass of tree	kg C tree^{-1}	c	5 years	100% sampling plot	Calculated
E.1.23	Carbon stock in above-ground biomass of plots	t C ha^{-1}	c	5 years	100% sampling plot	Calculated
E.1.24	Carbon stock in below-ground biomass of plots	t C ha^{-1}	c	5 years	100% sampling plot	Calculated
E.1.25	Mean carbon stock in above-ground biomass per unit area per stratum per species	t C ha^{-1}	c	5 years	100% of stratum and sub-stratum	Calculated from E.1.06 to E.1.23
E.1.26	Mean carbon stock in below-ground biomass per unit area per stratum per species	t C ha^{-1}	c	5 years	100% of stratum and sub-stratum	Calculated from E.1.06 to E.1.20
E.1.27	Area of stratum and substratum	ha	m	5 years	100%	Actual area of each stratum and sub-stratum

E.1.28	Carbon stock in above-ground biomass of stratum per species	t C	c	5 years	100% of stratum and sub-stratum	Calculated
E.1.29	Carbon stock in below-ground biomass of stratum per species	t C	c	5 years	100% of stratum and sub-stratum	Calculated
E.1.30	Carbon stock change in above-ground biomass per stratum per species	t C yr^{1}	c	5 years	100% strata and sub-strata	Calculated
E.1.31	Carbon stock change in below-ground biomass per stratum per species	t C yr^{1}	c	5 years	100% strata and sub-strata	Calculated
E.1.32	Total carbon stock change	t CO_2-e yr^{-1}	c	5 years	100% project area	Summing up carbon stock change in E.1.30 and E.1.31 for all stratum, sub-stratum and tree species

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

>> The GHG emissions expected from the project result from fossil fuel combustion in project activities, nitrogenous fertilizer application, and accidental fires. The increases in greenhouse gas emissions from fossil fuel combustion and nitrous oxide emissions from fertilizer application are monitored and calculated based on project monitoring data and IPCC default emission factors.

Hence, the increase in greenhouse gas emissions (GHG_E) is estimated as follows (see **Figure 33** for the parameters for calculating the project activity's GHG emissions):

- Emissions of greenhouse gases from combustion of fossil fuels for site preparation, thinning and logging;
- Decrease in carbon stock in living biomass of existing non-tree vegetation, caused by site preparation biomass loss (clearing of grassland steady state due site preparation with minimal cultivation techniques);
- N_2O emissions caused by nitrogen fertilization application.
- Emissions of non-CO_2 greenhouse gases from biomass burning due to accidental fires once the firing practice is not adopted by this project activity as good forestry management practice;

Figure 43: Assumptions and parameters used in the calculations of the project activity's GHG emissions

Pre-existing vegetation - Non-woody vegetation

$B_{pre,i}$	2.30	t d.m. ha^{-1}	IPCC GPG – LULUCF, Table 3.4.2
CF_{pre}	0.50	t C (t d.m.)$^{-1}$	Average carbon fraction of dry biomass in pre-existing non-woody vegetation IPCC GPG – LULUCF, Table 3A.1.8 and Table 3.4.3
$R_{bpre,i}$	1.60	dimensionless	

Fuel consumption within the stand

Activity	Fuel consumption per unit liters	Unit	Fuel type	Source of data
Site preparation	92.45	ha	diesel	Plantar records
Planting	151.11	ha	diesel	Plantar records
Thinning and harvesting	1.31	m3	diesel	Plantar records

Management

Stand age t - age	Stand Fertilization $N_{SN\text{-}Fert,t}$	tN ha^{-1}	Synthetic N fertilizer	Source of data
1, 14, 28	0,00780			Plantar records
2, 15, 29	0,00042			Plantar records
3, 16, 30	0,00013			Plantar records

Fertilization

EF	0,0125	Emission factor for emissions from N inputs (IPCC default: 2003 = 0,0125; 2006 = 0,01)
GWP N_20	310	Global Warming Potential for N_2O (= 310 for the first commitment period)
FracGASF	0,1	Fraction that volatilizes as NH_3 and NO_x for synthetic fertilizers (IPCC default = 0,1)
FracGASM	0,2	Fraction that volatilizes as NH_3 and NO_x for organic fertilizers (IPCC default = 0,2)

Fossil fuel consumption

EF_{diesel}	2,83	Emission factor for diesel (default = 2,83 Kg CO_2e l^{-1})

$$GHG_{E,t} = E_{FuelBurn,t} + E_{BiomassLoss,t} + E_{Non-CO_2,BiomassBurn,t} + N_2O_{direct-N_{fertilizer},t} \quad \textbf{(26)}$$

where:

$GHG_{E,t}$	= annual GHG emissions as a result of the implementation of the A/R CDM project activity within the project boundary; tonnes CO_2-e yr^{-1} in year *t*
$E_{FuelBurn,t}$	= CO_2 emissions from combustion of fossil fuels within the project boundary; tonnes CO_2-e yr^{-1} in year *t*
$E_{BiomassLoss,t}$	= GHG emissions from the loss of biomass in site preparation and conversion to A/R within the project boundary; tonnes CO_2-e yr^{-1} in year *t*
$E_{Non-CO_2,BiomassBurn,t}$	= non- CO_2 emission as a result of biomass burning within the project boundary due to accidental fires; tonnes CO_2-e yr^{-1} in year *t*
$N_2O_{direct-N_{fertilizer},t}$	= direct N_2O emissions as a result of nitrogen application within the project boundary; tonnes CO_2-e yr^{-1} in year *t*

E.4.2.a CO₂ emissions from burning of fossil fuels

These emissions most likely result from machinery use during site preparation and logging. They are strictly measured and calculated per unit of area planted and wood volume harvested as per the equation M.19 of Section III of the AR-AM0005 methodology.

$$E_{FuelBurn,t} = (CSP_{diesel,t} \bullet EF_{diesel} + CSP_{gasoline,t} \bullet EF_{gasoline}) \bullet 0.001 \quad \textbf{(27)}$$

where:

$E_{FuelBurn,t}$	= CO_2 emissions from combustion of fossil fuels within the project boundary; tonnes CO_2-–e yr^{-1} in year t
$CSP_{diesel,t}$	= volume of diesel consumption; litre (l) yr^{-1} in year t
$CSP_{gasoline,t}$	= volume of gasoline consumption; litre (l) yr^{-1} in year t
EF_{diesel}	= emission factor for diesel; kg CO_2 l^{-1}
$EF_{gasoline}$	= emission factor for gasoline; kg CO_2 l^{-1}
0.001	= conversion from kg to tonnes of CO_2

Project participants use default emission factors as provided in the 1996 Revised IPCC Guidelines.

E.4.2.b Emissions from loss of biomass in site preparation and conversion of grassland

The emissions from loss of biomass in site preparation and conversion of grassland are calculated as per Section III.5.b.2 and adopted the conservative assumption that all baseline stratum is conservatively

identified as grassland in its peak and steady state, independently that more than half of the baseline strata was identified to be "degraded areas".

$$E_{BiomassLos\ \ s,t} = \sum_{i=1}^{I} A_i \bullet B_{w,i} \bullet (1 + R_G) \bullet CF \bullet \frac{44}{12} \qquad \forall\ t = 1 \qquad \textbf{(28)}$$

$$E_{BiomassLos\ \ s,t} = 0 \qquad \forall\ t > 1 \qquad \textbf{(29)}$$

where:

$E_{BiomassLoss,t}$ = average annual decrease in grassland biomass due to conversion of grassland to forests in stratum *i*, species *j*, sub-stratum *k*; tonnes CO_2 yr^{-1} in year *t*

A_i = area of stratum *i;* ha

$B_{w,i}$ = peak (maximum) above-ground biomass of pre-existing non-tree vegetation in stratum *i;* tonnes d.m. ha^{-1}

R_G = root-shoot ratio appropriate for pre-existing non-tree vegetation; dimensionless

CF = carbon fraction of dry biomass in pre-existing non-tree vegetation; tonnes C (tonnes d.m)$^{-1}$

i = stratum *i* (total number of strata *I*)

$\frac{44}{12}$ = ratio of molecular weights of CO_2 and carbon, dimensionless

E.4.2.c Emissions from biomass burning due to the accidental fires

The ex-post calculation of the non-CO_2 emissions due to accidental fires are monitored and estimated as per Section III.5.b3 of the approved methodology AR-AM0005[92].

$$E_{Non-CO_2,BiomassBurn,t} = E_{BiomassBurn,N_2O,t} + E_{BiomassBum,CH_4,t} \qquad \textbf{(30)}$$

$$E_{BiomassBurn,N_2O,t} = E_{BiomassBurn,C,t} \bullet N/C\ ratio \bullet EF_{N2O} \bullet GWP_{N2O} \bullet \frac{44}{28} \qquad \textbf{(31)}$$

$$E_{BiomassBurn,CH_4\,t} = E_{BiomassBurn,C,t} \bullet EF_{CH4} \bullet GWP_{CH4} \bullet \frac{16}{12} \qquad \textbf{(32)}$$

where:

$E_{Non-CO_2,BiomassBum,t}$ = non-CO_2 emission as a result of biomass burning within the project boundary due to accidental fires; tonnes CO_2-–e yr^{-1} in year t

[92] Ex-ante calculations consider this sub-section result as zero.

$E_{BiomassBurn,N_2O,t}$ = N_2O emission from biomass burning due to accidental fires; tonnes CO_2-e yr^{-1} in year *t*

$E_{BiomassBurn,CH_4,t}$ = CH_4 emission from biomass burning due to accidental fires; tonnes CO_2-e yr^{-1} in year *t*

$E_{BiomassBurn,C,t}$ = loss of carbon stock in above-ground biomass due to burning from accidental fires; tonnes C yr^{-1} in year *t*

$N/C\ ratio$ = nitrogen/carbon ratio; dimensionless

EF_{N2O} = IPCC default emission ratio for N_2O of biomass burning (IPCC default: 0.007); kg CO_2-e. kg C)$^{-1}$

EF_{CH4} = IPCC default emission ratio for CH_4 of biomass burning (IPCC default: 0.012); kg CO_2-e. kg C)$^{-1}$

GWP_{N2O} = global warming potential for N_2O (IPCC default for the first commitment period: 310); kg CO_2 (kg N_2O)$^{-1}$

GWP_{CH4} = global warming potential for CH_4 (IPCC default for the first commitment period: 21); kg CO_2 (kg CH_4)$^{-1}$

$\frac{44}{28}$ = ratio of molecular weights of N_2O and nitrogen; dimensionless

$\frac{16}{12}$ = ratio of molecular weights of CH_4 and carbon; dimensionless

$$E_{BiomassBurn,C,t} = \sum_{i=1}^{I} \sum_{j=1}^{J} \sum_{k=1}^{K} A_{burn,ijk,t} \bullet B_{ijk,t} \bullet PP_{ijk,t} \bullet CE \bullet CF \qquad \textbf{(33)}$$

where:

$E_{BiomassBurn,C,t}$ = loss of carbon stock in above-ground biomass due to burning; tonnes C yr^{-1} in year *t*

$A_{burn,ijk,t}$ = annual area affected by biomass burning in stratum *i* species *j* sub-stratum *k;* ha yr^{-1} in year *t*

$B_{ijk,t}$ = average above-ground biomass before burning for stratum *i* species j sub-stratum k*;* tonnes d.m. ha^{-1}

Note: $B_{ijk,t}$ indicates the above-ground biomass of established forest in year *t*.

$PP_{ijk,t}$ = proportion of biomass burned, dimensionless

CE = combustion efficiency; dimensionless (IPCC default =0.5)

CF = carbon fraction of dry matter; tonnes C (tonne d.m.)$^{-1}$

i = stratum *i* (*I* = total number of strata)

j = species j (J = total number of species)

k = substratum k (K = total number of substrata)

E.4.2.d Calculation of nitrous oxide emissions from nitrogen fertilization practices

The calculations of the fertilizers application follows the provisions of Section III.5.b.4 of the CDM approved methodology AR-AM0005.

$$N_2O_{direct-N_{fertilizer},t} = \left[\left(F_{SN,t} + F_{ON,t}\right) \bullet EF_i\right] \bullet \frac{44}{28} \bullet GWP_{N2O} \quad \textbf{(34)}$$

$$F_{SN,t} = N_{SF-Fert,t} \bullet \left(1 - FRAC_{GASF}\right) \quad \textbf{(35)}$$

where:

$N_2O_{direct-N_{fertilizer}}$ = direct N_2O emission as a result of nitrogen application within the project boundary; tonnes CO_2-e yr^{-1}

$F_{SN,t}$ = annual amount of synthetic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NOx; tonnes N yr^{-1} in year t

$F_{ON,t}$ = annual amount of organic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NOx; tonnes N yr^{-1} in year t

$N_{SF-Fert,t}$ = annual amount of synthetic fertilizer nitrogen applied; tonnes N yr^{-1} in year t

EF_1 = emission factor for emissions from N inputs; tonnes N_2O-N (tonnes N input)$^{-1}$

$FRAC_{GASF}$ = the fraction that volatilizes as NH_3 and NO_X for synthetic fertilizers; (IPCC default: 0.02); dimensionless

GWP_{N2O} = global warming potential for N_2O (IPCC default: 310); kg CO_2 (kg N_2O)$^{-1}$

$\frac{44}{28}$ = ratio of molecular weights of N_2O and nitrogen; dimensionless

The table below expresses project emissions related to biomass loss, burn of fossil fuel and N_2O direct fertilizer. All numbers are related to ex-ante information of the project. The ex-post calculations will account for the remaining sources of project emissions like accidental fires. The total emissions account for **186 739** t CO_2e which means the annual emissions of **6 225** t CO_2e. These values can be found at the TARAM tool and calculations were presented to the DOE at time of validation.

Figure 44: GHG emissions by the sources

Biomass decrease	Emission		Total Emissions	Project Emissions per year
			t CO2e	t CO_2e/y
$E_{BiomassLoss\ (no\ woody)}$	$E_{FuelBurn}$	$N_2O_{direct\text{-}Nfertilizer}$ (negligible)	Including all carbon stock changes and emissions by sources	
128 396	56 507	1 836	186 739	6 225

ID number [93]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d) [94]	Recording frequency	Number of data points / Other measure of number of collected data.	Comment
E.1.33	Amount of diesel consumed in machinery use for site preparation, thinning or loggings	litre	m	Annually	100%	Monitoring either diesel consumption per unit area (planted area; standard yield hour/hectare; standard yield liters/hour) for site preparation, planting and maintenance, or per unit volume logged (volume logged; standard yield hour/m^3; standard yield liters/hour)
E.1.34	Emission factor for diesel	kg/litre	e	5 years	100%	GPG 2000, IPCC Guidelines, national GHG inventory. National inventory value should have priority
E.1.35	Emission from fossil fuel use within project boundary	t CO_2-e yr^{-1}	e	Annually	100%	Calculated using equations
E.1.36	Area affected by biomass accidental fire burning	ha	m	Annually	100%	Measured for different sub-stratum
E.1.37	Mean above-ground biomass stock before accidental fire burning	t d.m. ha^{-1}	e	At the beginning of the project	100%	Sampling survey for different sub-strata before wild or accidental fire burning
E.1.38	Proportion of biomass accidentally fire burned	dimensionless	m	Annually	100%	Sampling survey for different sub-strata after wild or accidental burning
E.1.39	Biomass combustion	dimensionless	e	Before the	100%	IPCC default value (IPCC

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

[94] Please provide full reference to data source.

	efficiency			start of the project		default: 0.05) should be used if no appropriate value available
E.1.40	Carbon fraction	t C (t d.m.) $^{-1}$	e	5 years	100%	
E.1.41	Loss of above-ground biomass carbon due to biomass accidental fire burning	t C yr^{-1}	c	5 years	100%	Calculated from equation
E.1.42	N/C ratio	kg N/kg C	e	Before the start of the project	100%	IPCC default value (IPCC default: 0.01) should be used if no appropriate value is available
E.1.43	N_2O emission from biomass accidental fire burning	t CO_2-e yr^{-1}	c	5 years	100%	Calculated using equation
E.1.44	CH_4 emission from biomass accidental fire burning	t CO_2-e yr^{-1}	c	5 years	100%	Calculated using equation
E.1.45	Increase in non- CO_2 emission as a result of biomass accidental fire burning	t CO_2-e yr^{-1}	c	5 years	100%	Calculated using equation
E.1.46	Amount of synthetic fertilizer N applied per unit area	kg N ha^{-1} yr^{-1}	m	Annually	100%	The amount of fertilizer N is the same for all sites and the application occurs in years 1, 2 and 3 of each rotation.
E.1.47	Area of land with N fertilized	ha yr^{-1}	m	Annually	100%	For different tree species and management
E.1.48	Amount of synthetic fertilizer N applied	t N yr^{-1}	c	Annually	100%	Calculated using equation
E.1.49	Fraction that volatilizes as NH_3 and NO_X for synthetic fertilizers	Dimensionless	e	At the time of validation	100%	IPCC default value (IPCC default: 0.1) should be used if no appropriate data is available
E.1.50	Emission factor for emission from N input	N_2O N-input^{-1}	e	At the time of validation	100%	IPCC default value (1.25%) should be used if no appropriate data is available
E.1.51	Direct N_2O emission of N input	t CO_2-e yr^{-1}	c	Annually	100%	Calculated using equation
E.1.52	Total increase in GHG emission	t CO_2-e yr^{-1}	c	Annually	100%	Calculated using equation

E.5. Leakage:

>> In this project activity leakage is assumed to occur as a result of increased emissions measurable and attributable to the project activity from fossil fuel combustion (mobile combustion) outside the project boundary.

Therefore, the form of leakage from the project are due to travel of project personnel and transportation of machines, cloned sprouts, fertilizers, labor, staff and harvested wood outside the project area. This leakage is accounted in the project while estimating the net GHG removals by sinks from the project (see section E.5.1 below for the parameters used for calculating leakage).

To monitor leakage the project entity's operational department will provide the information on vehicle types used, distance traveled and fuel consumed in the project related travels outside the project boundary in an annual basis to perform the calculations according to formulae presented in the following item E.5.1. All information will follow QA/QC procedures, as provided in item E.6 below.

As treated in detail in item A.5.6, the project entity has adopted an internal policy to prevent leakage due to the displacement of economic activities/household displacement. In this sense, only lands that were already for sale in the market were purchased to the implementation of the project activity. In order to evaluate and confirm the efficiency of its leakage prevention policy, the project entity has recently prepared and applied a structured questionnaire among the previous owners of the project lands. The answers confirmed that there is no leakage measurable and attributable to the implementation of the project activity. Hence, no displacement of economic activities or households attributable to the project activity was identified in areas outside the project boundaries that led to deforestation and land use change for agriculture/non-agricultural purposes, no harvesting of fuel wood for meeting domestic energy needs, and use of lands as pastures for grazing/fodder collection and no leakage emissions measurable and attributable to the project activity was therefore identified.

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

>> Under the project, leakage is from increased emissions from fossil fuel combustion outside the project boundary (e.g. personnel and supplies transportation etc.) and as previously stated no displacement of activities occurred as a result of the project.

The transit of personnel, cloned sprouts, fertilizers and wood will occur according to the specific origin and destination points which the most conservative distances are considered in order to calculate leakage emissions from fossil fuels. As per the provisions of the CDM approved methodology AR-AM0005, the fuel consumption is specifically monitored and calculated per measurements of the quantity and amounts of goods, personnel transported and the distances travelled throughout the crediting period.

ID number[95]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[96]	Recording frequency	Number of data points / Other measure of number of collected data.	**Comment**
E.1.53	Number of vehicle type used	number	e	Annually	100%	Monitoring number of each vehicle type used
E.1.54	Emission factor for road transportation	kg CO2-e t-1	e	Annually	100%	National or local value has the priority
E.1.55	Kilometers traveled by vehicles	km	m	Annually	100%	Monitoring kilometers for each vehicle type and fuel type used
E.1.56	Fuel consumption per km	litre km-1	e	5 years	100%	Estimated for each vehicle type and fuel type used
E.1.57	Fuel consumption for road transportation	litre	c	Annual	100%	Calculated using equation

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

[96] Please provide full reference to data source.

The periodic review of leakage calculation and monitoring should follow the AR-AM0005 which states that after establishing the leakage at the end of year 1 of the project implementation, the leakage is monitored prior to the first verification of the project to evaluate the validity of the estimates of leakage made at the end of year 1. Respecting the procedures shown above, the periodic review of implementation of activities is available at the TARAM Tool at the "CER" spreadsheet. According to the tool, reviews are expected to occur in years 9, 14, 19, 24 and 29 of the project's 30 year duration.

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

>> N/A

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

>>

Data (Indicate ID number)	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Stratum	Low	To ensure that represents the project characteristics
Sub-stratum	Low	To ensure that sub-strata represents the project characteristics
Sample plot	Low	Plot ID to uniquely identify each sample plot for monitoring & measurement
Plot location	Low	The carbon pools in the plots are monitored at each interval
No. of trees	Low	Tree counts are taken on the nested plots. The data collection and recording procedures are randomly verified.
Diameter at breast height	Low	Considering the large number of measurements taken, the measurement error is likely to be small. The random re-measurements are used to verify the prior measurements.
Tree height	Low	Measurement, data collection and recording procedures are subject to random re-measurements and verification.
Wood density	Low	Data from literature and local estimates shall be verified.
Biomass expansion factor	Low	Data from literature and from estimation from monitoring data
Root-shoot ratio	Low	Data from literature and local estimates should be checked.
Merchantable volume	Low	The local allometric equations are verified using destructive sampling
Fuel use in plantation activities	Low	Data from project records shall be verified.
Fertilizer application per ha	None	Data from project records shall be verified
No. of ha fertilized	Low	Data from project records shall be verified

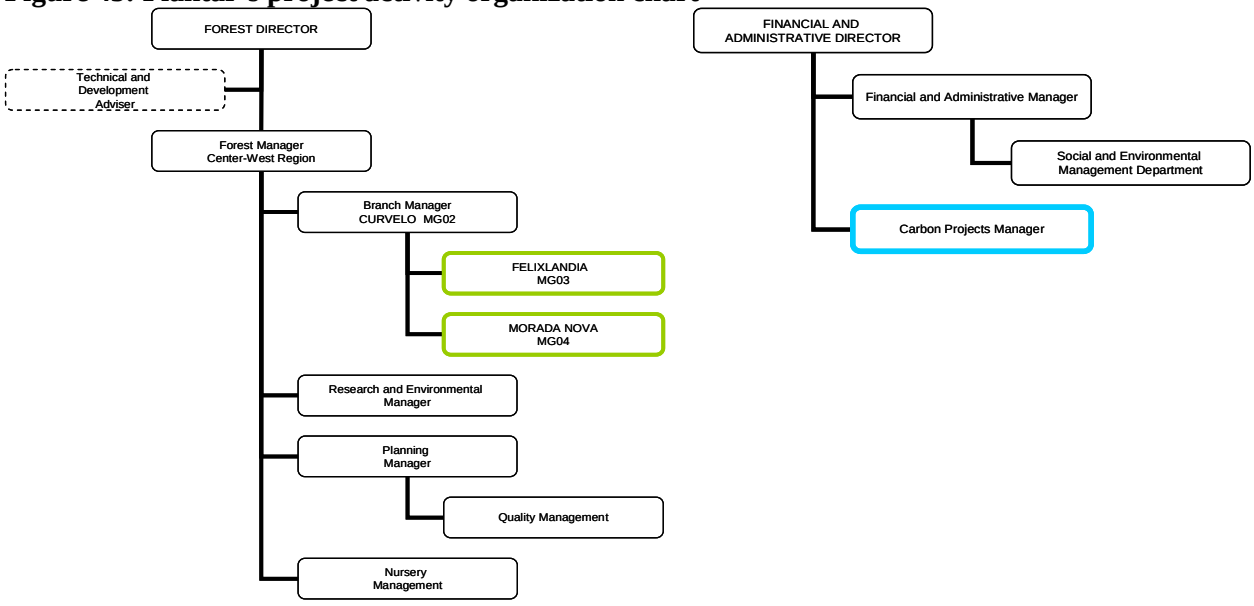
Area of biomass burned	Low	Data from project records shall be verified
Number of vehicles	Low	Data to be verified from project records
Distance in kilometers travelled	Low	Data to be verified from project records
Fuel consumption in transport	Low	Data to be verified from project records

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

>> The project entity holds large experience to manage and supervise A/R projects, with a highly qualified team, up to date with researches and operational technologies, developed and improved over time. The project entity's management structure is planned to cover all operational levels and activities, from research to harvesting (See below a summary of the project entity's organizational chart).

The management structure is divided into the regions where the project entity acts. Each regional office counts with its branch management structures, located in each farm. Every Branch Management controls the entire forestry operational processes, comprising a staff of forest analysts, operational and administrative coordinators and supervisors, forest assistants, machinery operators and others. The Planning Management also comprises the Quality Management structure, which counts with forest analysts and assistants. The farms where the project activity takes place, Felixlândia and Morada Nova de Minas, are subordinated to the Curvelo branch (MG02 Unit).

Figure 45: Plantar's project activity organization chart



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

>> Plantar - Belo Horizonte, Brazil; International Bank for Reconstruction and Development as a Trustee of the Prototype Carbon Fund/World Bank - Carbon Finance Unit, Washington DC, US (for details see Annex 1).

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

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

>>Silviculture activities, specially the plantation of Eucalyptus forests, are regularly in evidence due to their nature. Although the eucalyptus plantations for the production of wood for industrial and domestic use have contributed significantly in terms of socioeconomic development, wood productivity and environmental management quality of the plantations, some adverse public reactions to this activity are observed. Criticisms are based on ecological and social economical argumentations, some of them supported by technical parameters and others by myths and prejudice.

Among the most common arguments, the statement that eucalyptus trees consume more water than most crops, causing damage to water streams and reduction of the soil's fertility, is one that persists. Technical and scientific studies do not confirm such statement. According to Professor Sebastião Valverde from the Federal University of Viçosa[97], an academic reference in forestry studies, a research and comparison of the water consumption for each unit produced of meat, sugar cane, potato, corn, and soil, undermines the previous argument against the eucalyptus. The table below shows the water consumption of each crop in comparison to the eucalyptus.

Figure 46 – Water Consumption by crops

CROP	BIOMASS/ HECTARE	Water Consumption (liters)/ HECTARE	Water Consumption (liters) / Production Weight
Corn	3.5t/ ha	3.5millions l/ ha	1kg = 1000 l
Potato	20.0t/ ha	40.0millions l/ ha	1kg = 2000 l
Sugar Cane	77.0t/ ha	38.5millions l/ ha	1kg = 500 l
Eucalyptus	23 a 25.0t/ha	8.05millions l/ ha	1kg = 350 l

Source: Federal University of Viçosa

Corn, sugar cane and potato - Serviço Brasileiro de Respostas Técnicas (acesso em 10/02/2009 http://sbrtv1.ibict.br/upload/sbrt5207.pdf?PHPSESSID=6aa56910df57f5c60f1bee9de0deeaf0)

Eucalyptus - Agência FAPESP (acesso em 10/02/2009 http://www.portaldoagronegocio.com.br/conteudo.php?id=25961)

Regarding the eucalyptus plantations impact in the soil, the plantations can frequently enrich or restore

[97] VALVERDE, Sebastião Renato. Plantações de Eucalipto no Brasil. Revista da Madeira, nº 107, September 18th 2007.

the soil, due to the large amount of woody material deposited over the soil by the eucalyptus trees[98.] Nevertheless, the soil enrichment or restoration will happen in soils that were previously relatively poor and exhausted. In this sense, when evaluating the eucalyptus impacts (positive and negative) in the environment, it is always extremely important to consider the previous land use of the plantations areas.

The project's entity compromise to the sustainability of its activities was reinforced with an assessment of biodiversity indicators done by Daniel Nepstad and Luis Carlos Cardoso Vale[99], which occurred in 2001 to comply with baseline determination procedures required by the World Bank's Prototype Carbon Fund. It served as the basis for the project entity's monitoring program, which includes: (a) the conservation and maintenance of protected areas; (b) fauna and flora characterization (c) monitoring of the quality of the superficial and ground waters; (d) the establishment of management programs in the protected areas to ensure their preservation and expansion; (e) the monitoring of natural resources, accounting all changes in relation to the flora, fauna, and water resources; and (f) the establishment, when needed, of a restoration program of degraded areas.

The most recent assessment of the project's biodiversity and environmental impacts was developed in accordance with Brazilian environmental legislation, the Environmental Impact Assessment (EIA), the Environmental Control Report (ECR) and the Environmental Control Plan. It was prepared for the plantation units MG03 and MG04 where the project activity is located by a multidisciplinary technical team and included detailed analyses developed based on diagnosis of geophysical, biotic and social economical environments. The environmental assessment framework below presents all the environmental impacts caused by the project activity found in the study and its correspondents categories.

[98] ALCIDES, Felipe Rodrigues. Considerações Ecológicas Sobre Plantios de Eucalipto – Anais do VIII Congresso de Ecologia do Brasil, September 23rd to 28th, 2007, Caxambu, MG.

[99] Prototype Carbon Fund. Brazil Plantar Baseline Report – Appendix 5: Biodiversity assessment and proposal for further work, September 2001.

Figure 47: Environmental Impacts.

Environmental impacts – physical environment Forestry Projects in MG03 (Felixlândia) and MG04 (Morada Nova de Minas) Geophysical	Analyses of the Environmental Impacts						
	(I) P / N / T	(II) D/I	(III) R/I	(IV) T/P/C	(V) S/M/ L	(VI) L/R/ S	(VII) L/M/ H
Erosive processes during soil preparation	N	D	R	C	S	L	M
Erosive processes due to the implementation and maintenance of infrastructures (roads, firebreaks, towers, conservation units)	N	D	R	C	S	L	M
Protection against erosive processes and nutrients recycling	P	D	R	C	M	L	H
Soil and water contamination due to the use of pesticides	N	D	R	C	S	L	M
Correction of soil's acidity and neutralization of the Al+++ through the use of phosphate	P	D	R	C	M	L	L
Soil fertilization through the use of fertilizers	P	D	R	C	M	L	L
Increase of concentration of solids in suspension, nutrients and organic matter in the water streams	N	I	R	C	M	R	H
Contamination of water streams with pesticides and phenolic compounds	N	D	R	C	L	R	L
Contaminations of water capture sources by oil and grease	N	D	R	P	S	R	M
Changes in the pluvial regime and in the water quality of the basin	T	I	R	P	L	R	H
Supression of native vegetation	N	D	I	P	S	L	M
Compromise of the native vegetation due to the production of sediments and the silting up of natural streams	N	D	I	P	M	L	M
Degradation of remaining native vegetation due to fire	N	D/I	I	P	S	L	L
Impacts over the vegetation (isolated trees locally called "Reboleiras")	N	D	I	P	S/M	L	L
Supression of pastureland areas	N	D	I	T	S	L	L
Chemical weed control (extirpation of pasture)	N	D	R	T	M	R	M
Chemical weed control (vegetation control)	N	D	I	C	M	R	L
Forest harvest	N	D	R	C	S	L	L
Risks of Forest Fire	N	I	R	P	S	R	M
Deficiency on Communication and Surveillance	N	I	R	P	M	L	M
Environmental Noise	N	D	R	C	S	L	L

(I) Impact quality: Positive (P), Negative (N), Tough Qualification (T)	(II) Sequence: Direct (D) e Indirect (I)	(III) Reversibility: Reversible (R), Irreversible (I)	(IV)Periodicity: Temporary (T), Permanent (P), Cyclic (C)
(V)Temporality: Short-term (S), Medium (M), Long-term (L)	(VI) Spacial Scope: Local (L), Regional (R), Strategic (S)	(VII) Magnitude and Relative Importance: Low (L), Medium (M), High (H)	

As per table above, there are positive and negative environmental impacts of the project activities and each of them is classified per its nature, temporality, reversibility, periodicity, type, and scope. Considering the study's scope and analysis results, the most significant environmental positive impact of the project activity is the protection against erosive processes and nutrients recycling. The plantations establishment of Eucalyptus protects the soil, since it provides efficient cover due to the formation of a thick layer of litter. The decomposition of the litter promotes an increase of organic matter and the recycling of nutrients in the soil. In addition to these benefits, the dead wood left over the soil improves the micro-climate conditions, especially of the most superficial soils.

Eucalyptus plantations silviculture practices can also promote soil fertilization through the use of fertilizers. Natural phosphate is used for the planting and maintenance of the Eucalyptus forests in order to neutralize the aluminum and add phosphorus in the long run as a vegetal nutrient. In addition, calcium carbonate is added to correct the soil's acidity, a procedure called "calagem". The artificial fertilization and the correction of the acidity of the soils intensify the microbial activity and, consequently, increase the composition velocity of the pesticides. Furthermore, a good aeration and hydric equilibrium of the *latossols* also contribute to the pesticides decomposition.

Apart from the ultimate objective of this project which is to increase of carbon sinks through the implementation of eucalyptus plantations; other positive impacts on the environment promoted by the project activities include:

- an increase in the size of permanent preservation and protected areas comparing to the pre-existence land use conditions;
- the preservation of expressive native areas of the *Cerrado* ecosystem;
- the adoption of the mosaic stewardship practice;
- the formation of fauna corridors to interconnect vast native conservation areas with forest plantations, favouring the transit of wild animals and biodiversity enhancement;
- the establishment of monitoring parameters and indicators;
- the implementation of several environmental initiatives, such as the fire control program and the environmental education program;
- the elimination of the damages caused by the cattle trampling in the remaining native areas and in soil compaction process.

The relevant negative impacts were classified based on the assessment results indications of the parameter "High" for the magnitude and relative importance criteria and parameter "negative" for the impact quality criteria. Thus, out of the enlisted negative impacts, only one was identified with both criteria at the same time. However, adopting the application of the environmental precaution concept another impact is also being considered as highly relevant. Hence, only two significant negative impacts were identified in the study. They are indicated below and described in detail in the next section (F.2) of this PDD document.

1) Increase of concentration of solids in suspension, nutrients and organic matter in the water streams;
2) Changes in the pluvial regime and in the water quality of the basin.

Additional information on the treatment of the environmental impacts of this proposed project activity can be found in the Annex 6 of this document.

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

>> In the previous section, all environmental impacts, positives and negatives, of the project's activities in the forestry service units MG03 and MG04 were listed based on the Environmental & Social Impact Assessment Studies prepared in compliance with the Brazilian environmental regulations, as provided by

the *Conselho de Política Ambiental* (COPAM/MG)[100]. They were classified and assessed under the following parameters: impact quality; sequence; reversibility; periodicity; temporality; spatial scope; and magnitude and relative importance.

For the classification of the most relevant negative impacts of the project activities in the environment, it was considered the parameter "High" for the magnitude and relative importance criteria and parameter "negative" for the impact quality criteria. Thus, out of the twenty one negative impacts, only one was identified with both criteria at the same time. However, another impact is also being considered in this analysis due to its high relevance. Specific monitoring programs and remedial measures for these relevant negative impacts are detailed in Section F3 ahead.

Based on the study results presented in the previous section and considering the classification criteria mentioned above, the most significant negative environmental impact of the project activity is the increase of concentration of solids in suspension, nutrients and organic matter in the water streams.

Although *it was not detected in the study analyses*, the increase of the concentration of solids in suspension, nutrients and organic matter in the water streams, is a negative effect that may be caused by the reforestation activity and therefore to be monitored. Taking that into account a strict monitoring process is adopted by the project proponent to observe and control the possible damages on the water quality due to changes in its hydro biological and physic-chemical characteristics such as: increase of pH, reduction of oxygen levels, increase of the salt mixture and conductivity, changes in the aquatic communities prevailing species more resistant to pollution, silting up of water streams, and changes in the water's physical aspect (odour and taste).

Another relevant environmental impact, but of difficult qualification (whether positive or negative), and which needs further scientific studies, is referred to the changes in the pluvial regime and in the water quality of the basin.

The changes in the pluvial regime and in the water quality of the micro-basin constitute a phenomenon of difficult qualification once there are no technical elements available for immediate assessment. The management of the eucalyptus plantations can either increase the water quantity of the basin or decrease, depending on the procedures adopted. Small dams may not continue to store water after the forest plantations establishment due to the interception of the pluvial water by the trees' crowns and the reduction of superficial water flow as per introduction of soil conservation practices.

According to the study, there are two alternatives for the minimization of the possible losses caused by silviculture activities mentioned above. First, silviculture practices that effectively result in a lower erosion rate must be adopted. Second, practices of soil and water conservation also must be adopted. In order to achieve more effective control, a combination of both practices is recommended in order to prevent erosive processes and increase water infiltration rate in the soil due to the minimization of superficial flowage.

In the specific cases of the forest plantations within the project activity area, the study identified the adoption of both practices mentioned above. The minimum cultivation planting technique adopted seeks to preserve the environmental integrity of the area where the project activity is implemented. It includes

[100] Environmental Policy Council of the State of Minas Gerais

soil preparation techniques and monitoring of nutrients consumed in order to prevent erosion; minimum use of fertilizers as per the best practices in silviculture; and the practice of leaving the harvesting remainders in the soil to function as a protection cover among others. The adoption of the minimum cultivation planting technique, with the reduction of soil disturbance for the planting activities and the complete elimination of fuel burning practices, has resulted in an effective solution to prevent soil's direct exposure to erosion effects. It has also promoted residual organic matter incorporation in the soil.

In relation to soil and water conservation practices, although the project activities' plantation areas are located mostly in flat lands slightly uneven, part of these areas reveal small declines but with long slopes, which increases the risks to erosion. In order to mitigate the risks, retention systems are implemented in these areas, such as the locally called "camalhões", which promotes water drainage into the stands, and the "bacias de contenção", which aims to retain sediments from the superficial flowage. In the specific case of the project activity lands, their flat and slightly uneven characteristics and the high permeability of the *latossols* promotes the prevalence of pluvial water infiltration over the superficial flowage.

In adequate conditions, eucalyptus plantations can help to control the water superficial flowage. However, this effect will depend on the plants' growth conditions and on the cover and declivity of the soil. As such, soil and water conservation practices adopted in the plantations management play a major role, once in their absence the soil may be vulnerable to erosive processes. Thus, various factors need to be considered, such as landscape and soil characteristics and, the planting technology, including spacing being used.

The eucalyptus, if sustainably managed (keeping the residues in the area and replacing the nutrients lost during the harvesting), does not damage the soil's fertility (Neves, 2003).

Public data present clear evidence that the eucalyptus plantations, in respect to the hydric balance of the river basins, do not differ from other forest species, showing a medium increase of the flowing due to harvesting and a decrease of the flowing due to the reforestation of the basin, of same magnitude of results as those of similar forest species (Lima, 1986).

In addition to the environmental assessments mentioned above, the project activity area have also been certified in accordance with the FSC Principles and Criteria and audited by SCS (Scientific Certification Systems). Related documentation was presented to the DOE, in conjunction with the Environmental & Social Impact Assessment Studies. FSC certification reports are also available on the Internet at www.scscertified.com . Overall, the referred reports conclude that the project entity is capable of implementing the project related activities within an environmentally and socially sustainable manner, provided that the recommended monitoring provisions are adequately implemented. The project activity is expected to stimulate local and regional development and has allowed the project entity to implement first-of-a-kind social and environmental indicators in its industry.

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

>> The following table summarizes monitoring and remedial measures implemented to address the most significant negative impacts referred to in section F.2.

Figure 48: Planned monitoring and remedial measures to address significant environmental impact.

Impact:	**Increase of concentration of solids in suspension, nutrients and organic matter in the water streams**
Action:	Establishment of Monitoring Program of the Quality of the Superficial Water.
Justification:	The activities implemented in the project activity forest units may modify the quality condition of the microbasins water as to compromise the multiple and integrated use of the water streams.
Objective:	Developed in order to assess the effectiveness of the silviculture practices on the quality of the physical, chemical and bacteriological parameters of the superficial water that drains the areas of the forest plantations within the project activity.
Parameters:	Physical, chemical, and bacteriological parameters of the water.
Monitoring frequency:	Based on results of laboratory samples collected twice a year, one during the dry season and the other during a rainy season. Monitoring has been in place since December 2003.
Responsible:	Plantar's Social and Environmental Department.

Figure 49: Planned monitoring and remedial measures to address significant environmental impact.

Impact:	**Changes in the pluvial regime and in the water quality of the basin**
Action:	Establishment of Monitoring Program of the Microbasin of the Riacho Fundo Stream.
Justification:	Changes in the pluvial regime of the microbasins are difficult to measure, quantify and understand, once there are many technical variables that modify or change the water dynamics in a microbasin. The land use change of great areas may increase or decrease the flowing water of the microbasin, lower the ground water levels, or dry small dams. As such, further studies and assessments on the eucalyptus plantations effects in the project activity region is necessary.
Objective:	Developed in partnership with the Federal University of Viçosa, under the supervision of Professor Dr. Herly Carlos Teixeira Dias. It aims at monitoring the variables that interfere in the water dynamics versus the forest silviculture practices and management in a microbasin with eucalyptus plantations. The program has a minimum duration of 14 years, and will be an important tool to determine the most appropriate silviculture techniques for the region.
Parameters:	The flow variation in relation to the microbasin and local pluvial characteristics; the ground water level variation in a piezometer; an estimation of the evapotranspiration based on the use of an atmometer; superficial flow within the plantations due to effective precipitation; and the infiltration rate in different sites of the land.
Monitoring frequency:	Results are collected daily and assessment reports issued each semester. The project is currently in a fine tuning phase.
Responsible:	Plantar's Social and Environmental Department.

Other programs developed to mitigate or minimize the other environmental impacts are verified by the FSC certification and by the State Environment and Sustainable Development Secretary – SEMAD. In addition, Annex 6 of this document describes in detail additional programs developed by the project entity with the same purpose.

Another item subject to monitoring is the project activities' Operating Licenses. In the process to obtain the operating licenses for the forestry service units MG03 and MG04, the Environmental & Social Impact Assessment Studies prepared in compliance with the Brazilian environmental regulations, as provided by the *Conselho de Política Ambiental* (COPAM/MG)[101], were submitted for a technical and legal evaluation by the SEMAD.

In addition to the Environmental & Social Impact Assessment Studies, an Environmental Control Program (PCA) for each unit was submitted. The licenses were then judged by the council board of the COPAM/MG and granted under certain conditions.

During the validation period of the operating licenses, annual reports assuring the compliance with the Environmental Control Program (PCA) and with the conditions imposed for each unit must be prepared. Before the expiration date of each license, the Environmental Performance Evaluation Report (RADA) shall be prepared by a technical team and submitted in order to request the license's revalidation. The RADA report is then analyzed by the SEMAD which issues a statement to the council board of the COPAM/MG.

The monitoring of the operating licenses shall be executed as per details on the following table.

Figure 50: Operating licenses for MG03 and MG04 forestry service units.

Item subject to monitoring:	**Operating licenses for MG03 and MG04 forestry service units**
Objective:	Monitor the validation of the operating licenses.
Action:	Prepare reports assuring the compliance with the Environmental Control Program (PCA) and with the conditions imposed for each forestry service unit within the project boundary (MG03 and MG04).
Justification:	Operating licenses expire every 6 years and it is necessary to present an Environmental Performance Evaluation Report (RADA) to the State environmental body to renew them.
Parameters:	The current validation dates of the licenses are the following: MG03 – valid from 2006 to 2012 MG04 – valid from 2005 to 2011
Monitoring frequency:	Annualy
Responsible:	Plantar's Social and Environmental Department.

In addition to the maintenance of the environmental licenses, the FSC Certification is also a strong case for environmental control. The forestry services units MG03 and MG04 are audited annually as per the FSC's principles and criteria of sustainable forest management.

[101] Environmental Policy Council of the State of Minas Gerais

Moreover, a specific Environmental and Biodiversity Plan, tailored by the World Bank in conjunction with the project entity and local experts, is also being undertaken. The Plan consists of a series of indicators that are monitored throughout the project lifetime. The project is expected to strongly contribute to sustainable development within the project region[102] and in Brazil.

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

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

>> The Environmental Impact Assessment (EIA), the Environmental Control Report (ECR) and the Environmental Control Plan mentioned above in Section F.1, provide an analysis of the major socio-economic impacts of the proposed project activity inside and outside its boundaries. These documents were available to the DOE.In addition to these documents, the Annex 6 attached to this PDD describes in detail the project entity's various social initiatives and contributions to the sustainable development of the region.

The analysis of impacts on the social-economic environment is based on a diagnosis by the Environmental Impact Assessment by Del Rey Engineering which mainly considered the results of interviews, in which are highlighted the local population point of view on the alterations caused by the project activities in the regions of Forestry Projects MG03 and MG04 (areas where the project activities are located). The study has also considered the knowledge from the Department of Social Relations and the contributions of the environmental management based on the principles and criteria of the Forestry Certification of the Forest Stewardship Council – FSC.

Areas of relevant cultural or religious interest were not identified, as well as the presence of traditional communities ("quilombolas" and indigenous people) in the region of the Forestry Projects. This information can be confirmed by the Environmental Impact Assessment, by studies of the Social Relation Department of the company, by FSC maintenance audit reports, and by public consultation and public meetings held in the re-certification processes in 2002 and 2008.

The social assessment framework below presents all the social-economic impacts caused by the project activity found in the study and its correspondents categories.

Figure 51: Social-Economic Aspect Analyses.

Social-Economical aspects Forestry Projects: MG03 (Felixlândia) e MG04 (Morada Nova de Minas)	Social-Economical Aspect Analyses						
	(I) P/N/ T	(II) D/I	(III) R/I	(IV) T/P/ C	(V) S/M/ L	(VI) L/R/S	(VII) L/M/ H
Alteration in the productive pattern of the municipalities	T	I	R	P	S	L	M
Employment and Income Generation	P	D/I	I	C	S	R	H
Changes in regional migration flows	P	D/I	I	P	S	L	L
Changes in life quality	P	D	I	P	S	L	L
Municipal Income Generation	P	D	I	P	M	L	L

[102] The set of indicators and the methodology adopted by the project activity to assess the sustainable development generated by the project can be considered a first of its kind in the project region and industry.

Social-Economical aspects Forestry Projects: MG03 (Felixlândia) e MG04 (Morada Nova de Minas)	Social-Economical Aspect Analyses						
	(I) P/N/ T	(II) D/I	(III) R/I	(IV) T/P/ C	(V) S/M/ L	(VI) L/R/S	(VII) L/M/ H
Loss of Municipal productive potential	N	I	R	T	M	L	H
Perception of Insecurity	N	D	R	T	S	L	H
Weakening of communitarian organizations and Growth of the adverse demonstrations to reforestation development and greater communitarian organization	P/N	I	R	P	M	R	H
Social Projects	P	D	I	P	S/M	E	H
Investments for the benefit of youth	P	D	I	P	S	L	M
Health and Work Safety	P	D	I	P	S	L	H

(I) Impact quality: Positive (P), Negative (N), Tough Qualification (T)	(II) Sequence: Direct (D) e Indirect (I)	(II) Reversibility: Reversible (R), Irreversible (I)	(IV)Periodicity: Temporary (T), Permanent (P), Cyclic (C)
(V)Temporality: Short-term (S), Medium (M), Long-term (L)	(VI) Spatial Scope: Local (L), Regional (R), Strategic (S)	(VII) Magnitude and Relative Importance: Low (L), Medium (M), High (H)	

As per table above, there are positive and negative social impacts of the project activities and each of them is classified per its nature, temporality, reversibility, periodicity, type, and scope. Health and the work safety of employees are fundamental for forestry good practices. The company considers and respects the work law NR31 and the ILO Guide for forestry work. The employees handling pesticides are properly trained and equipped accordingly. There's a special scheme for the reception of used packages. They are sent to a specific Center of Collection in Montes Claros.

As for Social projects, the company has promoted a photographic research and art exhibition emphasizing routine images and cultural values of neighboring rural areas, with the objective of strengthening local self-esteem. It also created the Plantar Choir, which participates in various concerts contests in the State.

Regarding employment and income generation, there is an opportunity for the creation of jobs in the rural area since the project activity contributes on the opening of more than thousand positions the area, and from those approximately 70% in the clonal garden are for women. One of the initiatives for income generation is the monthly promotion of the Rural Producers Fair, where small producers, neighbors to the project areas sell their products to the company's employees and other guests;
Other positive social impacts promoted by the project activities include:

- Changes in regional migration flows.
- Changes in life quality
- Municipal Income Generation
- Investments for the benefit of youth:

The relevant negative impacts were classified based on the assessment results indications of the parameter "High" for the magnitude and relative importance criteria and parameter "negative" for the impact quality criteria. Hence, only two significant negative impacts were identified in the study. They

are indicated below and described in detail in the next section (G.2) of this PDD document. Additional information on the treatment of environmental impacts of this proposed project activity can be found in Annex 6 of this document.

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

>> The Environmental & Social Impact Assessment Studies were prepared in compliance with the Brazilian environmental regulations, as provided by the *Conselho de Política Ambiental* - COPAM/MG[103]. In addition, the project areas have also been certified in accordance with the "FSC Principles and Criteria". Related documentation was presented to the DOE. FSC certification reports are also available on the Internet at www.fsc.org and www.scscertified.com

All social-economic impacts, positive and negative, of the Forest plantation establishment within the project boundary were featured and evaluated under the following parameters: Impact Quality; Follow-up; Reversibility; Periodicity; Temporality; Spatial Range; Magnitude and Relative Importance.

In this section, for significant negative social impacts definition it was established the "High" classification for the Magnitude and Relative Importance criteria as in the Environmental Impact Assessment of Forestry Project MG03 and MG04. For the social context were identified and evaluated 11 impacts or social aspects, from which only 2 are considered significant negative social impacts. Based on the Environmental Impact Assessment the following significant negative social impacts were identified:

Perception of Insecurity: In terms of impact, the assessment of social-political issues highlighted a perception of insecurity regarding reforestation. There's a fear of having restrictions to the continuity of traditional productive activities due to possible environmental problems caused by reforestation. This insecurity has been noted in Felixlândia caused by lack of water. The insecurity is higher among rural properties near the dense forests as peer most interviewees and municipality leaders.

It is important that clarification measures are adopted and the establishment of systematic contacts in order to provide the construction of a trust relationship, preventing this insecurity perception to become an organized adverse demonstration.

Weakening of communitarian organizations and growth of the adverse demonstrations to reforestation development and greater communitarian organization: The insecurity of population associated to the dissatisfaction regarding Plantar's procedures (e.g. Soil conservation practices) and the fear of forestry activities could lead to a more consistent weakening of the communitarian organizations. Although there have been identified some demonstrations against the monoculture, it's not possible to suggest that it is an organized movement.

The organization of the community is considered a positive impact since it represents a mobilization capacity and a more critical attitude to reforestation or any other economic activity. This behavior

[103] Environmental Policy Council of the State of Minas Gerais

contributes to the development of the community which is able to demand for both public sector and Plantar more commitment to environmental issues and neighbouring communities' quality of life.

For the significant negative social impacts, specific social programs were proposed for the mitigation or compensation of these impacts. The details of the social programs and respective monitoring and indicators shall be detailed in section G3.

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

>> The following monitoring and remedial measures are being implemented to address the impacts as per the documentation referred to in section G.2. Moreover, specific social indicators, tailored by the World Bank in conjunction with the project entity and local experts, are also implemented. As previously mentioned, detailed documentation is presented in the attached Monitoring Plan and in Annex 6.

The programs developed for the treatment of identified significant negative social impacts in the Environmental Impact Assessment are described below. Besides the description, it is also presented verification sources and indicators for each program. Other social programs developed in order to mitigate or minimize other social impacts are verified by FSC Certification and by Abrinq Foundation.

Figure 52: Planned monitoring and remedial measures to address significant social impact.

Impact:	**Perception of Insecurity**
Action:	**Social Interaction Program**
Justification:	Considering environmental changes or expectation on changes by the impact generator projects may cause in their respective regions, the actions for social interaction are crucial in the process. Inadequate communication with the local population could motivate conflicts whenever the local stakeholders are not aware of adopted procedures for implementation and development of forestry activity.
Objective:	The purpose of the program is to implement an intense social interaction work which facilitates the construction of appropriate strategies for the improvement of the relations between Plantar and the local stakeholders. The goal is to support the discussions related to the project thru contact development and by the inclusion of interaction activities throughout all stages of reforestation.
Parameters:	Monthly visit rate; number of people benefited from social interaction activities.
Monitoring frequency	Annually
Responsible:	Plantar's Social and Environmental Department

Figure 53: Planned monitoring and remedial measures to address significant social impact.

Impact:	Weakening of communitarian organizations and growth of the adverse demonstrations to reforestation development.
Action:	Income Generation Activity Support Program
Justification:	The Income Generation Activity (IGA) Support Program intends to organize Plantar's actions in the support of IGA's demands considering the consequent change in the labor profile concerning the activities carried out before the area plantings.

	The weakening of communitarian organizations occurs due to the lack of policies for small landholders, and the eucalyptus monoculture could expedite the process and also profit from the situation. Strengthening the associations or stimulating them thru IGA's its possible to keep the families in the rural areas with their activities. The proposed actions reflect the company's position, sensitive to these matters even though it's evident that in the long run, the investment return for the municipalities is higher than other agricultural activities that which could be implemented in the company's areas.
Objective:	The program's goal is to identify and support actions proposed by organized groups in the municipalities of Felixlândia and Morada Nova de Minas stimulating communitarian organization and proposing alternatives, in order to generate income for the local community. Developing and supporting IGA's is a way to share the benefits and generate the belief that eucalyptus culture can bring a positive response to local community.
Parameters:	Developed IGA's, participant communities.
Monitoring frequency	Every 2 years
Responsible:	Plantar's Social and Environmental Department

Abrinq Seal – Friend of the Children Program

Plantar S/A is "Friend of the Children" company. The Abrinq Seal certifies that Plantar holds a social interaction favoring youth which is recognized by the Abrinq Foundation. This recognition is due to the company's commitment to the following subjects: Fighting Child Labor, Education, Health, Civil Rights and Investments on Children.

In the Forestry Project Municipalities, some investments are developed focusing youth. Besides the Abrinq Seal, other positive aspect of the Social Management by Plantar is the FSC Certification, where the FSC Principles and Criteria implementation is annually audited, having the reports as very important indicators.

SECTION H. Stakeholders' comments:

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

>> The project entity has invited and compiled comments from stakeholders, regarding its projects activities, in two stages. A third stage will occur when the project design document is published in the UNFCCC website and will be opened for public comments.

The first stage occurred in October 2001 and encompassed contractual requisites of the World Bank and of the Forestry Certification entity, considering the three components of the integrated carbon project of Plantar. The second stage occurred in November and December 2006, according to the Brazilian DNA instructions for CDM project registration, Resolution nº 1 of September 11th, 2003 (Article 3, Paragraph II). Registered letters with invitation for comments and a summary of the entity's environmental management plan were mailed to the official address of stakeholders listed in the DNA's Resolution mentioned above. Extra stamped envelopes for easy and free of charge mailing return were also sent. . Based on this Resolution, stakeholders' comments were solicited regarding the following project activities:

1) Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil
2) Mitigation of Methane Emissions in the Charcoal Production of Plantar, Brazil

During both stages, the project documents were made available for comments in the Prototype Carbon Fund - PFC's website, in the UNFCCC's website and in the local offices of the project entity. The lists of stakeholders who received invitation-for-comments letters are presented below.

List of stakeholders that received invitation-for-comments letters during the *firs*t stage:

Organization / Individual
Brazilian Association of Eucalyptus Producers for Domestic Use
Carbonita City Hall (Jequitinhonha Valley, MG)
Curvelo citizens
Curvelo City Hall
Curvelo Humanities College (Educational Foundation of Curvelo)
FASE-ES
Folha de Curvelo - Curvelo Newspaper
Forestry State Institute
Guaraciama City Hall (Jequitinhonha Valley, MG)
Itacambira City Hall (Jequitinhonha Valley, MG)
Juramento City Hall (Jequitinhonha Valley, MG)
Kudokai-Brasil Association (Curvelo Unit)
Ministry of Science and Technology – Non-objection letter
Municipal School Joao Batista (Curvelo/MG)
NGO *Amigos da Terra* (Friends of the Earth)
Plantar Neighbours
Rural Workers Union of Sao Mateus (ES)
Senator Eduardo Azeredo (MG)
Silviculture Brazilian Society
State Secretary for Environmental and Sustainable Development of Minas Gerais
State Secretary for Industry and Trade of Minas Gerais
The Curvelo Hospital
The Curvelo Retailers Association (*CDL Curvelo*)
The Divine Providence Human Promotion Association / Home of the Sao Vicente de Paulo Children
The Environmental Defence Association of Minas Gerais (*AMDA*)
The Lions Club of Curvelo
The Minas Gerais Land Institute (*ITER-MG*)
The Minas Gerais State Secretary for the Environment and Sustainable Development
The Regional Labor Office of Curvelo (Ministry of Labor)
The Town Council of Curvelo
The Union of Rural Workers, Small Producers and Curvelo Township Employees – CUT Affiliate
The Workers Union of the Wood Extraction Industry of Carbonita
Turmalina City Hall (Jequitinhonha Valley, MG)
World Rainforest Movement

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

List of stakeholders that received invitation-for-comments letters during the *second* stage:

Organization / Individual
Prefeitura Municipal de Curvelo
Prefeitura Municipal de Felixlândia
Prefeitura Municipal de Morada Nova de Minas
Prefeitura Municipal de Francisco Sá
Prefeitura Municipal de Grão Mogol
Prefeitura Municipal de Itacambira
Prefeitura Municipal de Juramento
Câmara Municipal de Curvelo
Câmara Municipal de Felixlândia
Câmara Municipal de Morada Nova de Minas
Câmara Municipal de Francisco Sá
Câmara Municipal de Grão Mogol
Câmara Municipal de Itacambira
Câmara Municipal de Juramento
IEF - Instituto Estadual de Florestas
IEF - Núcleo Operacional de Florestas, Pesca e Biodiversidade de Curvelo (Núcleo)
IEF - Agência de Florestas, Pesca e Biodiversidade de Felixlândia (AFLOBIO)
IEF - Agência de Florestas, Pesca e Biodiversidade de Morada Nova de Minas (AFLOBIO)
IEF - Núcleo Operacional de Florestas, Pesca e Biodiversidade de Bocaiúva (Núcleo)
IEF - Agência de Florestas, Pesca e Biodiversidade de Grão Mogol (AFLOBIO)
CODEMA - Conselho Municipal de Defesa e Conservação do Meio Ambiente de Curvelo
CODEMA - Conselho Municipal de Defesa e Conservação do Meio Ambiente de Felixlândia
CODEMA - Conselho Municipal de Defesa e Conservação do Meio Ambiente de Morada Nova de Minas
CODEMA - Conselho Municipal de Defesa e Conservação do Meio Ambiente de Francisco Sá
CODEMA - Conselho Municipal de Defesa e Conservação do Meio Ambiente de Itacambira
STR - Sindicato do Trabalhador Rural de Itacambira
Centro Comunitário São Bartolomeu
Centro Comunitário Vargem Grande
Centro Comunitário de Congonhas
Centro Comunitário de Venda Nova
Sindicato Rural de Felixlândia
Sindicato dos Trabalhadores Rurais de Felixlândia
Sindicato dos Trabalhadores Rurais de Curvelo
Sindicato dos Produtores Rurais de Morada Nova de Minas
Associação dos Moradores do Cobu
Associação Comunitária do Meleiro
Associação Comunitária da Canabrava
APAE de Morada Nova de Minas - Associação de Pais e Amigos dos Excepcionais de Morada Nova
AMPTRE - Assoc. dos Moradores e Produtores Rurais de Traçadal e Região
AMPCAR - Assoc. dos Moradores e Produtores Rurais de Cacimbas e Região

Comunidade de Campo Alegre
Lar dos Meninos Dom Orione Paróquia Nossa Senhora do Loreto
Escola Municipal Dom Orione
Escola Municipal Duque de Caxias
Escola Estadual São José do Buriti
Escola Estadual Sérgio Eugênio da Silva
Escola Municipal João Batista
UNIPAR - Associação dos Produtores de Leite
Fórum Brasileiro de ONG's e Movimentos Sociais para o Meio Ambiente e Desenvolvimento.
Sindicato dos Trabalhadores(as) na Agricultura Familiar de Curvelo
Ministério Público Promotoria de Justiça dos Municípios de Curvelo e Felixlândia
Ministério Público Promotoria de Justiça dos Municípios de Grão Mogol e Francisco Sá
Ministério Público Promotoria de Justiça do Município de Morada Nova de Minas
Ministério Público Promotoria de Justiça dos Municípios de Itacambira e Juramento
Ministério Público do Estado de Minas Gerais Procuradoria-Geral da Justiça
Ministério Público Federal Procuradoria-Geral da República

H.2. Summary of the comments received:

>> Most of the comments received by local stakeholders emphasized the importance of the project for the sustainable development at the local, regional and national levels, recognizing the project's potential to enable net GHG removals by sinks and GHG emission reduction. In this sense, comments were received regarding the project activity 1 (A/R) and the project activity 3 (industrial component – use of renewable charcoal instead of coal coke in the pig iron production). Other comments have raised concerns on the sustainability of large-scale eucalyptus plantations.

In the second stage, comments were received regarding project activities Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil (project activity 1) and Mitigation of Methane Emissions in the Charcoal Production of Plantar, Brazil (project activity 2). Local stakeholders, like the community center of Vargem Grande (Itacambira), the communitarian association of Meleiro (Curvelo), the Municipal School Duque de Caxias (Morada Nova de Minas), Campo Alegre Community (Curvelo) and the Itacambira Environmental Council (CODEMA), presented comments about the benefits resulted from the entity's project activities for the sustainable development in the local regions, and mentioned the entity as a model to other companies on how to manage technology without threatening the environment. The Itacambira Environmental Council (CODEMA) requested, on its response-letter to the entity, a list of the entity's environmental preservation areas within the farm where the project is located in order to update its database. (Please see entity's response in the next section). The Brazilian Forum of NGOs and Social Movements for the Environment and Development (FBOMS) answered our request declaring a strong interest to evaluate the project documents, but stated the impossibility of doing so due to the lack of the Federal Government technical and financial support. The forum suggested, the use of additional sustainability criteria, quoting the example of the Gold Standard certification. The comments were available to the DOE.

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

>> Regarding the comments received in the first stage, the project participants have addressed the GHG related comments as per responses and reports made publicly available on the World Bank's Prototype

Carbon Fund Website and, also, in several public presentations carried out by the project entity and by the PCF over the past seven years. Other comments related to the social and environmental aspects of eucalyptus plantations have been addressed by means of the socio-environmental impact assessment studies and of the forestry certification reports available at www.scscertified.com. Accordingly, the related documentation was presented to the DOE. The Participants Committee of the PCF has also provided detailed replies. The comments and replies are posted at www.prototypecarbonfund.org for public review. The information on forestry certification and related reports are available at the website of Scientific Certification Systems, www.scscertified.com, the independent certification agency.

In the second stage, the project entity fully responded to the requests by promptly mailing formal letters. The Itacambira's CODEMA request was punctually fulfilled with a detailed map of the areas of legal forestry reserve, permanent preservation areas, and ecological corridors connecting those environmental protection areas in the entity's property in the municipality. In relation to the comments received from the Brazilian Forum of NGOs and Social Movements for the Environment and Development (FBOMS), a response letter was sent to the institution re-stating the invitation of their technical staff to visit the project site. Answering to their recommendation to use the additional sustainability criteria, it was clarified that the management of the project plantations are already based on additional sustainability criteria, as they are certified according to the principles and criteria of the FSC (Forestry Stewardship Council). It was also expressed that several social and environmental indicators are monitored, fulfilling contractual agreements with the World Bank that are verified by independent auditors. It is worth mentioning that the project activity encompasses several social and environmental programs which are the first of its kind in the project entity's sector, providing a strong contribution to the CDM development dividend.

Copies of the stakeholders' responses to invitation for comments, as well as the final draft of the letter and the compilation registry were handed to the DOE at the time of validation.

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

Annex 1

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

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

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project activity does not receive any public funding and/or Official Development Assistance from Annex I countries.

Annex 3

BASELINE INFORMATION

As previously mentioned in this PDD, the baseline study was executed by the Plantar Carbon team in partnership with the World Bank's PCF. The baseline definition was based on the following three arguments:

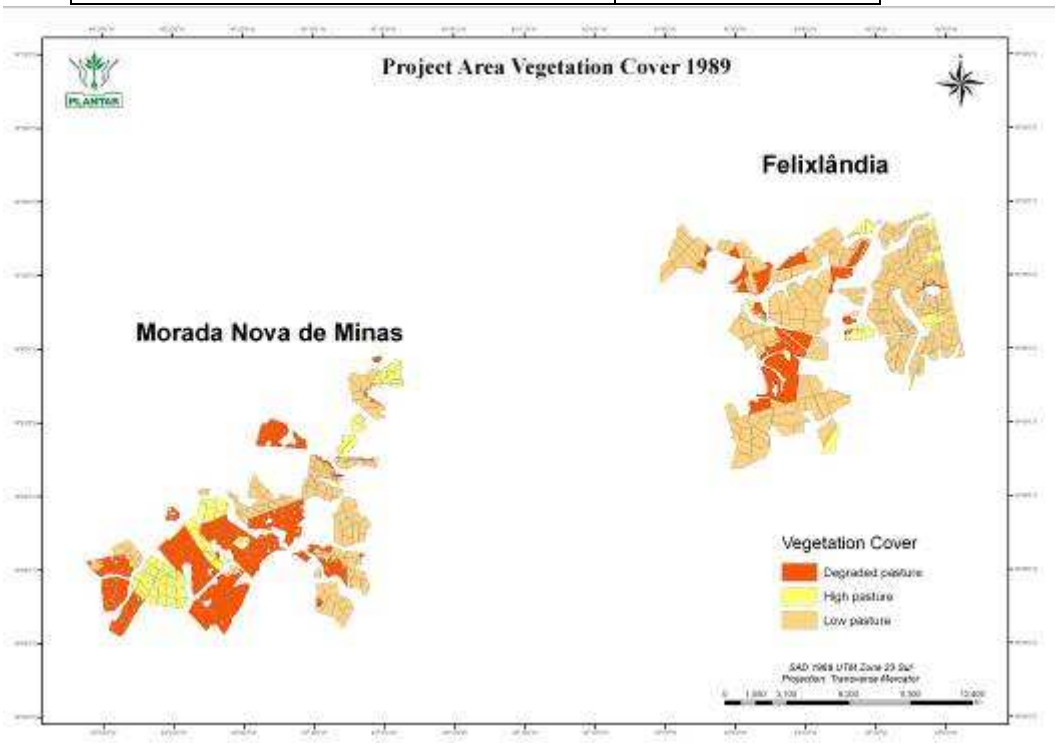
1. Project area's vegetation cover was grasslands in years 1989 and 2000.

Data from the land eligibility report identified the vegetation cover existing in the project areas in years 1989 and 2000. Past information was obtained through the use of remotely sensed data and data collected from the field, was also used for the baseline assessment. The results of actual field data are presented below for the total area of the project activity in both years.

1.1. Year Base 1989:

Total area of the project: 11 711.37 ha
Total area divided by strata:

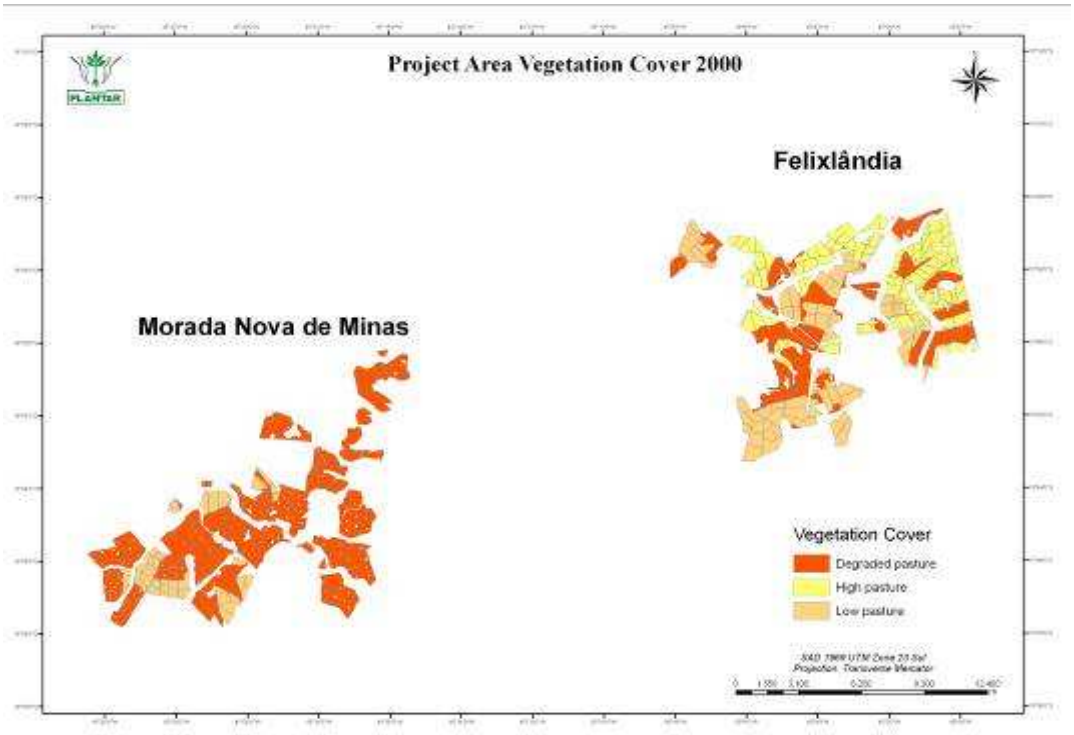
Vegetation Cover	Area (ha)
Degraded pasture/exposed soil	3 571.25
Low pasture	6 717. 89
High pasture	1 422.23
TOTAL	**11 711.37**



1.2. Year Base 2000:

Total area of the project: 11 711.37 ha
Total area divided by strata:

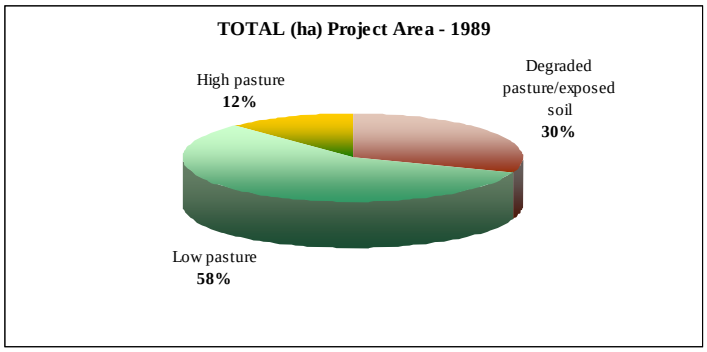
Vegetation Type	Area (ha)
Degraded pasture/exposed soil	6 558.37
Low pasture	2 810.73
High pasture	2 342.27
TOTAL	11 711.37

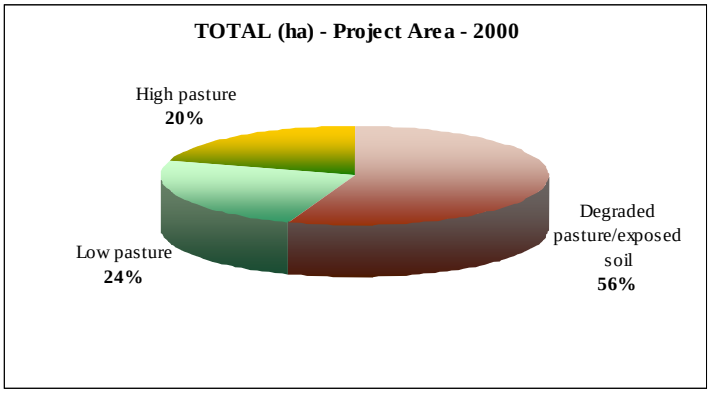


As presented in section C.4, Landsat satellite images and field collected data confirmed the pre-existing conditions of the area within the project's boundaries, which consisted of three different status of grasslands. For conservativeness purposes, the three different status of grasslands identified (high pasture, low pasture, and degraded areas) were classified as grassland (*brachiaria spp)* in its higher carbon stock (peak) and in steady state, which formed the baseline stratum of the project activity.

2. Project's area was under a degradation process.

The land eligibility study demonstrated that the project area was under an intensive degradation process. As per graphics shown below, in 1989 the size of the degraded pasture area represented 30% of the project activity's area, whereas in 2000, this portion of degraded areas increased to 56% of the total area.





3. Natural regeneration is not expected to occur within project boundary.

Natural regeneration is not expected to occur in the project area due to the prevailing land use, land use trends, and as per the common practice adopted in the region, which does not permit the establishment of tree vegetation. Scientific literature presents empirical evidences that under the pre-existing land use of the project area, which was extensively managed grazing activities under pastureland, natural regeneration is avoided or faces a great difficulty to happen due to the facts that grazing practices can cause a decrease in quantity and quality of the natural seed sources; and that without human intervention the chances that natural regeneration take place are remote. According to GASPARINO et al. (2006) in pasturelands, the cattle cause soil compaction, avoiding or creating difficulties to natural regeneration and causing soil seed sources impoverishment in quantity and in quality.

Based on the arguments mentioned above and on the following parameters, the total carbon stock was calculated for the project area's baseline in year 2000.

Parameters	Unit	Data applied
Pre-existing average above-ground living non-woody biomass (IPCC default)	t d.m. ha-1	2.300
Average carbon fraction of dry biomass in pre-existing non-woody vegetation (IPCC default)	t C (t d.m.)-1	0.50
Root to shoot ratio (IPCC default)	dimensionless	1.60
Baseline net GHG removals by sinks	CO_{2e}	0.00

Baseline above-ground carbon stock = (11 711.37 x 2.3) x 0.5 x 44/12
49 382.94 tons of CO_2e

Baseline below-ground carbon stock = 49 382.94 x 1.6
79 012.71 tons of CO_2e

Total baseline carbon stock (below-ground and above-ground) = 49 382.94 + 79 012.71
128 395.65 tons of CO_2e

Baseline above-ground carbon stock = (11 711.37 x 2.3) x 0.5 x 44/12
49 382.94 tons of CO_2e

Baseline below-ground carbon stock = 49 382.94 x 1.6
79 012.71 tons of CO_2e

Total baseline carbon stock (below-ground and above-ground) = 49 382.94 + 79 012.71
128 395.65 tons of CO_2e

Annex 4

Monitoring Plan
for the
Plantar Project Forestry Activity

Contents

Acronyms and Abbreviations

CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DOE	Designated Operating Entity
EF	Emissions Factor
ERPA	Emission Reduction Purchase Agreement
ERMs	Emission Removals
GHG	Greenhouse Gas
GWP	Global Warming Potential
MP	Monitoring Plan
MDC (metros de carvão)	Stacked meters of charcoal
UNFCCC	United Nations Framework Convention on Climate Change

1 THE MONITORING PLAN

This Monitoring Plan provides guidelines on monitoring and operational procedures of the Plantar Project Forestry Activity, which proposes to generate net anthropogenic GHG removals by implementing sustainable eucalyptus plantations in areas that are currently covered with pastureland. Areas which hold non-spontaneous plantations that were cleared and are expected to be reverted to pastureland are also monitored as per Annex 8 EB 20, but credits are not currently claimed under the enclosed PDD.

The MP fulfils the CDM requirement that the project activity should have credible and accurate monitoring procedures to enable the evaluation of project performance and verification of the net anthropogenic GHG emission removals. It sets out a number of monitoring procedures that follow the provisions outlined in the Project Design Document and the Monitoring Methodology.

1.1 PURPOSE OF THE MONITORING PLAN

This MP provides guidance on monitoring of project activity. It assists the project entity in establishing a credible and transparent monitoring and operating procedures and facilitates data collection, recording, and estimation of emission reduction and relevant project information required for the verification of the ERMs.

The MP facilitates the Designated Operational Entity (DOE) by the verification and certification of the project activity. It forms the basis for production and delivery of ERMs. Therefore, it is expected that the project entity adheres to the MP in order to accurately monitor and measure the project impacts and prepare for periodic verification of the emission removals.

The MP provides guidance and instructions on the following aspects of the project activity:

- Guidelines on monitoring procedures of the forestry activity and the associated responsibilities to the project personnel.
- Instructions on data collection, storage, and information management system.
- Organization of spreadsheet database for recording data and estimation of the emissions and net GHG removals.
- Guidance on the improvement of environmental and social impacts of the project.
- Instructions on project management, reporting, and verification processes.

The MP is adopted as a key component of the project and its guidance are taking into account in the operational manuals. Strict adherence to the guidelines set out in this monitoring plan is necessary to measure and track the project impacts. In particular, changes in the operational procedures and changes in the project emissions and emission removals are monitored.

1.2 STRUCTURE OF THE MONITORING PLAN

The Monitoring Plan of the forestry project activity is organized as follows:

- **Chapter 1**: outlines the purpose and organization of the Monitoring Plan
- **Chapter 2**: presents an overview on the organization of the project activity
- **Chapter 3**: outlines the procedures for monitoring of the project scenarios
- **Chapter 4**: presents the instructions on data collection, data storage, and information management.
- **Chapter 5**: outlines the procedures for assessment of the changes in the biomass pools adopted under the project and estimation of the net GHG removals based on the TARAM Tool V.1.2.Plantar spreadsheet database.
- **Chapter 6**: provides guidance on monitoring of the environmental and social issues of the project.
- **Chapter 7**: presents the instructions for project management, reporting, and quality assurance.

2 ORGANIZATION OF PROJECT ACTIVITY

The project activity relies on the establishment of approximately 11 711.37 hectares[1] of new and additional eucalyptus plantations, which are implemented in areas whose land-use in the baseline scenario is pastureland in steady state (IPCC, 2006). Thus, as the net changes in carbon stock of the project plantations are greater than the ones in the baseline scenario, the plantations established under the project promote net anthropogenic GHG removals.

The project plantations rely on advanced eucalyptus plantation technology. The project entity possesses significant experience in the establishment and management of plantations. Plantations are based on high yield eucalyptus clones, developed by the project entity, and reproduced within a fully equipped nursery. Mechanical planting techniques and strict environmental criteria are adopted in the plantation establishment.

Standard operational procedures are followed for each procedure in the entire plantation process. Strong quality control measures are implemented in accordance with the project entity's quality management system that is currently based on ISO 9001 standards. Therefore, this MP recommends the adoption of standard operational procedures required for transparent estimation of the net changes in carbon stocks in the project scenarios.

2.1 PROJECT BOUNDARIES

For organizational purposes the plantation areas are divided into three management units (farms), located in the central region of the state of Minas Gerais. The MG02 farm is located about 180km from Belo Horizonte (the capital of Minas Gerais), in the municipality of Curvelo. In the municipalities of Felixlândia (about 190km from Belo Horizonte) and Morada Nova de Minas (approximately 260km from Belo Horizonte) are located the MG03 and MG04 farms. These units are identified by a number and the associated plantation farm name, as per the following table

[1] Within the Plantar Projects an additional area of approximately the same size of the one within the proposed A/R activity is planted in response to the CDM, in order to ensure the supply of renewable charcoal for the integrated project's iron production. These lands that were previously stocked with Eucalyptus plantations in 1989 are expected to revert to grassland/pastureland in the absence of the project.

Region	Unit Number	Plantation Farm Name	Overall georreferenced points
Felixlandia	MG 03	Jacaré/Riachão	- Northeast extreme point: 18º36'19S/ 45º00'38W - Southeast extreme point: 18º40'15S/ 44º59'41W - Northwest extreme point: 18º35'30S/ 45º07'07W - Southwest extreme point: 18º43'19S/ 45º06'22W
Morada Nova de Minas	MG 04	Buriti Grande	- West extreme point: 18º47'52S/ 45º23'32W - Northeast extreme point: 18º41'07S/ 45º14'35W - Southeast extreme point: 18º47'48S/ 45º17'07W

The project boundaries are drawn around the limits of the plantation areas established under this project activity. For baseline determination purposes it is assumed that these are the areas that would not be reforested in the absence of the proposed project. Since plantation areas are not fully established under continuous portions of land, and are scattered throughout three different management units, as above, the project boundaries express the sum of the limits of each plantation stand.

The spatial boundaries of the project are partially identified by satellite imagery, by topographic maps, and official land administration records. Geo-referenced information on the project area and boundaries are available and details are provided in the Annex 5 of the PDD. All information on the area and limits of project plantations are centralized in the project entity's forestry inventory system. In Chapter 3, details on the procedures to register and monitor the area under the project activity are presented. Land use maps and GPS coordinates are used to demonstrate the spatial limits of the project plantations. The aforementioned data will be made available to the DOE at validation and verification, as applicable. Changes to stands boundaries will be recorded and reported to the DOE at the time of verification, if any.

2.2 ELIGIBILITY OF LANDS

The Plantar forestry activity will be implemented under the following land-use category:

- Lands that did not contain forest (i.e. pastureland) on December 31st, 1989, and that were expected to remain as pastureland in the absence of the project.

The land eligibility assessment of the project area was executed by a third party forester specialist[2]. The goal of such work was to confirm the type of vegetation existing in the years 1989 and 2000, seeking past information through the use of remotely sensed images of medium spatial resolution and data collected from the field. Through the use of remotely sensed data

[2] Oliveira, Adauta C. (March 2008): Land-use Survey, Executive Report.

processing techniques, such as the decision tree, satellites images were classified in groups or regions, according to a predefined homogeneity criterion.

The study assessed and mapped the land use and cover of both plantation units, MG03 and MG04, through the use of the decision tree algorithm, based on the Landsat images in two different times and images originated from data processing techniques. The list of the images used and their date, as well as the details and tools used on their processing, are well documented in the land eligibility assessment report mentioned above.

Most of the project area was acquired from two companies which were previously using the land for grazing while the area left was acquired from individuals who had their land for sale before Plantar's intention to buy them. Land tenure documentation will be available to the DOE at the time of validation.

2.3 MONITORING PERIOD

The project monitoring is expected to cover the total project's single crediting period of 30 years, starting from November, 2000, within the t'CER approach. The MP can be amended in response to changes that may occur in the project activity, as long as such amendments are in line with the general monitoring process described in this plan and are approved by a DOE during verification audits.

2.4 MONITORING PROCEDURES

The MP outlines the guidance on monitoring procedures, including the responsibilities of the personnel involved in the forestry project activity. The project entity is expected to provide written and oral instructions to project personnel on the monitoring procedures. It should also provide training and knowledge management procedures required for implementing monitoring procedures.

2.5 OPERATIONAL PROCEDURES

The operational procedures under this MP are defined as those of measuring, registering and estimating net carbon stock changes associated to the plantations under the project. In order to supply the required information on changes in carbon pools, the project entity shall measure and estimate biomass volumes as per the standard operational procedures of its forestry inventory system. The project entity's inventory system is based on statistically valid sampling procedures and on registered software, which performs merchantable biomass volume calculations upon scientifically designed allometric equations. It can thus be used as the main measurement and monitoring parameter within this MP, as it complies with the baseline and monitoring methodologies. Based on the input data on the merchantable biomass volume provided by the project entity's inventory system, the estimation and monitoring of net carbon stock changes are performed under the Tool for Afforestation and Reforestation Approved Methodologies - TARAM, V1.2.Plantar, a set of MSExcel spreadsheets developed by CATIE (Tropical Agricultural Research and Higher Education Center) and The World Bank personnel[3] to express within a systematic fashion the formulae presented in the CDM approved methodology AR-AM0005.

[3] Authors: Lucio Pedroni (The World Bank and CATIE) and Pablo Rodríguez-Noriega (CATIE).The data inputs and adaptation were undertaken to Plantar project activity reality.

3 MONITORING OF THE PROJECT ACTIVITY

3.1 BASELINE SCENARIO

Since the most-likely land-use within lands in the project activity forestry units is pastureland at steady state, no net carbon stock changes are expected and, thus, no monitoring provisions are adopted.

3.2 PROJECT SCENARIO

The monitoring of project scenario focuses on monitoring of variables that influence the changes in carbon pools and the emissions by sources in the forest establishment. The information related to project boundary, project implementation, forest establishment, stratification and GHG removals will be integrated to the Geographical Information System (GIS) for the management of spatial data and monitoring. The steps to be pursued in this context are as follows.

3.2.1 MONITORING OF THE PROJECT BOUNDARY AND PROJECT IMPLEMENTATION

3.2.1.1 MONITORING OF THE PROJECT BOUNDARY

• Field surveys will be undertaken to verify that the delineated project boundary is congruent with the ex-ante description presented in the AR-CDM-PDD. Any significant changes shall be recorded and integrated in the Forest Inventory System; Based on the standard operational procedures field surveys will be done by the inventory team in order to delineate project boundary and increase measurement accuracy, following the best practices of forestry management techniques and cost-effectiveness;

• The spatial extent and location of each stand's characteristics (e.g. type of the clone/density) of the project activity are recorded and monitored throughout the crediting period. Therefore, the confirmation and/or specific changes in the reforested sites within the project boundary in relation to the ex ante list of sites (see Figures 20 and 21 of the PDD) are recorded and monitored as per the forest management standard operational procedures (SOPs).

• According to Plantar's internal quality assurance and quality control system the forestry management maps shall contain: spatial extent, location of the plots, and number of the stands. The Geographic Inventory System is readily available for consultation of all issues related to the plantations. Hence, the spatial extent and location of the species planted under this A/R project activity, in each stratum, will be recorded and monitored as per the approved methodology.

• The actual net removals by sinks are estimated by monitoring the permanent sample plots in order to estimate the changes in biomass increment within the project boundaries following the good practices and cost-effectiveness of forest inventory management.

• Following the best practices of the forestry management techniques in case sub-strata inventory discrepancy is above 10%, for a 95% confidence interval, more plots should be established in order do reduce the sampling error. Then, any discrepancies between the area reported and the area estimated under the proposed A/R CDM project activity in any part of the strata or sub-strata along with the species planted, including the areas of mortality due to natural factors (e.g. fire and pests) and anthropogenic factors will be recorded and reported.

3.2.1.2 MONITORING OF FOREST ESTABLISHMENT

• The project proponent has a Quality Management Department in place which documents and records the significant activities related to forest establishment, including activities related to site preparation and vegetation affected as part of site preparation. The monitoring intervals and specific activities/ staff responsibilities are provided in the Standard Operational Procedures which are based on ISO rationale and are constantly updated based on the continuous improvement approach, including compliance with safety and quality regulations.

• The forestry inventory process consists of a series of field monitoring procedures executed by a project entity's forestry technical team, starting 2.5 years after the plantation establishment year. These procedures establish the required conditions for measuring the trees, collecting4 and processing data, allowing for the quantification of the forests' wood volume, taking into account the provisions of the approved methodology AR-AM0005 and the company's quality assurance and quality control system, which are based on ISO standards.

Inventory data processing is currently conducted by SPP EUCALYPTUS – Sistema para Prognose de Crescimento e Produção de Eucalyptus sp. Version 1.0.0 (NEMAF/UFLA). This system was developed by Professor José Roberto Soares Scolforo,5 from the Forest Engineering Department of Federal University of Lavras, and may be revised6 throughout the crediting period based on the quality assurance and quality control system.

• Deviations or any significant changes in the implementation of the ex ante forest management plan are justified and recorded in the forest inventory system, following the monitoring provisions of the approved methodology.

3.2.1.3 MONITORING OF PROJECT MANAGEMENT ACTIVITIES

• Fertilizers application occurs in years 1, 2 and 3 of planting and replanting stages. The fertilization used is an N type (NPK), a total amount of 0.008358 tons for each 3-year period;

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[4] Including information on the number of planted clones, area of stratum, and planting layout as per the management plan and approved methodology.

[5] Dr. Scolforo's curriculum vitae accessed on November 23rd, 2007 at http://buscatextual.cnpq.br/buscatextual/visualizacv.jsp?id=K4788018A0

[6] Relevant changes in the systems will be recorded and updated to the DOE at time of verifications.

• Harvesting instructions are provide in a specific SOP, thinning activities are not expected to occur in the project activity once forestry management techniques do not indicate these procedures are not required to produce charcoal[7].

• Harvesting starts at year 8 and continues throughout the project years; the first planting cycle is followed by a 7-year cycle of coppicing. At the end of this second cycle a new planting (replanting) shall be implemented.

• Diesel consumption monitoring is either per unit area (planted area; standard yield hour/hectare; standard yield liters/hour) for site preparation, planting and maintenance, or per unit volume logged (volume logged; standard yield hour/m^3; standard yield liters/hour). Therefore, the quantity of fossil fuels used in the forest management and operations during each year of the Project will be collected and recorded, and details about the monitoring frequency are presented in the tables below.

• The occurrence of natural or anthropogenic disturbances such as forest wild fires is closely monitored by the project entity, which maintains continuous vigilance at strategically located fire-watch towers. All stands and natural preservation areas of the forestry services units are surrounded by fire breaks. Forest fires are combated in conjunction with special trained fire-fighting brigade. Location and area data of stratum, stands and permanent sample plots are managed and recorded integrally as per the quality assurance and control systems of the project activity forestry inventory. Fire breaks are carefully built respecting SOPs related and also procedures for fire prevention including the use of a fire truck and fire brigades. There's a specific SOP for forest protection in which procedures for avoidance of insect infestation is proposed.

• The project proponent does not carry out any biomass burning practice.

[7] In case thinning activities occur due to the management requirements related to natural or anthropogenic disturbances data will be collected and registered as per the monitoring procedures of the approved methodology.

3.2.2 STRATIFICATION AND SAMPLING DESIGN

In monitoring the A/R project activity, particular emphasis will be paid to the varieties of clones planted. Any relevant changes in the area, forestry management procedures and planting dates will be recorded, including the areas of mortality due to natural factors (e.g. accidental fire and pests) and anthropogenic factors (e.g harvesting) in any part of the strata and sub-strata and the species affected.

The stratification process adopted by Plantar considered the similarities that reflect in the results of net actual GHG removal by sinks. Nevertheless, any changes in the number and area of strata will be adapted and recorded accordingly. Accidental fires, plagues and other events that may especially interfere in the volume of wood to be harvested and even in the definition of sub-strata (age class) in case of anticipating harvesting or replant an area are considered for the ex-post stratification.

The forestry management system adopted is supported by SOPs and QA/QC measures that can assure that changes in the stratification will be monitored and recorded accordingly. Local aspects that may lead to changes in the adopted silvicultural regime and any changes in site characteristics or other variables not considered in the ex-ante stratification will be correspondingly recorded and considered in the ex-post stratification.

The project adopts the recommendation of the methodology and adopts more conservative approach on sampling design patterns, plots distribution and stratification taking into account a permissible error below ±10% of the mean, at the 95% confidence level.

There is no differentiation in the management system adopted for all sample plots, as defined by the SOPs and QA/QC procedures.

Strata and sub-strata will be verified in the first verification and changes will be monitored every five years. The monitoring will be carried out through Forestry Continuous Inventory (FCI) data and maps. Any changes will be recorded and presented to the DOE at the time of verification.

3.2.3 MONITORING ACTUAL NET GHG REMOVALS BY SINKS

The monitoring of the actual net GHG removals by sinks covers the monitoring of the changes to the project boundary and the assessment of changes in the carbon pools under consideration within the project boundary. The monitoring procedures are designed based on the stratification, sample frame, and monitoring frequency.

3.2.3.1 MONITORING CARBON STOCK CHANGES

The permanent sample plots are defined to monitor the variability in carbon pools. The merchantable above-ground tree component on the permanent sample plots will be measured at each monitoring interval. The changes in the above and below-ground biomass are estimated as per the differences between two periods. The biomass is estimated using biomass expansion factors (BEF) and root to shoot ratio methods of the predominant species used in the project activity.

As the non-tree component in the project scenario is likely to be greater than in the baseline scenario and forms less than 5 percent of the total project biomass, and taking into account the costs of monitoring non-tree biomass, this methodology does not account for non-tree biomass carbon pools, thus being conservative.

Changes in carbon stock in the above-ground biomass pool are estimated taking into account the changes in the area afforested or reforested over the project period, such as: increases in carbon stock in the above-ground biomass pool due to growth; loss of carbon stock due to clearance of grassland biomass to implement the A/R project activity; losses in carbon stock due to natural or anthropogenic disturbances, such as accidental fire; and loss of carbon stock due to harvesting.

The first monitoring interval is between Year 2 and 3, as per the QA/QC system, and then it coincides with the verification interval, which is expected to occur at 5-year intervals, until the end of the crediting period.

3.2.3.1.1 USE OF LOCAL/NATIONAL PUBLISHED DATA AND BIOMASS EXPANSION FACTORS (BEF)

The changes in above-ground biomass are assessed using biomass expansion factor method (BEF method) and data from local measurements and publications, as prescribed by Section III.5.a.2 of the AR-AM0005 methodology. The changes that are related to below-ground biomass and root-shoot ratio calculation are assessed based on scientific experiments and public available data.

3.2.3.1.2 FOREST INVENTORY SYSTEM AND DESTRUCTIVE SAMPLING

The project entity uses customized and automated forest inventory system to support the forest inventory and estimation of merchantable volume. The project entity's forestry inventory system follow quality procedures closely based on ISO 9001 standards. Destructive sampling is used at the time of monitoring. The trees are randomly selected harvested and sampled to estimate the volume of the tree above-ground

3.2.3.2 MONITORING THE GHG EMISSIONS BY SOURCES

This methodology applies to monitoring A/R activities, including the completion of management and silvicultural procedures of A/R activities. The recording of the management and silvicultural practices aim at recording and reporting the inputs and outputs of the project (e.g. fertilizer application), that may affect the GHG removals from the project. In this context, the following categories of management operations are monitored and reported:

- Survival rates of A/R areas in various sub-strata and strata of the project, and the areas affected by natural and anthropogenic disturbances, such as accidental fires.

- Schedule of fertilization and the types and quantity of fertilizer applied.

- Thinning and harvest regimes prescribed and followed, and the biomass removed from the operations.

- Quantity of fossil fuels used in the management operations and the annual quantity of fossil fuels used up to the period of monitoring.

- Application of synthetic nitrogenous fertilizers.

3.3 LEAKAGE

In this project activity leakage is assumed to occur as a result of fossil fuel combustion (mobile combustion) outside the project boundary. Therefore, the only form of leakage from the project is due to travel of project personnel and transportation of cloned sprouts, fertilizers, labor, staff and harvested wood outside the project area.

3.3.1 MONITORING EMISSIONS FROM FOSSIL FUEL COMBUSTION OUTSIDE THE PROJECT BOUNDARIES

The following transportation activities are considered in the establishment of the forest asset: the transportation of the sprouts from the clonal gardens, of the fertilizers, of the wood harvested to the carbonization units, of the employees involved in the field activities.

To monitor leakage the project entity's operational department will provide the information on vehicle types used, distance travelled and fuel consumed in the project related travels outside the project boundary in an annual basis to perform the calculations according to formulae established by the AR/AM0005. All information will follow QA/QC procedures.

4 DATA COLLECTION, STORAGE AND INFORMATION MANAGEMENT

This section presents the guidelines for data collection in the project activity, including data storage policies to be followed to support audit and verification.

Adhering to data and information management procedures ensures that in the event of change in personnel or for other reasons, the continuity of data management procedures is not affected. The methods followed to collect field data, and procedures used to ensure data entry, data quality, data storage and retrieval are the important elements of project information management.

4.1 DATA COLLECTION

Collecting reliable field measurements is an important step in the quality assurance plan. Standard procedures should be followed to collect reliable data to ensure the estimation of credible baseline and project emissions. To ensure continuity, it is important that the coherent procedures are used during the project period and the personnel involved in forest activity are trained in field data collection. **Table 4.1** outlines relevant data for monitoring of the removals generated by the project activity and collected at different intervals.

4.2 DATA QUALITY

During the monitoring process, data collected by the field personnel are verified by the senior personnel overseeing the forestry activity. The results of verification are compared with the original data and errors corrected, if any. This random data checking and quality assurance procedures should be repeated at regular intervals. Considering the differences in the electronic and paper based formats, there must be clarity in the terms defined and procedures followed. Particular attention shall be paid to monitoring and measurement errors and mandatory data checks shall be performed.

4.3 DATA ENTRY AND STORAGE

The project entity shall make necessary arrangements for data entry on the registry forms in electronic formats and ensure transfer to the spreadsheet database at required intervals as outlined in the monitoring methodology.

The data shall be archived using acceptable standards and stored in compliance with the instructions of the project information management system: The electronic data shall be stored securely at multiple locations using monthly back-up procedures. Furthermore, the backed up data should also be stored on mobile media such as floppy disk, Zip disk, or CD ROM for easy retrieval.

All GHG related information collected shall be aggregated into annual data and transferred to the ERMs calculation spreadsheet that accompanies the MP and the PDD.

4.4 INFORMATION MANAGEMENT SYSTEM

The project information management links the operations of the field data collection and spreadsheet database management and outlines responsibilities of staff involved in collecting field data and organizing spreadsheet database. The supervisory staff overseeing the field data and spreadsheet database must certify the data and provide necessary clarifications on the changes, if any, in the data collected and processed.

Table 4.1: The following data shall be collected or used in order to monitor verifiable changes in carbon stocks:

ID number[8]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[9]	Recording frequency	Number of data points / Other measure of number of collected data	Comment	Responsible
MONITORING OF THE PROJECT BOUNDARY							
E.1.01	Stratum ID	Alphanumeric	e	See Comment.	100%	Stratum takes into consideration similar type of soil, climate, and possibly tree species	Planning manager
E.1.02	Sub-stratum ID	Alphanumeric	e	See Comment.	100%	Each sub-stratum has a particular age class referring to the planting date under each stratum	Planning manager
E.1.03	Confidence level	%	e	5 years.	100%	For the purpose of QA/QC and measuring and monitoring accuracy	Planning manager
E.1.04	Accuracy	%	e	5 years.	100%	For the purpose of QA/QC and measuring and monitoring accuracy	Planning manager
E.1.05	Standard deviation of stratum	Alphanumeric	e	5 years.	100%	Stratum and substratum, calculated from E.1.03– E.1.04	Planning manager
E.1.06	Number of sample plots	Alphanumeric	c	5 years.	100%	Plot ID shall be provided to each permanent sample plot	Planning manager
E.1.07	Sample plot ID	Alphanumeric	e	5 years.	100%	Numeric series ID will be assigned to each permanent sample plot	Planning manager
E.1.08	Plot location	GPS coordinates	m	5 years	100%	Using GPS	Planning manager
MONITORING OF THE FOREST ESTABLISHMENT							
E.1.09	Tree species	Species names		5 years	100%	Arranged in CDM-AR PDD	Planning manager

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

[9] Please provide full reference to data source.

E.1.10	Age of plantation	Alphanumeric	m	5 years	100%sampling plot	Counted since the planting date	Planning manager
E.1.11	Number of trees	Alphanumeric	m	5 years	100% of trees on plots	Counted in plot measurement	Planning manager
MONITORING OF THE FOREST MANAGEMENT ACTIVITIES							
E.1.12	Diameter at Breast Height (DBH)	m	m	5 years	100% trees on plots	Measured at each monitoring interval	Planning manager
E.1.13	Mean DBH	m	c	5 years	100% of sampling plots	Calculated from E.11 and E.12	Planning manager
E.1.14	Tree height	m	m	5 years	100% trees on plots	Monitoring at each monitoring time per sampling method	Planning manager
E.1.15	Mean tree height	m	m	5 years	100% trees on plots	Calculated from E.1.11 and E.1.14	Planning manager
E.1.16	Merchantable volume	m^3/ha	c/m	5 years	100% trees on plots	Calculated from E.1.13 and possibly E.1.15 using local-derived equations, or directly measured by field instrument	Planning manager
E.1.17	Wood density	t d.m. m^3	e	5 years	100% trees on plots	Local-derived and species-specific value have the priority	Planning manager
E.1.18	Biomass expansion factor (BEF)	dimensionless	e	5 years	100% of plots	Local-derived and species-specific value have the priority	Carbon projects manager
E.1.19	Carbon fraction	t C $(t\ d.m)^{-1}$	e	5 years	100% of plots	Local-derived and species-specific value have the priority	Carbon projects manager
E.1.20	Root-shoot ratio	dimensionless	e	5 years	100% of plots	Locally-derived and species-specific value have the priority	Carbon projects manager
E.1.21	Carbon stock in above-ground biomass of tree	kg C $tree^{-1}$	c	5 years	100% sampling plot	Calculated	Carbon projects manager
E.1.22	Carbon stock in below-ground biomass of tree	kg C $tree^{-1}$	c	5 years	100% sampling plot	Calculated	Carbon projects manager
E.1.23	Carbon stock in	t C ha^{-1}	c	5 years	100%	Calculated	Carbon projects manager

	above-ground biomass of plots				sampling plot		
E.1.24	Carbon stock in below-ground biomass of plots	t C ha^{-1}	c	5 years	100% sampling plot	Calculated	Carbon projects manager
E.1.25	Mean carbon stock in above-ground biomass per unit area per stratum per species	t C ha^{-1}	c	5 years	100% of stratum and sub-stratum	Calculated from E.1.06 to E.1.23	Carbon projects manager
E.1.26	Mean carbon stock in below-ground biomass per unit area per stratum per species	t C ha^{-1}	c	5 years	100% of stratum and sub-stratum	Calculated from E.1.06 to E.1.20	Carbon projects manager
E.1.27	Area of stratum and substratum	ha	m	5 years	100%	Actual area of each stratum and sub-stratum	Planning manager
E.1.28	Carbon stock in above-ground biomass of stratum per species	t C	c	5 years	100% of stratum and sub-stratum	Calculated	Carbon projects manager
E.1.29	Carbon stock in below-ground biomass of stratum per species	t C	c	5 years	100% of stratum and sub-stratum	Calculated	Carbon projects manager
E.1.30	Carbon stock change in above-ground biomass per stratum per species	t C yr^{1}	c	5 years	100% strata and sub-strata	Calculated	Carbon projects manager
E.1.31	Carbon stock change in below-ground biomass per stratum per species	t C yr^{1}	c	5 years	100% strata and sub-strata	Calculated	Carbon projects manager

E.1.32	Total carbon stock change	t CO_2-e yr^{-1}	c	5 years	100% project area	Summing up carbon stock change in E.1.30 and E.1.31 for all stratum, sub-stratum and tree species	Carbon projects manager

Table 4.2 presents the data to be collected or used in order to monitor GHG emissions:

ID number [10]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d) [11]	Recording frequency	Number of data points / Other measure of number of collected data	Comment	Responsible
E.1.33	Amount of diesel consumed in machinery use for site preparation, thinning or loggings	litre	m	Annually	100%	Monitoring either diesel consumption per unit area (planted area; standard yield hour/hectare; standard yield liters/hour) for site preparation, planting and maintenance, or per unit volume logged (volume logged; standard yield hour/m^3; standard yield liters/hour)	Branch manager
E.1.34	Emission factor for diesel	kg/litre	e	5 years	100%	GPG 2000, IPCC Guidelines, national GHG inventory. National inventory value should have priority	Carbon projects manager
E.1.35	Emission from fossil fuel use within project	t CO_2-e yr^{-1}	e	Annually	100%	Calculated using equations	Carbon projects manager

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

[11] Please provide full reference to data source.

	boundary						
E.1.36	Area affected by biomass burning	ha	m	Annually	100%	Measured for different sub-stratum	Socio-Environmental coordinator
E.1.37	Mean above-ground biomass stock before burning	t d.m. ha^{-1}	e	At the beginning of the project	100%	Sampling survey for different sub-strata before burning	Planning manager
E.1.38	Proportion of biomass burned	dimensionless	m	Annually	100%	Sampling survey for different sub-strata after burning	Planning manager
E.1.39	Biomass combustion efficiency	dimensionless	e	Before the start of the project	100%	IPCC default value (IPCC default: 0.05) should be used if no appropriate value available	Carbon projects manager
E.1.40	Carbon fraction	t C (t d.m.) $^{-1}$	e	5 years	100%		Carbon projects manager
E.1.41	Loss of above-ground biomass carbon due to biomass burning	t C yr^{-1}	c	5 years	100%	Calculated from equation	Carbon projects manager
E.1.42	N/C ratio	kg N/kg C	e	Before the start of the project	100%	IPCC default value (IPCC default: 0.01) should be used if no appropriate value is available	Carbon projects manager
E.1.43	N_2O emission from biomass burning	t CO_2-e yr^{-1}	c	5 years	100%	Calculated using equation	Carbon projects manager
E.1.44	CH_4 emission from biomass burning	t CO_2-e yr^{-1}	c	5 years	100%	Calculated using equation	Carbon projects manager
E.1.45	Increase in non-CO_2 emission as a result of biomass burning	t CO_2-e yr^{-1}	c	5 years	100%	Calculated using equation	Carbon projects manager

E.1.46	Amount of synthetic fertilizer N applied per unit area	kg N ha^{-1} yr^{-1}	m	Annually	100%	The amount of fertilizer N is the same for all sites and the application occurs in years 1, 2 and 3 of each rotation.	Branch manager
E.1.47	Area of land with N fertilized	ha yr^{-1}	m	Annually	100%	For different tree species and management	Branch manager
E.1.48	Amount of synthetic fertilizer N applied	t N yr^{-1}	c	Annually	100%	Calculated using equation	Branch manager
E.1.49	Fraction that volatilizes as NH_3 and NO_X for synthetic fertilizers	Dimensionless	e	At the time of validation	100%	IPCC default value (IPCC default: 0.1) should be used if no appropriate data is available	Carbon projects manager
E.1.50	Emission factor for emission from N input	N_2O N-$input^{-1}$	e	At the time of validation	100%	IPCC default value (1.25%) should be used if no appropriate data is available	Carbon projects manager
E.1.51	Direct N_2O emission of N input	t CO_2-e yr^{-1}	c	Annually	100%	Calculated using equation	Carbon projects manager
E.1.52	Total increase in GHG emission	t CO_2-e yr^{-1}	c	Annually	100%	Calculated using equation	Carbon projects manager

Table 4.3: The following data shall be collected or used in order to monitor leakage:

ID number [12]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d) [13]	Recording frequency	Number of data points / Other measure of number of collected data	Comment	Responsible
E.1.53	Number of vehicle type used	number	e	Annually	100%	Monitoring number of each vehicle type used	Branch manager
E.1.54	Emission factor for road transportation	kg CO_2-e t^{-1}	e	Annually	100%	National or local value has the priority	Carbon projects manager
E.1.55	Kilometers traveled by vehicles	km	m	Annually	100%	Monitoring kilometers for each vehicle type and fuel type used	Branch manager
E.1.56	Fuel consumption per km	litre km^{-1}	e	5 years	100%	Estimated for each vehicle type and fuel type used	Branch manager
E.1.57	Fuel consumption for road transportation	litre	c	Annual	100%	Calculated using equation	Branch manager

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

[13] Please provide full reference to data source.

5 ESTIMATION OF NET GHG REMOVALS USING SPREASHEET DATABASE

In order to monitor and estimate baseline and actual net GHG removals by sinks as well as net anthropogenic GHG removals by sinks, the project entity uses the Tool for Afforestation and Reforestation Approved Methodologies – TARAM V.1.2.Plantar, developed by CATIE and the World Bank personnel. The TARAM Tool is an MSExcel spreadsheet model where net changes in carbon stocks and GHG emissions from fuel consumption and leakage are registered and monitored, as per the baseline and monitoring methodologies. The database is appropriate for the project as it allows easy data entry and retrieval with minimum staff training, cost effective data storage, automates the estimation of removals and emissions, and is readily verifiable.

This chapter presents the TARAM Tool. It is intended to serve as the instruction note for the management of spreadsheet database and to outline the responsibilities of project entity in maintaining the database and generation of data reports on periodic basis.

5.1 TOOL FOR AFFORESTATION AND REFORESTATION APPROVED METHODOLOGIES – TARAM V.1.2.PLANTAR

The TARAM Tool was designed by the World Bank team as a self-explaining tool suitable A/R approved methodologies. It starts by choosing a methodology from the approved methodologies available list and the model automatically adapts all the worksheets to each methodology's particularities.

Table 5.1: Worksheet "Meth": list of methodologies covered by the TARAM V.1.2

Methodology		
Choose the methodology that is applicable to the proposed AR-CDM project activity		
This tool can be used for the selected methodology, but some notations used in this tool are different to the ones used in the methodology description.		
AR-AM0005	AR-AM0001	Reforestation of degraded land --- Version 2
	AR-AM0002	Restoration of degraded lands through afforestation/reforestation
	AR-AM0003	Afforestation and reforestation of degraded land through tree planting, assisted natural regeneration and control of animal grazing --- Version 2
	AR-AM0004	Reforestation or afforestation of land currently under agricultural use
	AR-AM0005	Afforestation and reforestation project activities implemented for industrial and/or commercial uses
	AR-AM0006	Afforestation/Reforestation with Trees Supported by Shrubs on Degraded Land
	AR-AM0007	Afforestation and Reforestation of land currently under agricultural or pastoral use
	AR-AM0008	Afforestation or Reforestation on degraded land for sustainable wood production
	AR-NM0026	Afforestation or Reforestation implemented by small and medium private land holders under an AR incentive program adopted before 11 November, 2001

The TARAM Tool uses the notations of AR-AM0004 methodology as standard notations; therefore some notations may be different from others cited in methodology's documents. The tool uses a color code to specify the functionality of each group of colored cells (Table 5.2), showing a red strip with a message once the input of the required data has finished. The sequence of the worksheets should be followed for a better use of the tool, starting with the sheet "Meth" and proceeding until the sheet "CERs" or, optionally, "Financial".

Table 5.2: Color code for the TARAM V.1.2

yellow	Cells with this color are the place where to input your data and parameter values.
white	Here you will find formulae and results. **It is recommended not to delete or modify the content of these cells.**
gray	Here you will see the result of a choice you have made in a yellow cell.
blue	These cells represent options that are not applicable to your AR-CDM project activity. Delete any data in these cells.
orange	If you are interested in additional results (not related to the methodology) input additional data (i.e. for financial analysis).
red	This color is used to provide important messages to the user.
red	

The TARAM V.1.2.Plantar calculates the net anthropogenic GHG removals for each project year, in compliance with the t'CER non-permanence approach and verification regimes for LULUCF projects, under the CDM. For planning purposes, the system estimates the amount of removals during the project activity's lifetime.

Carbon stocks are calculated by spreadsheets, using annual time steps, in seven-year rotations or harvesting cycles. Net carbon stock changes are estimated for each pool on an annual basis, and the resulting carbon stock is subsequently applied to fully transparent equations in compliance with the baseline and monitoring methodologies.

5.1.1 SPREADSHEET ORGANIZATION

The TARAM V.1.2.Plantar comprises the following worksheets:

Table 5.3: Worksheets comprised by the TARAM V.1.2.**Plantar**

Meth	Start your work here. In this worksheet, select the methodology applicable to your proposed CDM-AR project activity, then move to "Species".
Species	In this worksheet provide the appropriate parameter values for all tree and woody species that you have in the baseline and in the project scenario. You can define the parameters for a group of species (i.e. a cohort). Provide a unique ID_j for each species or group of species. When your are done, move to "BLS1".
BLS1 - BLS6	Each of these worksheets represent a different baseline stratum. If you have more than 6 baseline strata make different files from this tool and merge the results in a separate spreadsheet. Provide a unique ID_i for each baseline stratum and specify the required data and parameter values in the yellow cells. When you are finished move to the next baseline stratum or to "SM1".
SM1 - SM6	Each of these worksheets represent a different stand model. If you have more than 6 stand models make different files from this tool and merge the results in a separate spreadsheet. Provide a unique ID_k for each stand model and specify the required data and parameter values in the yellow cells. When you are finished move to the next stand model or to "Strata".
Strata	In this worksheet, identify the baseline strata in which the stand models will be implemented, then move to "AR-Plan"
AR-Plan	In this worksheet, define for each stratum the amount of hectares that will be afforested or reforested during each project year, then move to "Pre-AR".
Pre-AR	This worksheet applies only to CDM-AR project activities that have to include pre-existing AR activities in their baseline. Move directly to "Blexa" if the proposed CDM-AR project activities is implemented in a region where no pre-existing AR activities exist.
Blexa	This worksheet contains the estimated *ex ante* baseline net greenhouse gas removals by sinks.
Aexa	This worksheet contains the estimated *ex ante* actual net greenhouse gas removals by sinks. Some inputs are required.
Distance	In this worksheet, provide the distance between AR sites and supply points of inputs needed for establishing and managing the AR site and the destination points of the outputs expected from the AR activity. These inputs are required for the estimation of leakage.
LK	In this worksheet, specify additional parameters that are needed for the calculation of leakage.
CERs	This worksheet provides the estimated *ex-ante* net anthropogenic greenhouse gas removals by sinks and the anticipated volume of tCERs or lCERs.
Financial	Here you can analyze the financial aspects of the proposed CDM-AR project activity.
Chart	Here you will find a chart illustrating the net anthropogenic GHG removals by sinks and the associated flow of CERs
IPCC tables	Here we have reproduced some of the tables of IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (GPG-LULUCF). These tables provide useful default values for some parameters.
USDA density table	Here we have reproduced a table of wood densities from: Reyes *et al.* 1992. Wood Densities of Tropical Tree Species. USDA.

6 MONITORING OF SOCIAL AND ENVIRONMENTAL ISSUES

The main social and environmental impacts of this project have been addressed in several reports, since the project activity's starting date. The referred documentation includes the social and environment impact assessments referred to in the PDDs (Sections F and G) and World Bank assessments, available at the PCF's website[14]. Accordingly, various social and environmental monitoring provisions have been designed. Overall, the implementation of the project activity is expected to result in several social and environmental benefits, as it allows for the unprecedented incorporation of sustainable development criteria in the Brazilian charcoal-based iron industry and its supply chain.

The project activity areas shall be subject to independent forestry certification[15] and/or related quality management systems, which provide extensive coverage on a range of social and environmental aspects of forestry plantation operations. This is, per se, a very important additional social and environmental benefit which was also triggered by the project activity. Therefore, this MP does not aim at directly monitoring issues specifically addressed within the implementation of such certification and quality management schemes. Nonetheless, it provides for the monitoring of the project activity's overall compliance with the adopted principles, criteria and broader environmental programs, as detailed hereinafter.

6.1 ENVIRONMENTAL ISSUES

The Project Entity ensures the project activity's compliance with forestry certification process or applicable environmental quality management systems. Recommendations in forestry certification or quality management systems have to be followed on all land qualifying for carbon credits, including the legal reserves for the plantations. Certification ensures that no additional conversion of existing natural habitats will take place in the areas qualifying for CDM credits.

The project entity shall provide evidence that Persistent Organic Pollutants of pesticides are not being used and that proper controls for the handling, storage, transport and disposal of pesticide and herbicide containers are in place. Water quality monitoring activities on all areas shall be implemented and monitored.

Several environmental programs were prepared in compliance with the Brazilian environmental regulations (Section F of the PDD) and the project's activities compliance with such programs shall also be monitored, as detailed below.

[14] KORNEXL, Werner. *Environmental Assessment of Plantar Project/ Minas Gerais*, 2001.

[15] As of the submission of this MP, the currently adopted forestry certification scheme is provided by the Forest Stewardship Council (FSC). It applies to the areas of Curvelo, Felixlandia and Morada Nova de Minas. FSC holds strict sustainability standards for forestry related businesses. Its principles and criteria alongside the enforcement of a continuous improvement policy encompass social and environmental impact assessments, stakeholders' consultation, compliance with applicable laws, as well as a number of provisions which go beyond the Brazilian legislation and the current CDM social and environmental monitoring requirements. FSC auditing reports and eventual corrective action requests are publicly available and readily accessible on the Internet. Actually, the total project entity`s own forested areas are FSC certified.

Another item subject to annual monitoring is the validation dates of the project activities' operating licenses.

6.1.1 RECORDING AND MONITORING DATA

To promote the continuous registration on the occurrence of mammals as a way to assess the evolution of the natural scenery resulting from the implementation of environmental programs

Table 6.1 summarizes the project activity's monitoring of the environmental issues in terms of the units' responsible, periodicity and format of reporting.

Table 6.1: Environmental Monitoring

Impact:	Action:	Justification:	Objective:	Parameters:	Monitoring frequency:	Responsible:
Increase of concentration of solids in suspension, nutrients and organic matter in the water streams	Monitoring Program of the Quality of the Superficial Water.	The activities implemented in the project activity forest units may modify the quality condition of the microbasins water as to compromise the multiple and integrated use of the water streams.	Developed in order to assess the effectiveness of the silviculture practices on the quality of the physical, chemical and bacteriological parameters of the superficial water that drains the areas of the forest plantations within the project activity.	Physical, chemical, and bacteriological parameters of the water.	Based on results of laboratory samples collected twice a year, one during the dry season and the other during a rainy season. Monitoring has been in place since December 2003.	Plantar's Social and Environmental Department.
Changes in the pluvial regime and in the water quality of the basin	Monitoring Program of the Microbasin of the Riacho Fundo Stream.	Changes in the pluvial regime of the microbasins are difficult to measure, quantify and understand, once there are many technical variables that modify or change the water dynamics in a microbasin. The land use change of great areas may increase or decrease the flowing water of the microbasin, lower the ground water levels, or dry small dams. As such, further studies and	Developed in partnership with the Federal University of Viçosa, under the supervision of Professor Dr. Herly Carlos Teixeira Dias. It aims at monitoring the variables that interfere in the water dynamics versus the forest silviculture practices and management in a microbasin with eucalyptus plantations. The program has a minimum duration of 14 years, and will be an important tool to determine	The flow variation in relation to the microbasin and local pluvial characteristics; the ground water level variation in a piezometer; an estimation of the evapotranspiration based on the use of an atmometer; superficial flow within the plantations due to effective precipitation; and the infiltration rate in different sites of the land.	Results are collected daily and assessment reports issued each semester. The project is currently in a fine tuning phase.	Plantar's Social and Environmental Department.

		assessments on the eucalyptus plantations effects in the project activity region is necessary.	the most appropriate silviculture techniques for the region.			
Soil erosion	Monitoring Soil Preservation Program	Measures to avoid risks. of erosion	The purpose is to promote water drainage into the stands and retain sediments from the superficial flowage	Implementation and maintenance of "camalhões" (retention systems) and containment basins	Installed when establishing the fire breaks;	Branch Manager
Changes in the native vegetation preservation areas	Monitoring Program on Management and Preservation of Protected Areas	In order to guarantee compliance with forestry law and the maintenance of natural vegetation in the protected areas and corridors.	Preservation of native flora through the maintenance of native vegetation in protected areas and corridors.	The interconnectivity between fragments of native vegetation	Every 5 years	Plantar's Social and Environmental Department.
Occurrence of fire	Monitoring Program on Prevention and Fire Control	Surveillance action to avoid or minimize the impacts of any accidental fire occurring in the project or neighbouring areas.	Implementation of efficient actions to prevent and control fire occurrence in the Project's area and surroundings	Area burned, in hectares	Annually	Plantar's Social and Environmental Department.
Operating licenses for MG03 and MG04 forestry service units	Prepare reports assuring the compliance with the Environmental Control Program (PCA) and with the conditions imposed for each forestry service unit within the project boundary (MG03 and MG04).	Operating licenses expire every 6 years and it is necessary to present an Environmental Performance Evaluation Report (RADA) to the State environmental body to renew them.	Monitor the validation of the operating licenses.	The current validation dates of the licenses are the following: MG03 – valid from 2006 to 2012 MG04 – valid from 2005 to 2011	Annually	Plantar's Social and Environmental Department.

6.2 SOCIAL ISSUES

Monitoring provisions for the social impacts within the project boundaries are generally related to working conditions, job creation, health and safety of employees. In what concerns impacts attributable to the project outside its boundaries, the most likely changes are regarded as positive impacts, since the project activity is expected to increase the indirect number of jobs and the establishment of improved references regarding working conditions. Thus, this MP focuses on the social impacts within the project boundaries. Notwithstanding, considering the project's operations scale and the necessity of ensuring proper relations with local stakeholders, directly affected by the project activity, this MP shall also encompass the monitoring of the project entity's overall compliance with the social programs referred to in Section G and presented below.

6.2.1 RECORDING AND MONITORING DATA

The project entity shall ensure the maintenance of the following records and reporting on the social issues to the respective regional and local regulatory agencies, as applicable, and to the Designated Operating Entity (DOE) at the time of verification.

Table 6.2 summarizes the project activity's monitoring of the social issues in terms of the units' responsible, periodicity and format of reporting.

Table 6.2: Social Monitoring

Impact:	Action:	Justification:	Objective:	Parameters:	Monitoring frequency:	Responsible:
Changes in the project entity's employment rate, concerning local employees	Monitoring records of employment	Follow the oscillation of the project entity's employment rates in the project's region in order to monitor the impact of the project entity in offering income opportunities to local population	Follow recruitment and training of local people in forestry operations and to develop their skills for potential employment	Number of local workers hired by the project entity/ dismissed from job	Annually	Plantar's Social and Environmental Department
Rhythm of labor accidents	Monitoring safety records	Follow the quality of safety measures offered by the project entity to its employees	Record information on the number and frequency of accidents, protective clothing, and other safety measures implemented	Number and frequency of labor accidents	Annually	Plantar's Social and Environmental Department
Changes in employees' health conditions due to labor activities	Monitoring health records	Follow the project entity's employees' health conditions in order to evaluate the impacts of the labor activities	The project entity's Program for Medical Control in Occupational Health (PMCOH) should evaluate the health conditions of employees. The medical professionals managing the program should ensure adequate medical supplies and emergency care. The health records shall be made available to the DOE at the time of verification	Program for Medical Control in Occupational Health (PMCOH)	Annually	Plantar's Social and Environmental Department
Perception of Insecurity	Social Interaction Program	Considering environmental changes or expectation on changes by the impact generator	The purpose of the program is to implement an intense social interaction work which facilitates the construction of	Monthly visit rate; number of people benefited from social interaction activities	Annually	Plantar's Social and Environmental Department

		projects may cause in their respective regions, the actions for social interaction are crucial in the process. Inadequate communication with the local population could motivate conflicts whenever the local stakeholders are not aware of adopted procedures for implementation and development of forestry activity.	appropriate strategies for the improvement of the relations between Plantar and the local stakeholders. The goal is to support the discussions related to the project thru contact development and by the inclusion of interaction activities throughout all stages of reforestation.			
Weakening of communitarian organizations and growth of the adverse demonstrations to reforestation development.	Income Generation Activity Support Program	The Income Generation Activity (IGA) Support Program intends to organize Plantar's actions in the support of IGA's demands considering the consequent change in the labor profile concerning the activities carried out before the area plantings. The weakening of communitarian organizations occurs due to the lack of policies for small landholders, and the eucalyptus monoculture could expedite the process and also profit from the	The program's goal is to identify and support actions proposed by organized groups in the municipalities of Felixlândia and Morada Nova de Minas stimulating communitarian organization and proposing alternatives, in order to generate income for the local community. Developing and supporting IGA's is a way to share the benefits and generate the belief that eucalyptus culture can bring a positive response to local community.	Developed IGA's, participant communities.	Every 2 years	Plantar's Social and Environmental Department

		situation. Strengthening the associations or stimulating them thru IGA’s its possible to keep the families in the rural areas with their activities. The proposed actions reflect the company’s position, sensitive to these matters even though it’s evident that in the long run, the investment return for the municipalities is higher than other agricultural activities that which could be implemented in the company’s areas.				

The reports on the social and environmental issues of project activity shall be presented to the DOE at the time of verification. The reports shall also be submitted to the regional and local regulatory agencies as required. The validation of project activities' Operating Licenses shall be monitored through the annual reports prepared to comply with the Environmental Control Program (PCA) and with the conditions imposed for each unit. Other aspects will be managed and monitored according to independent forestry certification and/or environmental quality management systems. The basic indicator to be verified by the DOE is the valid certificate issued by the independent organization. Refer to Annex 6 of the PDD for more details on social and environmental actions performed by the project entity.

7 PROJECT MANAGEMENT, REPORTING AND QUALITY ASSURANCE

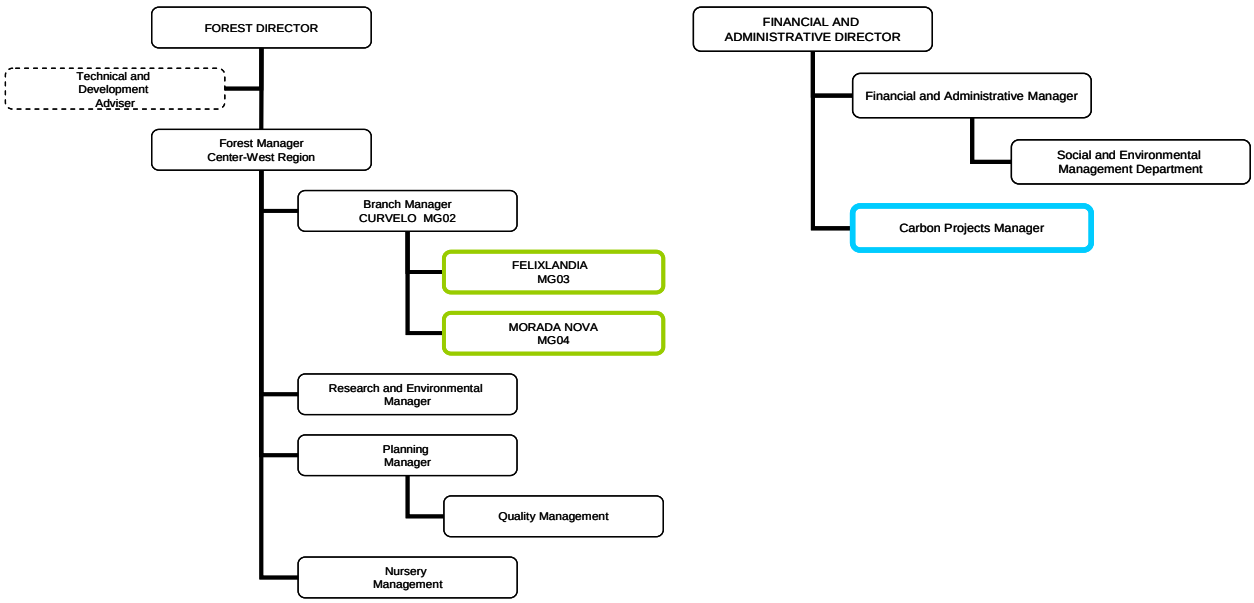
The project must have a well defined project management, reporting and quality assurance system in order to ensure successful project operation that result in credible and verifiable emission reductions. The project management and quality assurance shall be monitored at regular intervals and measures implemented to enhance the project effectiveness shall be submitted at the time of verification.

7.1 PROJECT MANAGEMENT AND OPERATION

It is the responsibility of the project entity to develop and implement a project management and operations system that meets the project requirements outlined in the Project Design Document and the procedures of this MP. The project management implemented by the project entity shall be subject to assessment during the initial verification to ensure that it is of satisfactory quality and reflects the quality of emissions reductions achieved and expected.

The project entity must appoint a competent manager who will be in charge of the project activity and accountable for generation of ERMs including monitoring, record keeping, computation of ERMs, audit and verification. The project manager shall officially represent the project entity and shall certify the GHG emissions and other reports on the project activity. The organization chart of the project entity's A/R project activity is presented below (Figure 1). The organization chart is under the policy for continuous betterment, therefore, in case of changes, they will be registered and presented to the DOE.

Figure 1: Plantar's project activity organization chart



7.2 TRAINING

The project entity must ensure that the required capacity and training is made available to its operational staff to enable them to undertake the tasks required under this MP. The registries of training programs shall be maintained and stored in the company's quality management system.

7.3 QUALITY ASSURANCE (QA)

To ensure that the estimates of emissions and net removals by sinks are reliable and meet the monitoring and measurement standards, quality assurance and quality control (QA/QC) procedures shall be implemented. The QA should include procedures to verify field data, management of the data collected, and steps used in the estimation of emissions.

It is recommended that the activities outlined for the project activity are monitored appropriately under an accredited quality assurance system such as ISO or other similar standard to ensure that project management and operations meet the desired standards. The standard operational procedures and data management system will ensure cost effective and transparent monitoring and data generation and are subject to verification.

Table 7.1: Data control and data quality procedures implemented in the project activity

Data (Indicate ID number)	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Stratum	Low	To ensure that strata represents the project characteristics
Sub-stratum	Low	To ensure that sub-strata represents the project characteristics
Sample plot	Low	Plot ID to uniquely identify each sample plot for monitoring & measurement
Plot location	Low	The carbon pools in the plots are monitored at each interval
No. of trees	Low	Tree counts are taken on the nested plots. The data collection and recording procedures are randomly verified.
Diameter at breast height	Low	Considering the large number of measurements taken, the measurement error is likely to be small. The random re-measurements are used to verify the prior measurements.
Tree height	Low	Measurement, data collection and recording procedures are subject to random re-measurements and verification.
Wood density	Low	Data project records of total area planted and QA/QC procedures shall be verified.

Biomass expansion factor	Low	Data from literature and from estimation from monitoring data
Root-shoot ratio	Low	Data from literature and local estimates should be checked.
Merchantable volume	Low	The local allometric equations are verified using destructive sampling
Fuel use in plantation activities	Low	Data project records of total area planted and QA/QC procedures shall be verified.
Fertilizer application per ha	None	Data project records of total area planted and QA/QC procedures shall be verified.
No. of ha fertilized	Low	Data project records of total area planted and QA/QC procedures shall be verified.
Area of biomass burned	Low	Data from project records shall be verified
Number of vehicles	Low	Data project records of total area planted and QA/QC procedures shall be verified.
Distance in kilometers travelled	Low	Data to be verified from project records
Fuel consumption in transport	Low	Data project records of total area planted and QA/QC procedures shall be verified.

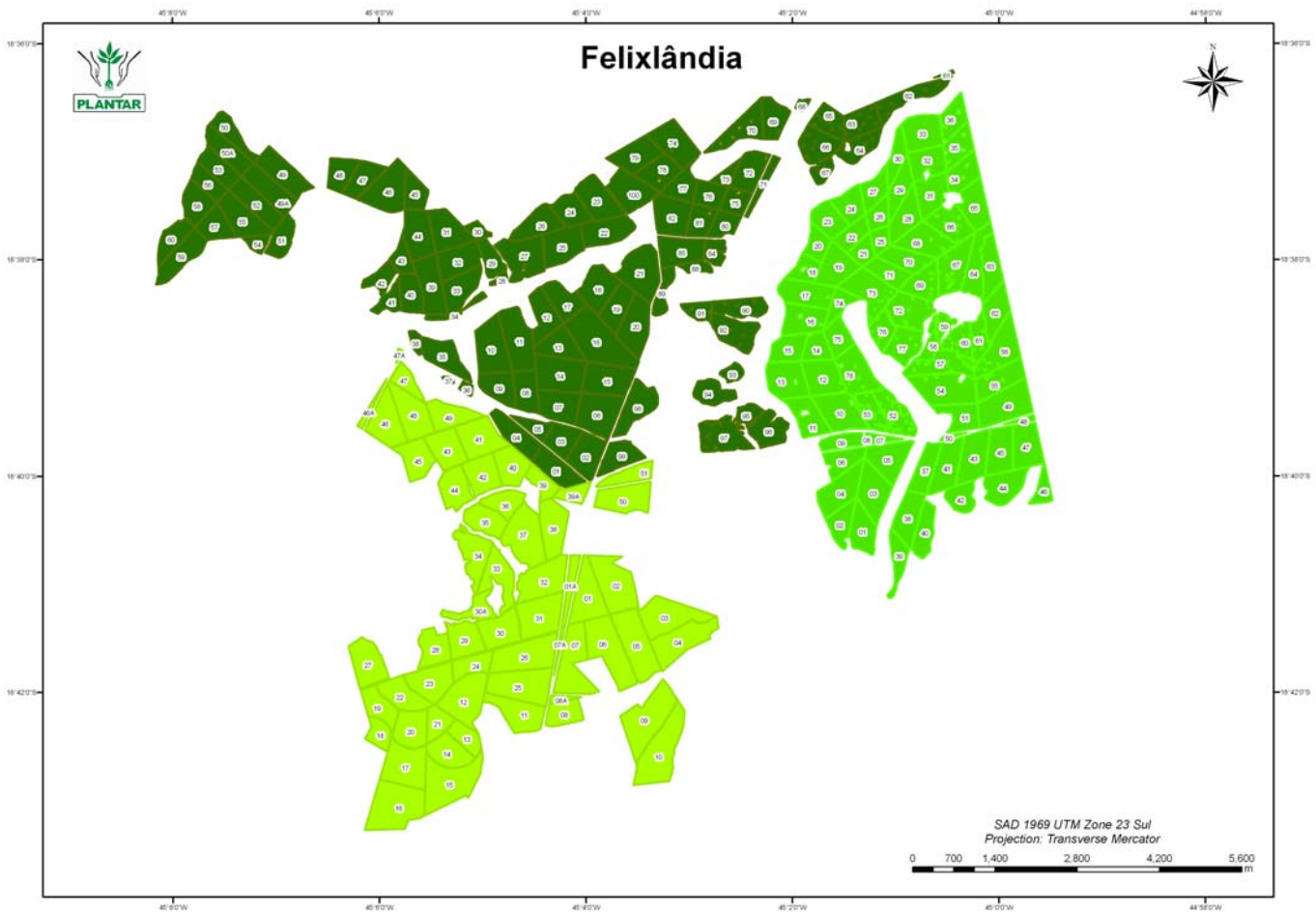
7.4 VERIFICATION OF MONITORING PROCEDURES

The verification of monitoring procedures and results is a requirement of CDM projects. The verification processes are intended to ensure that the project has achieved the net removals by sinks as outlined in the project documents. The verification is expected to be undertaken in periodic intervals, e.g. every five years.

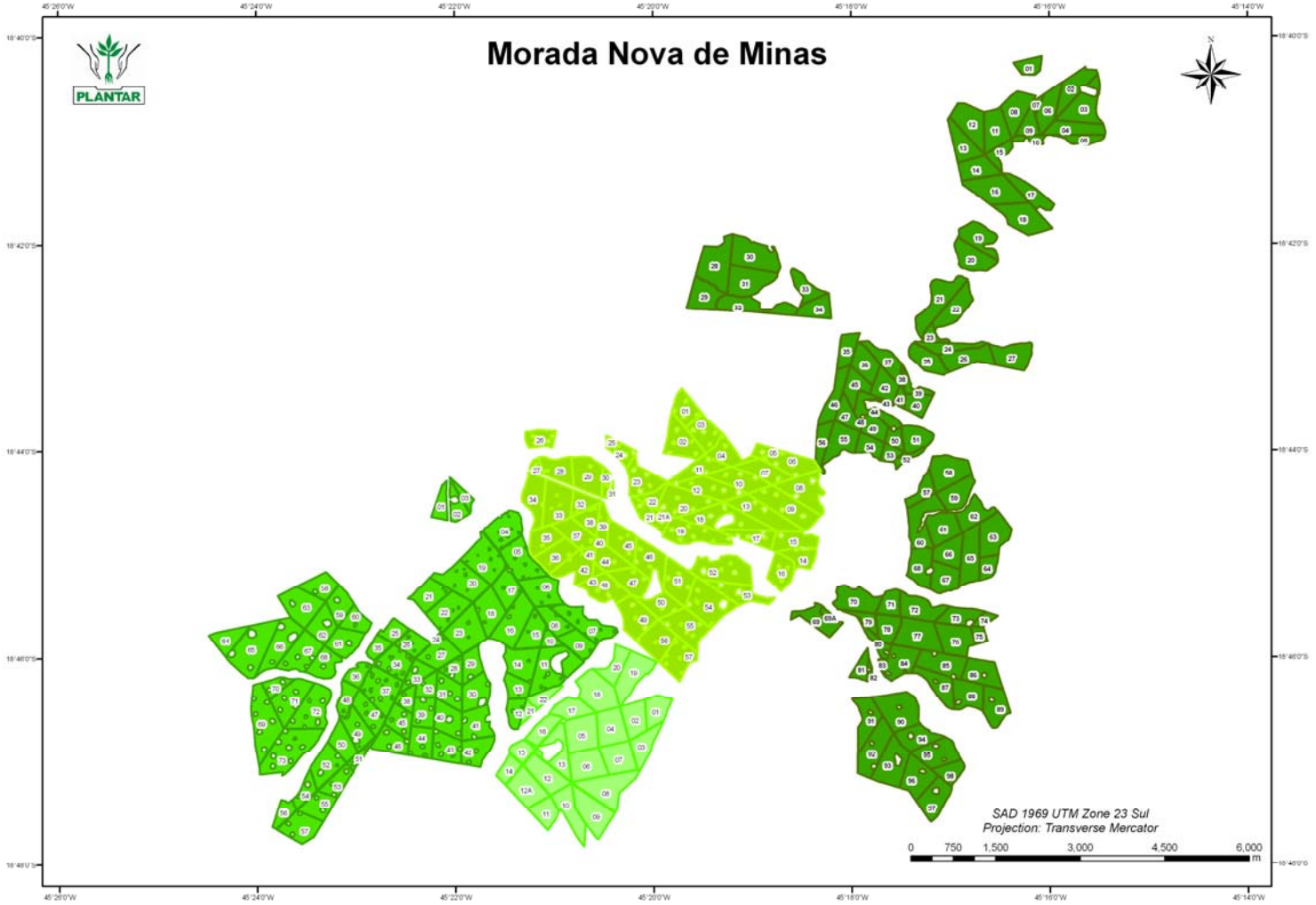
Annex 5

Project Boundary location maps and list of details about each discrete area of the project

MG03



MG04


Morada Nova de Minas
PLANTAR
N
45°26'0"W
45°24'0"W
45°22'0"W
45°20'0"W
45°18'0"W
45°16'0"W
45°14'0"W
18°40'0"S
18°42'0"S
18°44'0"S
18°46'0"S
18°48'0"S
SAD 1969 UTM Zone 23 Sul
Projection: Transverse Mercator
0 750 1,500 3,000 4,500 6,000
m

LIST OF DETAILS ABOUT EACH DISCRETE AREA OF THE PROJECT

Forest Unit	Project	Stand ID Umber	AREA (ha)	Forest Unit	Project	Stand ID Umber	AREA (ha)
MG03	Buritis	01	41,52	MG03	Buritis	47	15,90
MG03	Buritis	01A	12,93	MG03	Buritis	48	40,07
MG03	Buritis	02	51,75	MG03	Buritis	49	28,22
MG03	Buritis	03	48,90	MG03	Buritis	50	37,97
MG03	Buritis	04	46,18	MG03	Buritis	51	19,06
MG03	Buritis	05	27,09	MG03	Riachão	01	26,57
MG03	Buritis	06	57,74	MG03	Riachão	02	31,61
MG03	Buritis	07	50,74	MG03	Riachão	03	23,87
MG03	Buritis	07A	2,32	MG03	Riachão	04	28,13
MG03	Buritis	08	22,26	MG03	Riachão	05	12,33
MG03	Buritis	08A	3,92	MG03	Riachão	06	43,89
MG03	Buritis	09	59,36	MG03	Riachão	07	28,68
MG03	Buritis	10	60,49	MG03	Riachão	08	26,36
MG03	Buritis	11	38,00	MG03	Riachão	09	26,55
MG03	Buritis	12	48,98	MG03	Riachão	10	42,96
MG03	Buritis	13	18,96	MG03	Riachão	11	45,25
MG03	Buritis	14	30,26	MG03	Riachão	12	28,83
MG03	Buritis	15	59,99	MG03	Riachão	13	28,61
MG03	Buritis	16	63,39	MG03	Riachão	14	45,76
MG03	Buritis	17	46,80	MG03	Riachão	15	40,62
MG03	Buritis	18	16,51	MG03	Riachão	16	66,43
MG03	Buritis	19	24,93	MG03	Riachão	17	26,45
MG03	Buritis	20	32,00	MG03	Riachão	18	34,63
MG03	Buritis	21	18,57	MG03	Riachão	19	26,29
MG03	Buritis	22	30,65	MG03	Riachão	20	38,41
MG03	Buritis	23	36,76	MG03	Riachão	21	46,22
MG03	Buritis	24	20,68	MG03	Riachão	22	33,93
MG03	Buritis	25	52,67	MG03	Riachão	23	36,01
MG03	Buritis	26	52,11	MG03	Riachão	24	24,54
MG03	Buritis	27	37,06	MG03	Riachão	25	35,96
MG03	Buritis	28	27,62	MG03	Riachão	26	29,88
MG03	Buritis	29	30,47	MG03	Riachão	27	43,05
MG03	Buritis	30	34,65	MG03	Riachão	28	3,42
MG03	Buritis	30A	19,92	MG03	Riachão	29	16,84
MG03	Buritis	31	45,26	MG03	Riachão	30	7,61
MG03	Buritis	32	44,77	MG03	Riachão	31	35,12
MG03	Buritis	33	33,95	MG03	Riachão	32	32,70
MG03	Buritis	34	35,09	MG03	Riachão	33	29,60
MG03	Buritis	35	27,97	MG03	Riachão	34	7,23
MG03	Buritis	36	22,41	MG03	Riachão	35	30,32
MG03	Buritis	37	52,79	MG03	Riachão	36	3,55
MG03	Buritis	38	37,36	MG03	Riachão	37	1,21
MG03	Buritis	39	16,10	MG03	Riachão	38	5,73
MG03	Buritis	39A	12,68	MG03	Riachão	39	36,67
MG03	Buritis	40	28,87	MG03	Riachão	40	23,31
MG03	Buritis	41	39,59	MG03	Riachão	41	13,64
MG03	Buritis	42	30,51	MG03	Riachão	42	15,32
MG03	Buritis	43	32,27	MG03	Riachão	43	14,19

Forest Unit	Project	Stand ID Umber	AREA (ha)	Forest Unit	Project	Stand ID Umber	AREA (ha)
MG03	Buritis	44	29,55	MG03	Riachão	44	36,55
MG03	Buritis	45	29,85	MG03	Riachão	45	19,46
MG03	Buritis	46	38,91	MG03	Riachão	46	43,18
MG03	Buritis	46A	4,83	MG03	Riachão	47	23,62
MG03	Riachão	48	21,59	MG03	Riachão	100A	23,09
MG03	Riachão	49	35,18	MG03	Jacaré	01	27,83
MG03	Riachão	49A	32,40	MG03	Jacaré	02	21,49
MG03	Riachão	50	20,22	MG03	Jacaré	03	36,59
MG03	Riachão	50A	26,25	MG03	Jacaré	04	37,19
MG03	Riachão	51	21,07	MG03	Jacaré	05	33,91
MG03	Riachão	52	30,64	MG03	Jacaré	06	21,15
MG03	Riachão	53	23,77	MG03	Jacaré	07	5,26
MG03	Riachão	54	8,65	MG03	Jacaré	08	0,78
MG03	Riachão	55	35,22	MG03	Jacaré	09	15,49
MG03	Riachão	56	18,21	MG03	Jacaré	10	39,84
MG03	Riachão	57	23,86	MG03	Jacaré	11	28,86
MG03	Riachão	58	26,07	MG03	Jacaré	12	34,43
MG03	Riachão	59	32,39	MG03	Jacaré	13	37,29
MG03	Riachão	60	21,55	MG03	Jacaré	14	18,52
MG03	Riachão	61	0,94	MG03	Jacaré	15	23,61
MG03	Riachão	62	28,88	MG03	Jacaré	16	31,95
MG03	Riachão	63	24,95	MG03	Jacaré	17	35,01
MG03	Riachão	64	21,05	MG03	Jacaré	18	16,00
MG03	Riachão	65	21,38	MG03	Jacaré	19	33,48
MG03	Riachão	66	30,29	MG03	Jacaré	20	16,30
MG03	Riachão	67	10,44	MG03	Jacaré	21	13,90
MG03	Riachão	68	3,15	MG03	Jacaré	22	18,70
MG03	Riachão	69	24,03	MG03	Jacaré	23	24,74
MG03	Riachão	70	31,66	MG03	Jacaré	24	22,43
MG03	Riachão	71	9,71	MG03	Jacaré	25	11,63
MG03	Riachão	72	28,63	MG03	Jacaré	26	15,12
MG03	Riachão	73	8,70	MG03	Jacaré	27	19,99
MG03	Riachão	74	36,99	MG03	Jacaré	28	28,14
MG03	Riachão	75	16,72	MG03	Jacaré	29	22,54
MG03	Riachão	76	19,79	MG03	Jacaré	30	18,16
MG03	Riachão	77	21,57	MG03	Jacaré	31	29,06
MG03	Riachão	78	26,89	MG03	Jacaré	32	26,47
MG03	Riachão	79	32,49	MG03	Jacaré	33	35,13
MG03	Riachão	80	16,68	MG03	Jacaré	34	23,81
MG03	Riachão	81	20,38	MG03	Jacaré	35	22,31
MG03	Riachão	82	35,74	MG03	Jacaré	36	20,96
MG03	Riachão	84	12,66	MG03	Jacaré	37	24,40
MG03	Riachão	85	32,87	MG03	Jacaré	38	31,17
MG03	Riachão	88	7,87	MG03	Jacaré	39	18,26
MG03	Riachão	89	14,15	MG03	Jacaré	40	23,83
MG03	Riachão	90	24,25	MG03	Jacaré	41	33,83
MG03	Riachão	91	12,07	MG03	Jacaré	42	19,32
MG03	Riachão	92	32,17	MG03	Jacaré	43	35,51
MG03	Riachão	93	8,25	MG03	Jacaré	44	30,86

Forest Unit	Project	Stand ID Umber	AREA (ha)	Forest Unit	Project	Stand ID Umber	AREA (ha)
MG03	Riachão	94	21,35	MG03	Jacaré	45	31,91
MG03	Riachão	95	10,88	MG03	Jacaré	46	11,70
MG03	Riachão	96	27,75	MG03	Jacaré	47	33,20
MG03	Riachão	97	37,52	MG03	Jacaré	48	2,35
MG03	Riachão	98	34,08	MG03	Jacaré	49	45,92
MG03	Riachão	99	25,11	MG03	Jacaré	50	1,48
MG03	Riachão	100	12,50	MG03	Jacaré	51	23,85
MG03	Jacaré	52	27,28	MG04	Tamanduá	26	26,64
MG03	Jacaré	53	20,61	MG04	Tamanduá	27	27,23
MG03	Jacaré	54	47,28	MG04	Tamanduá	28	40,84
MG03	Jacaré	55	30,68	MG04	Tamanduá	29	25,02
MG03	Jacaré	56	38,76	MG04	Tamanduá	30	39,31
MG03	Jacaré	57	32,69	MG04	Tamanduá	31	34,09
MG03	Jacaré	58	11,79	MG04	Tamanduá	32	27,75
MG03	Jacaré	59	7,82	MG04	Tamanduá	33	16,12
MG03	Jacaré	60	19,09	MG04	Tamanduá	34	17,90
MG03	Jacaré	61	16,86	MG04	Tamanduá	35	16,24
MG03	Jacaré	62	26,78	MG04	Tamanduá	36	21,36
MG03	Jacaré	63	26,61	MG04	Tamanduá	37	19,07
MG03	Jacaré	64	28,82	MG04	Tamanduá	38	1,97
MG03	Jacaré	65	29,18	MG04	Tamanduá	39	7,59
MG03	Jacaré	66	30,41	MG04	Tamanduá	40	13,95
MG03	Jacaré	67	36,33	MG04	Tamanduá	41	4,80
MG03	Jacaré	68	34,85	MG04	Tamanduá	42	18,62
MG03	Jacaré	69	26,36	MG04	Tamanduá	43	1,33
MG03	Jacaré	70	24,52	MG04	Tamanduá	44	18,09
MG03	Jacaré	71	21,63	MG04	Tamanduá	45	18,03
MG03	Jacaré	72	35,34	MG04	Tamanduá	46	20,91
MG03	Jacaré	73	40,70	MG04	Tamanduá	47	14,92
MG03	Jacaré	74	14,84	MG04	Tamanduá	48	0,62
MG03	Jacaré	75	20,74	MG04	Tamanduá	49	15,96
MG03	Jacaré	76	17,78	MG04	Tamanduá	50	8,89
MG03	Jacaré	77	26,97	MG04	Tamanduá	51	20,25
MG03	Jacaré	78	38,47	MG04	Tamanduá	52	6,06
MG04	Tamanduá	01	11,24	MG04	Tamanduá	53	8,07
MG04	Tamanduá	02	24,08	MG04	Tamanduá	54	14,15
MG04	Tamanduá	03	30,38	MG04	Tamanduá	55	27,42
MG04	Tamanduá	04	22,22	MG04	Tamanduá	56	13,96
MG04	Tamanduá	05	9,78	MG04	Tamanduá	57	13,55
MG04	Tamanduá	06	21,02	MG04	Tamanduá	58	32,98
MG04	Tamanduá	07	2,66	MG04	Tamanduá	59	23,49
MG04	Tamanduá	08	25,83	MG04	Tamanduá	60	31,80
MG04	Tamanduá	09	12,26	MG04	Tamanduá	61	26,30
MG04	Tamanduá	10	6,05	MG04	Tamanduá	62	21,38
MG04	Tamanduá	11	26,83	MG04	Tamanduá	63	31,83
MG04	Tamanduá	12	29,75	MG04	Tamanduá	64	11,13
MG04	Tamanduá	13	21,45	MG04	Tamanduá	65	30,80
MG04	Tamanduá	14	21,57	MG04	Tamanduá	66	21,66
MG04	Tamanduá	15	10,62	MG04	Tamanduá	67	22,82

Forest Unit	Project	Stand ID Umber	AREA (ha)	Forest Unit	Project	Stand ID Umber	AREA (ha)
MG04	Tamanduá	16	37,29	MG04	Tamanduá	68	24,12
MG04	Tamanduá	17	20,64	MG04	Tamanduá	69	19,21
MG04	Tamanduá	18	33,31	MG04	Tamanduá	69A	3,47
MG04	Tamanduá	19	24,21	MG04	Tamanduá	70	28,66
MG04	Tamanduá	20	25,68	MG04	Tamanduá	71	14,85
MG04	Tamanduá	21	35,09	MG04	Tamanduá	72	26,79
MG04	Tamanduá	22	25,05	MG04	Tamanduá	73	17,84
MG04	Tamanduá	23	6,92	MG04	Tamanduá	74	5,93
MG04	Tamanduá	24	14,70	MG04	Tamanduá	75	6,20
MG04	Tamanduá	25	20,76	MG04	Tamanduá	76	29,86
MG04	Tamanduá	77	36,73	MG04	Buriti Grande	30	5,47
MG04	Tamanduá	78	17,13	MG04	Buriti Grande	31	1,05
MG04	Tamanduá	79	9,13	MG04	Buriti Grande	32	12,40
MG04	Tamanduá	80	9,26	MG04	Buriti Grande	33	32,43
MG04	Tamanduá	81	9,81	MG04	Buriti Grande	34	26,12
MG04	Tamanduá	82	2,15	MG04	Buriti Grande	35	20,41
MG04	Tamanduá	83	1,63	MG04	Buriti Grande	36	23,11
MG04	Tamanduá	84	26,27	MG04	Buriti Grande	37	22,09
MG04	Tamanduá	85	28,90	MG04	Buriti Grande	38	13,75
MG04	Tamanduá	86	25,18	MG04	Buriti Grande	39	10,60
MG04	Tamanduá	87	22,51	MG04	Buriti Grande	40	1,53
MG04	Tamanduá	88	24,29	MG04	Buriti Grande	41	3,24
MG04	Tamanduá	89	24,95	MG04	Buriti Grande	42	24,02
MG04	Tamanduá	90	39,71	MG04	Buriti Grande	43	2,79
MG04	Tamanduá	91	24,25	MG04	Buriti Grande	44	18,33
MG04	Tamanduá	92	32,78	MG04	Buriti Grande	45	25,19
MG04	Tamanduá	93	33,59	MG04	Buriti Grande	46	26,66
MG04	Tamanduá	94	22,33	MG04	Buriti Grande	47	22,16
MG04	Tamanduá	95	27,61	MG04	Buriti Grande	48	25,82
MG04	Tamanduá	96	28,50	MG04	Buriti Grande	49	29,35
MG04	Tamanduá	97	25,34	MG04	Buriti Grande	50	19,00
MG04	Tamanduá	98	13,88	MG04	Buriti Grande	51	28,27
MG04	Buriti Grande	01	18,20	MG04	Buriti Grande	52	39,08
MG04	Buriti Grande	02	29,87	MG04	Buriti Grande	53	20,75
MG04	Buriti Grande	03	21,72	MG04	Buriti Grande	54	38,93
MG04	Buriti Grande	04	19,29	MG04	Buriti Grande	55	31,10
MG04	Buriti Grande	05	6,64	MG04	Buriti Grande	56	27,37
MG04	Buriti Grande	06	24,12	MG04	Buriti Grande	57	25,68
MG04	Buriti Grande	07	22,34	MG04	Mutuca	01	11,22
MG04	Buriti Grande	08	32,29	MG04	Mutuca	02	11,53
MG04	Buriti Grande	09	38,96	MG04	Mutuca	03	6,36
MG04	Buriti Grande	10	25,02	MG04	Mutuca	04	29,04
MG04	Buriti Grande	11	19,94	MG04	Mutuca	05	32,10
MG04	Buriti Grande	12	26,23	MG04	Mutuca	06	29,22
MG04	Buriti Grande	13	31,94	MG04	Mutuca	07	30,84
MG04	Buriti Grande	14	15,18	MG04	Mutuca	08	16,41
MG04	Buriti Grande	15	21,56	MG04	Mutuca	09	19,56
MG04	Buriti Grande	16	20,46	MG04	Mutuca	10	7,06
MG04	Buriti Grande	17	16,69	MG04	Mutuca	11	40,65

Forest Unit	Project	Stand ID Umber	AREA (ha)	Forest Unit	Project	Stand ID Umber	AREA (ha)
MG04	Buriti Grande	18	34,99	MG04	Mutuca	12	12,89
MG04	Buriti Grande	19	34,22	MG04	Mutuca	13	14,92
MG04	Buriti Grande	20	33,63	MG04	Mutuca	14	27,31
MG04	Buriti Grande	21	13,85	MG04	Mutuca	15	21,76
MG04	Buriti Grande	21A	2,56	MG04	Mutuca	16	36,30
MG04	Buriti Grande	22	8,63	MG04	Mutuca	17	21,30
MG04	Buriti Grande	23	23,70	MG04	Mutuca	18	27,01
MG04	Buriti Grande	24	7,91	MG04	Mutuca	19	37,22
MG04	Buriti Grande	25	3,97	MG04	Mutuca	20	36,69
MG04	Buriti Grande	26	13,06	MG04	Mutuca	21	22,29
MG04	Buriti Grande	27	3,89	MG04	Mutuca	22	28,44
MG04	Buriti Grande	28	20,73	MG04	Mutuca	23	36,20
MG04	Buriti Grande	29	30,19	MG04	Mutuca	24	0,38
MG04	Mutuca	25	12,15	MG04	Mutuca	61	22,36
MG04	Mutuca	26	15,94	MG04	Mutuca	62	19,89
MG04	Mutuca	27	25,32	MG04	Mutuca	63	32,23
MG04	Mutuca	28	10,41	MG04	Mutuca	64	17,53
MG04	Mutuca	29	15,98	MG04	Mutuca	65	45,80
MG04	Mutuca	30	23,17	MG04	Mutuca	66	30,18
MG04	Mutuca	31	19,96	MG04	Mutuca	67	30,76
MG04	Mutuca	32	12,53	MG04	Mutuca	68	20,01
MG04	Mutuca	33	13,29	MG04	Mutuca	69	43,84
MG04	Mutuca	34	22,99	MG04	Mutuca	70	9,65
MG04	Mutuca	35	10,89	MG04	Mutuca	71	29,83
MG04	Mutuca	36	12,59	MG04	Mutuca	72	36,47
MG04	Mutuca	37	34,88	MG04	Mutuca	73	47,20
MG04	Mutuca	38	9,91	MG04	Vitória	01	19,59
MG04	Mutuca	39	18,31	MG04	Vitória	02	23,31
MG04	Mutuca	40	23,22	MG04	Vitória	03	21,56
MG04	Mutuca	41	24,67	MG04	Vitória	04	30,13
MG04	Mutuca	42	21,50	MG04	Vitória	05	33,62
MG04	Mutuca	43	21,91	MG04	Vitória	06	30,53
MG04	Mutuca	44	20,62	MG04	Vitória	07	27,38
MG04	Mutuca	45	17,39	MG04	Vitória	08	38,54
MG04	Mutuca	46	20,05	MG04	Vitória	09	34,07
MG04	Mutuca	47	21,41	MG04	Vitória	11	17,44
MG04	Mutuca	48	13,60	MG04	Vitória	12	27,32
MG04	Mutuca	49	20,96	MG04	Vitória	12A	29,37
MG04	Mutuca	50	19,67	MG04	Vitória	13	24,38
MG04	Mutuca	51	5,31	MG04	Vitória	14	11,35
MG04	Mutuca	52	25,13	MG04	Vitória	15	11,57
MG04	Mutuca	53	14,52	MG04	Vitória	16	15,11
MG04	Mutuca	54	11,41	MG04	Vitória	17	24,04
MG04	Mutuca	55	19,27	MG04	Vitória	18	34,28
MG04	Mutuca	56	10,94	MG04	Vitória	19	32,37
MG04	Mutuca	57	25,81	MG04	Vitória	20	18,34
MG04	Mutuca	58	18,48	MG04	Vitória	21	6,76
MG04	Mutuca	59	17,97	MG04	Vitória	22	10,44
MG04	Mutuca	60	14,83				

Annex 6

Annex III of the Brazilian Interministerial Commission on Global Climate Change's First Resolution

REFORESTATION AS RENEWABLE SOURCE
OF WOOD SUPPLIES FOR INDUSTRIAL USE IN BRAZIL

CONTRIBUTIONS OF THE PLANTAR PROJECT TO SUSTAINABLE DEVELOPMENT

March 2008

Summary

Introduction

This document is elaborated in compliance with Resolution n^{o} 1, of September 11th 2003, of the Brazilian Interministerial Commission on Global Climate Change in regards to the contributions of a CDM project activity to the country's sustainable development (referred to as Annex III).

The project activity of "Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil" aims at the establishment of additional plantations to enable the use of renewable charcoal in the production of pig iron and is expected to result in a twofold benefit to the climate[1]:

- generation of carbon stocks and of net GHG removals by sinks additional to those that would occur in the absence of such plantations;
- use of sustainable sources of biomass in place of GHG intensive fuels, contributing to GHG emission reductions in one of Brazil's major development drivers, i.e. the iron and steel industry.

Both of the above mentioned benefits have been integrated into a single and first-of-a-kind project under implementation by the project entity, i.e. the establishment of plantations to supply all of its iron production with charcoal from renewable wood supplies instead of GHG intensive reducing agents. The project's integrated activities are implemented in response to the CDM incentive, which will allow the project entity to overcome the constraints to the supplies of sustainably produced biomass[2]. As the harvesting of the project plantations established in 2000, commences in 2007/2008, the project entity will be the first of its kind to have 100% of its iron production based on renewable charcoal, a solid biofuels. The project entity has also developed a partially integrated project to reduce de emissions of methane in the carbonization process.

In accordance with the Brazilian DNA regulations, this document is organized in the following sections, encompassing social and environmental aspects that go beyond the expected benefits to the climate brought about by the project: (a) local environmental sustainability, (b) development of working conditions and job creation, (c) income distribution, (d) capacity building and technology development, and (e) regional integration with other sectors.

The project is expected to result in various social and environmental benefits, as per a comprehensive Monitoring Plan. The project activity contributes to the creation of more than one thousand direct jobs. There is a significant gender component, with a large participation of women in the production of cloned sprouts. In addition, several indicators on biodiversity (fauna and flora), soil conservation, water and social aspects have been incorporated and will be subject to monitoring throughout the project's lifetime. One third of the total areas involved in the project entity farms are devoted to the preservation and regeneration of native *cerrado* vegetation. This is the second largest biome of the country and many environmental and scientific groups considers the *cerrado* as one of the most

[1] The production of iron and steel requires thermal energy and reducing agents to convert iron ore into primary iron through a reduction process using blast furnace technology Whereas 98.55 % of the world's iron ore reduction in blast furnaces was undertaken using coal coke, only 0.73% of the global iron production in 2005 used charcoal from renewable biomass from planted forests supplies as the reducing agent (Research on IISI 2006; SINDIFER, 2006 and AMS, 2006. Whereas the decisions on the type of reducing agents do not determine the quantity of iron produced or demanded, the choice of reducing agents significantly influences GHG emissions. As such, marginal incentives like the CDM can play a major role in the choice of reducing agents for iron manufacturing.

[2] As the projects are integrated, common data, information and analyses that relate the components are used to establish and corroborate the baseline scenarios, and to fulfill additionality criteria transparently, in spite of different calculation, accounting and monitoring methods.

important Brazilian “hot spots” once only 20% of its original area is conserved in its natural state[3]. The multiple benefits of the project arise from long-term backward and forward linkages within the iron industry supply chain. It integrates rural and industrial development through the production and use of renewable biomass, in an industry locked in fossil fuels (see Unruh 2000).

The proposed project is a pioneer activity within its sector scope and it possesses a substantial potential to be replicated by other organizations in Brazil, in Latin America and the Caribbean as well as in many African and Asian developing countries. The project and its sustainability indicators are a first-of-a-kind experience in the Brazilian iron industry, clearly contributing to the CDM’s sustainable development dividend at an industrial scale.

[3] In the *cerrado*, or Brazilian Savanah, more that 10,000 vegetal species are identified. Whereas it is estimated that the Brazilian Amazon rainforest has approximately 80% of its original cover, the cerrado, reaches only 20% of its primary 204 million hectares according to the Conservação Internacional do Brasil. Available at: http://www.conservation.org.br

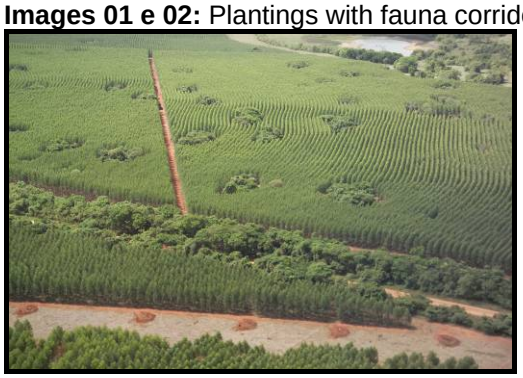
PROJECT'S CONTRIBUTIONS TO SUSTAINABLE DEVELOPMENT

a) Contribution to Local Environmental Sustainability

Brazil is the country with the largest proportion of its territory covered with forests, representing 64.3% (544 millions of hectares) of the country's total area. Whereas native vegetation represents 99.1% of the country's total forest area, forest plantations represent only 0.9% of the area (LEITE, 2003). Nonetheless there is a large historical, current, and expected deficit of forest plantations in Brazil, which is widely recognized by local, state and federal governments, universities, research institutes, by NGOs and private sector entities. This is attributable to many barriers that prevent the establishment of sustainable and sufficient forest plantations (see Section C of the PDD).

In this context, the project activity has special relevance. It promotes the establishment of additional eucalyptus forest plantations on degraded or less productive lands, generating a renewable source of energy and promoting sustainable development in the region. An indirect but not less important benefit is the contribution to diminish the pressure on native forests in Brazil. Historically, native forests have fulfilled the great demand for wood in the country, which resulted in immense deforestation of many native biomes of the country.

Images 01 e 02: Plantings with fauna corridors in the MG03 unit.



The project entity is strongly committed to sustainable development, following strict international patterns in respect to the environment, according to Principles and Criteria of the FSC – Forest Stewardship Council. Some of the indicators of this commitment are presented below:

- Adoption of minimal cultivation techniques;
- Adoption of soil conservation techniques;
- Monitoring of water quality and quantity;
- Preservation of legal reserve areas and reduction of fragmentation;
- Substantial reduction of water consumption in the sprouts nursery, through water reutilization and micro-dripping technology;
- Monitoring of flora and fauna;
- Formation of fauna corridors through recovery areas including direct planting of native species as well as favoring natural regeneration;
- Development of special projects with neighboring communities to promote social development at the local level;
- Generation of good quality jobs, in line with strict policies regarding health and safety, and training.

Before starting fauna and flora monitoring, the company elaborated a complete biodiversity diagnosis (characterization). Some of the pictures below were taken by a camera trap[4] during the biodiversity mapping (avifauna and mammals)[5] carried out by SETE – Solution and Environmental Technology in the cultivation units located in the areas of Felixlândia and Morada Nova de Minas.

Image 03: Seriema (*Cariama cristata*) Registered by camera trap 3 in Jacaré farm reserve area in January 2004.

Image 04: Lobo-guará registration (*Chrysocyon brachyurus*) in the Cerrado Reserve area of Jacaré farm in May 2004.

Image 05: Documentation of deer (*Mazama americana*) in bordering forest (23K 469118 UTM 7926433) in Buriti Grande farm in June 2004. The specie had been registered in January in the same place.

Image 06: Puma (*Puma concolor*) registered by camera trap 1 (23K 469118 / UTM 7926433) in the bordering Forest situated in Buriti Grande farm. The specie documentation occurred in January 2004.

The project is grounded on a comprehensive forest management plan, which includes several provisions to protect and enhance local and regional environmental welfare, as follows:

- Adoption of the minimum cultivation technique.
- Soil preparation based on a technology that aims at minimum physical changes, preventing erosion and the silting up of water courses;
- Planting on contour lines or across soil declivity as to avoid erosion and the silting up of water courses;
- No deforestation practices.
- Minimum use of pesticides according to the principles of human's health and environment protection defined by law and international agreements;
- Monitoring of the soil nutrients' replacement;
- Minimization of the traffic of vehicles in the harvesting areas, avoiding soil compaction and facilitating the refill of ground waters.
- The harvesting remainders (leaves and branches) are left on the soil as a protection cover and as an extra measure to allow for the recycling of soil nutrients.

[4] Photographic trap shot by a photo and thermo-sensitive device.
[5] Report "*Projeto de mapeamento da biodiversidade nas Fazendas Jacaré-Riachão e Buriti Grande"* – Camera Trap Picture File, August 2005.

Image 07: Harvesting residues left on the ground in MG02.

The project activity holds a management system of plastic packages of pesticides used in the planting stewardship. Every empty package goes through a triple wash and it's returned to the Receive and Return Package Center in Montes Claros, MG in order to be recycled. The fertilizer packages (plastic and paper) are also directed to recycling.

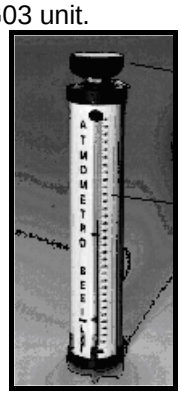
An important action in this project activity is the treatment of the water used in the sprout nursery before it is returned to the water body. The water goes through a system composed by decantation tanks which contribute for contention of solids and reduction of nutrients concentration throughout stewardship of aquatic plants and algae population. The physical, chemical and bacterial parameters of the creek that provides water resources are constantly monitored and transparently controlled.

Another initiative is the correct destination of oils used in the project activity. The discard of oils used in the operation and maintenance of machinery are stored into a tank and sent to recycling organizations. The black smoke rates of machinery are also subject to ongoing monitoring provisions.

An important partnership with the Federal University of Viçosa (UFV) started in 2006 to further study the effects of eucalyptus cultivation on water resources. A project micro-watershed (Riacho Fundo watershed) located in the MG 03 unit, Felixlândia, will be monitored as to evaluate the water flow variation vis-a-vis the characteristics of the water shed and the local pluviometrical rate. The variation of the ground water level will be assessed thru piezometers; and the evapo-transpiration thru an atmometer. Superficial leakage inside the planting due to effective precipitation; and the infiltration rate in different positions of the terrain will also be addressed. All equipment was acquired by Plantar within the project activity. Some of them are shown below:

Image 08: Pluviometer installed at the MG03 unit.

Image 09: Atmometer installed at the MG03 unit.



This micro-shed project is currently in its gauging phase. Later on, the shallow cut impacts will be analyzed as well as the different types of harvesting, in light of mosaic crop stewardship practices. The overall objective is to corroborate, at the local level, the evidence provided by the literature, regarding the sustainability of forest plantations in terms of water resources and to optimize the micro-shed balance.

Image 10: Picture of spillway at the MG03 unit.

Image 11: Measurement shelter at the MG03 unit.

In respect to native vegetation inside the project activities area, the company preserves expressive portions of the *Cerrado* ecosystem, and adopts the mosaic stewardship practice. It promotes the formation of ecologic corridors in a way to interconnect conservation areas and favor wild animal transit and to enhance biodiversity. The charts below show the current typology of conservation areas in the project region:

Chart 01: General classification of Conservation Areas of MG02 Unit.

The Plantar Group - Social and Environmental Development Department **MG02 UNIT (Buenos Aires Farm/Others - Curvelo and Felixlândia/MG) Year 2007**		
General Classification of the Conservation Areas		
Typology	**Area (ha)**	**Percentage**
Campo limpo (Cl)	120.13	3.16%
Campo Cerrado (Cc)	71.51	1.88%
Cerrado (Ce)	2,178.71	57.25%
Regenerating *Cerrado* (Cer)	162.50	4.27%
Cerradão (Cd)	13.44	0.35%
Deciduous and semi-deciduous seasonable forests (Fs)	42.39	1.11%
Harvested planted forest (Fpc)	138.59	3.64%
Non harvested planted forest (FpSc)	19.56	0.51%
Bordering forest (Fc)	428.60	11.26%
Vereda (Ve)	219.47	5.77%
Pastureland (Pa) (Under recovery)	401.12	10.54%
Gravel pit (cascal) (Under recovery)	9.40	0.25%
Total	3,805.42	100.00%
Source: Landsat 7 images April 2002 and Plantar's maps - Area obtained by automatic planimetry on the images, which may lead to some distortions in relation to the areas obtained by topographic assessment.		

Chart 02: General classification of Conservation Areas of MG03 Unit.

The Plantar Group – Social and Environmental Department

MG03 UNIT (Jacaré/Riachão III Farms- Felixlândia/MG) - Baseline Year 2002

Protection Area General Classification		
Classification	**Área (ha)**	**Percentage**
Açudes	24.80	0.68%
Campo Cerrado (Cc)	201.13	5.53%
Campo de Várzea (Cv)	36.55	1.01%
Campo Hidromórfico (Ch)	12.37	0.34%
Cerradão (Cd)	578.89	15.93%
Cerrado (Ce)	1,031.90	28.39%
Bordering forests (Fc)	534.60	14.71%
Decidual forest(Fd)	16.20	0.45%
Regenerating *Cerrado* (Cr)	959.41	26.39%
Regenerating Exposed Soil (Se)	23.91	0.66%
Vereda (Ve)	215.11	5.92%
Total	3,634.87	100.00%

Source: Landsat 7 images April 2002 and Plantar's maps - Area obtained by automatic planimetry on the images, which may lead to some distortions in relation to the areas obtained by topographic assessment.

Chart 03: General classification of Conservation Areas of MG04 Unit.

The Plantar Group – Social and Environmental Department		
MG04 UNIT (Buriti Grande Farm - Morada Nova de Minas/MG) Baseline Year 2002		
Protection Area General Classification		
Classification	**Area (ha)**	**Percentage**
Campo Cerrado (Cc)	254.70	9.83%
Campo Hidromórfico (Ch)	18.91	0.73%
Cerradão (Cd)	195.88	7.56%
Cerrado (Ce)	911.16	35.17%
Bordering forest (Fc)	448.83	17.32%
Deciduous forest (Fd)	151.10	5.83%
Regenerating Cerrado (P)	321.92	12.42%
Regenerating Exposed Soil	43.27	1.67%
Vereda (Ve)	245.32	9.47%
Total	2,591.09	100.00%
Source: Landsat 7 images April 2002 and Plantar's maps - Area obtained by automatic planimetry on the images, which may lead to some distortions in relation to the areas obtained by topographic assessment.		

The project area's flora and fauna diagnosis indicates the presence of many protected species. These areas are preserved with the goal of maintaining the region's biodiversity. The table below represents the species of protected flora in the project's area.

Chart 04: Project's Flora Conservation Status.

SPECIES	PRESERVATION STATUS			EVENT VISAGE
	ENDANGERED	PRESUMED ENDANGERED	RESTRICTION TO HARVEST	
ANACARDIACEAE				
Myracrodruon urundeuva	Vulnerável Vulnerable	-	-	Floresta Decidual Deciduous Forest
ANNONACEAE				
Duguetia furfuracea	-	X	-	*Cerrado, Campo Cerrado*
Duguetia lanceolata	-	X	-	*Bordering Forest*
Rollinea laurifolia	-	X	-	Floresta Semidecidual Semi-deciduous Forest
BIGNONIACEAE				
Tabebuia aurea	-	-	X	*Cerrado*
Tabebuia impetiginosa	-	-	X	Floresta Decidual Deciduous Forest
Tabebuia ochracea	-	-	X	*Cerrado, Campo Cerrado*
Tabebuia roseo-alba	-	-	X	Floresta Decidual Deciduous Forest
Tabebuia serratifolia	-	-	X	Floresta Ciliar e Semidecidual Ciliar and Semi-deciduous Forest
CARYOCARACEAE				
Caryocar brasiliense	-		X	Cerrado, Campo Cerrado, Cerradão
OPILIACEAE				
Agonandra brasiliensis	-	X	-	*Cerrado*, Floresta Semidecidual Semi-deciduous Forest

Source: Del Rey (2000)

The tables below present the amount and the classification of species of avifauna and mammals existing in the project's area.

Chart 05: Registered fauna species in the project area.

Social and Environmental Development Department **# of registered fauna species – avifauna and mammals.** Buenos Aires Farm – Jacaré/Riachão Farm – Buriti Grande Farm			
Group	**number of species**		
	MG02 UNIT	**MG03 UNIT**	**MG04 UNIT**
Avifauna	159	172	174
Mammals	29	36	38
Species of a certain importance (endemic, endangered, etc)	8	19	15

Source: Del Rey (2000)

Chart 06: Avifauna and mammals of project activity areas.

MG02 UNIT	MG03 UNIT	MG04 UNIT
Avifauna: 159 bird species registered, distributed into 43 families. Among them, six are endangered species in Minas Gerais State: Rhea (*Rhea americana*), *Platalea ajaja*, *Mycteria americana*, *Ara ararauna*, *Culicivora caudacuta* and *Sicalis flaveola*. Moreover, 4 c*errado* endemisms were found (SILVA, 1995c): *Antilophia galeata*, *Cyanocorax cristatellus*, *Charitospiza eucosma* and *Saltator atricollis*. **Mammals:** 29 mammal species registered, including 2 endangered species: the *Tamandua tetradactyla* and the lobo-guara (*Chrysocyon brachyurus*).	**Avifauna:** 172 bird species registered, distributed into 40 families. Among the 172 birds, 6 are endangered species: rhea (*Rhea americana*), *Platalea ajaja*, *Mycteria americana*, *Ara ararauna*, *Culicivora caudacuta* and *Sicalis flaveola*. Among the endemic birds, it is mentioned: *Antilophia galeata*, *Cyanocorax cristatellus*, *Charitospiza eucosma* and *Saltator atricollis* **Mammals:** 38 mammal species registered, including 9 at some point of risk or relevancy in Minas Gerais or Brazil: *Myrmecophaga tridactyla*; *Tamandua tetradactyla*, *Cabassous* sp.; *Chrysocyon brachyurus*; *Leopardus pardalis*; *Puma concolor*; *Tapirus terrestris*; *Tayassu* pecari; *Phyllomys brasiliensis*.	**Avifauna:** 174 bird species registered, distributed into 39 families. Important to note that the *Platalea ajaja* and the *Ara ararauna* are endangered species in Minas Gerais. The *Hylocryptus rectirostris*, *Antilophia galeata*, *Cyanocorax cristatellus*, *Charitospiza eucosma* and the *Saltator atricollis* are endemic birds of the *cerrado* region. **Mammals:** 38 mammal species registered, including 9 species at some level of risk or relevancy: *Myrmecophaga tridactyla*; *Tamandua tetradactyla*, *Cabassous* sp.; *Chrysocyon brachyurus*; *Leopardus pardalis*; *Puma concolor*; *Tapirus terrestris; Tayassu* pecari; *Phyllomys brasiliensis*.

Source: Del Rey (2000)

The Plantar biodiversity monitoring plan encompasses the following programs and objectives:

- Preserving the protected areas of its properties;
- Knowing the existent protected areas through the characterization of fauna and flora and the quality of superficial and ground waters;
- Establishing a stewardship program in the protected areas in order to guarantee their preservation and expansion, as a factor for the overall environmental balance;
- Monitoring the existent natural resources, recording variations related to flora, fauna and water resources,
- Establishing regeneration programs for degraded areas.

Image 12: Conservation areas inside project activity area (MG02).

Several methodologies are applied to monitor changes that might occur within the project's area: (a) natural disasters, such as fires and plagues; (b) anthropogenic actions, as thinning, harvest and other forestry practices that contribute to changes in the carbon pools.

The project entity's Social and Environmental Department adapted the social carbon methodology[6] to project entity's context. Overall, the project's contribution to sustainable development is monitored through 24 indicators within 6 different resources, as below:

Chart 07: Indicators adapted according to Social Carbon Methodology.

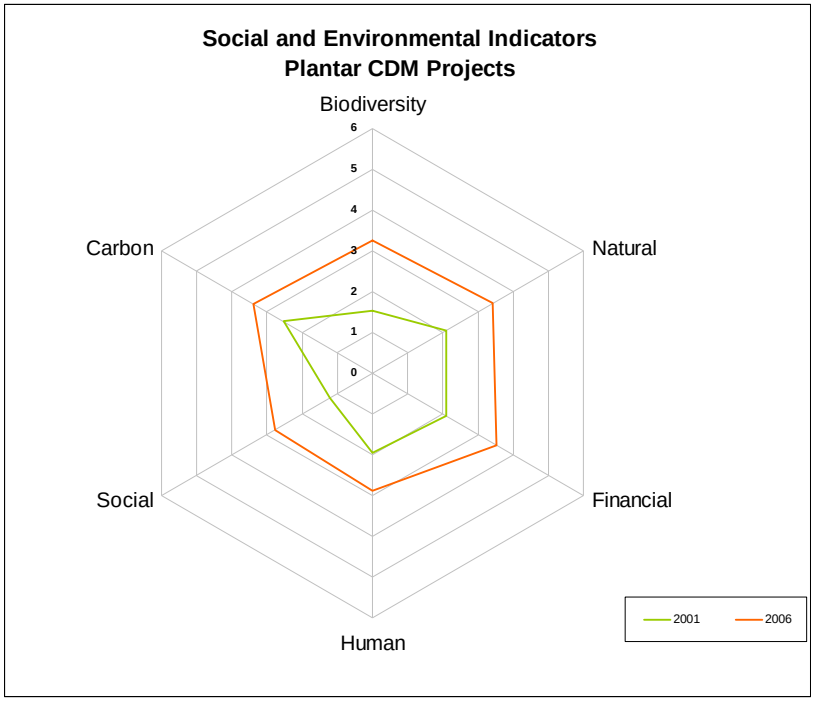
Resources	2001	2006	Indicator	# of indicators	Weight	2001 Index	2006 Index
Biodiversity	2	3	1 Information on local flora and fauna	4	0,8	1	4
			1.2 Endangered species		0,7	2	5
			1.3 Protect areas conservation integrity		0,9	3	5
			1.4 Use of biodiversity by stakeholders		0,6	2	3
Natural Resources	2	3	2.1 Project's total protected area	4	0,7	3	5
			2.2 Protected areas connection		0,9	2	4
			2.3 Soil preservation and management		0,6	3	5
			2.4 Quantity and quality of water		0,9	3	4
Financial Resources	2	4	3.1 Government taxes	2	0,6	3	5
			3.2 Development of local market		0,8	3	5
Human Resources	2	3	4.1 Quality of work conditions	6	0,6	3	4
			4.2 Illiteracy		0,7	4	5
			4.3 Education		0,6	3	5
			4.4 Work safety		0,8	2	3
			4.5 Health at work		0,8	2	4
			4.6 Access to leisure		0,7	3	4
Social Resources	1	3	5.1 Management of social issues	5	0,9	2	4
			5.2 Relationship with stakeholders (Duties)		0,8	2	4
			5.3 Support to social development		0,7	2	4
			5.4 Selection and support to social projects		0,8	1	4
			5.5 Relation with the supply chain		0,5	1	2
Carbon	3	3	6.1 Transactional costs (Methodology, etc)	3	0,7	1	3
			6.2 CDM eligibility		0,7	6	5
			6.3 Social and environmental benefits from project's implementation		0,9	3	5

Source: Plantar's Social and Environmental Department.

The following graph shows the evolution of the indicators since the project started until 2006. The company's goal is to reach sustainability levels close to 5 and 6 in all indicators.

[6] D. Rezende e S. Merlin, Carbono Social – Agregando valores ao desenvolvimento sustentável, 2003.

Image 13: Social and Environmental indicators adapted according to the Social Carbon methodology.



Source: Plantar's Social and Environmental Department.

Images 14 e 15: Project's conservation areas *(Cerrado* Ecosystem) MG02.

b) Contribution for the improvement of working conditions and net employment generation

More than a thousand new direct jobs in rural areas are created within the Project. According to the Minas Gerais Forestry Association (AMS), three indirect jobs are generated for every direct job in forest plantations. As the project has a strong replication potential, the table below illustrates the potential of net-employment generation within the forestry based industry:

Segment/Activity	Number of employees	
	Direct (1)	Indirect (2)
Forestry Plantations – Implementation/Maintenance	42,300	169,200
Wood carbonization	47,600	190,400
Fuel wood – including transport	4,200	8,400

Source: AMS; SINDIFER; FIEMG; Companies from the sector.
Notes: (1) In the activity; (2) In the production chain.

The project operations include a wide range of activities: clone research and cloned sprouts production, the complete formation of the forest plantations and forest stewardship. In the production of cloned sprouts, Plantar contributes to employment generation for women. Only in the clonal gardens located in Curvelo there are 354 women working[7], which corresponds to 68% of the total employees in the activity. The clonal garden employees practice routine gymnastics within the company's labor quality policy. Besides, 36 clonal garden employees are part of Plantar Choir, which aims at improving self-esteem and motivating the company's employees.

Image 16: Woman working in the clone garden at the MG02 unit.

Image 17: Labor exercising at the MG02 unit.

Image 18: Plantar Choir at the MG02 unit.

As part of its Quality System, Plantar runs a Training Program to build up working capacity. Special focus is given to the use of Individual Protection Equipment (EPI's), recycling, and environmental care. Environmental supervisors are trained and qualified in a way to conduct an environmental education programs with the local communities.

Image 19: Environmental lecture in the municipal school Pedro Epifânio, in Felixlândia.

Image 20: Employees in training at the MG02 unit.

The company also runs the Medical Control and Occupational Health Program (PCMSO) which monitors employee's health conditions. The health professionals who manage the program provide routine and emergency care, which are appropriately registered and recorded. Within the project, Plantar also offers private health care insurance (Unimed Health Plans) to all of its field employees, without any extra costs. These benefits have

[7] Number of employees as of January 2008, according to the Plantar's Human Resources Department.

significantly improved the access to health services and the actual health conditions of the project employees, who have often experienced precarious conditions before.

Different campaigns are carried out by the company annually. The most relevant ones regarding employee's health are listed below:

Chart 08: Plantar's promoted campaigns.

Name of the Company	Period	Actions
Diabetes Campaign	World Diabetes Day (November 14th)	381 capillar glucose exams, informative leaflet distribution and orientations
Vaccination Campaign	During the months of March, August and November.	931 doses of: Yellow Fever, diphtheria, tetanus, mumps, measles and rubella. Partnership with the Municipal Health Secretary.
Sexually Transmitted Disease Campaign	During the SIPATR in October.	Partnership with the Sete Lagoas Health Regional and the Technical School of Nursery Monsenhor D'Amato. Distribution of 576 condoms.
Prevention of Uterine Cervix Cancer Campaign	March, September, October and December	Partnership with the Sete Lagoas Health Regional and the Technical School of Nursery Monsenhor D'Amato. Educational lectures, cytology collection, medicinal treatments and specialized consults whenever necessary.
Dengue Campaign	March	Partnership with the Sanitary Watch. Leaflet distribution with the paycheck and educational lecture.

Plantar values its employees offering new personal and professional development opportunities, with training projects, qualification, educational programs. The company develops and supports a series of social actions in the regions where the project activities are taking place. As an example, the Environment Week promoted by the project entity supports activities to improve environmental responsibility. Drama skits, educational video presentations and other activities are used as methodological tools. The company also promotes the Work Accident Prevention Week, with lectures about health and safety, and family planning, Sexually Transmissive Diseases, defensive driving, body posture education, and motivation programs. Games, contests and parties for the employees are also carried out.

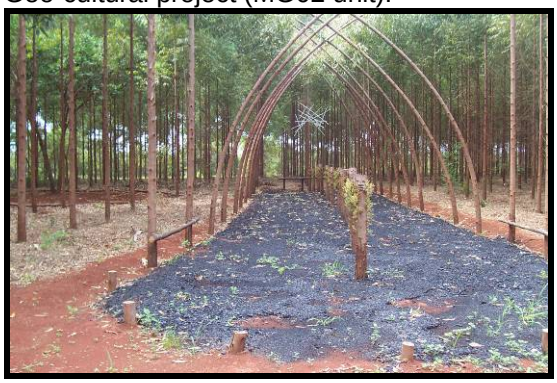
In order to improve communication channels between Plantar and local communities, Plantar developed a bi-monthly newsletter called "*Jornalipto*" that provides information about the company's activities. *Jornalipto*, which has editions of 4000 copies, is distributed for local and global stakeholders A illustrative copy of a "Jornalipto" - English version - is attached (Appendix I).

Another communication channel developed by Plantar is called "*Seu Espaço*" ("Your Space", in English). It has the purpose of promoting the company integration with the community, establishing procedures for questions, suggestions, compliments and complaints from employees and neighbors. Suggestion collecting boxes, along with communication forms were especially elaborated to encourage comments about all company's activities and were installed in the project units located in Curvelo, Felixlândia

and Morada Nova de Minas. These forms are collected by the environmental supervisor, according to a flow chart of directives for the consideration of comments.

Plantar has supported a project of preservation, restoration, and creation of earth based art pieces, through the implementation of visual symbols within the project's plantation areas. The goal is to strengthen the community's feeling of territoriality, of belonging to the place they live, and to serve as local references for spatial orientation for pedestrians. These cultural references established on the landscape of the forest plantation areas can improve the relationship between the company and the community. They are inspired by the "*Land art"* concept and aim at promoting the geo-cultural development of monoculture plantations landscapes, by minimizing their visual impact.

Image 21: "Cathedral", the first art piece of Geo-cultural project (MG02 unit).



c) Contribution for income distribution

The reference scenario where the Project is located (municipalities of the Center-North region of Minas Gerais), is characterized by a combination of climate and soil features, which make the cultivation of short cycle agricultural products difficult, especially for the production of food crops. The concentrated precipitation in few months of the year and the existence of acid soils with low fertility make the region of the project an area of predominant extensive cattle raising. To a certain extent, the illegal exploitation of native forests to supply the unsustainable market of non-renewable charcoal have also taken place. These and other features related to lack of credit access and to the regional economic conditions result in low levels of per capita income in the project region.

On the other hand, the natural conditions of the project regions are appropriate to forestry activities.The investments required to the establishment of dedicated plantations with long-term maturity cycles allow the maintenance of low rotation jobs.

The local jobs created within the project contribute to a better income distribution in the region, increasing the individual income of residents and the quality of life of the families in the project area. This is significantly attributable to the project's labor policy which gives priority to the hiring of local residents, within the rural and urban areas closer to the project areas.

The project also provides additional income for rural households that use their animals (e.g. donkeys, and asses.) to collect and transport forestry remainders (eucalyptus bark) from the Carbonization Units.

Within the project, Plantar also contributes for the income distribution in the region through the monthly promotion of the Rural Producers Fair, where small producers, neighbors to the project areas, have access to the project premises to sell their handmade products to the company's employees and other guests, e.g. cheese, cakes, breads and sweets. During the fair, some leisure and educational activities take place, as willing to promote interaction of the project employees with the surrounding neighborhood.

Image 22: Neighborhood production fair at MG02.

Image 23: Biscuits produced by neighbors and sold at the MG02 fair.

Image 24: Delicacies produced by neighbors and sold at the MG02 fair.

Through a partnership with the Association of Beekeepers of Felixlândia (Apifelix) initiated in 2005, Plantar promotes beekeeping as an alternative income generation activity for the residents of the project region. The entity is composed by 14 producers and is located in São Geraldo do Salto – Felixlândia District (MG). The Apifelix managed to insert this initiative in the Fight Against Rural Poverty Project (PCPR), implemented by the Federal Government. The beekeeping activity offered the community members higher incomes and an opportunity for learning new skills in a more sustainable economic activity, generating genuine local development. The annual production is of 800 kilos of honey, distributed in seven apiaries with 45 beehives.

Image 25: Beekeeping project in a partnership with Apifelix (MG03).

Image 26: Beekeeper in the plantation area at MG03.

Another activity that contributes to the generation of income is the adoption of a decentralized procurement policy within the project, which brings substantive additional benefits to local markets. As an example, the meals for the field and clonal garden workers are provided by companies from the municipalities around the project units.

Since 2004, Plantar has been supporting an activity that seeks the preservation and the sustainable use of the *minhocuçu* (*Rhinodrilus alatus*) in the municipalities of Paraopeba, Caetanópolis, and Curvelo, in the project region. The initiative's goals include: (a) the legalization of the extraction and trade of *minhocuçu*; (b) the reduction of existing social conflicts, such as land illegal appropriation and fires; (c) the long term preservation of the

minhocuçu; and (d) the generation of extra income for small land owners by allowing them to lend areas in their property for the *minhocuçu* sustainable extraction.

d) Contribution for capacity building and technological development

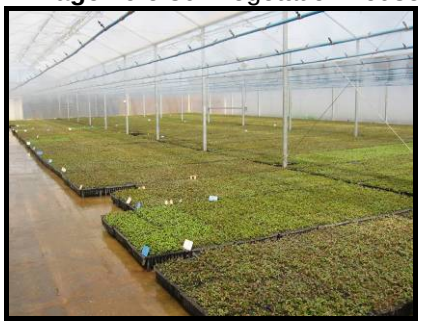
The Project is based on sustainable practices of forestry production and on advanced planting and sprout cloning technology developed by the project entity. This is a national technology that has a vast replication potential to other Latin American, African and Asian countries. Some aspects involving this technology are listed below.

- Research and Development: The Company has a research program focused on the attainment of eucalyptus clones of high productivity. The program is conducted throughout field experiments based on advanced scientific protocols. In order to illustrate the scale of the research, for every 2.000 trees researched, only one new clone is selected. The strict selection criteria and the spreading methods guarantee a genetic improvement which intends to continuously generate, introduce and select hybrid eucalyptus clones, adapted to the edapho-climatic conditions of the geographical region at stake. In the long-run, the program allows for the continuous improvement of productivity and wood quality, resulting in a lower demand for areas and in lower costs.

Image 27 e 28: Clone garden at planting unit MG02.

- Clone reproduction: The project entity is a pioneer in the production of mini-sprouts, and in other advanced techniques for the production of cloned sprouts. The mini-sprouts are selected from main trees, developed in field experiments, and disseminated in a clone nursery totally equipped with clone gardens and greenhouses with electronically controlled temperature and humidity. The production process of a sprout takes approximately 100 days. After this period, the sprouts are taken to the field for planting.

Image 29 e 30: Vegetation house and greenhouse (MG02).



- Planting process: The implementation process of a forest, involves techniques to minimize the soil impact and optimize the use of water. Fertilizers, herbicides, and plague control products are used according to best forestry practices. Using a high-end technology, the company constantly develops new techniques and equipment for the planting and, maintenance of forest plantations.

Image 31: Clone sprouts in tubes (MG02 unit).

Image 32: Planter developed by the company (MG02 unit).

- Productivity management: It guarantees that the expected production outcomes are monitored since the first months of the planting, in accordance with an inventory system. The survival levels of the plantings are monitored. Whenever necessary, replanting occurs to guarantee a minimum survival level of 95%. Due to its good planting practices, the company frequently overcomes this level.

- Quality management system: the forestry activity is totally integrated with the company's quality program, which follows the principles of ISO9001:2000. Each operational procedure is registered, described and monitored as per formal principles and standard procedures. Social and environmental aspects are monitored by a specific department in the company, as to ensure a higher conformity with legislation, corporative principles, and forestry certification demands.

- Fire monitoring: In order to assist the detection of fire spots the company has developed a constant surveillance system, equipped with 40-meter-high fire observation towers, strategically located in the project region (see picture below). The company has fire-trucks with high-pressure hoses capable of supporting many fire brigades. The company's Legal and Permanent Preservation Reserves and the surrounding areas are also included in the system.

Image 35: Fire towers in MG02 unit.

Image 36: Fire truck at the MG02 unit.

The social and environmental monitoring programs of the project areas are performed by a team of almost 30 people, known as “Friends of the Forest”. The team is formed by employees who act as environmental education supporters in the communities, and address multiple issues, including fire prevention, and the prohibition of hunting and fishing in reserve areas.

e) Contribution for regional integration and articulation with other sectors

As previously mentioned, the project activity is part of a broader project of the company, which ultimately aims to supply the production of iron with renewable charcoal, a solid biofuel which allows for net GHG removals and emission reductions in the iron industry supply chain. Thus, the activities of this reforestation project are directly linked to the sustainable development of rural areas, with its sustainable plantations, as well as to the state’s industrial economy.

The project’s iron production Plant is located in the iron and steel cluster of Minas Gerais. The most significant part of the State economy is based on the iron and steel industry, which sums more than 60 companies that represents approximately 60% of the Brazilian production[8]. Iron and steel exports accounts for 5.92 % of the total amount of exports in the State, only behind the iron ore (22.98%) and coffee (13.41%).[9]

Since the great part of the iron and steel production is based on coal coke, there is a huge potential for replication of the Plantar project in the State and in other regions of Brazil. Through the integration with public policies, partnerships with the private sector, the company has been presenting the experience with its CDM projects as a sustainable alternative. As a matter of fact, the Minas Gerais Climate Change Forum, which encompasses governmental bodies, private sectors and civil society representatives, has already established the promotion of similar CDM projects in the iron industry as one of its priorities. The State Government of Minas Gerais is also incorporating the project concept in several of its sustainable development policies (see Section C of the PDD).

As the production of iron and steel is expected to double in Brazil over the next ten years, the alternatives provided by this first of a kind project activity may play a major role in the decarbonization of a strategic industry in the country, which is currently locked into the use of fossil fuels. Therefore, this project activity is inserted into a very important context of supplying renewable energy to a sector of great socioeconomic impact at the regional and national levels.

The project activity promotes the socioeconomic integration with other rural and urban sectors, enhancing regional development and generating direct and indirect jobs in agricultural, industrial and services sectors, as initially discussed in Section D.

Another example of how the project is integrated with local social development is the “Grade A Student Program” aimed at strengthening local education. Started in 2007, the program was developed to assure that the employees’ children are registered in schools and to stimulate academic performance during the school year, by rewarding the best students. It takes into consideration the Abrinq Foundation’s fifth commitment: “Assure that the employees register their under 18 children at school and undertake efforts to make all students attend classes”.

[8] *http://www.sindifer.com.br/inst.html*
[9] *http://www.desenvolvimento.mg.gov.br/index.php?option=com_content&task=view&id=24&Itemid=38*

Since 2001, through the Abrinq - Friends of Children Company Foundation, Plantar keeps its commitment with the promotion of children and youth's rights, as per the following actions:

- Investments in Childhood and Youth Funds (FIAs), instruments that allow companies and individuals to reserve part of their income taxes to social actions;
- According to the 10th ABRINQ commitment, Plantar invests 1% of its billing in projects that beneficiates children and teenagers.

In the 2007 edition of the "Grade A Program", more than one hundred students, from 6 to 16 years-old, enrolled to participate in the evaluation of their grades. The program was initially conducted the project units of Curvelo and Felixlandia and the prizes included a computer, digital camera and a MP4 player. The program resulted in great participation of the employees, supporting and stimulating the education of their children.

Image 36: Grade A Student Program.

Image 37: *Arte na Infância* Project in a local school of Cobu, Curvelo.

Starting at the end of 2007, the "Producer Friend Project" was created as an initiative to make viable improvements in the rural communities neighboring the Plantar's planting units. The first beneficiated communities were Meleiros and Paiol de Cima, in the rural area of Curvelo, MG. Aiming to stimulate, improve and make viable the rural production in these areas, the company has executed several actions. As an example, attending request of the Community Association of Meleiro's Residents, Plantar concluded the initial phase for fighting woodworms in the region. Around 20 houses were visited by the team that applied anti-woodworms products, following safety and environmental prescriptions.

The interaction with other sectors also occurs by means of technical visits from universities, governments, clients and members of the communities neighboring the project activities in Curvelo and the project's iron mill, located in Sete Lagoas. These visits promote the transfer of the know-how developed by Plantar to other companies in Brazil and abroad. So far, the visitors to the project site include:

- ✓ Brazilian Designated National Authority
- ✓ Brasil-Australia Chamber of Commerce
- ✓ Brazilian Institute for the Environment and Natural Resources (IBAMA)
- ✓ Brazilian National Development Bank (BNDES)
- ✓ CCAP Members (Center for Clean Air Policy), USA
- ✓ China's Institute of Geology and Geophysics
- ✓ Climate Change Forum of the Minas Gerais State
- ✓ Consul of Uruguay
- ✓ Economic Services, National Treasury Department of Africa
- ✓ Federation of Industries of the State of Minas Gerais
- ✓ Head of the Service of Multilateral Cooperation Environment Ministry of Territorial Planning, Water and Environment - Morocco
- ✓ Interamerican Institute for Global Change Research
- ✓ Intergovernmental Panel on Climate Change (IPCC) (10 specialists and technicians)
- ✓ Interministerial Global Climate Change Commission, Ministry of Science and Technology (MCT) of Brazil
- ✓ Japan Delegation (Mitsubishi and NEDO - New Energy and Industrial Technology Development Organization)
- ✓ Kerala Government Mission, Índia
- ✓ Members of the Embassy of the Netherlands in Brazil.
- ✓ Members of the NGO Friends of the Earth
- ✓ Members of the NGO Robin Wood from Germany
- ✓ Minas Gerais Development Bank
- ✓ Minas Gerais Environmental Defense Association
- ✓ Minas Gerais Silviculture Association
- ✓ Ministry for the Environment of New Zealand
- ✓ New Zealand Climate Change Ambassador
- ✓ Patients from the Psychosocial Care Center (CAPS) of Curvelo
- ✓ President of the Zôo-Botânica Foundation
- ✓ Regional Labor Authority
- ✓ School of Agriculture Luiz de Queiroz (ESALQ), USP
- ✓ Several Members of the Minas Gerais State Congress and of the Brazilian National Congress
- ✓ State Forestry Authority of China
- ✓ State Secretary of Agriculture of Minas Gerais
- ✓ State Secretary of Economic Development of Minas Gerais
- ✓ State Secretary of Environment and Sustainable Development of Minas Gerais
- ✓ State Secretary of Science and Technology of Minas Gerais

- ✓ Sub-secretary of Energy Policy of the Minas Gerais Development, Mining and Iron/Steel Secretary
- ✓ Thunderbird University, USA
- ✓ Uganda Delegation, Africa
- ✓ World Bank

Within the project activity, Plantar also cooperates with graduate researchers. The project entity has been supporting the work of many masters and doctorate students regarding CDM project activities. Since the project's starting date more than 20 graduate and undergraduate students from Brazil and abroad have analyzed the project's case. The project entity also develops long-term research partnerships with research institutes and university, which are directly related with the project activity. The main research partnerships are listed below:

1. Soil compactness study - Research to evaluate the capacity of supporting loads and the impact of different equipment used in harvesting and transshipment of wood. Initiated in partnership with the Lavras Federal University (UFLA).

2. Study on the effect of salinity and ways to apply the irrigation water in the development of eucalyptus mini-sprouts. Started in 2007, in partnership with Diamantina Federal University.

3. Study on forestry nutrition using "NUTRICAL C Program", based on the collection of soil samples. It performs calculations for specific fertilization practices to increase productivity. Conducted in partnership with the Viçosa Federal University (UFV).

4. Study on the impacts of the eucalyptus stewardship and its decomposition rate. In progress, in partnership with Viçosa Federal University (UFV).

5. Research of patterns, calibration and validation of the 3-PG model, developed to estimate the productivity of the forestry population in the *cerrado* region of Minas Gerais. This research is part of the thesis of a student from the Viçosa Federal University (UFV).

6. Study developed in partnership with Viçosa Federal University (UFV) to develop of a filter to reutilize the water from the clone gardens, exterminating water pathogenic germs and to optimize the use of water, reducing the fertilization and agrochemical residues.

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2) D. Rezende and S. Merlin (2003). Carbono Social – Agregando valores ao desenvolvimento sustentável.

3) SETE/Plantar S.A (Agosto 2005). Mapeamento da Biodiversidade - (Avifauna e Mastofauna) - Fazenda Jacaré/Riachão: documento técnico.

4) SETE/Plantar S.A (Agosto 2005). Mapeamento da Biodiversidade - (Avifauna e Mastofauna) - Fazenda Buriti Grande: documento técnico.

5) SETE/Plantar S.A (Agosto 2005). Projeto de Mapeamento da Biodiversidade nas Fazendas Jacaré-Riachão e Buriti Grande – Arquivo de Fotos das Câmera Traps.

6) Del Rey Engenharia Ltda (October 2005). Environmental Impact Study (EIA) and Environmental Impact Report (RIMA).

7) AVIVA Ltda (2005). Projeto de Sinalização Geo-Sócio-Cultural em Áreas de Monocultura.

8) Plano de Manejo Florestal da Plantar (2008). Gerência de Desenvolvimento Sócio Ambiental e Gerência de Operações – Revised version 045-2008.

Links of interest:

- The Plantar Group – www.plantar.com.br
- Minas Gerais Industries Federation (FIEMG) - http://www4.fiemg.com.br/
- Forest Stewardship Certification (FSC) - http://www.fsc.org/en/
- UNFCCC - http://cdm.unfccc.int
- World Bank –Prototype Carbon Fund - http://carbonfinance.org
- Brazilian Ministry of Science and Technology (MCT) - http://www.mct.gov.br
- Minas Gerais State's Secretary of Economical Development - http://www.desenvolvimento.mg.gov.br
- ABRINQ Foundation - http://www.fundabrinq.org.br
- AM0041 Methodology (Methane mitigation) at the UNFCCC website - http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_6AUG884HINVSFPDZN0LQY4N581BSF9
- AR-AM0005 (A/R) Methodology at the UNFCCC website – http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_5L2RY88A7GXK4PNTG2JEH50SBU3HOH

APPENDIX I

PLANTAR NEWSLETTER - # 23 – 2007.

Jornalipto

40 YEARS

PLANTAR NEWSLETTER Nº 23 • 2007

CHARCOAL

Eucalyptus is transformed into energy

The wood and its byproducts supply a variety of industries

Do you remember the story of Felisberto, from the last issue of the *Jornalipto*? Then you remember the wood-burning stove from the farm. For many, many years, people have used wood as a source of energy. In Brazil, at the end of the 16th century, it was used in the pre-industrial foundries that produced tools for use in the fields.

Iron, which is present in these tools, is a chemical element found in nature in mineral form, normally as an oxide. In the production of iron for industrial purposes, the iron ore must undergo a "reduction" process, whereby charcoal plays a fundamental role. It provides carbon for the chemical reaction and as such it is responsible for transforming the iron ore into pig iron, from which steel is made.

But what would happen if even today, the charcoal came from the Cerrado or the Atlantic Forest? During the last four decades, Brazil made a great leap forward to obtain wood from eucalyptus forests, through an environmentally correct process. In the production of iron and steel, Plantar opted to use "renewable charcoal" made from eucalyptus trees within a pioneer project to fight climate change under the Kyoto Protocol. By using charcoal from eucalyptus forests instead of coal coke or of wood from our native forests it is a major way to contribute with fighting climate change.

According to data from the Minas Electricity Company (Companhia Energética de Minas Gerais, or Cemig), in 2005, wood and its byproducts accounted for the largest percentage of energy demand in the State, equal to 32.7% of the total. Besides supplying the steelmaking and iron alloy industries, which are quite representative of the Minas Gerais state economy, this input also supplies farms, bakeries and pottery factories. This is the case of Felisberto, who opted to use eucalyptus wood for his wife, Maria, to make her pamonhas, which are soft corn cakes. See why in the next edition of the *Jornalipto*.

Production process

During the month of October, students from Interventor Alcides Lins State School and Indyu School, who work at the Environmental Education Center of Curvelo (CEAC), visited some of the production processes at Plantar. The idea was to show them how a eucalyptus forest preserved the Cerrado region in Minas. See below:

Students visit the Plantar Nursery, where the eucalyptus sprouts are "prepared" to be planted

The eucalyptus forests are surrounded by ecological corridors, which preserve the native plant and animal life. Everything is protected by the Plantar fire prevention system

In twelve days, the wood is transformed into charcoal, which is then transported to Plantar Siderúrgica, located in Sete Lagoas

After a seven year cycle, the wood is cut to be transformed into charcoal

The wood is piled into the brick kilns, with most rigorous security procedures possible

At one of the Plantar protected areas, the students see the preservation of the Cerrado region in practice

Children's Friend

ALUNO NOTA DEZ

The academic performance of the children of Plantar's collaborators in Curvelo, Felixlândia and Morada Nova de Minas, led to the creation of the "Aluno Nota Dez" (Grade A Student Program, in English). Launched this year, this initiative will award students, in 1st through 4th grades and 5th through 8th grades, between the ages of 6 and 16, who present the highest grade average for the 2007 school year. In general, this action, which will continue in 2008, abides by the fifth commitment of Abrinq: "Guarantee that employees enroll their children under the age of 18 in school and work to ensure that they all attend school." This year, the first place student will take home a computer. The student in second place will win a digital camera. The student in third place will receive an MP4 Player. The prizes will be awarded at the end of December.

Your space

Take part in the making of *Jornalipto*! Tell us your story or send us a message:

- By e-mail: comunicacao@plantar.com.br
- By post to: Dep. Socioambiental Fazenda Buenos Aires II, BR 135, km 165 - Zona Rural - Curvelo (MG) CEP: 35790-000

A socially responsible way

This is the philosophy of the Socio-environmental Department of Plantar

According to the Ethos Institute, one of the most important Civil Society Organizations of Public Interest (Oscip) in the country, corporate social responsibility is "the form of management that is defined by the ethical and transparent relation between the company and all the publics with which it relates for the establishment of business goals that are compatible with sustainable development of society (...)". At Plantar, this concept is part of the work philosophy of the Socio-Environmental Department and is present in every one of its initiatives.

Within the scope of this department's actions, in addition to the government and the citizens of the municipalities where the company is located, are the 200 families who live in the rural areas surrounding Plantar's farms, in the Center-North region of Minas Gerais. Knowing all the neighbors is one of the tasks. But, to be able to share the needs of the community, the team supports and works in partnership with the residents' associations. Everything is based on dialogue and the exchange of experiences.

Another of the department's activities is the development of social projects. These are actions and projects in the areas of education, health and safety, infrastructure, income generation and the environment, which are created whenever a need is identified and analyzed. Priority is given to children and adolescents. In general, one of the requirements for the initiatives created by Plantar is for the community to evolve and "stand on its own feet" with the project. For this reason, in 2008, the goal is to strengthen community associations even more, so that stronger and more legitimate solutions arise at the grass roots level.

Social responsibility also includes our collaborators. Internally, new opportunities for personal and professional development are offered, with projects designed to promote training, education and well-being.

The *Jornalipto* is the result of all this work. With each issue, a report, a new piece of information, a letter sent or an item of interest show socially responsible conduct. From the relationship with our neighbors to the creation of programs designed to generate income, Plantar believes that this is the true path of sustainable development.

Tiago Morais, Janaína Fonseca and Daniel Alves make up the team of Plantar's Socio-Environmental Department

My Roots

28 years ago, José Cláudio de Souza Alves left the municipality of Bom Sucesso (MG) for Curvelo (MG). The reason? To work at Plantar. Time passed, and Zé Cláudio, as he is called by his colleagues, married the Curvelo native Sandra Maria Rocha Alves. The result? He became a Curvelo native in his heart. Since August 2006, he has been the Plantar Administrative Supervisor at Três Marias (MG). But like all diligent students, he expects to graduate with a degree in Business soon; he commutes back and forth every day to the college in Curvelo, where his family also lives. During one of these trips, on November 9, there was Zé Cláudio applauding the presentation of the Plantar Choir and the Jesus Amigo Choir, at the Central do Brasil Square. And he soon demonstrated his roots in Curvelo and with Plantar "I had seen both choirs before, but this was the first time I saw a presentation like this. I like it very much and I felt that everyone was very excited and enthusiastic," he commented.

Zé Cláudio (on the left), during a presentation at Curvelo

FRIENDS

With an eye on the forests

Socio-Environmental monitoring is done by a team of almost thirty people

More than 21 thousand hectares of existing eucalyptus planted in the regions of Curvelo, Felixlândia and Morada Nova de Minas, and some ten thousand hectares of preservation areas - caring for all this seems like an impossible task, but it isn't. This task is performed by the "Friends of the Forest", a team of almost thirty people, who work in the fire fighting towers, highways and watchtowers located in Plantar's areas.

According to the Socio-Environmental and Occupational Safety Coordinator of Plantar, Tiago Morais, this group was created to aid in environmental education of the community, covering topics ranging from fires to hunting and fishing in reserves. "When we realized that monitoring also takes into account the routines of the neighbors, we decided to prepare the 'Friends of the Forest' to work in close proximity, with a focus on the relationship," he explained.

Beginning in 2008, Plantar will visit the residents to explain the team's role in the region. "The most important thing is to show our neighbors that they are also supported by this service, principally because it works to protect native vegetation," Tiago Morais emphasized.

"Friends of the Forest" perform tracking socio In the areas of Plantar

One of the fire trucks, with a high water pressure cannon

40 meters high, the tower helps to fight fires

Fighting Fires

From the end of June until the beginning of October, the Center-North region of Minas Gerais registers a high number of fires, which is a major concern to both Plantar and to many farmers in the region This is because in addition to the eucalyptus forests, the native plants and animals of the Cerrado region in Minas, which are protected by the reserve, are also at risk.

Three 40-meter high towers in Curvelo, and two in Felixlândia, help in the observation of possible fires. In Morada Nova de Minas, a lookout fulfills the same function. In the field, three fire trucks, with high pressure water cannons, offer support to several fire brigades, each with an average of with ten people. The groups undergo annual training and are on call during the critical periods of the dry season.

The "Friends of the Forest", initiative adds much to these actions. In addition to the technical support, the work of raising environmental awareness also calls on the community to participate to help protect local biodiversity. The Cerrado region is one of the richest biomes in Brazil. According to the Brazilian Institute of the Environment and Renewable Natural Resources (Ibama), there are 10 thousand species of plants, 837 species of birds, 161 species of mammals, 150 species of amphibians, in addition to a wide variety of invertebrates.

Global Warming

What is it and what must we do to reduce its effects?

Hurricanes, melting of polar ice caps, floods... For some years now, these catastrophes have become more and more common. The explanation is global warming, a climactic phenomenon characterized by an increase in the average temperature of the Earth's surface.

As a consequence, we see the greenhouse effect worsen. Contrary to what many believe, the greenhouse effect is not a natural villain. It is natural and necessary to maintain life on our planet. The Earth's atmosphere is formed by a layer of gases (e.g. carbon dioxide, methane, etc.). whose effect is similar to that of a greenhouse, thus the term "greenhouse gases" GHG. This means that when the Sun emits infrared radiation to the Earth, part of this radiation is reflected back and remains in our environment. Otherwise, our planet would be covered by ice.

However, the problem occurs when this layer of GHG "thickens". Scientific literature demonstrates that it is mostly due to the excessive burning of fossil fuels intensive in GHG, like gasoline, diesel and coal, which has been going on for several years. The higher the concentration of greenhouse gases in the atmosphere, the greater the imbalance between the energy that enters and leaves the Earth. This leads to climate change and the much-feared global warming.

Changing this scenario, in an industrialized world with enormous growth in the large metropolises around the world, may seem impossible, but it isn't. Reducing fossil fuel consumption, deforestation, adopting renewable energy and recycling materials are some of the most common examples. Cutting your time in the shower by half, optimizing energy consumption at home and saying no to waste fossil fuels are some of the attitudes that contribute to reducing this impact. And in your day-to-day life, one little change can make all the difference in the world.

On November 13, the director of the Research Center on Contemporary Brazil at the Advanced Studies in Social Sciences of Paris, Ignacy Sachs, visited the main offices of the Plantar Group, in Belo Horizonte. The Administrative Financial Director of Plantar S/A, Geraldo Moura, and the Carbon Project Manager, Fábio Marques were also present. At this meeting, Sachs spoke of the large Brazilian potential to reduce the emission of greenhouse gases, through a charcoal-based steel making model, using planted forests. He also emphasized the importance of giving international publicity to the technology adopted by Brazilian industries in the forest planting area.

FYI

The fourth report of the Intergovernmental Panel on Climate Change (IPCC) predicts that rainfall will be heavier in higher latitudes, but will diminish in most subtropical regions. In Brazil, global warming has already had a direct impact on the intensity of rainfall. In 2007, according to the Weather Research and Climate Study Center of the National Institute of Space Research (Inpe), rainfall will be less frequent, but more intense. This situation is harmful for agriculture, which needs lighter and more constant rain.

PLANTAR

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