Multi-Species Reforestation in Mato Grosso, Brazil

VCS Small Scale ARR Monitoring Report

ONF International

Multi-Species Reforestation in Mato Grosso, Brazil

VCS Small Scale ARR Monitoring Report

ONF International - 2009

CAMARA_01

Project Identification

Project name :	*Multi-Species Reforestation in Mato Grosso, Brazil (Carbon Sink ONF- Peugeot S.A.)*						
Host country :	Brazil						
Selected standard / Project activity	VCS	ARR:	X	☐	☐	☐	
Selected methodology :	AR-AMS0006 Version 1						
Project area :	1 971.79	ha					
Eligible area under chosen standard :	1 096.25	ha					
Operational lifetime :	More than 40	years					
Date of project start :	1st September 1999						
Crediting period :	40	Years,	renewed	NA	times		
Date of crediting period start :	1st September 1999						

Brief project description :

The project is located in Mato Grosso (Brazil) and aims at the restoration of grasslands that were formerly deforested for the purpose of cattle grazing activities.
The baseline scenario is the continuation of cattle grazing activities with the decrease of carbon stocks as it is still observed around project area; the region is a front of agriculture going towards north to Amazonia.
The project scenario is, on one hand, the reforestation of 1'971.25 ha of private lands that were deforested before land purchase by ONF in 1998, and on the other hand natural forest management on 7'000 ha (not considered for issuance of carbon credits).
Reforestation activities started in 1999, jointly with the elimination of pre-existing grazing activities. Grazing activities were not displaced and therefore did not represent a source of leakage as explained in the PDD. Then, cattle grazing activities were newly developed under silvopastoral system two years after project start.
About 50 mixed tree species are used for project activities (local species, but *Tectona grandis* on 87 ha) as the project was designed for the following objectives: (i) greenhouse gas removals, (ii) pedagogic activities on carbon sequestration, (iii) preservation of biodiversity, and (iv) local development.
.

Name of entity implementing baseline study :	ONF International	
Name of entity implementing project monitoring :	ONF International	
Date of monitoring completion :	April 25th, 2009	
Contact person in charge of monitoring :	**Name :**	Thomas Dufour
	Entity :	ONF International
	Tel :	+33(0)1 4019 7172
	E-mail :	thomas.dufour@onf.fr

Localization of area

◈ *Simple project area (simple stand alone area)*

ID point	Longitude	Latitude	Area (ha)	Local denomination

Comments

Maps to integrate (parcels)
.

◈ *Discrete simple project areas (discrete areas with a few sides)*

ID area	ID point	Longitude	Latitude	Area (ha)	Local denomination

Comments

Maps to integrate (parcels)
.

◈ *Complex project area (multiple discrete areas with numerous sides)*

In case of complex area, give the name of the database where multiple points have been referenced (e.g. geodatabase in GIS).

Name:	SIG_FAZENDA
Format:	ArcView 3.2 (.dbf)
Place of archive[1]:	ONF Brasil (MT, Brazil) and ONF International (Paris, France)

For QC/QA, two places shall be chosen for archiving

Places for archiving are on project site by ONF Brasil and in France by ONF International.

[1] For QC/QA, two places shall be determined for archiving.

Comments

The GPS database lead to the spatial representation below

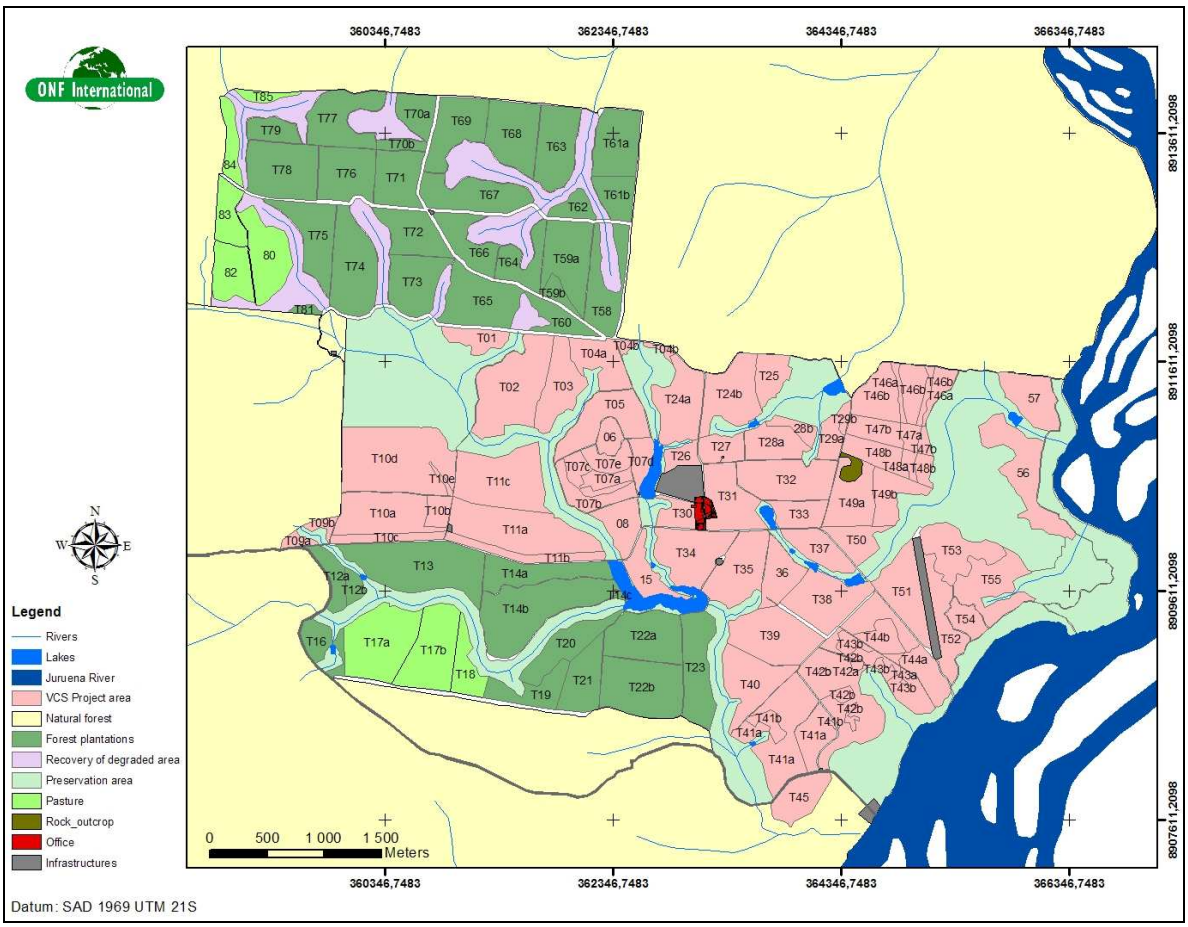

Figure 1: Zonation of the project area encompassing the VCS project boundary.

.

CAMARA_02
Methodology application

02.A- Carbon pools selected

AGB:	BGB:	DW:	L:	SOC:
X	X			X

AGB *Above-ground biomass*
BGB *Below-ground biomass*
DW *Dead wood*
L *Litter*
SOC *Soil organic carbon*

Comments

In accordance with the methodology, above-ground biomass includes trees and below-ground biomass includes roots of trees. Other vegetation is not considered
Soil organic carbon is not monitored as it is calculated following the default method provided by the selected methodology
.

02.B- Sources of greenhouse gas selected

	CO_2:	CH_4:	N_2O:
Burning of biomass			
Removal of pre-existing vegetation			
Livestock emissions (manure and enteric fermentation)		X	
Fertilization			
Fossil fuel			

Comments

In accordance with decisions of the CDM Executive Board reports 42[2] (paragraph 35) and 44[3], (paragraph 37) GHG emissions from fossil fuel, N-fixing species and use of fertilizers are negligible. Therefore, they were not considered in the present monitoring report.

As a matter of fact, neither N-fixing species nor fertilizer is used for the project A/R activities.
On another hand, for research purpose, GHG emissions due to fossil fuel combustion were calculated.

Livestock emissions were considered for calculation of GHG project emissions and GHG baseline emissions in accordance with *VCS guidance for AFOLU projects*[4], under Agricultural Land Management (ALM) activity.
.

[2] http://cdm.unfccc.int/EB/archives/meetings_08.html#042
[3] http://cdm.unfccc.int/EB/archives/meetings_08.html#044
[4] Voluntary Carbon Standard Guidance for Agriculture, Forestry and Other Land Use Projects, 2007.1, §6.2 and §6.3.1

02.C- Sources of leakage considered

Removal of existing vegetation (displacement of crops or grazing activities)	CO_2: ☐	CH_4: ☐	N_2O: ☐
Livestock emissions (manure and enteric fermentation)	CO_2: ☐	CH_4: ☐	N_2O: ☐
Fossil fuel	CO_2: ☐	CH_4: ☐	N_2O: ☐
Posts (fences)	CO_2: ☐	CH_4: ☐	N_2O: ☐
Fuel wood (collection displacement)	CO_2: ☐	CH_4: ☐	N_2O: ☐

Comments

See related Project Design document
.

02.D- Tools used with the selected methodology

UNFCCC CDM Executive Board Tools

Tool for the demonstration and assessment of additionality in A/R CDM project activities	☐
Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM activities	☐
Calculation of the number of sample plots for measurements within A/R CDM project activities	X
Tool for testing significance of GHG emissions in A/R CDM project activities	☐
Estimation of GHG emissions related to fossil fuel combustion in A/R CDM project activities	☐
Estimation of direct nitrous oxide emissions from nitrogen fertilization	☐
Tool for estimation of GHG emissions from clearing, burning and decay of existing vegetation due to implementation of a CDM A/R project activity	☐
Tool for estimation of GHG emissions related to displacement of grazing activities in A/R CDM project activity	☐
Tool for calculation of GHG emissions due to leakage from increased use of non-renewable woody biomass attributable to A/R CDM project activity	☐
Tool for estimation of carbon stocks, removals and emissions for the dead organic matter pools due to implementation of a CDM A/R project activity	☐
Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities	X
Estimation of changes in the carbon stocks of existing trees and shrubs within the boundary of an A/R CDM project activity	☐

Other tools

TARAM	
CO_2Fix	
ENCOFOR toolkit	
IPCC tool (for estimation of SOC)	
CDM Assistant	
Other: CAMARA (ONFI tool)	X
……	
……	

Comments

The tool CAMARA, developed by ONF International for AR projects, was used in its latest version (version 1.0) for the calculation of carbon stocks in each stratum within project boundary based on field measures within permanent sample plots.
Procedures are detailed in the Annex 4 of the related PDD.

.

02.E- CAMARA Module selection

In accordance with the selected methodology (See CAMARA_01) and the specificities of the project activities (see CAMARA_02), the following CAMARA modules are used for the project monitoring.

CAMARA_01	X		
CAMARA_02	X		
CAMARA_03	X		
CAMARA_04			
CAMARA_05	X		
CAMARA_06			
CAMARA_07			
CAMARA_08			
CAMARA_09			
CAMARA_10	X		
CAMARA_11			
CAMARA_A1	X		
CAMARA_A2	X		

Comments

.

CAMARA_03

Stratification

03.A- Baseline stratification

Stratification criteria

Stratification criteria	Stratum level	Denomination	Comments
Initial vegetation cover	1	Stratum	

Comments

In accordance with the methodology, and as demonstrated in the related PDD, the baseline stratification is set as one stratum being the land-use prior to project activity: grazing activities.
.

Strata

Stratum level	ID stratum	Denomination	Area (ha)	Comments
1	B01	Pasture (degraded land)	1’096.25	

03.B- Project stratification

AGB and BGB of tree biomass

Stratification criteria	Stratum level	Denomination	Comments
Species or group of species	1	Stratum	
Planting density (N.ha^{-1})	2	Stratum	
Planting year	3	Cohort	

ID stratum	Area (ha)	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Comments
P01	29.42	*Simaruba amara*	208	1999			
P02	52.06	*Simaruba amara*	500	1999			
P03	29.31	*Simaruba amara*	1111	2000			
P04	5.44	*Simaruba amara*	1667	2000			
P05	50.54	*Spondias mombin*	500	1999			
P06A	35.25	*Spondias mombin*	556	1999			
P06B	26.12	*Spondias mombin*	556	2005			
P07A	2.11	*Spondias mombin*	1111	1999			
P07B	5.58	*Spondias mombin*	1111	2000			
P08A	11.61	*Spondias mombin*	1667	1999			
P08B	1.13	*Spondias mombin*	1667	2000			
P08C	30.98	*Spondias mombin*	1667	2001			
P09	13.68	*Tabebuia rosea*	208	1999			
P10	54.12	*Tabebuia rosea*	500	1999			
P11	2.69	*Tabebuia rosea*	1667	1999			
P12	54.18	*Tectona grandis*	1111	2001			
P13	33.11	*Tectona grandis*	1667	2001			
P14	36.83	*Ficus maxima*	556	2002			
P15	43.26	Mixed species	0	NA			No planting (assisted natural regeneration)
P16	156.82	Mixed species	208	1999			
P17A	257.94	Mixed species	500	1999			
P17B	12.59	Mixed species	500	2000			
P18	40.53	Mixed species	556	2002			
P20A	2.76	Mixed species	1667	1999			
P20B	12.96	Mixed species	1667	2000			
P20C	95.23	Mixed species	1667	2001			

Comments

The stratum number 19 is missing in the list above as it is part of non eligible lands under VCS or CDM. Under the VCS, non eligible lands are lands that were deforested from 1989 onward, as first project activities started in 1999. Therefore only lands that were deforested in 1981, 1984, 1986 and 1987 are eligible (see figure 1and figure 2 below). The same lands are eligible under CDM.

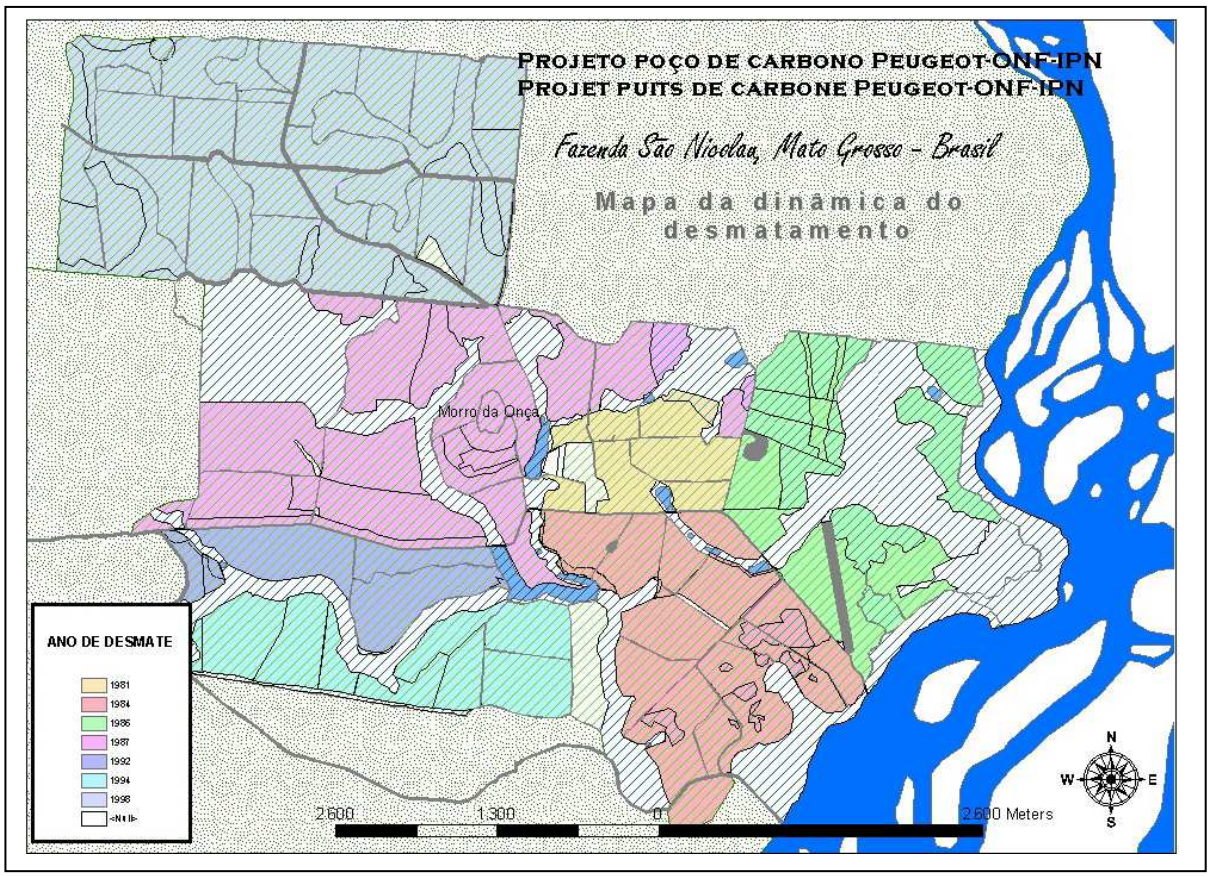

Figure 2: Deforestation dynamic within the *fazenda*.

The *ex-ante* stratification presented in the PDD was conserved for *ex-post* stratification, and is presented in figure 3 below. The annual field observation of the project area did not lead to change the *ex-ante* stratification.

.

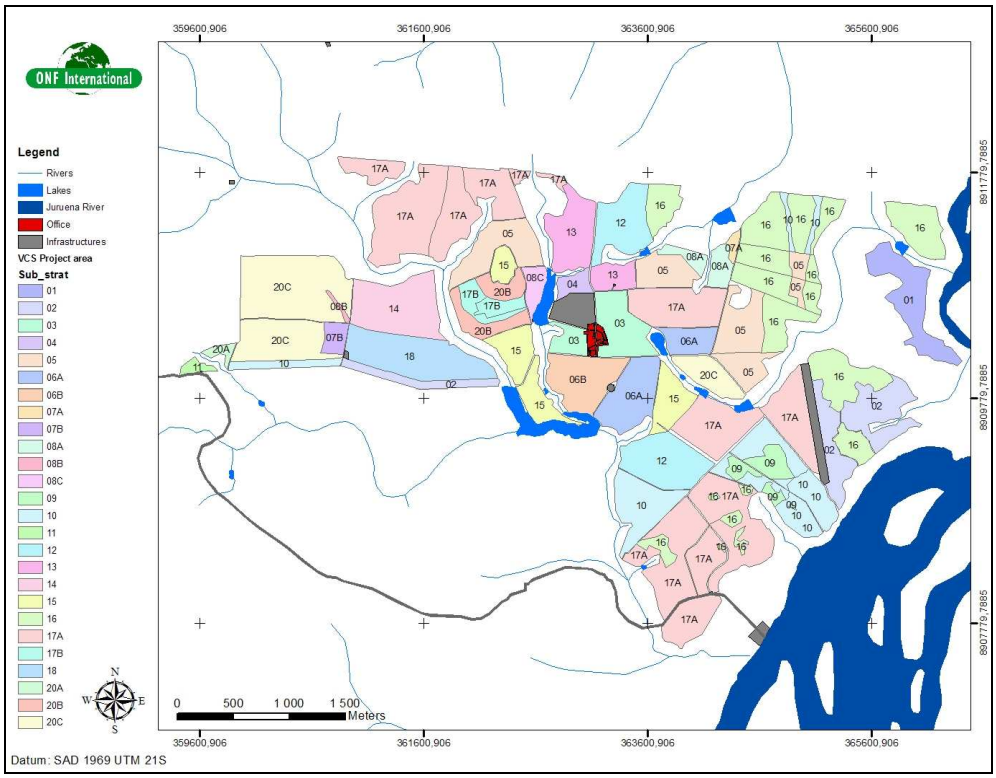

Figure 3: stratification of the project area under the VCS

The integrity of the project plantation and stratification was observed by satellite imagery. SPOT image of 2008 was used to check project boundary and boundaries of strata (figure 4 below). The comparison between figure 4 and figure 5 below shows the integrity of strata boundaries.

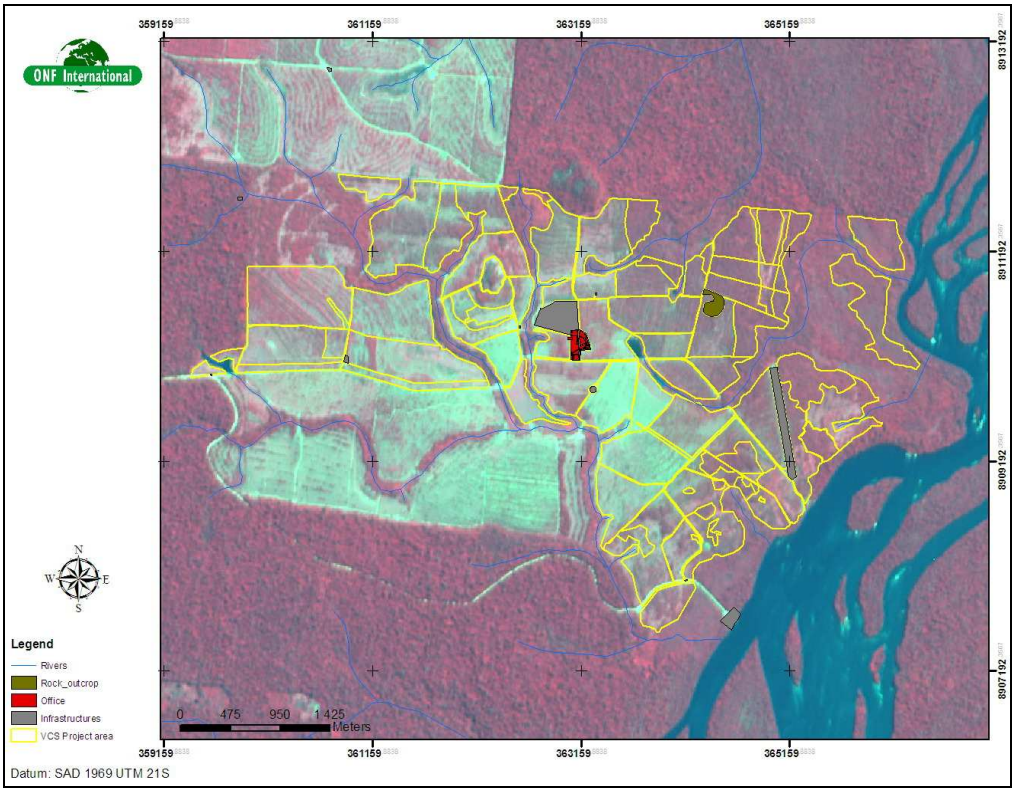

Figure 4: Boundaries of strata verified with SPOT imagery.

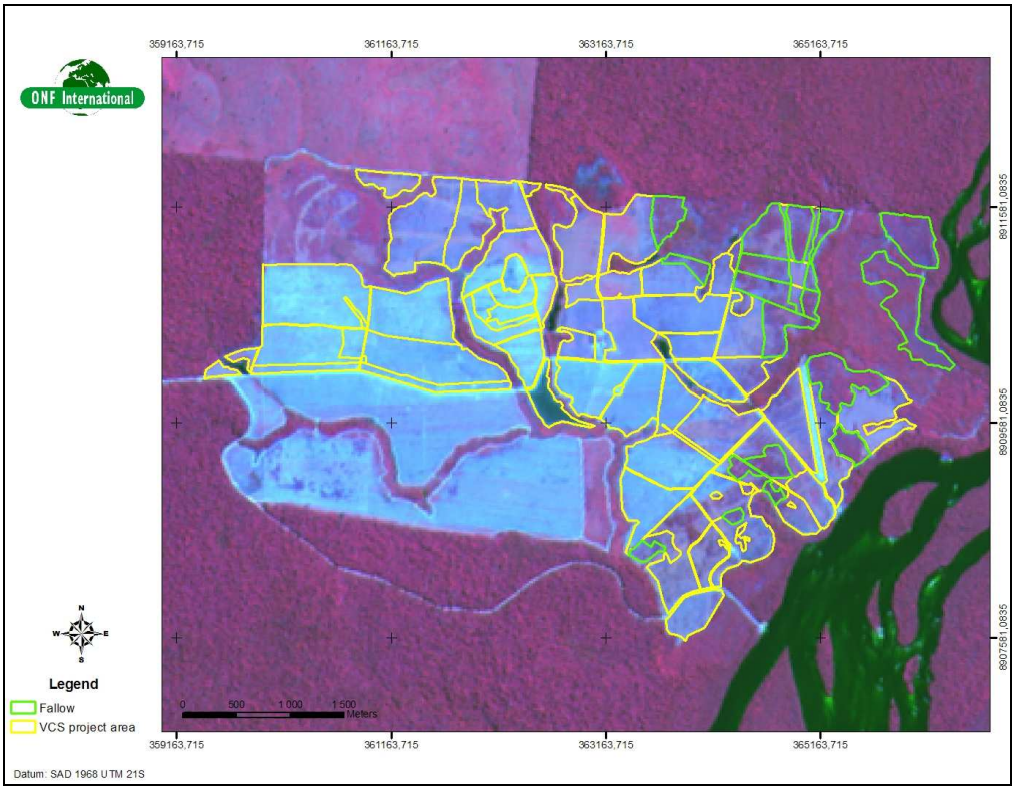

Figure 5: Stratification established *ex-ante* during the elaboration of the PDD.

.

03.C- Description of stratified project area

In accordance with the applied methodology, the stratification of the project scenario was made depending on species or group of species, plantation density and age class.

After verification of stratification, the area of each stratum was defined through the project GIS. The description of area A_i is presented in the table below

Table 1: Stratification of the project area

ID stratum	**Area** A_i (ha)	**Criteria 1** species planted	**Criteria 2** spacing	**Criteria 3** planting year	**Criteria 4**	**Criteria 5**	**Comments**
P01	29.42	*Simaruba amara*	208	1999			Promotion of natural regeneration
P02	52.06	*Simaruba amara*	500	1999			
P03	29.31	*Simaruba amara*	1111	2000			
P04	5.44	*Simaruba amara*	1667	2000			
P05	50.54	*Spondias mombin*	500	1999			
P06A	35.25	*Spondias mombin*	556	1999			
P06B	26.12	*Spondias mombin*	556	2005			
P07A	2.11	*Spondias mombin*	1111	1999			
P07B	5.58	*Spondias mombin*	1111	2000			
P08A	11.61	*Spondias mombin*	1667	1999			
P08B	1.13	*Spondias mombin*	1667	2000			
P08C	30.98	*Spondias mombin*	1667	2001			
P09	13.68	*Tabebuia sp.*	208	1999			Promotion of natural regeneration
P10	54.12	*Tabebuia sp.*	500	1999			
P11	2.69	*Tabebuia sp.*	1667	1999			
P12	54.18	*Tectona grandis*	1111	2001			
P13	33.11	*Tectona grandis*	1667	2001			
P14	36.83	*Ficus sp.*	556	2002			
P15	43.26	Mixed species	0	NA			Promotion of natural regeneration
P16	156.82	Mixed species	208	1999			Promotion of natural regeneration
P17A	257.94	Mixed species	500	1999			
P17B	12.59	Mixed species	500	2000			
P18	40.53	Mixed species	556	2002			
P20A	2.76	Mixed species	1667	1999			
P20B	12.96	Mixed species	1667	2000			
P20C	95.23	Mixed species	1667	2001			
Total	**1’096.25**						

The tool “calculation of the number of sample plots for measurements within AR CDM project activities" was used in its version 02. The tool was integrated in the tool CAMARA for automatic calculation. The project stratification led to define the following sampling for data measurement:

Table 2: Sampling and area sampled for each stratum within the project area

ID Stratum	***Area***	***Expected amount***	***Standard deviation***	Number of sample plot per stratum		
Reference	(ha)	MgC.ha-1	-	Stratum	n	Sampling Area Asp_i (ha)
P01	29.42	28.20	14.10	P01	3	0.3
P02	52.06	28.20	14.10	P02	5	0.5
P03	29.31	25.38	12.69	P03	3	0.3
P04	5.44	25.38	12.69	P04	1	0.1
P05	50.54	28.20	14.10	P05	5	0.5
P06A	35.25	28.20	14.10	P06A	3	0.3
P06B	26.12	11.28	5.64	P06B	6	0.6
P07A	2.11	28.20	14.10	P07A	1	0.1
P07B	5.58	25.38	12.69	P07B	1	0.1
P08A	11.61	28.20	14.10	P08A	1	0.1
P08B	1.13	25.38	12.69	P08B	1	0.1
P08C	30.98	22.56	11.28	P08C	4	0.4
P09	13.68	28.20	14.10	P09	2	0.2
P10	54.12	28.20	14.10	P10	5	0.5
P11	2.69	28.20	14.10	P11	1	0.1
P12	54.18	30.08	15.04	P12	5	0.5
P13	33.11	30.08	15.04	P13	3	0.3
P14	36.83	19.74	9.87	P14	5	0.5
P15	43.26	32.90	16.45	P15	4	0.4
P16	156.82	28.20	14.10	P16	13	1.3
P17A	257.94	28.20	14.10	P17A	22	2.2
P17B	12.59	25.38	12.69	P17B	2	0.2
P18	40.53	19.74	9.87	P18	5	0.5
P20A	2.76	28.20	14.10	P20A	1	0.1
P20B	12.96	25.38	12.69	P20B	2	0.2
P20C	95.23	22.56	11.28	P20C	10	1
				Total	**114**	**11.4**

Comments

.

CAMARA_05

Tree biomass

05.A- Species data

Species Latin name	**Species** local name	**Wood density** (WD)	**Carbon fraction** (CF)	**Biomass expansion factor** (BEF)	**Root:shoot ratio** (R)	**Allometric equation**	**Comments**
Simaruba amara	Caixeta	0.5	0.47		0.2	*AGB = exp{-2.134 + 2.530*ln(DBH)}*	IPCC, 2003 values
Spondias mombin	Cajazeira	0.5	0.47		0.2	*AGB = exp{-2.134 + 2.530*ln(DBH)}*	IPCC, 2003 values
Tabebuia rosea	Ipe	0.5	0.47		0.2	*AGB = exp{-2.134 + 2.530*ln(DBH)}*	IPCC, 2003 values
Tectona grandis	Teca	0.5	0.47		0.2	*AGB = exp{-2.134 + 2.530*ln(DBH)}*	IPCC, 2003 values
Ficus sp.	Figueira	0.5	0.47		0.2	*AGB = exp{-2.134 + 2.530*ln(DBH)}*	IPCC, 2003 values
Mixed native species	NA	0.5	0.47		0.2	*AGB = exp{-2.134 + 2.530*ln(DBH)}*	IPCC, 2003 values

Comments

IPCC default values are used as not enough destructive samples were made for the elaboration of project specific allometric equations. The project specific equations will be used for the next monitoring.

.

05.B- Samples for elaboration of allometric equations and biomass expansion factors

05.C- Sample plots

ID Plot	**Coordinates**	**ID area**	**Slope** (%)	**Rectangular plot**		**Circular plot**	**Comments**
				Width (m)	**Length** (m)	**Radius** (m)	

Comments

The data are given in the Annex Excel file "CAMARA_E1_Core_v1.0_Data2009_20091113"

.

ID Plot	**Date** *(dd/mm/yyyy)*	**ID Tree**	**Planted/ Regenerated**	**Line**	**Tree Number**	**Total height** *(cm)*	**Commercial height** *(cm)*	**DBH** *(cm)*	**CBH** *(cm)*	**Living/ dead**	**Health** *(O, G, R, B)*	**State** *(WL, WB, PT)*	**Form**	**Comments**

Comments

The data are given in the Excel annex file "Data Inventory FCPO 2009"
The direct results depending on previous data parameters monitored are given in the same excel file.
.

CAMARA_10

GHG Sources

The monitoring of GHG sources may approach the following elements:

- Emissions from N-fertilization
- Emissions from fossil fuel combustion
- Emissions from livestock (enteric fermentation, manure management, etc.)
- Emissions from site preparation (removal of existing vegetation)
- Emissions from biomass burning

10.A- N-Fertilization

10.B- Fossil fuel combustion

10.C- Livestock

Pre-existing livestock data (baseline)

Date	**Type of animal**	**Purpose of animal** (e.g meat, milk)	**Number of animals**	**Emission factor for enteric fermentation**	**CH4 emissions from enteric fermentation**	**CH4 emissions from manure management**	**Emission factor for Manure management**	**Comments**
1998	Buffalo	meat	3'750		0.56 tCH_4/head/ha			

Comments

.

Actual animal data

Date	**Type of animal**	**Purpose of animal** (e.g meat, milk)	**Number of animals**	**Emission factor for enteric fermentation**	**CH4 emissions from enteric fermentation**	**CH4 emissions from manure management**	**Emission factor for Manure management**	**Comments**
1999	Buffalo	meat	0		0.56 tCH_4/head/ha			Renting contract 1999
2000	Buffalo	meat	0		0.56 tCH_4/head/ha			Renting contract 2000
2001	Buffalo	meat	250		0.56 tCH_4/head/ha			Renting contract 2001
2002	Buffalo	meat	400		0.56 tCH_4/head/ha			Renting contract 2002
2003	Buffalo	meat	280		0.56 tCH_4/head/ha			Renting contract 2003
2004	Buffalo	meat	490		0.56 tCH_4/head/ha			Renting contract 2004
2005	Buffalo	meat	1’400		0.56 tCH_4/head/ha			Renting contract 2005
2006	Buffalo	meat	1’900		0.56 tCH_4/head/ha			Renting contract 2006
2007	Buffalo	meat	2’100		0.56 tCH_4/head/ha			Renting contract 2007
2008	Buffalo	meat	1’400		0.56 tCH_4/head/ha			Renting contract 2008

2009	Buffalo	meat	2’100		0.56 tCH_4/head/ha			Renting contract 2009

Comments

See Excel PDD Annex file “PDD_GHG_Removals_Peugeot_v01” for calculation.

.

10.D- Removal of existing vegetation

10.E- Biomass burning