



Voluntary Carbon Standard

Using: Project Description Template, 19 November 2007

Campo Verde VCS PD: 15 June 2009

Revision 2

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1 Description of Project:

1.1 Project title

Reforestation of pastures in Campo Verde with native species, Pucallpa, Peru

1.2 Type/Category of the project

The project can be classified as an Afforestation, Reforestation, and Revegetation (ARR) project, according to VCS Standards. The project proponents intend to replicate this project throughout the region as a grouped project; however, specific lands have yet to be identified.

1.3 Estimated amount of emission reductions over the crediting period including project size:

The project plans to sequester a long-term average of 169,971 tons of CO₂e in 30 years through the reforestation of 740 hectares and the assisted natural regeneration of 179.7 hectares.

1.4 A brief description of the project:

Deforestation and unsustainable farming practices emanating from cities, towns, roads and rivers have resulted in a pattern of degradation in the Peruvian Amazon. Valuable timber species are initially extracted, before the rest of the forest is cleared, burnt and put into agriculture. As a result of the biophysical conditions and the traditional slash-and-burn agriculture system, deforested lands can only support arable agriculture for a few years following clearing of the native forest cover because of rapid depletion of nutrients from the soil. After this, land is normally turned over to ranching or abandoned for several years whilst it regenerates, before the process is repeated. Ranching and arable lands alike become increasingly degraded over time. Invasive grasses commonly establish on pasture lands, after which it becomes difficult for tree species to regenerate, even on abandoned pasture lands. This is compounded by the frequency of fires, mainly started by burning for agriculture. The result is vast swaths of abandoned, unproductive pastures that sequester little carbon.

The Campo Verde project proposes to restore pasture lands which have been deforested since the 1960s and have subsequently degraded in the ensuing years. Pastures will be restored with native commercial timber species with the intention of further replication of the project activities in the region over time. The proposed afforestation and reforestation project is located in the department of Ucayali in the Peruvian Amazon. The annual deforestation rate in the department of Ucayali was 7931ha from 1990-2000 and accumulated deforestation in the region to the year 2000 totalled 627,064hectares¹. The project developers envision that this project will serve as a model that can be replicated and expanded elsewhere in the region.

This project will reforest 740 ha of VCS compliant pastures with commercial native timber species through direct planting of seedlings. These species are Caoba (*Swietenia macrophylla*) Tahuari (*Tabebuia serratifolia*), Marupa (*Simarouba amara*) and Shihuahuaco (*Dipterix odorata*). Restoration of degraded soils will be facilitated initially through the planting of Guaba trees (*Inga edulis*) to incorporate organic matter, enhance soil nutrients and provide wind protection and shade for the timber species. On an additional 179.7 ha of VCS compliant pastures, natural regeneration of forest will be facilitated through integrated weed management, control of grazing and prevention of fires.

The Campo Verde project approach incorporates capacity building with local people on sustainable forestry management, low impact logging techniques as well as nursery and plantation management. The project's hiring practices give priority to workers from local communities and surrounding areas, with both permanent (39 workers) and temporary (284 workers) contracts in place. The hiring

¹ Jorge Elgengen, La Deforestacion en el Peru, Paracas, October 2005; based on official statistics of INRENA and PROCLIM

practices ensure balanced gender participation. Also, the project provides technical and financial support for out grower nurseries thereby providing an opportunity for local communities to establish business enterprises.

Over time it is anticipated that stakeholders will be able to build on the expertise they have developed from this project and expand it for use on their own land and in the forestry sector in the region more broadly. The “Asociación para la Investigación y el Desarrollo Integral” (AIDER²) a Peruvian non-governmental organization will provide technical advice for the project and assist with project management and implementation.

1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:

The project is located 46 km from the town of Pucallpa and 12 km from the village of Campo Verde in the Campo Verde District, Coronel Portillo Province, Ucayali Region, Peru (Figure 1). The project boundary consists of 24 areas of VCS eligible pasture all located within one piece of property (Figure 2). The boundaries of the project area have been delineated via a GPS and stored in a GIS environment³.

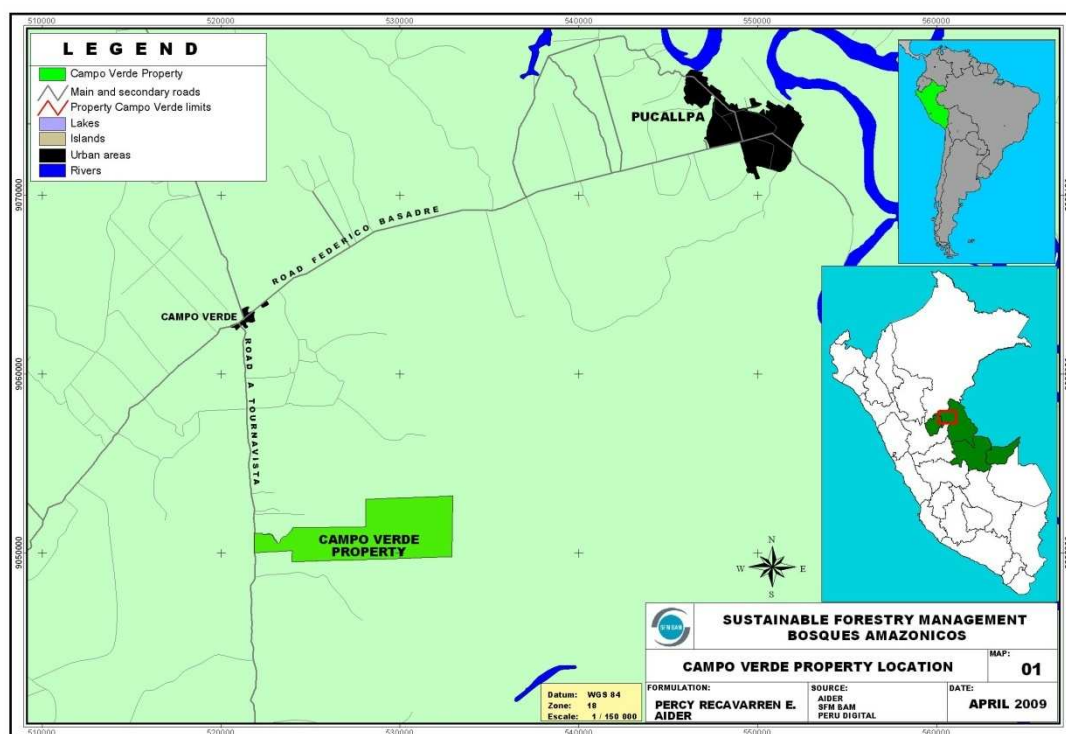


Figure 1 Map of project location

² The Association for Research and Integral Development

³ Presented to third-party during validation

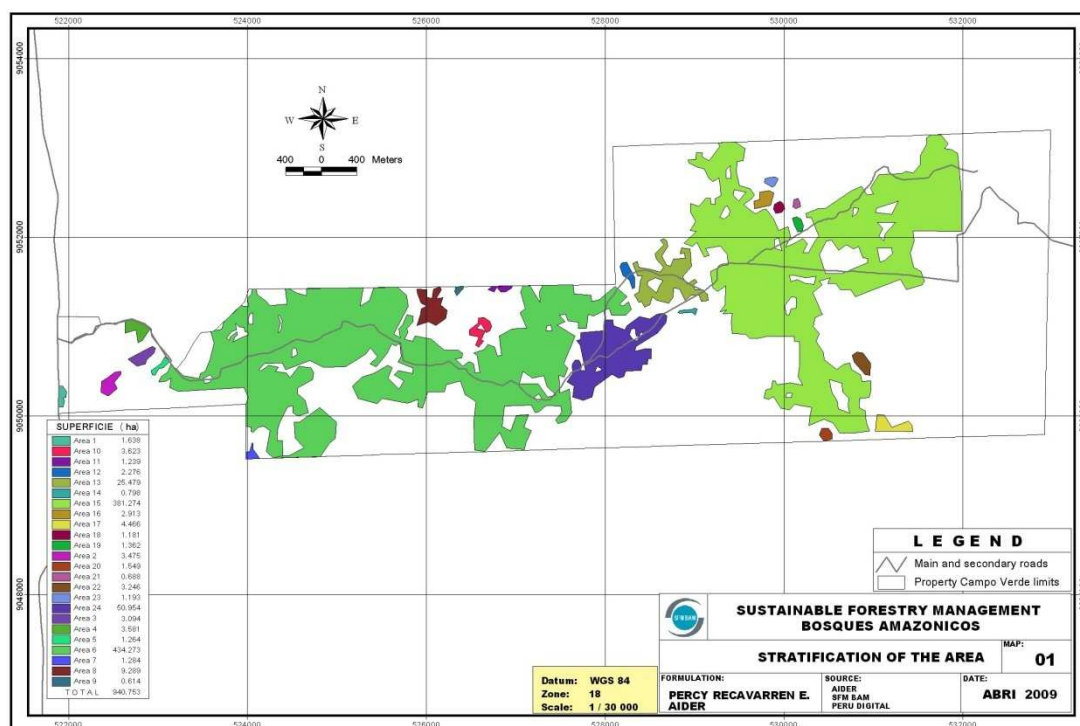


Figure 2 Map of VCS eligible areas

1.6 Duration of the project activity/crediting period:

Project start date: December 23, 2007. This is the date that planting began. A Shareholders Agreement, signed April 20, 2007, sets out terms of carbon finance provided to the Campo Verde project developers – cash provided for reforestation in consideration of carbon credits. (See section 2.5 for further details)

Crediting period start date: December 23, 2007.

VCS project crediting period: 10 years, renewed two times (For AFOLU projects, must be a minimum of 20 years. A thirty year crediting period will be used for this project.)

1.7 Conditions prior to project initiation:

The AR-AM0003 Version 4 stepwise approach for *ex ante* stratification of the project area was applied using site classification maps and tables, the most updated land-use and land-cover maps, satellite images, soil maps, vegetation maps, and landform maps as well as supplementary surveys described below. Following the methodology one stratum is identified for the baseline condition as described in Step 3 of Section 2.4.

Climate:

The climate at Campo Verde can be described as tropical, with year round high temperatures and high precipitation. The annual average of highest and lowest temperature (period 1997-2003) is 31.9°C and 21.8°C, respectively.⁴ The average annual rainfall is 1861.68 mm and relative humidity is 83.71%. (1997-2003).⁵ There is, however, a dry season, from June to September, when humidity and precipitation drop significantly. 'Dry' in this context means a monthly average rainfall of around 40-70mm.

⁴ Estacion Meteorologica, Universidad Nacional de Ucayali, Almanaque de Ucayali 2002-2003

⁵ Estacion Meteorologica, Universidad Nacional de Ucayali, Almanaque de Ucayali 2002-2003

Relief and Soils:

The project area is characterized by gently undulating terraces, with low gradients of between 0- 4%. The height ranges from 155 to 220m above sea level. The project area contains relic small hills created by historic fluvial action. The relief of the lands means they are not affected by flooding during the rainy season. There is good to moderate drainage across the project area. The soils in the project area classified using the pH scale range from extremely to strongly acidic (pH around 3.5). The soils display an average bulk density of 1.13 g/cm³ and a low organic content, averaging 0.86% carbon in the top ten centimetres.

Biodiversity:

The clearing of native forest cover, overgrazing and frequent fires has led to degradation, loss of biodiversity and soil impoverishment at the project site. Forest removal and consequent habitat destruction has affected most species of fauna, which generally live in low densities in the forests of the region. Birds such Guacamayo (*Ara* spp.), Perdiz (*Tinamus* spp.), Pihuicho (*Brotogeris* spp), Toucan (*Rhamphastos* spp) are not able to live in a pasture habitat.

Because of this degradation, the project area does not represent a permanent habitat for native species of fauna, but the remnant primary forests and mature secondary forests bordering the project area continue to provide habitat to a range of species.

According to a recent study of the biodiversity in the forest areas bordering the project area, there are 62 vertebrate species; the most common species are Carachupa (*Dasypus novemcinctus*), Majaz (*Agouti paca*) and Sachacuy (*Proechimys* spp.).⁶ The planned reforestation activities in the project area will contribute to providing biological corridors between the various forest ecosystems in the region thereby expanding species habitat and increasing genetic diversity.

The main fauna species found in the bordering forest areas are listed in Table 1:

Table 1 Main fauna species found in forest boarding project area

Common name	Scientific name
Carachupa	<i>Dasypus novemcinctus</i>
Majaz	<i>Agouti paca</i>
Sachacuy	<i>Proechimys</i> spp
Perdiz	<i>Crypturellus cinereus</i>
Musmuqui	<i>Aotus</i> spp
Paucar	<i>Cacicus</i> sp
Zorro	<i>Didelphis marsupialis</i>
Añuje	<i>Dasyprocta fuliginosa</i>
Choshna	<i>Potos flavos</i>
Tucán	<i>Rhamphastos</i> spp
Achuni	<i>Nasua nasua</i>
Huasa	<i>Saimiri sciureus</i>
Jergón	<i>Bothrops</i> sp.
Pichico	<i>Saguinus fuscicollis</i>
Pucacunga	<i>Penelope jacquacu</i>
Sajino	<i>Tayassu tajacu</i>
Ardilla	<i>Sciurus</i> sp.
Camungo	<i>Anhima cornuta</i>
Gavilán	<i>Leucopternis occidentalis</i>
Ronsoco	<i>Hydrochoerus hydrochaeris</i>
Trompetero	<i>Psophia leucoptera</i>

⁶AIDER. 2006. Diagnostico biofisico, zonificacion y caracterizacion de flora y fauna del area de trabajo.

Common name	Scientific name
Panguana	<i>Crypturellus undulatus</i>

Of the species listed above, five are considered as endangered according to the National Institute of Natural Resources⁷. *Leucopternis occidentalis* is considered in the category Endangered, *Bothrops sp.* And *Crypturellus cinereus* are considered in the category Vulnerable, *Cacicus sp* and *Rhamphastos spp* are considered in the category Almost Threatened. The habitat is outside the border of the project area.

Hydrology

Within the Project area and surrounding zone, the following rivers are found, with important populations of fish and other water species. Rivers are illustrated in Figure 3.

Table 2 Rivers in Project area

Name	Classification
Agua blanca	Medium river
Garzal	Small river
Shiquihual	Small river
Oriol	Small river
Mojaral	Small river
Maputay	Small river

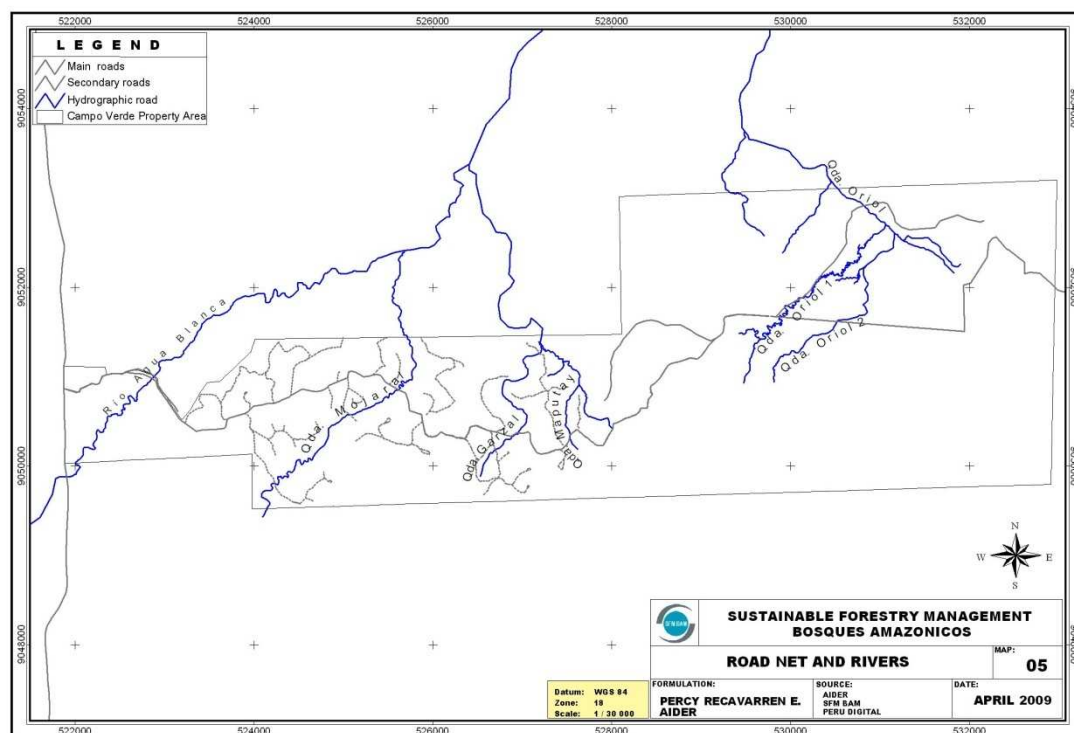


Figure 3 Map of rivers in project area

Origin and destination of the rivers

The rivers in the project area are generated by the high level of rainfall and from underground springs. The rivers are part of Amazon Basin and feed into the Ucayali River, one of the most important tributaries of Amazonas River, the largest river of the world. The rivers cross the project in several areas (Figure 3), thus guaranteeing the permanent availability of water in the project area.

⁷ Categorización de especies amenazadas de fauna Silvestre. Aprobado per Decreto Supremo No 034-2004-AG

Ecosystem

The entire project area is located in the Subtropical Amazon bio-geographic province and the native forest cover is classified as pre-mountain tropical humid forest in transition to tropical humid forest.⁸

Vegetation:

In the project area, the dominant vegetation is the invasive grass *Braquiaria decumbes* with a few shrubs, isolated trees or clumps of trees. The area surrounding the project area is a mixture of secondary and remnant primary forest. According to the ecological assessment,⁹ the project area contains 18 species of flora. *Braquiaria decumbes* is the dominant species, covering 62% of the pasture area and with a mean height of 57 cm (Table 2). This species is also associated with hard stem grass (8.8% of cover) and Cashaucsha grass (*Imperata brasiliensis*) (7.8%). Together these grasses represent a total of more than 75% of the vegetation cover of the area. These grasses are invasive and have a high fuel load, leading to regular fires that then prevent natural regeneration in the pasture areas.

Table 3 Vegetation cover and mean height in pasture area

Species		Mean Value	
Scientific name	Common name	Cover (%)	Mean Height (cm)
<i>Brachiaria decumbens</i> Stapf. Stapf.	Braquiaria decumbes	62.0	57
<i>Alyra</i> sp.	Hard stem grass	8.8	83
<i>Imperata brasiliensis</i>	Cashaucsha	7.8	85
<i>Escleria</i> sp.	Cortadera	5.0	76
<i>Hyparrhenia rufa</i>	Yarahua	3.2	100
<i>Urena</i> sp.	Yute	2.6	87
<i>Axonopus compressus</i> , <i>Paspalum conjugatum</i>	Torourco	2.6	67
<i>Tetraura</i> sp.	Paujil chaqui	1.4	150
	Shapumba	1.3	93
	Sogal	1.1	200
<i>Brachiaria</i> sp. (<i>humidicola</i> , <i>dictioneura</i>)	Braquiaria	0.7	70
	Pasto nudillo	0.6	120
<i>Brachiaria brizantha</i>	Braquiaria	0.6	100
	Huaquilla	0.5	89
<i>Cyperus</i> sp.	Piri piri	0.5	55
<i>Andropogon bicronis</i>	Cola de zorro	0.4	108
<i>Alyra</i> sp.	Gramalote	0.2	103
<i>Chusquea</i> sp.	Carrizo	0.1	90
	No vegetation	0.7	0
	Total	100	81

Land use:

The project lands were converted from forest into pastures in the early 1970's. The land was titled to the original owner around 1975. The pressure of cattle on the land, the inherent low fertility of Amazonian soils, the heavy rain and the natural undulation of the land led to its degradation over time.

The land was purchased by Jorge Cantuarias in 1987, under the auspices of his business Ganadera Campo Verde. From 1987-1993 the pastures were ranched intensely with 2,000 to 3,000 cattle on the pasture lands. In 1993 terrorism (Shining Path) worsened in the Pucallpa area and some cattle

⁸ According to the life zones classification developed by Holdridge in Holdrige, L.R. (1947) Determination of world plant formations from simple climatic data. *Science*, 105: 367-368.

⁹ RAMIREZ, Jacqueline and Eduardo MURRIETA. Reforestación en áreas degradadas recuperadas de la Amazonía Peruana. Campo Verde – Ucayali.

belonging to the Ganadera Campo Verde were killed. Following the terrorism incident of 1993, Ganadera Campo Verde abandoned cattle grazing in Campo Verde because of fear of further attack. However, in the same year (1993) a consortium was formed between Ganadera Campo Verde and a Russian Company AMUR, leading to the creation of COPERSA (Consortio Peruano Ruso). This consortium was formed to develop an aquaculture business, and most notably the construction of fish-ponds on the lands adjacent to the pastures.

For over ten years the owner of the property, Jorge Cantuarias, has not actively produced products or income from the land within the project boundary. However, surrounding neighbours have allowed a low number of cattle to graze on project lands.

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

The project will achieve greenhouse gas emission reductions through reforestation of native tree species on land that has been degraded due to cattle ranching. The planting of seedlings and growth of trees will sequester carbon dioxide from the atmosphere in the above and below ground biomass of the trees. In some areas natural regeneration will be assisted through the prevention of fires and grazing. It is expected tree growth in these areas will be lower than in the planted areas. The land was converted from forest to pasture in the 1970s and was extensively grazed by cattle until 1993. The land was abandoned for cattle grazing in 1993, but the extensive deforestation and degradation was such that it could not revert to forest. The current lands within the project boundary are degraded lands populated by grasses and shrubs. The carbon stocks in these degraded lands will either continue to deteriorate or remain in a steady state. Therefore, the project activity of reforestation will achieve greenhouse gas removals by sinks activity.

Reforestation will be carried out using a group of native species to maximize positive impacts on biodiversity. Table 4 lists the species which will be used.

Table 4 Botanical classification of species and varieties selected

Scientific Name	Common name
<i>Swietenia macrophylla</i> King	Caoba
<i>Tabebuia serratifolia</i> (Vahl) Nichols.	Tahuari
<i>Simarouba amara</i> Aubl.	Marupa
<i>Dipteryx odorata</i> (Aubl.) Willd.	Shihuahuaco
<i>Inga edulis</i> Mart.	Guaba

1.9 Project technologies, products, services and the expected level of activity:

In some areas of the project (Strata 3), natural regeneration will be assisted through the prevention of fires which will enable grazing lands to recover. Direct seeding will not take place in these areas. The only management to be practiced in these areas is weed management and the prevention of fire (see section 1.9.5.2 Fire protection) and grazing.

The following description of activities will only take place in the project areas where direct seedling planting will take place (Strata 1 and 2)

1.9.1 Species choice for reforestation and enrichment plantings

In order to emulate the successive stages of forest regeneration, *Inga edulis* (guaba) is planted as nursery crop and pioneer species. *I. Edulis*, is well suited to this role as it is endemic to the area, seed is readily available and trees are easily propagated. In addition the tree is Nitrogen-fixing. Six to nine months after the establishment of *I. Edulis*, a fast growing secondary species *Simarouba amara* (marupa) together with 'climax' species *Dipteryx odorata* (shihuahuaco) or *Tabebuia serratifolia*

(tahuari) will be planted. A small percentage of *Swietenia macrophylla* (caoba) will also be planted at this time.

The seeds will all be sourced from the remnant native forests and forest reserves in Ucayali. *I. edulis* and *T. serratifolia* seeds are sourced from the forests proximate to Campo Verde. The *D. Odorata* seeds are derived from Sinchi Roca, a native community about 40 km west of the project area. *S. amara* are collected from Curimana, located about 50 km north-west from the project area. The *S. macrophylla* seeds are collected from the Purus Forests, located in the south-east of the Ucayali region, near the border with Madre de Dios. Each tree from which seeds are collected is being documented, and geo-referenced using GPS. Additionally, arrangements have been made with local communities living in the vicinity of these seed trees so as to ensure these trees are protected for subsequent seed harvest.

1.9.2 Nursery practice

Due to the large volume of seedlings required, the propagation of seedlings is carried out under contract with the Instituto Nacional de Investigacion Agraria (INIA) as well as within SFM-BAM's nursery. INIA will produce approximately 250,000 seedlings for SFM-BAM (Figure 4).



Figure 4 Seedlings growing at the INIA nursery, Pucallpa

The SFM-BAM nursery on Campo Verde occupies an area of 1.65 ha and was established in July 2007. The nursery has an annual production capacity of approximately 550,000 seedlings (Figure 5).



Figure 5 Seedlings growing in Campo Verde nursery

Seed harvesting activities are illustrated in Table 5. Seeds are collected, cleaned and stratified and then sown in germination beds. 15 days after germination the seedlings are picked out and transplanted into 25 x 15 cm polythene bags. The growing medium comprises a mixture of sand, loam and chicken litter. The relative proportions are illustrated in Table 6. Depending upon the species, nursery duration from germination to seedlings ready for planting out in the field ranges from six to twelve months. Seedlings are graded and only those with a root collar diameter greater than 8mm and height range 100 to 180 cm are despatched from the nursery. The schedule of activities is illustrated in Table 5.

Table 5 Schedule of activities starting in 2007.

Activity	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov
1. Seed harvesting												
<i>S. amara</i>												
<i>D. odorata</i>												
<i>S. macrophylla</i>												
<i>T. serratifolia</i>												
<i>I. edulis</i>												
2. Seed beds												
Seed stratification	For all species											
Sowing	For all species											
Growth	For all species											
Pricking out	For all species											
3.- Nursery beds												
3.1 Preparation												
Growing medium												
Filling of polythene bags												
Pricking out of seedlings												
3.2 Growth												
<i>S. amara</i>			10 months to maturity									
<i>D. odorata</i>				15 months to maturity →								
<i>S. macrophylla</i>							8 months to maturity →					
<i>T. serratifolia</i>											12 months →	
<i>I. edulis</i>				6 months to maturity →								
3.3 Selection and loading												
3.4 Inventory and registry												

Table 6 Growing media for tree species

Species	Nursery growing media			Polyethylene bags		
	Loam	Sand	Chicken manure	Mass (kg)	Volume (m ³)	Dimensions (cm)
<i>I. edulis</i>	58	28	14	2.400	0.0015	13 x 30
<i>D. odorata</i>	62	30	8	2.530	0.0017	18 x 23
<i>S. amara</i>	44	44	12	2.530	0.0017	18 x 23
<i>S. macrophylla</i>	62	30	8	2.530	0.0017	18 x 23
<i>T. serratifolia</i>	62	30	8	2.530	0.0017	18 x 23

1.9.3 Planting configurations and regimes

The regimes for the reforestation of the pasture areas are provided in the below table. The regime is based upon results of a pilot trial established on Campo Verde as well as other trials carried out by INIA.

The planting configuration for the pastures is illustrated in the below figure. The purpose of the initial planting with *I. edulis* at approximately 1111 stems/ha is to create the most appropriate light, moisture and nutrient regime for the interplanting of the secondary and primary successional stage species six to nine months later.

Table 7 The two regimes for the reforestation of the pasture areas

Species	Strata 1 Regime 1	Strata 2 Regime 2	Comments
	Stems/ha	Stems/ha	
<i>I. edulis</i>	1111	1111	<i>Inga edulis</i> planted at 3 x 3 m spacing. 6 to 9 months later and within the rows of <i>Inga</i> the remaining species are planted. Final configuration therefore 3 x 1.5m.
<i>S. amara</i>	555	555	
<i>D. odorata</i>	539	0	
<i>T. serratifolia</i>	0	539	
<i>S. macrophylla</i>	17	17	

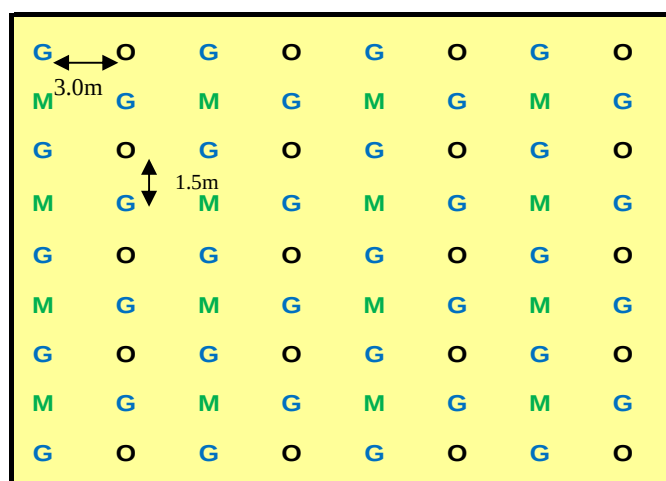


Figure 6 Planting configuration for pastures G = *I. edulis*; M = *S. amara*; O = *T. serratifolia* or *D. odorata*

Pilot plantings of pasture according to this regime demonstrate rapid canopy closure by *I. Edulis* and good growth of the secondary (*S. amara*) and primary tree species (*D. odorata* and *T. serratifolia*) (Figures 7, 8, 9, 10). An 85% survival rate of the secondary and primary forest tree species has been set.

Based upon observations of the existing plantings, revised planting configurations and stockings are being considered for the remaining new plantings. The current configuration results in a combined stocking of *I. Edulis*, primary and secondary species of 2222 stems/ha. This stocking is considered too high for the following reasons:

- Because of the excellent growth and survival observed, interspecific and intraspecific competition will rapidly develop between and within the species resulting in loss in increment and subsequent mortality of suppressed trees.
- Planting input costs at this high stocking are considered too high.

Consequently plantings at stockings of between 1666 and 1900 stems/ha are being considered. The reduced competition and mortality will lead to compensatory increases in growth and yield and therefore will not have a marked impact upon the CO₂ density. Therefore the *ex ante* calculations currently used need not be revised.



Figure 7 Pilot trial three months after establishment



Figure 9 Pilot trial 22 months after establishment



Figure 8 Pilot trial six months after establishment



Figure 10 View of pilot trial 22 months after establishment

1.9.4 Site preparation and establishment

The management regime for the site preparation and establishment of the pasture areas is presented in the following table.

Table 8: A chronogram of activities starting in 2007 associated with the reforestation of pastures

Activity	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1. Delimitation of MU's															
2. Classification & eval.															
3. Weed management															
4. Site preparation															
5. Transport of seedlings															
6. Planting															
<i>Simarouba amara</i>															
<i>Dipterix odorata</i>															
<i>Swietenia macrophylla</i>															
<i>Tabebuia serratifolia</i>															
<i>Inga edulis</i>															
7. Monitoring survival															
8. Fertiliser															

Burning will be used for site preparation in order to reduce the occurrence of weeds, insects, and disease as well as to reduce the risk of unplanned brush fire in the established plantation. Circular burn areas will be used for greater control of the fire. Management units where burning is to be used will be evaluated to ensure that all safety criteria are met¹⁰.

1.9.4.1 Site classification and evaluation

All pasture areas have been classified according to various soil types, slope classes, terrain features and levels of weed competition. Based upon this classification, the sites are evaluated to optimize silvicultural regimes in terms of soil preparation, weed management, soil nutrition and species choice.

1.9.4.2 Weed management

The dominant weed that occurs in the pastures is the perennial grass *Braquiaria decumbes*. This grass is particularly aggressive and unless successfully controlled it will suppress the growth and kill the trees. Weed control is carried out by either cutting the vegetation using a tractor-mounted mower or using tractor-mounted sprayers (Figure 11). The chemical used is glyphosate and depending on the level of infestation is applied at a rate of between 4 and 6 litre ha⁻¹. Up to three treatments may be required to successfully suppress *B. decumbes* competition. The application of this herbicide is monitored and accounted.

In certain instances because the *B. decumbes* is so dense, the plough discs get clogged with the grass and cannot penetrate the soil. In these instances, the grass is burnt prior to ploughing. The area burned is monitored and accounted.



¹⁰ SFM. 2009. Plan de prevencion y control de incendios forestales



Figure 11 Mowing and herbicide application using tractor mounted sprayers

1.9.4.3 Soil cultivation

There are 2 systems used to cultivate the soil, eliminating the *Brachiaria decumbes*.

- a) Mechanized. For Forest Management Units with a slope lesser than 10 grades. Previously, level curves were drawn as a guide for strip-plough machine (Figure 12). After ploughing, holes of 40 cm of depth and 20 cm of diameter were dug and 1 kilo of chicken manure was applied in each hole. The distance between 2 strip-ploughing varies from 2-4 meters.
- b) Non-mechanized: In areas with a higher slope, the ploughing was done manually. In these cases, the holes have the same depth and diameter and the volume of chicken manure applied was between 1.5 to 2 kilos.

Ploughing is carried out along the contours (Figure 12) to retain surface runoff of rainwater and prevent soil erosion. Where there is no soil compaction or impedance to root growth, only planting pits are prepared.

The area that was not sub-soiled during the first year was 198.08 hectares and the area that was sub-soiled was 127.29 hectares.



Figure 12 Offset disc ploughing of 1m wide strips along the contour



Figure 13 View of a management unit which has been contour ploughed

1.9.4.4 Nutrition

Soils are acidic with pH's ranging from less than 4.5 to 5.5. These dystrophic soils have high levels of Al and a high P-fixation capacity. In addition, these degraded sites have a low organic C content (1.5%). The current fertiliser regime prescribes the application of 1kg of chicken manure and 100g of dolomite lime per tree.

There is recognition that the current regime is based on best available information and a range of fertiliser trials have been established to determine the optimal nutrient regimes. Initial recommendations are the addition of superphosphate (10.5% P) fertiliser at rates of approximately 15g P (elemental) per tree. The initial planting of N-fixing *I. Edulis* will supplement the soil N, facilitating the growth of the secondary and primary tree species planted six to nine months later. In addition, the increase in organic material as a result of the planting of *I. Edulis* will increase N-mineralisation. Consequently levels of organic or inorganic N may be reduced. Pursuant to EB 44, *I. edulis* is not considered a significant source of GHG emissions.

1.9.4.5 Planting

The dimensions of the planting pits are 20 x 40 cm and are prepared by hand along the plough line. Where no ploughing occurs, pits are 30 x 40 cm in dimension. Trees are removed from the polythene bags and planted in these holes. Planting activities are shown in Figure 7-10. Figure 10 shows an area that has been successfully established with *I. Edulis*.

1.9.5 Maintenance

1.9.5.1 Pruning

In order to maximize the value of the high value timber species, green pruning is utilised to eliminate lateral branching and corrective pruning to maintain stem form and apical dominance will be implemented.

Investigations will be carried out to determine the optimum pruning regime. However, preliminary recommendations are to prune at a frequency that will maintain a knotty core of no greater than 15cm in diameter and to a maximum height of 5m. This regime will ensure that two knot-free and consequent high value peeler veneer logs of approximately 2.3 m each can be obtained from each tree.

1.9.5.2 Fire protection

The high relative humidity and rainfall in the Pucallpa area implies that the relative risk of fires and consequent damage to the reforested areas is low. Most of these fires are likely to occur as a result of the burning of pasture areas on neighbouring properties.

Nevertheless precautions are taken to minimise the risk¹¹. These are:

- Maintenance of 20 to 30 m wide firebreaks along the borders of Campo Verde where pastures occur.
- Design of road infrastructure to act as firebreaks.
- Maintenance of cordial and co-operative relationships with neighbouring communities.
- Training of personnel in fire-fighting techniques.
- Provision of fire-fighting equipment.
- Construction of water points for fire tenders.

1.9.5.3 Pests and diseases

a. Nursery

The maintenance of a high phyto-sanitary standard at the nursery is critical for the production of healthy seedlings. The nursery has been designed to minimise the risk of fungal diseases by ensuring the adequate through-flow of air and rapid drainage of the site. In addition, to avoid contamination, only borehole water is used for the irrigation of seedlings. Daily inspections of seedlings are carried out to ensure a rapid response to any pest or disease.

b. Reforested areas

The mixed species planting configuration is designed to minimise the risk of insect and fungal attack so often experienced in monoculture hardwood plantations in the tropics. In this respect, *S. macrophylla* is planted at a low density to minimise the risk from the shoot tip borer, *Hypsipyla grandella*. Regular monitoring of the reforested areas to evaluate the occurrence of any pests or diseases are carried out

1.9.6 Thinning and harvesting regimes

Currently there are no thinning and harvesting prescriptions directly applicable for the species choices and configurations being planted at Campo Verde. In this respect, in order to monitor the growth and yield of the trees as well as to develop growth and yield models, permanent sample plots (PSP's) will be laid out in the management units.

In the interim, based upon literature reviews, single species trials and growth and yield modes, the following regimes have been adopted (Table 9).

Table 9: Current harvesting regime adopted at Campo Verde

Species	Stocking (s/ha) ²	% Survival ³	Stocking (s/ha) ³	Harvesting
				Age (yrs)
<i>Inga edulis</i> ¹	1111	85	944	n/a
<i>Simarouba amara</i>	555	85	472	12
<i>Dipteryx odorata</i>	539	85	458	30
<i>Tabebuia serratifolia</i>	539	85	458	30
<i>Swietenia macrophylla</i>	17	85	15	30

¹ No commercial thinning or harvesting

² At establishment

³ One year after establishment

¹¹ SFM. 2009. Plan de prevencion y control de incendios forestales

1.9.7 Planning and Inventory

Critical to the successful management of information and the scheduling of operations is a well – designed plantation management system.

Key components of this plantation management system are:

- A spatial representation of the area using a geographical information system (GIS). The delineation of the management units for reforestation in GIS is illustrated in Figure 14.
- An attribute database linked to the spatial database where all information pertaining to particular management units is stored. A component of this attribute database is illustrated in Table 10. All management activities or interventions associated with the management units including species provenance, weed management, site preparation, fertiliser application etc are also included.

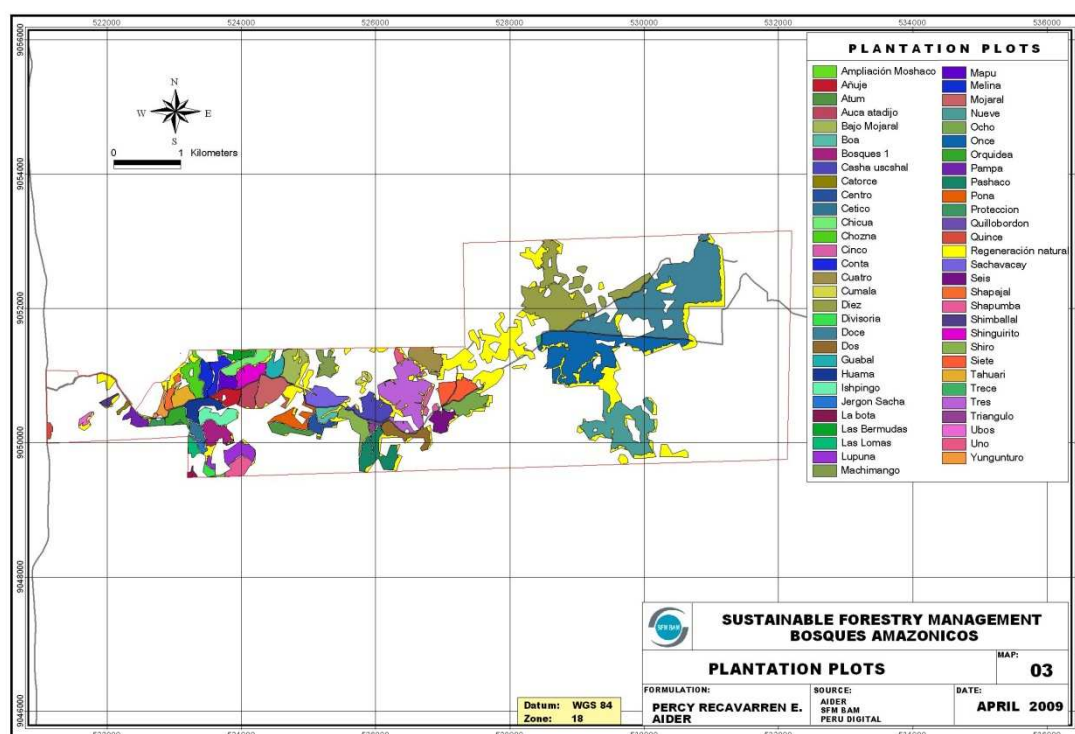


Figure 14 Map of Campo Verde showing the management units to be reforested

Table 10 A component of the Campo Verde plantation database with information for *I. edulis* and *S. amara*

Block	Compt.	Area (ha)	VCS eligible	Species 1				Species 2			
				Species	Date planted	Stocking (s/ha)	Spacing	Species	Date planted	Stocking (s/ha)	Spacing
1	A	18	Y	<i>I. edulis</i>	30/11/07	1111	3 x 3	<i>S. amara</i>	22/08/08	555	3 x 6
1	B	32	Y	<i>I. edulis</i>	10/12/07	1111	3 x 3	<i>S. amara</i>	11/9/08	555	3 x 6
1	C	27	N	<i>I. edulis</i>	12/12/07	1111	3 x 3	<i>S. amara</i>	1/10/08	555	3 x 6
.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.
3	F	24	Y	<i>I. edulis</i>	15/10/09	1111	3 x 3	<i>S. amara</i>	12/4/10	555	3 x 6

1.9.8 Health and Safety

The health and safety of all employees, contractors and visitors to Campo Verde is a key management objective.

1.9.8.1 Safety

As a precursor to developing a safety management plan for Campo Verde, a risk assessment has been carried out. The object of this risk assessment is to:

- Identify the risks associated with each activity on Campo Verde
- Determine the likelihood that the risk occurs, and
- Quantify the impact of the particular risk.

A high-level risk matrix that identifies risks is presented in Table 11. In participatory workshops involving both employees and contractors, each of the primary risks will be broken down into various sub-components and measures implemented to mitigate each one.

Table 11: Principal and specific activities identified through risk analyses

No.	Principal activity	Specific activity
1	Management of seed orchards	Collection of seed
2	Basic Infrastructure	
	Nursery	Heavy earth moving equipment
	Bridges	Construction
	Roads	Use of road making equipment
	Compartments	Delineation of compartments
3	Management of agrochemicals	
	Storage	Insecticides, fungicides, herbicides
	Nursery	Insecticides, fungicides
	Plantation	Insecticides, fungicides, herbicides
4	Use of agricultural equipment	
	Tractors	Site preparation
	Implements	Site preparation
	Spraying equipment	Site preparation
	Chainsaws	Site preparation
	Transport of materials	Use of tractors and trailers
5	Transport of personnel	
	On Campo Verde	Use of tractors, trailers and vehicles
	To Campo Verde	Use of buses
	Contractors	Use of vehicles
	Vehicles	General use of vehicles
6	Fire	
	On Campo Verde	Control
	On neighbouring property	Control
7	Harvesting equipment	
	Clear felling	Chainsaws
	Extraction	Skidders, cables
	Loading	Cranes. Log decks
	Transport	Trucks

1.10 Compliance with relevant local laws and regulations related to the project:

According with Forestry Law 1090, a reforestation project must be registered within 3 years of the establishment of plantation. The project is currently preparing the registration documentation for the registration of the first 20 hectares of pilot trials established in 2005. These trials are not included in the boundaries of the proposed VCS project area. However, these 20 hectares will be maintained by the overall plantation even though they are outside of the project boundaries.

Regarding the use of fire as part of forest management practices, pursuant to point G of Article 410 of the Forestry and Wild Life Law, DS 002-2009-AG, DL N° 1090¹² and Law 29317, there is no legal restriction regarding the use of fire as a management technique in site preparation. Therefore it is not necessary to seek authorization for the use of fire as a management technique.

According to national laws, a plantation that applies for registration must be registered in INRENA, the national office for natural resources. Also, a management plan should be developed and sent to INRENA for approval. Forest plantations must be registered with the Forestry and Wildlife Regional Office within three years of establishment according to Article 154 of the Forestry and Wild Life Law, DS 002-2009-AG and TUPA INRENA 2008¹³. Campo Verde is in the process of obtaining the required documents for registration. At this time, the management plan¹⁴ is being developed by an AIDER-SFM-BAM team and will be concluded soon and submitted to INRENA.

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

Project Management to reduce loss of permanence:

The project will establish a permanent plantation with regular rotation periods on lands owned by the project developers and managed by a team of experienced foresters. The project developer, SFM, is a company with sound financial practices and is financially invested in the successful continuation of the project area as a highly productive plantation.

As documented in the management plan¹⁵ and section 1.9, the plantation has been carefully designed to minimize the risk of loss of permanence. Firebreaks have been created, a fire-fighting strategy has been developed and outreach and fire reduction strategies are being carried out with land owners from surrounding properties to reduce the use and threat of fire¹⁶. Attack of trees by pests and disease will be carefully managed and monitored using a best practice and adaptive management approach. The planting design and schedule has been developed to minimize commonly known pest and disease problems.

Non-permanence risk Analysis

Based on both the general risk and the project specific risk analyses performed below, the project falls into the "low" risk category. In the case of ARR projects under the VCS, this translates into a buffer requirement of 10-20% of issued credits. In terms of the project specific risks, the majority fall into the "low" risk category. The same is true of the "general" risks to the project. For these reasons, a 10% buffer is applied to the project.

Table 12 Risk factors applicable to all project types

Risk Factor	Risk Rating	Campo Verde Project
Project Risk		
Risk of unclear land tenure and potential for disputes	Low	SFM-BAM owns the land

¹² DS 002 2009 AG Aprueban Reglamento DL 1090 Ley Forestal y de Fauna Silvestre; Ley Forestal D.L. N° 1090; LEY 29317.modifica e incorpora arts. a la ley Forestal y de fauna Silvestre; tupa2008 INRENA.pdf

¹³ DS 002 2009 AG Aprueban Reglamento DL 1090 Ley Forestal y de Fauna Silvestre; Ley Forestal D.L. N° 1090; LEY 29317.modifica e incorpora arts. a la ley Forestal y de fauna Silvestre; tupa2008 INRENA

¹⁴ SFM. 2008. Management plan for Campo Verde 2008-2012. Sustainable Forestry Management and Bosques Amazonicos.

¹⁵ SFM. 2008. Management plan for Campo Verde 2008-2012. Sustainable Forestry Management and Bosques Amazonicos.

¹⁶ SFM. 2009. Plan de prevencion y control de incendios forestales

Risk Factor	Risk Rating	Campo Verde Project
Risk of financial failure	Low	A Shareholders' Agreement was signed between SFM Ltd and the project landowners (Bosques Amazonicos) in April 2007. The Shareholders' Agreement established a Joint Venture Company SFM-BAM. Under the terms of the Shareholders Agreement, SFM Ltd. acquired a 30% interest in SFM-BAM and Bosques Amazonicos contributed the land assets. In July 2007, SFM Ltd. entered into an Assignment Agreement with SFM-BAM. The Assignment Agreement specified that SFM Ltd pre-purchase the carbon rights from the project area. The consideration paid by this pre-purchase of carbon rights has provided the financing necessary for the project to undertake its operations. The Assignment Agreement was updated in October 2008 (Restated and Amended Assignment Agreement) and further includes an investment commitment of about \$10 millions for the first 10 years of the implementation of the project. The confidential document can be reviewed by validator^{17,18} Extensive financial modeling has been undertaken by both SFM Ltd and SFM-BAM which support the economic basis of the deal.
Risk of technical failure	Medium	The stand model being implemented has not previously been planted in Peru. Thus, it is an innovative practice. However, to test the planting strategy a 3 hectare pilot area was planted with the same species mix in 2005. Trees have successfully been established, as can be seen in section 1.9. A recent evaluation (July 2008) took place demonstrating plantation success. Height, stem diameter, and mortality rates will be used to adjust the modeled growth rates used in the model to estimate carbon tones captured per year. A recent survey was recently conducted to evaluate the growth and mortality rate of the pilot plantation. The results indicate that the plantation has been established successfully considering both these criteria. After 3 years of guaba and 2 years of timber wood species establishment, the average mortality rate is

¹⁷ SFM BAM, 2007. Shareholders Agreement.

¹⁸ SFM BAM, 2007. Assignment Agreement.

VCS Project Description – Campo Verde

Risk Factor	Risk Rating	Campo Verde Project
		4% for the guaba and 1% for the timber wood species. SFM-BAM has a highly skilled group of Peruvian Foresters working at the reforestation site. Expert forestry consultants have been consulted on the forestry planting regime and management, as well as relevant literature sources consulted.
Risk of management failure	Medium	The project has an experienced management team, covering a range of relevant expertise. The CV's of key personnel have been submitted to the third party validator including: - General manager - Administrator - Field Manager - Nursery Manager - Forest Specialist - GIS Specialist - Carbon Specialist - Monitoring Responsible
Economic Risk		
Risk of rising land opportunity costs that cause reversal of sequestration and/or protection	Low	There is always a risk that alternative economic activities will raise land opportunity costs and threaten reversal of sequestration in a project area. This risk, however, is mitigated in several ways in the Campo Verde project. 1. The project is on freehold land owned by the project developer, SFM- BAM. This enables the project management to take a long-term perspective on the underlying business opportunity. 2. The project's management has specifically targeted this land for reforestation. The lands in the surrounding area currently support little economic activity, apart from low-density cattle grazing and subsistence agriculture. Degradation trends across the project area show that the current state of the lands is likely to persist in its current condition as it has done since the 1980's. Large scale, commercial cattle ranching was abandoned many years ago due to the economic downturn and terrorist activity, and was not re-established due to the degraded state of the lands and hence the prospect of low returns in the future.

VCS Project Description – Campo Verde

Risk Factor	Risk Rating	Campo Verde Project
		Reforestation is a long-term activity and is unique in that the value of “inventory” accrues the longer the trees are in the ground. Many of the trees in the Campo Verde project have been planted on a 30 year rotation and revenues are to be generated both by timber and carbon. Land opportunity costs may rise in the surrounding areas (though unlikely, see point 2 above), but this will be offset by the rising economic value of trees (in terms of timber value) and carbon on the project land over time.
Regulator and social risk		
Risk of political instability	Low	Political stability has been maintained on almost invariable low ratings according to indicators provided by the Multilateral Investment Guarantee Agency (MIGA) of the World Bank. For example, it has an overall risk rating of 6.7 on a scale of 1 to 10 (0 maximum risk; 10 no risk). This compares very favorably with other countries in the region such as Ecuador (4.0), Argentina (4.1) Brazil (5.3), and even Chile (6.0), all with lower ratings and thus higher perceived political risk. This low political risk has translated into the attainment of investment grade by the country that has been provided in the last two years by Fitch (currently BBB-), Moody’s (Ba1), and Standard and Poor’s (BBB-). All these ratings are showing sustained increases over time due to the consolidation of economic reforms and very robust macro-economic performance of the country. According to the “Evaluación de Riesgos Sociales del Proyecto de Manejo Forestal en Areas Degradadas con Fines de Certificación para la Venta a Futuro del Vuelo Forestal”, elaborated by the Social Capital Group, there is a risk (medium likelihood and high significance) of project failure due to political reasons. These ratings were provided taking into account the overall risk perception of the country based on the paragraphs above. It is noteworthy that such risks in the Social Assessment were estimated in 2006; since

Risk Factor	Risk Rating	Campo Verde Project
		then, country risk in Peru has decreased even further. ¹⁹
Risk of social instability		There has been no wide-spread social unrest in Peru in the recent past. This area is relatively rural and has not experienced any unrest since the Shining Path period. SFM-BAM has made a commitment toward working directly with the surrounding local communities and local government and has a strong positive relationship with the major stakeholders. There were no people living within the boundaries of the project prior to the start of project activities and all the project land is privately owned. There were four families living outside the project area, but within the SFM-BAM property at the start of the project. These families were aware they were living on SFM-BAM land and were moved to existing lands covered by pasture and cropland.²⁰ While recent national political issues concerning the rights of indigenous people have affected the communities of the Ucayali region, to this date violent protests and confrontations between groups have not occurred nor has the region observed any national strike. In the Ucayali region political dissent is expressed in the form of peaceful marches and meetings.²¹
Natural disturbance risk		
Risk of devastating fire	Low	The risk of devastating fire was calculated using: VCS “Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination, Appendix A” ²² . Using this tool, the risk was classified as “Low” ²³ .

¹⁹ World Bank Group, 2007. Political Risk Insurance Center – Country Analysis – Peru. http://www.pricenter.com/country/country_specific.cfm?countrynum=156

²⁰ La Torre, L., 2009. Ubicacion de Familias. Informe No. 009-2009-SFM BAM SAC-LLATC. SFM BAM.

²¹ AIDER, SFM BAM., 2009. Informe: Aspecto Social.

²² VCS. Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination. <http://www.v-c-s.org/docs/Tool%20for%20AFOLU%20Non-Permanence%20Risk%20Analysis%20and%20Buffer%20Determination.pdf>

²³ SFM, 2009. Calculation of Risk Class for Devastative Fire.

VCS Project Description – Campo Verde

Risk Factor	Risk Rating	Campo Verde Project
		Although wildfires do occur in Peru,²⁴ the risk of fire compared to other South American countries is extremely low - records going back to 1973 show that overall the occurrence of fires was low though the frequency of fires increased in early 2000's.²⁵ Therefore it is assumed that a devastating fire event is likely to occur less than once during the life of the project. SFM has a strong commitment to preventing any fires from taking place. A Fire Prevention Plan has been developed and is currently being implemented.²⁶ The Plan identifies factors that cause fires and includes a map of potential fire risk areas. It outlines countermeasures using best practices specifically adapted to the conditions found in the project area and describes protocols, training and procedures for review and internal auditing with periodical meetings and workshops with neighboring land owners. A fire prevention team has been created and trained to act when necessary.
Risk of pest and disease attacks	Low	SFM will address the complex problem of pest and disease attacks with an integrated pest management program. A contract has been created with the Servicio Nacional de Sanidad Agraria (SENASA) to initiate studies of ecological pest and disease control. Until now the only pest problem of economic significance has been the attack of an insect of the genus <i>Tropidacris</i>. The attack was immediately controlled by ecological means as mentioned in the document "Control Langosta by Campo Verde"²⁷. On the other hand, attacks of <i>Umbonia</i> sp., a parasite that causes defoliation, have been observed in gauba. Personnel of SFM discovered that this insect can be controlled naturally with <i>Bauveria</i> sp. This natural control will be propagated by SFM and will

²⁴ Fire Information for Resource Management System, University of Maryland, 2009. Web Fire Mapper: South America. <http://maps.geog.umd.edu/firms/>

²⁵ Manta, M., 2006. Global Forest Resources Assessment 2005 – Report on fires in the South American Region. Food and Agriculture Organization of the United Nations.

²⁶ SFM. 2009. Plan de prevencion y control de incendios forestales

²⁷ Chavez, J. Estado actual de la poblacion de "Langosta" – *Tropidacris* sp.

Risk Factor	Risk Rating	Campo Verde Project
		be applied to avoid damage to guaba by <i>Umbonia</i> sp.
Risk of extreme weather events	Low	The only common extreme climatic events in the region are strong winds and floods²⁸. Both events occur with greater frequency during the rainy season from December through April. The study shows strong winds affect crops but extensive damage to natural forest or forest plantations has not been reported. Strong winds only affect isolated trees and trees on the edges of forests. Floods primarily affect low-lying regions and risk of floods in the project area is minimal due to its topography. When rivers in the region overflow their banks waters usually recede within a matter of hours. With regards to the risk of drought from ENSO, ENSO events typically occur every 2 to 7 years and drought can occur anywhere in the world during an ENSO event, however there is not a strong connection between ENSO events and drought in Peru.²⁹ Although droughts associated with ENSO have occurred in the Amazon region, prolonged droughts in the Ucuyali region have not been registered and there is no reason to believe that a drought associated with ENSO is likely to occur in the region nor that this would be severe enough to damage plantation species.
Geological risk	Low	Geologic risks are not probable. The National Centre for Geophysical Data (an office in the Peruvian Geophysical Institute) considers this area as a low geological risk area as it is not located in the active seismic area of Peru.³⁰ The latest earthquake occurred in 1981 and was not severe.

Table 13 Risk factors applicable to ARR projects

Risk Factor	Risk Rating	Campo Verde Project
Project longevity/Commitment Period		
Long-term commitment with harvesting	Medium	A permanent plantation is planned. Based on the management plan, the tree species

²⁸ SINADECI, 2005. Compendio Estadístico del SINADECI 2003 y 2004; SINADECI, 2008. Compendio Estadístico de Prevención y Atención de Desastres 2005, 2006 y 2007

²⁹ National Drought Mitigation Center, University of Nebraska – Lincoln, 2009. Understanding ENSO and Forecasting Drought. <http://drought.unl.edu/whatis/elnino.htm>

³⁰ Peruvian Geophysical Institute, 2009. Marco Geológico y Geodinámico; Peruvian Geophysical Institute, 1998. Áreas de peligrosidad por caídas de tefras volcán ubinas; Centro Nacional de Datos Geofísicos de Perú, 2009. Datos de sismología.

VCS Project Description – Campo Verde

Risk Factor	Risk Rating	Campo Verde Project
		<i>Marupa</i> will be harvested at year 12 and the remaining trees harvested at year 30. The area will then be replanted to begin a subsequent rotation period.
Ownership type		
Established NGO or conservation agency; owner-operated private land	Low	SFM-BAM owns the land (see section 8.1)
Technical capability		
Technologies proven to be effective in other regions under similar soil and climate conditions but lacking local experimental results and having limited access to relevant expertise	Medium	A native species plantation of this size has not previously been planted in Peru. Thus, it is an innovative practice. However, to test the planting strategy a 3 hectare pilot area was planted with the same species mix in 2005. Trees have successfully been established, as can be seen in section 1.9. A recent evaluation (July 2008) took place demonstrating plantation success. Height, stem diameter, and mortality rates will be used to adjust the modeled growth rates used in the model to estimate carbon sequestered each year. A survey was recently conducted to evaluate the growth and mortality rate of pilot plantation. The results indicate that the plantation has been established successfully considering both these criteria. After 3 years of guaba and 2 years of timber wood species establishment, the average mortality rate is 4% for the guaba and 1% for the timber wood species. SFM-BAM has a highly skilled group of Peruvian foresters working at the reforestation site. Expert forestry consultants have been consulting on the forestry planting regime and management, as well as relevant literature sources consulted. This pilot area is not included within the carbon project boundaries
Financial capacity		
Demonstrable backing from established financial institutions, NGOs and governments	Low	A Shareholders' Agreement was signed between SFM Ltd and the project landowners (Bosques Amazonicos) in April 2007. The Shareholders' Agreement established a Joint Venture Company SFM-BAM. Under the terms of the Shareholders Agreement, SFM Ltd. acquired a 30% interest in SFM-BAM and Bosques Amazonicos contributed the land assets. In July 2007, SFM Ltd. entered into an Assignment Agreement with SFM-BAM. The Assignment Agreement specifies that SFM Ltd pre-purchase the carbon rights from the project

Risk Factor	Risk Rating	Campo Verde Project
		area. The consideration paid by this pre-purchase of carbon rights has provided the financing necessary for the project to undertake its operations. The Assignment Agreement was updated in October 2008 and further includes an investment commitment of about \$20 millions for the first 10 years of the implementation of the project. The confidential document can be reviewed by validator^{31 32}, Extensive financial modeling has been undertaken by both SFM Ltd and SFM-BAM which support the economic basis of the deal.
Management capacity		
Limited project experience (<5 years) with on-site management team	Medium	The project has an experienced management team, covering a range of relevant expertise. The CV's of key personnel have been submitted to the third party validator including: - General manager - Administrator - Field Manager - Nursery Manager - Forest Specialist - GIS Specialist - Carbon Specialist - Monitoring Responsible
Future income		
Appropriate management plan and financial analysis include future income to finance future management activities (e.g. carbon finance to be used for project management, tending operations etc.)	Low	SFM-BAM will generate revenues from two sources: 1. the sale of carbon emissions offsets under the guidelines of the Voluntary Carbon Credits Standard, and, 2. the sale of certified high-value timber (tropical hardwoods) Extensive and detailed cash flow projections have been made by SFM-BAM³³. The carbon finance and revenues from carbon emission offsets will provide enough finance to the project to undertake the planned operations. The project's costs and revenues were projected until the end of the project in year 30. The results of the analysis forecast an

³¹ SFM BAM, 2007. Shareholders Agreement

³² SFM BAM, 2007. Assignment Agreement

³³ SFM BAM, 2007. Financial Planning Projections

Risk Factor	Risk Rating	Campo Verde Project
		internal rate of return of around 19% and a NPV of US\$3 million.
Future/current opportunity cost		
Future income – Alternative land uses are unlikely to occur in the future	Low	The risk that alternative land uses will occur in the future is mitigated in several ways: 1. The project is on freehold land owned by the project developer, SFM- BAM. This has enabled the project management to take a long-term perspective on the underlying business opportunity. 2. The pre-project land use and the surrounding area land use support little economic activity, apart from low-density cattle grazing and subsistence agriculture. Without the project activities providing capital investment, the degraded state of the land has prevented alternative land uses such as large-scale agriculture. The degraded land will continue to prevent such alternatives from being implemented in the future. 3. Reforestation is a long-term activity in which the 'inventory' accrues value overtime as the trees grow. Although it is possible that land opportunity costs will rise in the surrounding areas (though unlikely, see point 2 above), this will be offset by the rising economic value of trees (in terms of timber value) and carbon on the project land over time.
Endorsement of project or land-use activity by local or national political establishment		
Endorsement given and not likely to change in the future	Low	The project has the necessary support from regional and national government, including the recently created Ministry of Environment. SFM-BAM executives have had interviews with President of Peru Mr. Alan García about the benefits of the project for the Amazon Region and forest sector. The Minister of Environment, Antonio Brack, has visited the project site several times. He is a long-term advocate of reforestation in the rainforest. The Minister has used the project as an example of how the private sector could help the environment by reforesting degraded land. Before taking his government position, Mr. Brack conducted a television show that focused on ways to improving the environment. In one episode, Mr. Brack made a documentary of the project in

Risk Factor	Risk Rating	Campo Verde Project
		Campo Verde. Meetings with political figures were featured in the Peruvian press. ^{34 35}

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

The project activity is establishing a permanent plantation with a 30-year rotation period. As stated in the Management Plan³⁶, at the end of each rotation period, trees will be replanted after harvesting.

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates).

The project is not seeking to generate any other environmental credits other than carbon credits associated with the VCS.

1.14 Project rejected under other GHG programs (if applicable):

N/A

1.15 Project proponents' roles and responsibilities, including contact information of the project proponent, other project participants:

Table 14 Project Proponents

Entity	Description	Function
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³⁴ 2006. President Garcia preside nueva session del Consejo de Ministros. *Diario La República*. http://www.larepublica.com.pe/index.php?option=com_content&task=view&id=129679&Itemid=0

³⁵ 2006. Anuncian inversion de US\$ 25 millones para reforestar 16 mil hectareas en Ucayali. *24 Horas Libre Peru*. <http://www.24horaslibre.com/nacionales/1162480906.php>

³⁶ SFM. 2008. Management plan for Campo Verde 2008-2012. Sustainable Forestry Management and Bosques Amazonicos.

VCS Project Description – Campo Verde

Entity	Description	Function
SFM Ltd. Canon's Court, 22 Victoria Street, Hamilton HM EX, Bermuda Company Registration Number: 27334 Contact Person: Gonzalo Castro Correspondence address: Canon's Court 22 Victoria Street PO Box HM 1179 Hamilton HM EX Bermuda Email: gcastro@sfm.bm	A company, established in 1999 to demonstrate that attractive returns can be generated by investment in the world's tropical and subtropical forests. This opportunity arises out of the emerging market for carbon dioxide and other greenhouse gases which has emerged since the Rio Earth Summit in 1992 and the ratification of the United Nations Convention on Climate Change and negotiation of the Kyoto Protocol and other international environmental agreements. SFM's business is to address these issues on an integrated, sustainable and ethical basis. SFM is building a global portfolio of forest-based enterprises with the help of commercial, financial, not-for-profit and multilateral partners including leading participants in forestry, bio-prospecting and eco-tourism. SFM's principal revenues will be derived from supplying and trading carbon dioxide emission credits and offsets in the carbon market and from the harvest of timber from its projects. SFM intends to be both a first mover in the carbon marketplace and to set the world standard for investment in tropical and subtropical forest areas.	Shareholder, project developer, Carbon program manager
SFM-BAM SAC Contact Person: Mr. Jorge Cantuarias Address: Av. Juan Fanning 880 – Miraflores Telephone: 51 1 447 2249 Email : jorge.cantuarias@sfbam.com	A Peruvian company created by SFM Ltd. And Bosques Amazonicos SAC with the goal to develop projects that leverage the potential of Peruvian Amazon's rich biodiversity to recover degraded lands and preserve nature in a financially sustainable way, by accessing carbon markets and other environmental services payment schemes.	Land owner
AIDER Contact Person: Mr. Jaime Nalvarte Executive Manager Address: Av. Jorge Basadre 180 Oficina 6 – San Isidro. Lima, Perú Telephone: 51 1 421 5835 Email : lima@aider.com.pe	A Peruvian NGO with more than 20 years of experience in forest projects including forest management, reforestation and nature conservation, working with companies, indigenous communities and small landowners promoting eco-businesses.	Forest assessment

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information.):

Historically, Peru has neglected its forestry sector despite the country's high potential for sustainable forestry management, timber extraction, and the resulting associated industries. Three successive forestry laws (1975, 2000, and 2008) have declared reforestation to be of national interest; yet in practice the forestry sector continues to be, for all practical purposes, a "mining" sector where timber is extracted unsustainably due to weak enforcement, remoteness of forestry areas, and in some cases, corruption. Furthermore, the abundance of valuable timber provides an economic incentive to extract timber at a fast and unsustainable rate, as opposed to sustainable extraction or reforestation.

Peruvian Law 28852 promotes private investment in reforestation activities by granting reforestation concessions of state-owned deforested lands. At the present time, a modification of this law is under discussion to award these lands to private investors as private property. Unfortunately, passage of these modifications is proceeding slowly due to political disagreements and opposition from some indigenous groups.

In summary and for all practical purposes, today there are no specific state incentives for reforestation in private lands. Establishment and maintenance costs required for reforestation and the long payback period required to recover upfront investment costs make commercial reforestation all but impossible financially.

Peru has chosen the following parameters for its CDM forest definition:

- A minimum tree crown cover of 30 per cent;
- A minimum land area of 0.5 hectare; and
- A minimum tree height value of 5 meters

This project applies the 'Procedures to demonstrate the eligibility of lands for afforestation and reforestation CDM project activities' (EB 35 Report, Annex 18) except that instead of the requirement that all areas have been non-forested on 31 December 1989, all areas have not been forested for at least ten years prior to the proposed VCS project start date.

1 a) All land within the project boundary at the start of the project does not contain forest:

i) All vegetation on the projects land is below the forest thresholds for tree crown cover, minimum land area and minimum tree height as defined by Peru under decisions 16/CMP.1 and 5/CMP.1 and communicated by MINAM the Peruvian DNA. This was verified by first delineating all lands meeting the definition of forest and all lands meeting the definition of non-forest using both IKONOS imagery from November 2005 and Quickbird 2004.³⁷ The high resolution of this imagery type allows for the exclusion of forested areas lying along the small streams throughout the project area. The classification of the forest and non-forest was then verified in the field. 941.58 hectares were classified as eligible areas (non-forest since 1996) but, from that number, only 740 hectares are workable (the difference includes flood areas, pilot area, roads, etc.) and that will be planted during the first 2 years of the project with 2 standing models as will be described later. Additionally, there are 113 hectares of pasture areas that are not eligible as they were deforested after 1996.

ii) During the baseline field measurements 110 plots were sampled for saplings, shrubs, and herbaceous biomass. No saplings (trees greater than 1.3 m height, diameter at 1.3 less than 5 cm) were found in any of the plots measured. Although a small number of seedlings did exist, these seedlings are not able to mature into saplings due to the pervasive baseline activities: grazing, fires, and an aggressive grass. This area is currently grazed by animals owned by neighboring farmers. Additionally, fires frequently pass through the grazing lands. The herbaceous grass layer is dominated by *Braquiaria decumbes* which is very aggressive and prohibits the natural regeneration of trees. The combination of these three activities prevents trees from leaving the seedling state.

iii) The land has been in a constantly degraded state of pasture since the early 1970's as described in Section 1.7.

1 b) The project is a reforestation project

³⁷ Huerta, P., 2008. Procesamiento digital de imagenes de satellite y elaboracion de mapas de cobertura vegetal para SFM BAM.

All areas within the boundaries of the project have been in a deforested state since at least October of 1996, at least ten years prior to the project start date of October 1, 2007. This was determined through the classification of Landsat imagery and an interview with Jorge Cantuarias, the owner of the land since 1987 and other local witnesses. Landsat images of the project area (dates: 16.Oct.1996 and 25.Aug.2006) were classified into forest and non-forest areas. The classification methodology used and the forest classification were verified through field measurements.³⁸

103 data points were taken in the field to assess the accuracy of the satellite imagery of the land cover. 48 data points were taken in forests and 55 in pastures. Accuracy in the pasture areas was 100%, while in forest areas accuracy was 85.4% with differences found between young secondary forest, adult secondary forest, and primary forest.

2. In order to demonstrate 1 a) and 1 b), a combination of remote sensing imagery: Landsat, Ikonos, Quickbird, field surveys, and interviews with local witnesses were used.

1.17 List of commercially sensitive information (if applicable):

The commercially sensitive documents were provided to the audit team during the onsite visit.

2 VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

AR-AM 0003 Version 04 'Afforestation and reforestation of degraded land through tree planting, assisted regeneration and control of animal grazing'

The project area contains degraded lands that are currently being grazed at a low level. No other pre-project activities are taking place in the project area. Project activities will lead to the displacement of grazing animals outside the project area. This project is fully applicable to methodology AR-AM0003 V04

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The project activity of reforestation is taking place on degraded pasture lands. Without the project, the lands would continue to remain at a low carbon steady state or continue to degrade due to continued grazing and wildfires. Grazing animals will be displaced to other existing grazing lands outside the project boundary.

- The appropriate baseline methodology to develop the project baseline pursuant to paragraph 22 CDM A/R modalities and procedures is (a) Existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary
- Lands will be reforested by direct planting in the proposed ARR project activity. Due to the degraded nature of the land a nursery crop of *Inga edulis* will be planted initially to restore the lands before native hardwoods which have been cultivated in a nursery are planted out
- The project activities will lead to a shift of pre-project activity of grazing to outside the project boundary on existing grazing lands.

³⁸ Huerta, P., 2008. Procesamiento digital de imagenes de satellite y elaboracion de mapas de cobertura vegetal para SFM BAM.

- Lands to be reforested have been at a low carbon steady state, or are continuing to degrade as explained in section 1.7. The land is covered by grass and shrubs, dominated by the grass *Braquiaria decumbes*. *Braquiaria decumbes* is aggressive and prohibits the natural regeneration of trees. Grazing throughout the project area and frequent fires also prevent any change in the current land use.
- As stated, due to the combination of grazing, fires, and the grass *Braquiaria decumbes*, natural regeneration is prevented. Field measurements in 110 randomly placed throughout the project area found no saplings (trees >1.3 m height, less than 5 cm DBH)
- Site preparation will not cause significant long –term net decrease in soil carbon stocks. Based on field measurements, the soils in the project area contain very low levels of carbon (average 0.86% in top ten cm). The maximum loss of soil carbon from ploughing would be 40% of soil carbon or 24,000 t CO₂e. (740 ha * 33t CO₂e/ha = 24,420 tCO₂e). Current vegetation cover is dominated by an average of 2 t C ha⁻¹ of grass that is grazed and burned over time, thus organic inputs into the soil are minimal. The trees planted during the project will supply significantly large amounts of organic inputs into the soil. Thus, even if minimal amounts of soil carbon are lost initially, this soil carbon loss will be regained quickly.
- The project area has been in a degraded pasture state for more than ten years. The litter levels from the dominant grass vegetation can be assumed to be at a steady state or decreasing due to degradation in the absence of the project. In the project, the amount of leaf litter will increase significantly within the first year of the project. The very limited number of existing trees produces only minimal amounts of dead wood that will either decrease more or increase less than the project activity. Soil carbon levels are very low (Less than 1%). Soil carbon levels were measured in the project area and an adjoining forest area and were found to not be significantly different³⁹. Therefore, soil carbon can be expected to increase less in the baseline than in the project scenario.
- There is no flooding irrigation. The project area is located on undulating terraces of the terra firma
- Soil drainage disturbances are insignificant, such that non-CO₂-greenhouse gas emission from this type of activities can be neglected. In project areas where soil drainage can result in temporary flooding, soil preparation for direct planting will not take place. These areas are included in the ‘natural regeneration’ stratum.
- Greenhouse gas emissions from denitrification can be neglected pursuant to EB 44.
- There are no other AR CDM or VCS reforestation activities going on the land.

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

Above and below ground carbon will be measured and monitored in the proposed project. Measuring soil carbon can be excluded as any minimal soil carbon emissions resulting from soil preparation will be recovered within five years and all project lands comply with the tool “Procedure to determine when accounting of the soil organic carbon pool may be conservatively neglected in CDM A/R project activities”^{40,41}. The use of fertilizers does not take place in the baseline scenario but will take place in the project. Biomass burning does take place in the baseline scenario, however, accurate estimates of the rate of such burning are unknown and therefore GHG emissions resulting from such burning are conservatively omitted. Biomass burning will take place in a proportion of project area during site preparation and will be monitored and accounted for.

³⁹ AIDER, 2008. Analysis Comparative de Carbono en el Suelo en el Fundo Campo Verde

⁴⁰ A/R Methodological tool “Procedure to determine when accounting of the soil organic carbon pool may be conservatively neglected in CDM A/R project activities.”
http://cdm.unfccc.int/EB/Meetings/033/eb33_repan15.pdf

⁴¹ SFM. 2009. Evidence to support the applicability of the CDM AR-AM0003 methodology to Campo Verde project. Sustainable Forestry Management.

Table 15 Selection of Carbon Pools examined in baseline scenario and for the project

Carbon Pools	Selected Yes/No	Justification / Explanation of choice
Aboveground	Yes	Major carbon pool subjected to the project activity
Belowground	Yes	Major carbon pool subjected to the project activity
Deadwood	No	There are few existing pre-project activity trees existing in the degraded pastures. Deadwood can be expected to decrease more or increase less in the baseline, relative to the project scenario. Therefore, based on the applicability conditions of the methodology, this pool can be conservatively omitted.
Litter	No	As the pasture is in a degraded or degrading state, it can be expected that litter will decrease more or increase less in the baseline relative to the project scenario. Therefore, based on the applicability conditions of the methodology, this pool can be conservatively omitted.
Soil organic carbon	No	As the lands to be planted are degraded and degrading or in a low-level steady state, and comply with the applicability conditions set in A/R Methodological tool “Procedure to determine when accounting of the soil organic carbon pool may be conservatively neglected in CDM A/R project activities”⁴² as follow: a) The lands to be planted are not organic soils (e.g., peat-lands), or wetlands; b) The rate of loss of carbon stocks in mineral soils due to erosion within the project boundary is not be permanently increased above baseline rates by the proposed ARR project activity⁴³. c) Fine litter (woody twigs less than 2mm diameter, bark and leaves) will not be collected and removed. As a result, the soil organic carbon stocks in the baseline scenario can be expected to decrease more or increase less, relative to the project scenario. Therefore based on applied methodology, this pool can be conservatively omitted.

Table 16 GHG emissions by sources and sinks

Sources	Gas	Included/excluded	Justification / Explanation of choice
Combustion of fossil fuels by on-site vehicles	CO ₂	No	As per EB44, GHG emissions from fossil fuel combustion in A/R CDM activities can be assumed to be insignificant and neglected in measurements ⁴⁴
	CH ₄	No	Potential emission is negligibly small
	N ₂ O	No	Potential emission is negligibly small
Burning of aboveground biomass	CO ₂	No	However, carbon stock decreases due to burning are accounted as a carbon stock change
	CH ₄	Yes	Non-CO ₂ gas emitted from biomass burning
	N ₂ O	Yes	Non-CO ₂ gas emitted from biomass burning
Change of	CO ₂	Yes	Main gas of this source

⁴² A/R Methodological tool “Procedure to determine when accounting of the soil organic carbon pool may be conservatively neglected in CDM A/R project activities.”
http://cdm.unfccc.int/EB/Meetings/033/eb33_repan15.pdf

⁴³ SFM. 2009. Evidence to support the applicability of the CDM AR-AM0003 methodology to Campo Verde project. Sustainable Forestry Management.

⁴⁴ Executive Board of the Clean Development Mechanism Forty-Fourth Meeting.
<http://cdm.unfccc.int/EB/044/eb44rep.pdf>

Sources	Gas	Included/ excluded	Justification / Explanation of choice
aboveground biomass	CH ₄	No	Potential emission is negligibly small
	N ₂ O	No	Potential emission is negligibly small

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

Based on the methods laid out in AR-AM0003 V04 Section II.4, the baseline scenario is determined by the following steps:

Step 1: The project boundary

The project boundary has been defined and meets the eligibility criteria as described in Section 1.16 above.

Step 2: Assessment of historical land use and sectoral land-use policies or regulations and land use alternatives

Analysis of historical and current land use

In the Pucallpa region over at least the last ten years there has been a successive clearing of tropical forest into farm and pasture land. Traditional slash-and-burn agriculture is practiced followed by ranching or abandonment followed by agriculture again. Over time invasive grasses have come to dominate the pasture. The combination of this grass, grazing, and fires has lead to progressive land degradation and prevents the regeneration of trees. Of the roughly 600,000 hectares surrounding Pucallpa, more than 56% of the forest has been converted to either agriculture or grazing lands. Research by INRENA⁴⁵ found the area deforested in Ucayali to be 608,917 ha in 1995 and 956,262 ha by 2002. Prior to land use conversion, the project area contained high carbon stock tropical forest. Since this land use conversion, estimated to have taken place in the 1960's, the area has remained at a low carbon state of unproductive pasture land. A report by WWF found that prior to the Campo Verde-Tornavista road, the region was covered by tropical forest and has been becoming deforested overtime since the road opened⁴⁶. In the following map, it can be seen the level of deforestation in the surrounding area of the project caused by the direct influence of nearby capital city Pucallpa and other minor cities.

⁴⁵ Instituto Nacional de Recursos Naturales, Ministerio de Agricultura de Peru, 2005. Plan Nacional de Reforestacion.

⁴⁶ WWF Peru. 2003. Analisis de cambios de paisaje: Tournavista-Campo Verde y su area de influencia. Pérdida y Fragmentación de Bosques : (1963 – 2000)

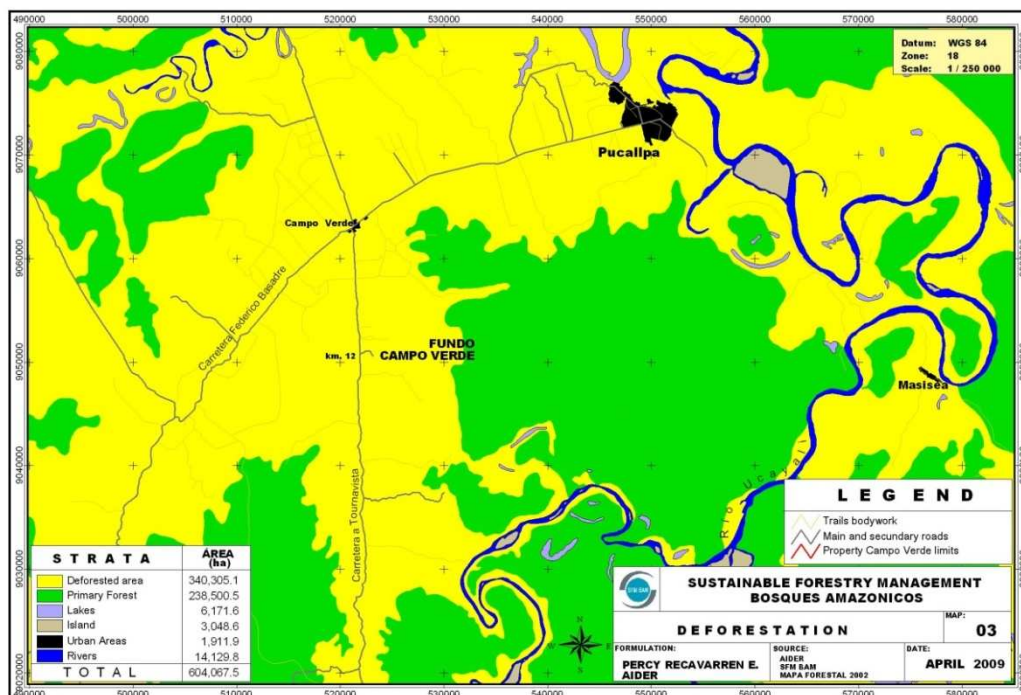


Figure 15 Forest (green) and nonforest (yellow) land cover surrounding the proposed project area in 2002.

Assessment of the national and/or sectoral policies

Although there are programs that promote the forestation of grazing land in Peru,⁴⁷ these programs possibly have little or no impact. There are no ongoing or planned ARR activities on pastureland in the Pucallpa region where the project activity is taking place. Therefore, without the proposed project activity the project area would not be reforested.

Although there are national policies that promote the reforestation of degraded zones, there are no financial resources provided for the reforestation with native species.. In Peru Law 28852, the State has not allocated any resources for the reforestation of such degraded lands.⁴⁸ As for the degraded areas in private lands, the State has not promoted reforestation. Therefore, without the proposed project activity the project area would not be reforested.

Assessment of alternative land use scenarios

According to INRENA and PROCLIM,⁴⁹ in Ucayali the annual deforestation rate was almost 8,000 hectares during the 1990-2000 period. The majority of this deforestation is attributed regionally to deforestation for small-holder shifting cultivation (INRENA)⁵⁰. The unsustainable land use practices common in the region have led to the creation of large areas of degraded lands such as those in the project area. Analysis of Landsat imagery from 1996 and 2006 show that in the Pucallpa region, areas that were non-forested in the past have remained unforested.

⁴⁷ Dance, J., 2006. Estrategia Nacional de Desarrollo Forestal en el Peru. ENDF, Instituto Nacional de Recursos Naturales, Ministerio de Agricultura de Peru, 2005. Plan Nacional de Reforestacion.

⁴⁸ Instituto Nacional de Recursos Naturales, Ministerio de Agricultura de Peru, 2005. Plan Nacional de Reforestacion.

⁴⁹ Jorge Elgegren, La Deforestacion en el Peru, Paracas, October 2005 based on official statistics of INRENA and PROCLIM

⁵⁰ Jorge Elgegren, La Deforestacion en el Peru, Paracas, October 2005 based on official statistics of INRENA and PROCLIM

Land use scenario a: Continuation of pre-project land use: unproductive pasture land

As detailed in Section 1.4, the lands to be reforested are abandoned degraded pastures with some herbaceous vegetation and few trees. These lands currently support little activity apart from low-density cattle grazing. This area has remained in a state of degraded pasture since the 1980's. There have been no ecological changes that would result in a change in the current land use except the possible further degradation due to continued grazing and fires. Interviews with local officials and project stakeholders indicate that there is no common practice of converting unproductive pasture into another land use.

There are no barriers preventing this land use from continuing. The continuation of this land use scenario requires no investment or technology. It is the common land use scenario and many of the land surrounding the project lands are also under the same land use.

Land use scenario b: Commercial cattle ranching

Large scale, commercial cattle ranching was abandoned many years ago due to the economic downturn and terrorist activity and was not re-established due to its degraded state and prospect of low returns. Intensive management of the pastureland via suppression of the invasive grass, planting of additional forage plants, and rotational grazing could be instituted in this area. However, improved grazing management is not a common practice in the region.

Land use scenario c: Crop production

Although this area may have supported crop production in the past, the area has been under pasture for over ten years. Due to the degraded nature of the pasture area, agricultural production could not be supported. The common land use trajectory in this region following conversion from forest is shifting cultivation followed after a few years by grazing land. It is not common for grazing land covered with invasive grass species to be converted into cropland as it is seen as too infertile to produce sufficient yield.

Land use scenario d: Afforestation/reforestation of the project area through direct planting without being registered as a VCS project activity

Because of the large area of existing tropical forest surrounding the Pucallpa region, afforestation of existing pastureland is not a common practice. A number of barriers prevent afforestation through direct planting from being the most likely land use scenario. More detailed information can be found below in Section 2.5. Debt funding is not available for reforestation projects in Peru. Reforestation through direct seeding require considerable investment in the initial years to implement the project but returns are generated only in the long-term and as such require considerable up-front financing. As afforestation through direct planting has not been practiced in the Ucayali region, there is lack of information on success, growth rates, and yield. Investors therefore perceive such projects to have too high investment risk.

Land use scenario e: Afforestation/reforestation of the project area through human-assisted natural regeneration without being registered as a VCS project activity

A number of barriers prevent reforestation through human-assisted natural regeneration from being the most likely land use scenario. More detailed information can be found below in Section 2.5. To allow for natural regeneration, baseline activities of fire and grazing would need to be prevented through the financial investment of active management and fire fighting activities. As reforestation through human-assisted natural regeneration has not been practiced in the Ucayali region, there is lack of information on success, growth rates, and potential timber yield. The long term returns are unknown and therefore investors perceive such projects to have too high investment risk.

Land use scenario a: unproductive pastureland is the only land use scenario that does not face any barriers to implementation.

Step 3: Stratification of the project area as explained in AR-AM0003 Section II.3.

Pre-existing conditions and baseline strata:

The entire project area was examined to determine the factors that would influence carbon stock changes in above and belowground biomass pools. These factors were defined as soil, climate, previous land use, existing vegetation, and current land use such as the grazing of animals. Local site classification tables, land use and cover maps, satellite images and literature reviews of site information as well as field data were collected. Field measurements of existing vegetation including trees and shrubs took place. Results of this analysis are detailed in the baseline studies.⁵¹ Decisions by the UNFCCC EB and AR-Working group reports and decisions were reviewed and baseline and ex ante analyses were created to be in line with such reports.

Information was also collected on the pre-project distribution of ruminant animals and summarized in the grazing study.⁵² It was determined that the entire project area contains degraded pastureland with low levels of grazing animals. As grazing animals move freely, the pre-project distribution of ruminant animals is uniform across the project area.

Although some trees exist within the project area, these trees are distributed throughout the project area. Since the pastureland is contiguous and relatively small, any actual differences in soil type or climate were not large enough to influence baseline carbon stocks. The baseline scenario was sufficiently homogeneous for all factors considered such that it was determined that carbon stocks were uniform across the project area in the baseline scenario.

Therefore it was determined that the entire project area would be considered as one stratum for the baseline condition.

Stratification of planned A/R Project activity

Two planting regimes will be used for the planned A/R activities. The stand models for the two planting regimes are defined in Table 7. Details on growth assumptions for each species and combination of species as well as planting, fertilization, harvesting etc. are provided in Section 1.9. Two planting regimes were chosen to facilitate the survival, growth, and carbon sequestration capacity of the two primary species, *D. Odorata* and *T. Serratifolia*. In addition, Assisted Natural Regeneration will be implemented in a third stratum. The two stand models and the Assisted Natural Regeneration strata differ significantly from each other in terms of their actual net greenhouse gas removals by sinks because of the different species and stem densities found in the different stand models and areas of natural regeneration, therefore the stratification of the planned A/R Project Activity consists of three strata.

Based on the above specifications, the following ex ante strata have been defined:

Table 17 Ex ante Campo Verde Project Strata

Strata	Description	Planting Years	Hectares
Strata 1	Stand Model 1	2009	180.08
		2010	230.04
Strata 2	Stand Model 2	2009	79.83
		2010	249.68
Strata 3	Assisted Natural Regeneration	No planting	179.68

⁵¹ AIDER, 2008. Determinación de la Línea Base de Carbono en el Fundo Campo Verde; Huerta, P., 2008. Procesamiento digital de imágenes de satélite y elaboración de mapas de cobertura vegetal para SFM BAM; AIDER, 2008. Análisis Comparativo de Carbono en el Suelo Fundo Campo Verde

⁵² La Torre, L., 2007. Inventario Físico de Ganado Existente en el Fundo Campo Verde. Informe No 002 SFM BAM SAC.

Strata	Description	Planting Years	Hectares
Total area planted			739.9
Total area in baseline			919.3

Table 18 Ex ante parcels and strata in Campo Verde Project

Unique ID	Location/Parcela	Strata	Stand Model	Planting Year Guaba	Planting Year	Hectares
001Str1PIY2009	Ampliación Moshaco	1	1	2008	2009	0.711
002Str1PIY2009	Añuje	1	1	2008	2009	7.449
003Str1PIY2009	Atum	1	1	2008	2009	7.042
004Str1PIY2009	Bajo Mojaral	1	1	2008	2009	13.253
005Str1PIY2009	Boa	1	1	2008	2009	5.429
006Str1PIY2009	Centro	1	1	2008	2009	5.723
007Str1PIY2009	Cetico	1	1	2008	2009	4.383
008Str1PIY2009	Chozna	1	1	2008	2009	11.197
009Str1PIY2009	Conta	1	1	2008	2009	7.017
010Str1PIY2009	Divisoria	1	1	2008	2009	2.6
011Str1PIY2009	Ishpingo	1	1	2008	2009	9.928
012Str1PIY2009	La bota	1	1	2008	2009	1.284
013Str1PIY2009	Las Bermudas	1	1	2008	2009	5.138
014Str1PIY2009	Las Lomas	1	1	2008	2009	3.585
015Str1PIY2009	Lupuna	1	1	2008	2009	10.91
016Str1PIY2009	Machimango	1	1	2008	2009	8.327
017Str1PIY2009	Mapu	1	1	2008	2009	5.595
018Str1PIY2009	Mojaral	1	1	2008	2009	16.348
019Str1PIY2009	Orquidea	1	1	2008	2009	6.869
020Str1PIY2009	Pampa	1	1	2008	2009	5.494
021Str1PIY2009	Sachavacay	1	1	2008	2009	13.168
022Str1PIY2009	Shapumba	1	1	2008	2009	7.799
023Str1PIY2009	Shinguirito	1	1	2008	2009	10.102
024Str1PIY2009	Tahuari	1	1	2008	2009	7.333
025Str1PIY2009	Yungunturo	1	1	2008	2009	3.395
026Str1PIY2010	Casha uscshal	1	1	2009	2010	14.935
027Str1PIY2010	Catorce	1	1	2009	2010	1.264
028Str1PIY2010	Cinco	1	1	2009	2010	3.419
029Str1PIY2010	Cuatro	1	1	2009	2010	13.385
030Str1PIY2010	Cumala	1	1	2009	2010	2.078
031Str1PIY2010	Dies	1	1	2009	2010	75.618
032Str1PIY2010	Dos	1	1	2009	2010	10.683
033Str1PIY2010	Ocho	1	1	2009	2010	12.832
034Str1PIY2010	Once	1	1	2009	2010	75.874
035Str1PIY2010	Proteccion	1	1	2009	2010	2.57
036Str1PIY2010	Quillobordon	1	1	2009	2010	1.034
037Str1PIY2010	Seis	1	1	2009	2010	8.455

Unique ID	Location/Parcela	Strata	Stand Model	Planting Year Guaba	Planting Year	Hectares
038Str1PIY2010	Shimballal	1	1	2009	2010	2.006
039Str1PIY2010	Trece	1	1	2009	2010	0.847
040Str1PIY2010	Triangulo	1	1	2009	2010	1.103
041Str1PIY2010	Ubos	1	1	2009	2010	1.917
042Str1PIY2010	Uno	1	1	2009	2010	2.021
043Str2PIY2009	Auca atadijo	2	2	2008	2009	8.351
044Str2PIY2009	Bosques 1	2	2	2008	2009	10.982
045Str2PIY2009	Chicua	2	2	2008	2009	9.888
046Str2PIY2009	Guabal	2	2	2008	2009	6.965
047Str2PIY2009	Huama	2	2	2008	2009	9.813
048Str2PIY2009	Jergon Sacha	2	2	2008	2009	1.923
049Str2PIY2009	Melina	2	2	2008	2009	6.871
050Str2PIY2009	Pona	2	2	2008	2009	9.946
051Str2PIY2009	Shapajal	2	2	2008	2009	4.422
052Str2PIY2009	Shiro	2	2	2008	2009	10.672
053Str2PIY2010	Doce	2	2	2009	2010	123.2
054Str2PIY2010	Nueve	2	2	2009	2010	48.379
055Str2PIY2010	Pashaco	2	2	2009	2010	19.059
056Str2PIY2010	Quince	2	2	2009	2010	1.638
057Str2PIY2010	Siete	2	2	2009	2010	14.016
058Str2PIY2010	Tres	2	2	2009	2010	43.384
059Str3PIY	Regeneración natural	3				179.675

Final *ex ante* stratification

The boundary of the baseline stratum is delineated in Figure 16. The boundaries of the *ex ante* strata are delineated in the below map *ex ante* Campo Verde Project Strata⁵³. There is one baseline stratum and three *ex ante* strata.

⁵³ Tables of GPS points and GIS boundaries submitted to third party during validation

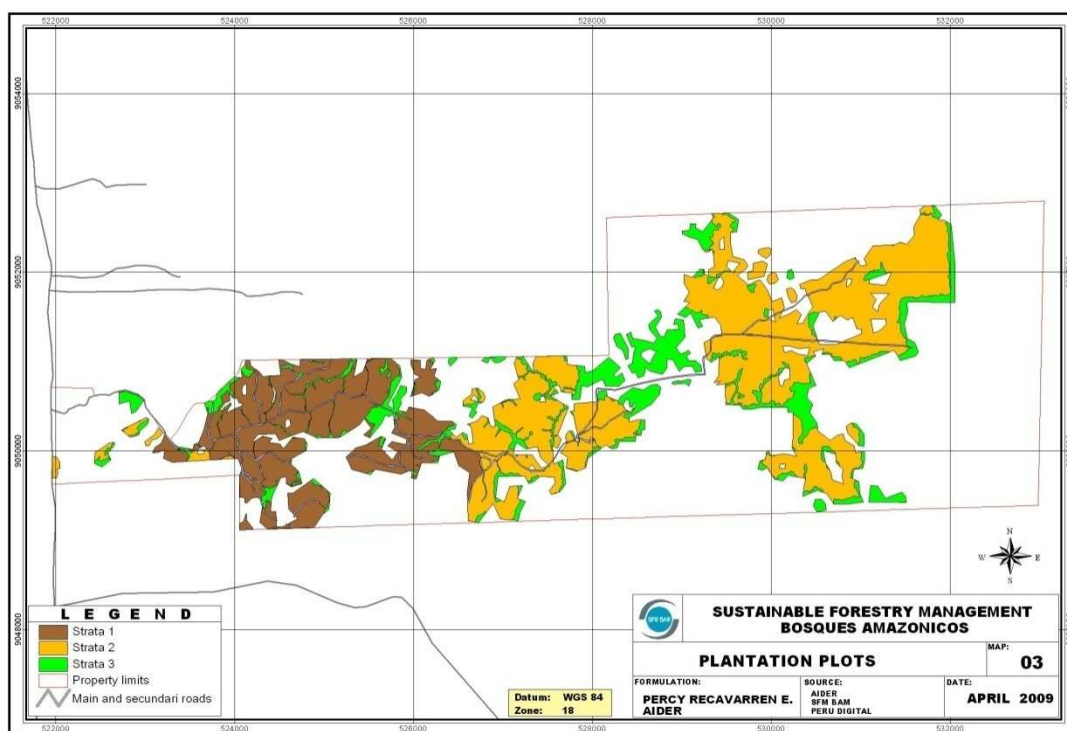


Figure 16 *Ex ante* Campo Verde Project Strata

Step 4: Determination of baseline land use scenario for each stratum

The existing land use is the most likely land use baseline scenario and only one stratum exists. Therefore there is one baseline land use scenario for the three A/R project activity strata identified in *ex ante* stratification.

A survey was conducted of the project area was conducted to identify existing trees growing on in the project area. On average, less than two trees per hectare were found in the project area.

36.1 km of the project perimeter is bordered by standing mixed tropical forest (including secondary and primary forest) which could act as an external seedbank. However, field measurements of saplings in 110 plots with 0.126 ha of size in the project area found no naturally regenerated saplings (defined as trees >1.3 m h, diameter at breast height <5 cm). Although some seedlings do exist, because of fire, grazing, and the invasive grass, *Braquiaria decumbes*, the seedlings do not survive to become saplings or trees.

Step 5: Determination of baseline carbon stocks changes

Prior to the start of the project, the project area contained existing growing trees. As according to AR-AM0003, the sum of carbon stock changes in the soil organic carbon, deadwood, and litter carbon pools is set to zero. The net positive change in living tree biomass is based on the current biomass of the existing trees, allometric equations, and the estimated projected rate of biomass increase.

Tree plot field measurements were conducted to estimate the average biomass, trees per hectare, and average diameter of the existing trees at the start of the project⁵⁴.

To estimate aboveground biomass, a biomass allometric equation was used⁵⁵:

⁵⁴ AIDER, 2008. Determinacion de la Linea Base de Carbono en el Fundo Campo Verde, AIDER, SFM, 2009. Pre existing Tree - Measurements and Calculations

$$C_{AG \text{ existing tree}} = (WD * \exp(-1.499 + (2.148 * \ln(DBH)) + (0.207 * (\ln(DBH))^2) - 0.0281 * (\ln(DBH))^3)) * CF ** 44/12$$

Where:

$C_{AG \text{ existing tree}}$	= Total aboveground biomass existing tree carbon; t CO ₂ e
DBH	= Diameter at breast height (1.3 m); cm
WD	= Wood Density (IPCC Default: <i>Simarouba amara</i> = 0.36), t m ⁻³
CF	= Carbon fraction of dry biomass in tree vegetation; t C (IPCC default 0.5)

To estimate the existing belowground tree biomass, the IPCC default ratio of belowground biomass to aboveground biomass in tropical moist deciduous forest (0.22) was used.⁵⁶ The upper bounds of the 95% confidence interval was assumed to be the mean carbon stock of the existing trees per hectare at the start of the project.

Table 19 Existing tree biomass at the start of the project

	AG t C/ha	BG t C/ha	Tree t CO ₂ /ha	Mean DBH (cm)
Mean of stratum	0.27	0.06	1.2	26.6
Upper bounds of 95% CI	0.79	0.17	3.54	

To estimate the change in existing tree biomass overtime, the growth rate of a typical secondary forest species *Simarouba amara* (Marupa)⁵⁷ starting with a DBH of 27 cm was used⁵⁸.

Marupa Growth Model⁵⁹:

$$DBH = 3.482 t^{0.6836}$$

Where:

DBH	= Diameter at breast height (1.3 m); cm
t	= Time; years

Table 20 Baseline carbon stocks in existing trees

Year of project	Year	Estimated Growth rate per year	Project Total t CO ₂ e/ha)	Project Total t CO ₂ e)	ΔC _{P,LBT} change in tree carbon stocks (tonnes of CO ₂ e)
	2007		3.54	3,250	
1	2008	1.10	3.87	3,560	310
2	2009	1.09	4.22	3,882	322
3	2010	1.09	4.58	4,215	333
4	2011	1.08	4.96	4,559	344
5	2012	1.08	5.35	4,915	355
6	2013	1.07	5.74	5,281	366
7	2014	1.07	6.15	5,658	377
8	2015	1.07	6.58	6,045	387
9	2016	1.07	7.01	6,443	398
10	2017	1.06	7.45	6,850	408

⁵⁵ Chave J, Andalo C, Brown S, Cairns MA, Chambers JQ, Eamus D, Folster H, Fromard H, Higuchi N, Kira T, Lescure JP, Nelson BW, Ogawa H, Puig H, Riera B, Yamakura T (2005) Tree allometry and improved estimation of carbon stocks and balance in tropical forests. *Oecologia* 145: 87-99

⁵⁶ 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 4, Table 4.4`

⁵⁷ Recavarren, P. 2007. Marupa plantation volume accumulation study in the Loreto Region

⁵⁸ SFM, 2009. Pre existing Tree - Measurements and Calculations

⁵⁹ Recavarren, P. 2007. Marupa plantation volume accumulation study in the Loreto Region

Year of project	Year	Estimated Growth rate per year	Project Total t CO ₂ e/ha)	Project Total t CO ₂ e)	ΔC _{P,LBT} change in tree carbon stocks (tonnes of CO ₂ e)
11	2018	1.06	7.91	7,268	418
12	2019	1.06	8.37	7,695	427
13	2020	1.06	8.85	8,132	437
14	2021	1.05	9.33	8,578	446
15	2022	1.05	9.83	9,034	456
16	2023	1.05	10.33	9,499	465
17	2024	1.05	10.85	9,973	474
18	2025	1.05	11.37	10,456	483
19	2026	1.05	11.91	10,947	492
20	2027	1.05	12.45	11,448	500
21	2028	1.04	13.01	11,956	509
22	2029	1.04	13.57	12,474	517
23	2030	1.04	14.14	12,999	526
24	2031	1.04	14.72	13,533	534
25	2032	1.04	15.31	14,075	542
26	2033	1.04	15.91	14,624	550
27	2034	1.04	16.51	15,182	558
28	2035	1.04	17.13	15,747	565
29	2036	1.04	17.75	16,320	573
30	2037	1.04	18.38	16,901	581
Total					13,651

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

To demonstrate additionality, the project proponents apply the five-step Methodological Tool “Tool for the Demonstration and Assessment of Additionality in A/R CDM project activities (version 02)”⁶⁰. Specifically, the barrier analysis will be used. The below analysis also fulfils the requirements of the VCS Additionality Project Test⁶¹.

The project meets the applicability conditions of the tool:

- *Forestation of the land within the proposed project boundary performed with or without being registered as the A/R CDM project activity shall not lead to violation of any applicable law even if the law is not enforced;*

The project is consistent with the Law for the conservation and sustainable use of biological diversity (Nº 26839) and the Law for the sustainable use of natural resources (Nº 26821).

There are no laws, statutes, or other regulatory framework that mandates afforestation in the region. Taking into account that no commercial activities were taking place in the project areas, and that the land is owned by the project proponents, the baseline land use scenarios are not determined against any applicable law. Additionally, there are no laws, statutes, or other regulatory framework that would require any of the baseline land use scenarios to take place.

⁶⁰ “Tool for the Demonstration and Assessment of Additionality in A/R CDM project activities (version 02)” <http://cdm.unfccc.int/Reference/tools/index.html>

⁶¹ Voluntary Carbon Standard, 2007.1, Section 5.8 ,
http://www.v-c-s.org/docs/Voluntary%20Carbon%20Standard%202007_1.pdf

Nationally, Peru does have a reforestation plan, launched by INRENA and Agriculture Ministry in 2005 with the goal of promoting plantations with commercial purposes and basin conservation purposes (more than 100,000 hectares for year 2024). Unfortunately, the plan lacks resources, organisation and funding to support implementation, and no activities have been witnessed in Ucayali to date

- *The use of this tool to determine additionality requires the baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario.*

This project uses CDM Methodology AR-AM0003 V04. This methodology contains a stepwise approach for determining the most plausible baseline scenario. The identification of the baseline scenario is presented in the above “Section 2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario”.

- *This tool is not applicable to small-scale afforestation and reforestation project activities.*
The proposed project is not a small-scale project.

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

Provide evidence that the starting date of the A/R project activity was after 31 December 1999

The Project was conceived in 2003 and planting activities initiated in 2007. This is confirmed through the classification of LandSat imagery of the project area (dated: 16 October 1996 and 25 August 2006) and an interview with Jorge Cantuarias, the owner of the land since 1987 as well as other local witnesses. The first activity of the project was the application to financial support from the Regional Government of Ucayali and Fondo de las Américas (US government funds) in 2003 to implement a pilot project with the goal to validate the model of recovering degraded lands over 100 hectares⁶².

Provide evidence that the incentive from the planned sale of Emissions Reductions was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available to third parties at, or prior to, the start of the project activity.

The Project initiated its planting activities in 2007, however the Campo Verde CDM was conceived in 2003. This can be proven unequivocally through the project forming part of the Peruvian carbon portfolio sponsored by the National Environmental Fund – FONAM (Fondo Nacional del Ambiente) and promoted at the Carbon Expo in 2004 and 2005. Presentations and marketing documentation used by FONAM provide evidence of this.⁶³

Reforestation projects require considerable investment in the initial years to implement the project; namely the funding of nursery development, road construction, planting costs and maintenance. In contrast, returns are generated only in the long-term. As such reforestation projects require considerable up-front financing, with only long-term returns for investors. The initial project proposal did not include revenues from carbon credits and was unsuccessful in finding investors. Below is a description of the investments that Bosques Amazonicos pursued between 2003 and 2006 without the inclusion of carbon credits, and which was unsuccessful:

- Debt funding is not available for reforestation projects in Peru. Efforts were made by BAM to access debt funding, but this proved unfruitful over a period of 3 years.
- In year 2003, the project received financial support from Regional Government of Ucayali and Fondo de las Américas (US government funds) to implement a pilot project with the goal to validate the model of recovering degraded lands over 100 hectares. With that support and

⁶² FONDAM-GOREU, Contrato cofinanciamiento entre Fondo de Las Americas, Gobierno Regional de Ucayali, Bosques Amazonicas y AIDER

⁶³ Carbon FAIR - Ficha Proyecto AIDER-BAM

through its own resources, Bosques Amazonicos undertook the following actions in order to find an investor to provide the necessary investment to implement the developed model in the project area and to develop other forest businesses:

- o In September 2004, Bosques Amazonicos hired Control Union, a Netherlands-based company and a member of Control Union World Group, founded in 1956 and operating in 80 countries worldwide, supplying certification, evaluation, monitoring and control services to forest projects and financial management services. Control Union organised business meetings in Europe and the US with investors groups to introduce the business model and project⁶⁴.
- o In the first quarter of 2005, Bosques Amazonicos developed marketing and promotional tools such as videos and brochures (in English and Spanish) with technical and financial information about the project. This material is also available for review.
- o In 2005 and 2006, Bosques Amazonicos promoted meetings with potential investors such as retirement funds (AFP Horizonte) and insurance companies (Rimac Insurance Company). Meetings were also held with other companies, among them Pennyinvest and SEAF SAFI (private investors managing multilateral funds).
- o In 2005 and 2006, Bosques Amazonicos held meetings with multilateral bank IADB and the National Office in Peru in charge of developing productive programs in Amazon Region for the substitution of coca crops. Copies of the presentations and economic analysis are also available.
- o Bosques Amazonicos was invited by the National Fund of Environment to design a PIN and participate in May 2005 at the Carbon Expo Fair in Cologne, Germany on Peruvian Stand. In that event, Bosques Amazonicos met GFA Terra System GmbH, a German company specialising in forest certification processes and carbon marketing. Communications were exchanged between companies and formal proposals were exchanged. GFA decided not to pursue the opportunity.

In conclusion, Bosques Amazonicos spent three years unsuccessfully trying to raise investment for the project. Risks of investing in reforestation projects in Peru were perceived as too high by investors, both foreign and domestic. Until the possibility of the additional revenue from the sale of carbon credits was factored into the business planning, Bosques Amazonicos was unable to secure investors for the project activity.

The first contact between Bosques Amazonicos and company Sustainable Forestry Management (SFM Ltd). took place at the Carbon Expo in Cologne, Germany in May 2005 at which representatives of Bosques Amazonicos were present as part of the Peruvian delegation. SFM Ltd showed interest in obtaining carbon credits produced by the proposed VCS carbon project activity and visited the project site for the first time in August 2006. Between October and December 2006, SFM Ltd and Bosques Amazonicos entered detailed negotiations regarding the formation of a Joint Venture to execute this forestry project⁶⁵. The generation of carbon credits was a condition precedent as part of the negotiation as SFM does not invest in forestry projects without the anticipation of securing carbon rights from the project.

SFM Ltd agreed to finance the project activity in April 2007 through the Joint Venture Company, SFM-BAM. Under the terms of the Shareholders Agreement, SFM Ltd. acquired a 30% interest in SFM-BAM. Bosques Amazonicos contributed the land assets to the Joint Venture Company. At the same time, SFM Ltd. entered into an Assignment Agreement with SFM-BAM. The Assignment Agreement specifies that SFM Ltd pre-purchase the carbon rights from the project area. The consideration paid by this pre-purchase of carbon rights provides the financing necessary for the project to undertake its operations. Thus, carbon finance has provided the funding mechanism for the “Campo Verde” project and thus has removed the institutional barriers preventing project implementation.

⁶⁴ BAM. 2004. Investment Agreement BA-C Union and Project Document BA-C Union.

⁶⁵ SFM, BAM. 2006. Memorandum of Understanding between BAM and SFM.

Step 1. Identification of alternative land use scenarios to the proposed A/R C project activity***Sub-step 1a. Identify credible alternative land use scenarios to the proposed VCS project activity***

As detailed in Section 1.7, the lands to be reforested are abandoned degraded pastures with some herbaceous vegetation and few trees. These lands currently support little activity, apart from low-density cattle grazing. Degradation trends across the project area show that the current state of the lands is likely to persist in its current condition as it has done since the 1980's. Large-scale, commercial cattle ranching was abandoned many years ago due to the economic downturn and terrorist activity, and was not re-established due to its degraded state and prospect of low returns. It is estimated that in Peru the deforestation rate is 250,000 ha per year of which 81.1% attributable to the expansion of the agricultural frontier according to official sources (INRENA). These unsustainable land use practices have led to the creation of barren degraded lands such as those of the project area. Given the high degree of degradation, the project land can no longer support agricultural activities or intense commercial cattle ranching.

In this context, the continuation of the current situation and historical land use (no project activity or other alternatives undertaken) represents the only alternative to the project activity.

According to INRENA and PROCLIM, in Ucayali the annual deforestation rate was almost 8,000 hectares during the 1990-2000 period.⁶⁶ The majority of this deforestation is attributed regionally to deforestation for small holder shifting cultivation (INRENA). The unsustainable land use practices common in the region have led to the creation of large areas of degraded lands, such as those in the project area. Analysis of Landsat imagery from 1996 and 2006 show that in the Pucallpa area, areas that were non-forested in the past have remained unforested.

Land use scenario a: Continuation of pre-project land use: unproductive pastureland

As detailed in Section 1.4, the lands to be reforested are abandoned degraded pastures with some herbaceous vegetation and few trees. These lands currently support little activity, apart from low-density cattle grazing. This area has remained in a state of degraded pastureland since the 1980's. There have been no ecological changes that would result in a change in the current land use except the possible further degradation due to continued grazing and fires. Interviews with local officials and project stakeholders indicate that there is no common practice of converting unproductive pastureland into another land use.

This activity is widespread along the Federico Basadre and Tornavista highways. The neighboring lands are also under low level grazing lands.

Land use scenario b: Commercial cattle ranching

The last commercial activity in the project area was commercial cattle grazing. However, this commercial cattle ranching was abandoned many years ago due to the economic downturn and terrorist activity, and was not re-established due to its degraded state and prospect of low returns.

At the regional level, the Ucayali Government promotes the development of cattle grazing projects by giving concessional financing to the developers. Intensive management of the pastureland via suppression of the invasive grass, planting of additional forage plants, and rotational grazing could be instituted in this area. However, improved grazing management is not a common practice in the region.

Land use scenario c: Crop production

Although this area may have supported crop production in the past, the area has been under pasture for over ten years. Due to the degraded nature of the pasture area, agricultural production would result in low yields. This degraded land cover is very common in the region. The Peruvian National

⁶⁶ Jorge Elgegren, La Deforestacion en el Peru, Paracas, October 2005 based on official statistics of INRENA and PROCLIM

Plan for Reforestation⁶⁷ found that 966,191 hectares were deforested in 2005 and only 57% was being worked. The other 43% were abandoned.

Land use scenario d: Afforestation/reforestation of the project area through direct planting without being registered as a VCS project activity

Because of the large area of existing tropical forest surrounding the Pucallpa region, afforestation or reforestation of existing pastureland is not a common practice. There is no legal requirement to reforest in the Ucayali region of Peru. There has been virtually no reforestation or afforestation via large scale commercial forestry in the Pucallpa region. According to INRENA from 2001-2006 only 196 hectares of land have been reforested in the Ucayali Region.

Land use scenario e: Afforestation/reforestation of the project area through human-assisted natural regeneration without being registered as a VCS project activity

There is no legal requirement to reforest in the Ucayali region of Peru. There has been virtually no reforestation or afforestation in the Pucallpa region. According to INRENA from 2001-2006 only 196 hectares of land have been reforested in the Ucayali Region. Reforestation through human-assisted natural regeneration requires capital investment in land management and fire fighting activities. The potential for timber returns from such an activity are unknown.

Outcome of Sub-step 1a: *List of credible alternative land use scenarios that would have occurred on the land within the project boundary of the A/R project activity.*

Land Use Scenario a: Unproductive pastureland

Land Use Scenario b: Commercial cattle grazing

Land Use Scenario c: Crop production

Land Use Scenario d: Reforestation through direct planting without registration as a VCS Project

Land Use Scenario e: Reforestation through human-assisted natural regeneration without registration as a VCS Project

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

Land Use Scenario a: Unproductive pastureland

The current land use is in compliance with all legal and regulatory requirements.

Land Use Scenario b: Commercial cattle grazing

At the regional level, the Ucayali Government promotes the development of cattle grazing projects by giving concessional financing to the developers. However, there is no legal regulation requiring cattle grazing take place in the project area.

Land Use Scenario c: Agricultural production

There are no legal or regulatory requirements blocking or requiring the proposed project area used for crop production.

Land Use Scenario d: Afforestation without registration as a VCS Project

At the national level, Peru has a reforestation plan aimed at promoting plantations with commercial purposes and basin conservation purposes. However this plan lacks resources, organisation and funding to support implementation, and no activities have been witnessed in Ucayali to date.

Afforestation is not mandated by any enforced law, statute, or other regulatory framework⁶⁸

Land Use Scenario e: Reforestation through assisted-natural regeneration without registration as a VCS Project

Afforestation is not mandated by any enforced law, statute, or other regulatory framework⁶⁹

⁶⁷ Instituto Nacional de Recursos Naturales, Ministerio de Agricultura de Peru, 2005. Plan Nacional de Reforestacion.

⁶⁸ VCS Additionality Project Test: Step 2: Regulatory Surplus (Section 5.8 of VCS 2007.1)

Outcome of Substep 1b: : *List of plausible alternative land use scenarios to the A/R project activity that are in compliance with mandatory legislation and regulations taking into account the their enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations*

Land Use Scenario a: Unproductive pastureland

Land Use Scenario b: Commercial cattle grazing

Land Use Scenario c: Agricultural production

Land Use Scenario d: Reforestation through direct planting without registration as a VCS Project

Land Use Scenario e: Reforestation through human-assisted natural regeneration without registration as a VCS Project

Sub-step 1c. Selection of the baseline scenario:

Section 2.4 “Description of how the baseline scenario is identified and description of the identified baseline scenario” of the VCS PD was used to identify the most likely baseline scenario. Using this stepwise approach the most plausible baseline scenario is the continuation of the existing land use: unproductive pastureland.

Step 2. Investment analysis

N/A. For the Campo Verde project, barrier analysis is performed as a stand-alone additionality analysis.

Step 3. Barrier analysis⁷⁰

The proposed project activities face barriers that prevent the implementation of the proposed project activity. The barriers for both project activities: A/R through direct planting and A/R through assisted natural regeneration face the same barriers and therefore the analysis is presented together. However, the most likely baseline scenario, unproductive pastureland, does not face any barriers to implementation.

The Campo Verde project had been looking for a financial partner for approximately 3 years before SFM became involved. As documented below, the project undertook several efforts to raise finance from a variety of sources, all of them unsuccessful until SFM agreed to finance the reforestation activities. SFM’s financing has been provided on an all equity basis as conventional bank finance was not available.

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

Investment Barriers:

Debt funding is not available for long-term reforestation projects in Peru. Reforestation through direct planting or assisted natural regeneration requires considerable investment in the initial years to implement the project; namely negotiations with stakeholders to expel grazing animals, the funding of nursery development, planting costs, maintenance, fire prevention and fire fighting. Returns are generated only in the long-term. Consequently reforestation projects require considerable up-front financing, with only long-term returns for investors. The project’s risk-adjusted return to investors is not appealing to local or international investors. One of the main risks is that there is a lack of commercial demonstration of the growth and yield of native species plantations or of assisted natural regeneration. Therefore, making the risk-adjusted return to investors unattractive.

⁶⁹ VCS Additionality Project Test: Step 2: Regulatory Surplus (Section 5.8 of VCS 2007.1)

⁷⁰ VCS Additionality – Project Test – Step 2 Implementation Barriers (Section 5.8 VCS 2007.1)

Public funding for reforestation activities in the Ucayali region is almost nonexistent. In the 2008 Ucayali's budget, funding for reforestation projects of native species was not considered while funding for reforestation of fast-growth species and for the recovery of degraded areas sums S/. 780,000 (seven hundred and eighty thousand Nuevos Soles) less than 1% of Ucayali's budget.⁷¹

Funding from commercial banks is very limited as well. According to the USAID report *Rural and Agricultural Finance: Emerging Practices from Peruvian Financial Institutions*, "the formal financial system in Peru, all entities regulated by the Superintendency of Banks and Insurance, provides very limited rural and agricultural finance services and most financial institutions focus uniquely on serving urban clients".⁷²

The banks that do provide rural and agricultural finance require a repayment period not longer than 3 years⁷³. Moreover, COFIDE, the government sponsored Peruvian development bank, offers funding for projects for up to 10 years only⁷⁴.

As an example, efforts were made by BAM to access debt funding for a period of three years unsuccessfully. Details of the efforts to secure funding by project proponents are provided in Step 5 below.

Technological Barrier:

Since afforestation is not a common practice, access to planting materials such as seedlings for projects on a commercial scale is limited in the region. This substantially increases the costs required to produce seedlings. Although plantation development in Peru had been advocated by the Reforestation Committee – INRENA, after the Committee was closed existing plantations were abandoned.

Prevailing Practice Barrier

Reforestation through direct planting or assisted natural regeneration is not commonly practiced in the Pucallpa region. According to INRENA,⁷⁵ for the period 2001-2006, only 196 hectares have been reforested in Ucayali Region. In the 1980's the Reforestation Committee of IRENA worked to promote plantations in local communities. However, the growth of the planted trees was not monitored and most plantations were not successfully established.

Plantation development has always been advocated by the Comité de Reforestación, a program under the authority of INRENA. The Comité was concerned about the establishment of the plantations mainly, but not about the maintenance of them. After the program was closed, plantations were abandoned by almost all of the communities and farmers that were associated with the project. For instance according to ITTO, in Peru "between 1997 and 2000 Prosopis was sown over more than 400,000 hectares to thicken sparse woody formations and to establish new woody cover where there was none before. However, it is estimated that only 10% survived."⁷⁶

Currently, a combination of fires, grazing, and an invasive grass species prevents reforestation through natural regeneration. The fires are anthropogenic and are initiated outside the proposed

⁷¹ Congreso de la Republica de Peru, 2008. Presupuesto Publico 2008.

⁷² http://www.congreso.gob.pe/comisiones/2007/presupuesto/libro/TOMO1/25_Ucayali.pdf

⁷³ USAID, microNOTE #27, Rural and Agricultural Finance: Emerging Practices from Peruvian Financial Institutions, April, 2007. http://pdf.usaid.gov/pdf_docs/PNADI834.pdf

⁷⁴ Food and Agriculture Organization of the United Nations, 2008. Peru: la industria de la nuez de Brasil en Madre de dios. <ftp://ftp.fao.org/docrep/fao/010/a0226s/a0226s08.pdf>

⁷⁵ COFIDE, 2009. Productos y servicios financieros <http://www.cofide.com.pe/productos2.html>

⁷⁶ Jorge Ellegren, La Deforestación en el Perú, Paracas, October 2005 based on official statistics of INRENA and PROCLIM

⁷⁷ Status of Tropical Forests 2005, International Tropical Timber Organization, p.270.

project boundary. MODIS HotSpot fire maps show the occurrence of fire in the region⁷⁷. Grazing also takes place by animals moving from outside the boundary to inside the project boundary. Therefore, human intervention would be required to prevent such activities from taking place. As the human populations do not benefit from the prevention of such activities, actively stopping these activities is not a prevailing practice.

Social Condition Barrier:

As commercial scale afforestation and reforestation are not prevailing practices, there is a lack of skilled or properly trained labour in the region.⁷⁸ This includes the lack of experienced forestry contractors.

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):

The identified barriers do not affect the baseline scenario, continuation of unproductive pastureland. The continuation of existing land use requires no investment capital or technological inputs. It is one of the main prevailing practices in the Pucallpa area. The majority of the landowners surrounding the project area practice low-input grazing on their lands, therefore there is no lack of labour experienced with this low technology grazing practice.

Step 4. Common practice analysis⁷⁹

Reforestation via large-scale commercial forestry is not commonly practiced in the Pucallpa region. According to the 2005 ITTO's report Status of Tropical Forests, "current realistic estimates suggest the total forestry plantation area [in Peru] to be between 200,000 and 300,000 hectares (CIEF pers. comm., December 2005). Most plantations are located in the Andean region, the main species there being Eucalyptus globulus. About 70% of all planted forest is privately or community owned, and 30% is owned publicly."⁸⁰

According with INRENA,⁸¹ for the period 2001-2006, only 196 hectares have been reforested in Ucayali Region. This reforestation is not the result of large-scale commercial forestry practices. Therefore, there are no similar forestation activities in the Pucallpa region that can be compared.

Step 5: Impact of VCS registration

The proposed registration of the project area as a VCS project removed the investment and technological barriers.

The Campo Verde project had been looking for a financial partner for approximately 3 years before SFM became involved. As documented below, the project undertook several efforts to raise finance from a variety of sources:

- In September 2004, Bosques Amazónicos hired Control Union, a Netherlands-based company and a member of Control Union World Group, founded in 1956 and operating in 80 countries worldwide, supplying certification, evaluation, monitoring and control services to forest

⁷⁷ Information for Resource Management System, University of Maryland, 2009. Web Fire Mapper: South America. <http://maps.geog.umd.edu/firms/>

⁷⁸ Programa de Estadísticas y Estudios Laborales, Ministerio de Trabajo y Promoción del Empleo del Perú, 2007. Encuesta de Hogares Especializada en Niveles de Empleo 2007. http://www.mintra.gob.pe/peel/publicaciones/informes/PEEL_Empleo_LIMA_METROPOLITANA_2007.pdf

⁷⁹ VCS Additionality Project Test, Step 3: Common Practice (Section 5.8 VCS 2007.1)

⁸⁰ Status of Tropical Forests 2005, International Tropical Timber Organization, p.267

⁸¹ Jorge Elgegren, La Deforestación en el Perú, Paracas, October 2005 based on official statistics of INRENA and PROCLIM

projects and financial management services. Control Union organised business meetings in Europe and the US with investors groups to introduce the business model and project. Reports and documents (Attached copy of executive summary, power point presentations about those meetings and the contract between Bosques Amazónicos and Control Union.)

- In the first quarter of 2005, Bosques Amazónicos developed marketing and promotional tools such as videos and brochures (in English and Spanish) with technical and financial information about the project⁸².
- In 2005 and 2006, Bosques Amazónicos promoted meetings with potential investors such as Peruvian pension funds (AFP Horizonte) and insurance companies (Rimac Insurance Company). Meetings were also held with other companies, among them Pennyinvest and SEAF SAFI (private investors managing multilateral funds)⁸³
- In 2005 and 2006, Bosques Amazónicos held meetings with Inter-American Development Bank (IADB) and the National Office in Peru in charge of developing productive programs in Amazon Region for the substitution of coca crops⁸⁴..

However, the Campo Verde project was able to find an investor when the project was presented as a project that would create sellable carbon credits. Owing to the promise of carbon credit rights, SFM Ltd agreed to finance the project activity in April 2007 through the Joint Venture Company SFM-BAM. Under the terms of the Shareholders Agreement, SFM Ltd. acquired a 30% interest in SFM-BAM. Bosques Amazónicos contributed the land assets to the Joint Venture Company. At the same time, SFM Ltd. entered into an Assignment Agreement with SFM-BAM. The Assignment Agreement specified that SFM Ltd pre-purchase the carbon rights from the project area. The consideration paid by this pre-purchase of carbon rights provides the financing necessary for the project to undertake its operations. Thus, carbon finance has provided the funding mechanism for the “Campo Verde” project and thus has removed the investment barrier preventing project implementation.

3 Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

AR-AM 0003 ‘Afforestation and reforestation of degraded land through tree planting, assisted regeneration and control of animal grazing is applied. This methodology has been chosen because the project is taking place on degraded pasturelands and no other project activities are taking place in the project area. The justification of this choice is given in section 2.2 of the VCS PD.

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

The purpose of monitoring is to have all the information concerned to the project development, allowing the estimation of VERs at the end of an accreditation period.

The monitoring activities include gathering information directly from the field and indirect sources and making the calculations and estimations required to know if the project is being developed according to the PDD and management plans and to determinate GHG removals and leakage.

⁸² Presented to third-party during validation

⁸³ Presented to third-party during validation

⁸⁴ Presented to third-party during validation

Monitoring of forest establishment will be done permanently during the plantation phases, gathering information from the seed collection zones, nursery and plantation areas. Monitoring of forest management also will be done permanently, according to the occurrence of management activities.

Monitoring of project boundaries and stratum and stand models boundaries will occur semi-annually. Monitoring of permanent sample plots to determinate GHG removals will be done one time at year five, but these plots also will be used for trees growth monitoring with forest management aims. The frequency will be defined according to the plantation status.

Monitoring of leakage will be done monthly, except the grazing monitoring activities which will be conducted every year.

Monitoring will be conducted by a professional team consisting of a coordinator, a field agent and a processing agent. The coordinator will report directly to the General Manager.

All monitoring activities will be implemented using Standard Operational Procedures (SOPs) and personnel will be trained permanently to ensure the data quality⁸⁵.

3.3 Data and parameters archived and monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

Table 21 Data and parameters to be monitored

Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Project area coordinates	UTM	UTM polygon coordinates for calculate the project area.	Measured	Annually	Measure using GPS unit the coordinates of the project area and check them with the VCS-PDD.	Using Monitoring SOP Training new personnel for the data collection.	
Desired level of precision	%	Maximum acceptable error for measuring and monitoring	Defined	Before the start of the project	According to the precision level required	Using Monitoring SOP	
Confidence level	%	Expression of uncertainty in calculations	Defined	Before the start of the project	According to the precision level required	Using Monitoring SOP	
Stratum area coordinates	UTM	UTM polygon coordinates for calculate each stratum area.	Measured	Annually	Measure using GPS unit the coordinates of the area of each strata and check them with the VCS-PDD.	Using Monitoring SOP Training new personnel for the data collection.	

⁸⁵ AIDER. 2008. Procedimientos operativos estandar para la aplicación del plan de monitoreo. Proyecto Campo Verde.

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Stratum ID	Alpha-numeric	Identified and mapped for each stratum for monitoring changes in carbon stocks.	Measured	100% area	Assign a code for each stratum.	Using Monitoring SOP	
Stand model area coordinates	UTM	UTM polygon coordinates for calculate each stand model area.	Measured	Annually	Measure with GPS unit the coordinates of the area of each stand model and check them with the VCS-PDD.	Using Monitoring SOP Training new personnel for the data collection.	
Stand ID	Alpha-numeric	Identified and mapped for each stand model for monitoring changes in carbon stocks.	Measured	100% area	Assign a code for each stand model.	Using Monitoring SOP	
Tree species	---	Names of tree species in baseline and project activities	Measured	100% area	Record names of species present	Using Monitoring SOP Training new personnel for the data collection.	
Seed collection zones coordinates	UTM	Areas where the seeds are collected and processed before they are put into the seed beds.	Measured	Annually	Measure with GPS unit the coordinates of the area of each seed collection zone	Training new personnel for the data collection.	
Disturbed area	Ha	Any areas affected because of deforestation or plantation failure.	Measured	Semiannually	Field verification of project area, stratum and stand models, identification of the disturbance type and registration of the area affected in a 11paper form.	Using Monitoring SOP	
National, local and sectoral policies	Various	Regulations that may influence land use in the absence of project activities.	Various	Start and end of the crediting period	Conduct a general evaluation of existing and new legislation and regulations	Using Monitoring SOP	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Natural and anthropogenic factors	Various	Natural and anthropogenic factors that may influence land use, land cover and natural regeneration.	Various	Start and end of the crediting period	Conduct a general evaluation of natural and anthropogenic factors	Using Monitoring SOP	
Lost biomass because of disturbance	t C	Biomass lost because of deforestation or plantation failure.	Calculated	Semiannually	Calculate the biomass lost using field data collected in paper forms.	Using Monitoring SOP Randomly verification of the field data in paper forms.	
Date of disturbance	alphanumeric	Date when the deforestation occurred or when the plantation failure was identified.	Estimated	Semiannually	Register the date on the paper forms used for checking disturbances.	Using Monitoring SOP	
Mechanized area (tracked area)	Ha	Area with mechanized site preparation	Measured	During plantation establishment	Measure the area and register in a paper form. Also register important area characteristics.	Compare the field data with the administration records.	
Average above-ground biomass stock before burning	Kg*ha-1	Biomass present in project area before burning for site preparation	Measured	During plantation establishment	Measure the area and register in a paper form	Using Monitoring SOP Random verification of field data.	
Biomass burnt during site preparation	%/ha	Percentage of biomass burnt because of site preparation	Estimated	During plantation establishment	Estimate on the field, the proportion of biomass burnt during site preparation	Using Monitoring SOP Randomly verification of field data (proportion of biomass burnt).	
Area of biomass burn because of site preparation.	Ha	Area where biomass has been burnt because of site preparation activities.	Measured	During plantation establishment	Register the burnt area in paper forms.	Using Monitoring SOP	
Lost biomass because of site preparation	M3	Biomass lost because of site preparation activities	calculated	During plantation establishment	Calculation using data from baseline and field data estimated during site preparation.	Using Monitoring SOP	
Average biomass combustion efficiency	Dimensionless	Conversion factor	0.5	During plantation establishment	IPCC default value is used	---	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Carbon fraction of biomass burnt	t C	Carbon fraction of biomass burnt during preparation activities	Calculated	During plantation establishment	Use monitoring data, default values and equations from the methodology	Verification of the data consistence. Training new personnel for the calculation	
Increase in GHG emissions as a result of biomass burn	t CO2-e	Increase in GHG emissions due to preparation activities	Calculated	During plantation establishment	Use monitoring data, default values and equations from the methodology	Verification of the data consistence. Training new personnel for the calculation	
CH4 emission from biomass burning as a result of biomass burn	t CO2-e	CH4 emission due to preparation activities	Calculated	During plantation establishment	Use monitoring data, default values and equations from the methodology	Verification of the data consistence. Training new personnel for the calculation	
N2O emission from biomass burning as a result of biomass burn	t CO2-e	N2O emission due to preparation activities	Calculated	During plantation establishment	Use monitoring data, default values and equations from the methodology	Verification of the data consistence. Training new personnel for the calculation	
CO2 emission from biomass burning as a result of biomass burn	t CO2-e	CO2 emission due to preparation activities	Calculated	During plantation establishment	Use monitoring data, default values and equations from the methodology	Verification of the data consistence. Training new personnel for the calculation	
Emission factor for emission from N input	t N2O-N	Conversion factor	Default value	During plantation establishment and once per crediting period	Use IFCC default value (1.25%) if no more appropriate data	---	
Area with weed elimination	ha	Project area where weeding has been done	Measured	During plantation establishment	Measure the area where weeding has been done and register which area deviates from that described in the methodology	Using Monitoring SOP	
Area with mechanized site preparation	ha	Project area where mechanized site preparation has been done	Measured	During plantation establishment	Measure the area where mechanized site preparation has been done and register types of activities. Also register which area deviates from that described in the methodology	Using Monitoring SOP	
Date of mechanized site preparation	Alpha-numeric	Date when mechanized site preparation occurs	Measured	During plantation establishment	Register the date in paper forms.	Using Monitoring SOP	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Date of weed elimination	Alpha-numeric	Date when weed elimination occurs	Measured	During plantation establishment	Register the date in paper forms.	Using Monitoring SOP	
Total planted area	ha	Total area where the plantation is established	Measured	During plantation establishment	Measure the area where the plantation is established	Randomly verification of field data every year.	
Planted area by stand model	ha	Area of plantation differentiated by combination of species	Measured	During plantation establishment	Measure the area where the plantation is established, differentiating for combination of species	Randomly verification of field data every year.	
Project area	UTM, ha	Total area where the project is taking place; e.g total size of all strata	GPS, measured	During the year 1: semi-annual from the year 2: annual	Measurement with GPS of the total area of the project	Randomly verification of field data every year.	
Disturbed area	ha	Area where some kind of disturbance has occurred (deforestation, plantation failure, fire).	Measured	Semi annually	Check disturbances by direct observation. Travel through by the project area to identify changes that should have occurred so much in the limits of the area, as in the strata and stand model. If changes have occurred, these should be documented in paper forms.	Randomly verification of field data every year.	
Seeded plants	Alpha-numeric	Number of plants seeded by specie, by stand model	Measured	Weekly during the phases of plantation	Register the number of plants installed on field, by specie and by stand model. Also register the seed collection zone.	Randomly verification of field data at the end of the phase of plantation.	
Survival rate	%	Percentage of plants seeded by specie, by stand model that have survived on field.	Measured	Measured at 3 months, and 3 years	Check of survival by sampling.	Using Monitoring SOP Randomly verification of field data at the end of the sampling. Training new personnel for the data collection.	Final stem density should be at least 90% of initial
Area affected by forest management activities	ha	Project area where a specific management activity is applied	Measured	According to occurrence	Measurement with GPS of the total area where a specific management activity is applied.	Training new personnel for the data collection.	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Biomass removed because of forest management	t C	Amount of biomass removed of the plantation because of activities like pruning, or harvesting.	Measured	According to occurrence	Register on paper forms the amount of biomass removed, by species and by stand model.	Randomly verification of field data at the end of the registration event.	
Registration of plantation in areas harvested	ha	Checking if the areas harvested are being re-planted according to it established in the PDD.	Measured	Once after the harvesting	Register the number of plants installed on harvested areas, by specie and by stand model.	Using Monitoring SOP	
Natural regeneration conditions registration	To be defined	Checking if the adequate conditions for the natural regeneration in the areas are being given that has been harvested.	Estimated	Each 6 months, after harvesting	Define regeneration conditions and make a field evaluation.	Randomly verification of variables on field	
Area of stratum	ha	Area of an stratum (determine by its physiographic, soil and vegetation characteristics)	Calculated	At the beginning of the project.	Calculated from the GPS coordinates.	Randomly verification of GPS points every year.	
Area of stand models	ha	Area of every stand model, defined by the year of planting and combination of species.	Calculated	At the beginning of the project.	Calculated from the GPS coordinates.	Randomly verification of GPS points every year.	
Plot ID	Alpha-numeric	Identified and mapped for each stratum and stand model for monitoring changes in carbon stocks.	Measured	100% area	Assign a code for each plot.	Using SOP for permanent sample plots	
Plot location	UTM	UTM coordinates	Measured	100% area	Measure with GPS and register in GIS data base.	Randomly verification of field data	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Plot area	m2	Area of the plots	Calculated	100% area	Calculated from the GPS coordinates.	Randomly verification of GPS points.	
Number of plots	Number	Total number of plots in stratum and stand models	Calculated	100% area	Calculated according to the sampling frame.	Using SOP for permanent sample plots	
Cost of establishment of a sample plot	Local currency	Total costs associated with the establishment of a plot in stratum i	Measurement	All tree plots	Measured according to established costs	Using SOP for permanent sample plots	
Area of sampling frame	m2	Total area of the project that will be sampled.	Calculated	Using a SOP	Calculated according to the sampling frame.	Using SOP for permanent sample plots	
Error level	%	The level of error in estimated tree carbon stock levels	Calculated	All tree plots	According to the precision level required.	Using SOP for permanent sample plots	
Standard deviation of each stratum	Number	A measure of the variance of the measured tree carbon stocks	Estimated	All tree plots	Calculated from tree plot measurements	Using SOP for permanent sample plots	
Sample size	Number	The number of tree plots estimated to be required to achieve a desired error level	Calculated	100% area	Calculated from literature values	Using SOP for permanent sample plots	
Maximum number of sample plots in the project area	Number	Maximum number of sample plots that can be accommodated	Calculated	Every 5 years	Calculated from literature values	Using SOP for permanent sample plots	
Maximum number of sample plots in stratum i	Number	Maximum number of sample plots that can be accommodated	Calculated	Before the project start and every 5 years thereafter	Calculated from literature values	Using SOP for permanent sample plots	
Age of plantation	Year	Years since the plantation have been established, by strata and stand model.	Measured	100% area	Register in paper forms.	Cross check	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Number of trees in a plot	Number	Number of trees inside the monitoring plot	Measured	100% trees in sample plots	Register in paper forms.	Using SOP for permanent sample plots Training new personnel for the data collection.	
DBH	cm	Diameter of the trees in plots at breast height.	Measured	100% trees in sample plots	Register in paper forms.	Using SOP for permanent sample plots Training new personnel for the data collection.	
Tree height	m	Height of the trees in plots	Measured	100% trees in sample plots	Register in paper forms.	Using SOP for permanent sample plots Training new personnel for the data collection.	
Allometric equation for species j linking aboveground tree biomass to DBH and tree height	Kg*tree-1	Function used to calculate biomass using field measurements	Literature or field measurements	100% trees in sample plots	Register in paper forms	---	
Carbon fraction of species j	tonnes C*(tonne d.m.)-1	IPCC default value to calculate carbon fraction of trees	Default value	0.5	---	---	
Wood density of species j	t,d,m*m-3	Ratio of dry matter and volume	Default value	100% trees in sample plot	Locally derived, national inventory, IPCC GPG LULUCF	Local-derived and species specific values have priority	
BEF	Dimension less	Biomass expansion factor	Estimated	100% of sample plots	Locally derived, national inventory, IPCC GPG LULUCF	Local-derived and species specific values have priority	
Plot expansion factor from per plot values to per hectare values	Dimension less	Factor to convert plot area to hectare level	Calculated	100% of sample plots	10,000/plot area (m ²)	---	
Value of the statistic z for $\alpha=0.05$	Dimension less	Normal probability density function	Statistic book	According to the precision level required	---	---	
Root-shoot ratio appropriate	Dimension less	Amount of tree roots in comparison	IPCC Default value	0.22	Estimation based on IPCC default	---	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
to increments for stand model k		to above ground biomass					
Carbon in dry matter aboveground biomass in stratum i, stand model k, time t	t C	Total carbon stock found in stratum	Calculated	100% of sample plots, stratum	Estimation resulting from field measurements and biomass equation used	Verification of results	
Carbon in dry matter belowground biomass in stratum i, stand model k, time t	t C	Total carbon stock found in stratum	Calculated	100% of sample plots, stratum	Estimation resulting from field measurements and biomass equation used	Verification of results	
Above-ground biomass of a tree of species j	kg*tree-1	Estimated biomass of tree based on field measured tree diameter at breast height (cm)	Calculated	100% of trees in sample plots	Field measurement of DBH (cm), application of biomass allometric equation.	Verify the applicability of equation using SOP (Destructive sampling of trees)	
Mean carbon stock in belowground biomass per unit area	kg*ha-1	Estimated carbon stock based on field measured tree diameter at breast height (cm)	Calculated	100% of sample plots	Use monitoring data, default values and equations from the methodology.	Using Monitoring SOP	
Mean carbon stock in aboveground biomass per unit area	kg*ha-1	Estimated carbon stock based on field measured tree diameter at breast height (cm)	Calculated	100% of sample plots	Use monitoring data, default values and equations from the methodology.	Using Monitoring SOP	
Mean merchantable volume per unit area for stratum i, species j, time t	m3*ha-1	Estimated merchantable volume based on field measured tree diameter at breast height	Calculated	100% of sample plots	Use monitoring data, default values and equations from the methodology.	Using Monitoring SOP	
Tree ID	Alpha-numeric	Identified and mapped for each stratum and stand model for monitoring changes in carbon stocks.	Measured	100% area	Assign a code for each plot.	Using SOP for permanent sample plots	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Emission ratio for N ₂ O	Dimension -less	Conversion factor	Default value	Annually	Literature	---	
Emission ratio for CH ₄	Dimension -less	Conversion factor	Default value	Annually	Literature	---	
Global warming potential of N ₂ O	Dimension -less	Conversion factor	Default value	Once per commitment period	IPCC literature – EB decisions	---	
Global warming potential of CH ₄	Dimension -less	Conversion factor	Default value	Once per commitment period	IPCC literature – EB decisions	---	
Number of animals present in project area at time t	Dimension -less	Animals that were grazing inside the boundaries of the project.	Measured	100% At the beginning of the project and annually thereafter	Inventory of the animals and registration in paper forms.	Using Monitoring SOP	
Ex ante estimated number of animals in the baseline scenario	Dimension -less	Ex ante estimated pre-project number of animals from the different livestock groups that would be grazing in the project area under the baseline scenario	Estimated	Ex-ante estimation	Inventory of the animals and registration in paper forms.	---	
Number of animals displaced in EGL areas	Dimension -less	Animals that were present in project area, that have been move to existing grazing land areas.	Measured	100% Annually	Register the animals in paper forms.	Using Monitoring SOP	
Number of animals displaced in NGL areas	Dimension -less	Animals that were present in project area, that have been move to not existing grazing land areas.	Measured	100% Annually	Register the animals in paper forms.	Using Monitoring SOP	
Number of animals displaced in XGL areas	Dimension -less	Animals that were present in project area, that have been moved to XGL areas	Measured	100% Annually	Register the animals in paper forms.	Using Monitoring SOP	
Number of animals displaced outside the project area	Dimension -less	Total number of animals that were present in	Measured	100% Annually	Register the animals in paper forms.	Using Monitoring SOP	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
in year t		the project area that have been moved outside the project area.					
EGL coordinates	UTM	UTM coordinates of existing grazing land areas where the animals are present.	Measured	100% Annually	Measure with GPS and register in GIS data base.	Verification of the data consistence annually.	
NGL coordinates	UTM	UTM coordinates of not existing grazing land areas where the animals are present.	Measured	100% Annually	Measure with GPS and register in GIS data base.	Verification of the data consistence annually.	
XGL coordinates	UTM	UTM coordinates of not existing grazing land areas where the animals are present.	Measured	100% Annually	Measure with GPS and register in GIS data base.	Verification of the data consistence annually.	
EGL area	Ha	Area of the existing grazing lands that are been used by the animals.	Calculated	100% Annually	Calculated from the GPS points	Verification of the data consistence annually.	
NGL area	Ha	Area of the existing grazing lands that are been used by the animals.	Calculated	100% Annually	Calculated from the GPS points	Verification of the data consistence annually.	
XGL area	Ha	Area of the existing grazing lands that are been used by the animals.	Calculated	100% Annually	Calculated from the GPS points	Verification of the data consistence annually.	
Fraction of sampled project areas sampled for grazing animals	Dimension-less	Ratio of sampled areas as a proportion of total area	Calculated	Ex-ante estimate	Defined using statistical criteria	Using Monitoring SOP	
Leakage due to the conversion of non-grassland to grassland per displaced	Tonnes CO ₂ -e*animal-1	Leakage due to the displacement of grazing animals from project area	Calculated	100% Annually	Use monitoring data, default values and equations from the methodology.	Using Monitoring SOP	

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Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
animal in NGL area		to NGL lands outside of the project area.					
Fraction of EGL areas sampled with respect to total	Dimension -less	Ratio of sampled areas as a proportion of total area	Calculated	Ex-ante estimate	Defined using statistical criteria	Using Monitoring SOP	
Fraction of sampled NGL areas sampled with respect to total	Dimension -less	Ratio of sampled areas as a proportion of total area	Calculated	Ex-ante estimate	Defined using statistical criteria	Using Monitoring SOP	
Leakage due to the conversion of non-grassland to grassland in XGL area	t CO2-e	Leakage due to the displacement of grazing animals from project area to NGL lands outside of the project area.	Calculated	100% Annually	Use monitoring data, default values and equations from the methodology.	Using Monitoring SOP	
Leakage due to the conversion of non-grassland to grassland	t CO2-e	Leakage due to the displacement of grazing animals from project area to lands outside of the project area.	Calculated	100% Annually	Use monitoring data, default values and equations from the methodology.	Using Monitoring SOP	
Fraction of sampled project areas sampled fencing posts	Dimension -less	Proportion of areas sampled to estimate leakage associated with the use of posts with respect to the total project area	Calculated	Ex-ante	Defined using statistical criteria	---	
Total change in carbon stocks	t CO2	Variation of CO2 stocks after the project, compared to baseline	Calculated	Every five years	Use monitoring data, default values and equations from the methodology.	Verification of the data consistence. Training new personnel for the calculation.	
Ratio of molecular weights of carbon and CO2	Dimension -less	Conversion factor	Default value	According to occurrence	Universal constant	---	

VCS Project Description – Campo Verde

Data / Parameter:	Data unit:	Description:	Source of data to be used:	Value of data applied for the purpose of calculating expected emission reductions:	Description of measurement methods and procedures to be applied:	QA/QC procedures to be applied:	Any comment:
Ratio of molecular weights of CH ₄ and carbon	Dimension-less	Conversion factor	Default value	According to occurrence	Universal constant	---	
Ratio of molecular weights of N ₂ O and nitrogen	Dimension-less	Conversion factor	Default value	According to occurrence	Universal constant	---	
Nitrogen-carbon ratio	Dimension-less	Conversion factor	Default value	According to occurrence	Universal constant	---	
Total project emissions	t CO ₂	CO ₂ emissions generated by the project activities	Calculated	Monthly	Use monitoring data, default values and equations from the methodology.	Verification of the data consistence semiannually. Training new personnel for the calculation.	
Total leakage of the project expressed in CO ₂ equivalents	t CO ₂ -e	Leakage associated with displacement of activities	Calculated	Semiannually	Use monitoring data, default values and equations from the methodology.	Verification of the data consistence semiannually. Training new personnel for the calculation.	

3.4 Description of the monitoring plan

3.4.1 Monitoring of project implementation: forest establishment and management

3.4.1.1 *Project Boundary:*

According to AR-AM0003, **project boundary** will be monitored as follows:

- Measure with GPS all the UTM coordinates and input into the project GIS system, marking out project boundary.
- Checking whether the actual boundary is consistent with the eligibility criteria given in the VCS - PDD.
- Using the GIS system, calculate the area of stratum and stand models.
- Do the field verification of the stratum and stand models areas.
- Semiannually, verify that the project boundary remains the same, also the stratum and stand models boundaries. If some disturbance occurs, the exact location of these lands will be registered to modify the boundaries and update the project area.

3.4.1.2 *Political, natural, and anthropogenic factors:*

National, local and sectoral policies that could influence land use in the absence of the planned project activities as well as natural and anthropogenic factors that could influence land use, land cover, and natural regeneration have been examined in anticipation of the beginning of the crediting period. These factors will again be evaluated at the end of the crediting period as follows:

- Review relevant national, local and sectoral regulations to identify any possible conflicts in project activities.
- Evaluate the level of risk of natural factors including fire, pest and disease attack, geological instability, and climate.
- Monitor relevant anthropogenic factors including human activity in project area and social instability

3.4.1.3 *Forest Establishment:*

Standard operating procedures of commonly accepted forest management will be implemented to ensure that planting practice and quality conforms to that described in VCS-PDD.

The following monitoring activities shall be conducted in the first three years after planting:

- Register the type of activities of site and soil preparations and the areas involved. Confirm that are implemented based on the practices documented in VCS – PDD.
- Register the type of activities of weeding and the areas involved. Confirm that are implemented based on the practices documented in VCS – PDD.
- Register the seed collection zones and nursery production to determinate the precedence of the plants.
- Register the planting: date, area, tree species, number of plants and precedence by stand models.
- Survival checking:
 - The initial survival rate of planted trees shall be counted three months after the planting, and re-planting shall be conducted if the survival rate is lower than 90 percent of the final planting density;
 - Final checking three years after the planting;
 - The checking of the survival rate will be conducted using temporary sample plots.
- Check that species and planting for each stand model are in line with the VCS-PDD.
- Document and explain any deviation from the planned forest establishment.

3.4.1.4 *Forest Management:*

Commonly accepted forest management techniques will be used by the project and the following practices will be monitored:

- Weeding: date, area, stand model.
- Fertilizer application: date, area, number of plants, stand model.
- Pruning: date, location, number of trees pruned, stand model.
- Harvesting: date, location, area, tree species and number of trees.
- Fuel wood collection: date, location, stand model, tree species, estimation of biomass removed.
- Checking and confirming that harvested lands are re-planted, re-sowed as planned.
- Checking and ensuring that good conditions exist for natural regeneration if harvested lands are allowed to regenerate naturally.
- Register disturbances: date, location, and stand model, type of disturbance, area and number of trees involved.
- Fire control: date, location, stand model, type of activity done, area and number of trees involved.

3.4.2 Sampling design and stratification

The stratification strategy is presented in Section 10, Monitoring Plan. When found appropriate, the area will be divided into stratum based on planting year. In addition, post stratification will be also conducted after the first monitoring to address possible changes of project boundary and planting year in comparison to the project design. The post stratification will also address the change in carbon stocks if they are more or less variable than it is expected. Strata or substrata may be grouped into

one stratum or substratum if they have similar carbon stock, carbon stock change and spatial variation. Otherwise, new strata may be defined.

Stratification will be based on the following criteria:

- Identification of factors influencing the carbon stocks: major factors that will influence tree growth (erosion processes, soil type, physiographic characteristics, etc.).
- Site classification based on factors identified in a).
- Field visits on each piece of land to inspect existing vegetation, soil condition and erosion status.
- Interviews with local farmers on land use/cover history, important events that have impacted or area impacting the land use/cover.
- Sampling surveys on representative land use and land cover types including baseline biomass
- Field measurements.

The methods described in approved methodology AR-AM0003 will be used to determine the sampling design. The methods are further detailed in the Monitoring Plan.

3.4.3 Monitoring baseline net GHG removals by sinks.

As per AR-AM0003 V04, monitoring of the baseline net GHG removals by sinks is not required.

3.4.4 Monitoring actual net GHG removals by sinks

The actual net greenhouse gas removals by sinks represent the sum of the verifiable changes in carbon stocks in the carbon pools within the project boundary, minus the increase in non-CO₂ GHG emissions measured in CO₂ equivalents by sources that are increased as a result of the implementation of an VCS-AR project activity, while avoiding double counting, within the project boundary, attributable to the VCS-AR project activity⁴. Therefore according to Eq. 13 of AR-AM0003 V04,

$$C_{ACTUAL} = \Delta C_{P, LB} - GHG_E$$

Where:

- C_{ACTUAL} = actual net greenhouse gas removals by sinks; tons CO₂-e
- $\Delta C_{P, LB}$ = sum of the changes in living biomass carbon stocks (above- and below-ground); tonnes CO₂-e
- GHG_E = sum of the increases in GHG emissions by sources within the project boundary as a result of the implementation of an VCS-AR project activity; tons CO₂-e

3.4.4.1 Measuring and estimating carbon stock changes over time

According to Eq. 15 of AR-AM0003 V04,

$$\Delta C_{P, LB} = \sum_{t=1}^{t^*} \sum_{i=1}^{m_p} \sum_{k=1}^{K_p} \Delta C_{P, ikt}$$

Where:

- $\Delta C_{P, LB}$ = sum of the changes in living biomass carbon stocks in the project scenario (above- and below-ground); tonnes CO₂-e
- $\Delta C_{P, ikt}$ = annual carbon stock change in living biomass for stand model k , in stratum i , at time t ; tonnes CO₂-e yr⁻¹
Note: As the same equation is used for baseline and actual removals in the following the index P is omitted (e. g. $\Delta C_{P, ikt} = \Delta C_{ikt}$)
- i = 1, 2, 3, ... m_p strata in the project scenario

- k = 1, 2, 3, ... K_p stand models in the project scenario
 t = 1, 2, 3, ... t^* years elapsed since the start of the AR project activity

For all stratum, “SOP Calculation of Tree Carbon Stock Changes with or without harvesting” will be utilized to calculate the changes in live carbon stock changes between monitoring events.

3.4.4.2 Monitoring GHG emissions by sources increased as result of project activity

According to Eq. 22 of AR-AM0003 V04,

$$GHG_E = E_{FuelBurn} + E_{BiomassBurn}$$

Where:

- GHG_E = sum of the increases in GHG emissions by sources within the project boundary as a result of the implementation of an VCS-AR project activity; tonnes CO₂-e
 $E_{FuelBurn}$ = increase in GHG emission as a result of burning of fossil fuels within the project boundary; tonnes CO₂-e
 $E_{BiomassBurn}$ = increase in GHG emission as a result of biomass burning within the project boundary; tonnes CO₂-e

Machinery will be used during site preparation and forest management activities within the project area during the life of the project. The emissions from the use of these vehicles will be monitored.

Standard operational procedures for monitoring emissions resulting from the project are described in Section 10, Monitoring Plan.

3.4.4.3 Increase in GHG emissions as a result of decrease in non-tree carbon stock

According to AR-AM0003 V04, it is assumed that all non-tree vegetation existing on in the project area prior to project activities will disappear. It is assumed that this occurs at the start of the project, and therefore, non-tree carbon stocks are not measured during subsequent monitoring events.

The carbon stock in this non-tree vegetation was measured prior to the start of project activities during baseline data collection. A full description of the sampling that took place can be found in the baseline report. The average non-tree carbon stock was determined and the emission resulting from this reduction in non-tree carbon stock estimated using Eq. 14 of AR-AM0003 V04

$$E_{biomassloss} = \sum_{t=1}^{t^*} \sum_{i=1}^{m_{ps}} A_i \cdot B_{non-tree,i} \cdot CF_{non-tree} \cdot \frac{44}{12}$$

Where:

- $E_{biomassloss}$ = increase in GHG emissions as a result of decrease in non-tree carbon stock, tonnes CO₂-e
 A_i = area of stratum i, ha
 $B_{non-tree,i}$ = average biomass stock of non-tree vegetation on land to be planted before the start of a proposed ARR VCS project activity for stratum i, tonnes d.m.ha-1
 $CF_{non-tree}$ = the carbon fraction of dry biomass in non-tree vegetation, tonnes C (tonne d.m.)-1
 $44/12$ = fraction of molecular weights of CO₂ and carbon, dimensionless

- i = 1,2,3 ... m_{ps} strata in the project
 t = 1,2,3,.. t^* years elapsed since the start of the ARR project activity

3.4.5 Monitoring leakage

The leakage represents the increase in GHG emissions by sources which occurs outside the boundary of an ARR VCS project activity which is measurable and attributable to the ARR VCS project activity.

Methodology AR-AM0003 V04 covers two types of leakage in Eq 28 and Eq. 29 respectively:

$$LK = LK_{ActivityDisplacement} + LK_{fencing}$$

$$LK_{ActivityDisplacement} = LK_{conversion} + LK_{fuelwood}$$

However, there is no collection of firewood in the project area in the baseline. Therefore this can be set to zero:

$$LK_{fuel-wood} = 0$$

Where:

- $LK_{ActivityDisplacement}$ = Leakage due to activity displacement; tonnes CO₂-e
 $LK_{conversion}$ = Leakage due to conversion of land to cropland and grassland ($LK_{conv-crop} + LK_{conv-graz}$); tonnes CO₂-e
 $LK_{fuel-wood}$ = Leakage due to the displacement of fuel-wood collection; tonnes CO₂-e
 $LK_{fencing}$ = leakage due to increased use of wood posts for fencing up to year t^* ; tonnes CO₂-e

Leakage through activity shifting and fence creation will be monitored as determined in the methodology. Full details of the monitoring plan including monitoring for leakage are given in Section 10: Monitoring Plan.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

The project area contains degraded lands that are currently being grazed at a low level. No other pre-project activities are taking place in the project area. Project activities will lead to the displacement of grazing animals outside the project area. For the reasons explained, this project is fully applicable to methodology AR-AM0003.

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

Based on the database of the baseline report,⁸⁶ it was found an average of 0.74 tons of CO₂e per hectare⁸⁷ from shrubs. According to AR-AM0003, it is assumed that non-tree carbon stocks will not increase over the life of the project. Frequent annual fires from neighbours' plots commonly burn the project area. Additionally, some remaining trees were found in the area adding an initial CO₂e stock of 3.87 tons per ha. Conservatively, we will assume that it will grow at a highly decreasing rate similar

⁸⁶ AIDER, 2008. Determinacion de la Linea Base de Carbono en el Fundo Campo Verde; SFM, 2009. Baseline Biomass Measurements

⁸⁷ The average tons of CO₂ per hectare from shrubs is obtained by multiplying the CO₂ content in the AGB of shrubs (0.19) by the root-shoot ratio (3.8) following IPCC guidelines (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_06_Ch6_Grassland.pdf). The CO₂ content in the AGB of shrubs is obtained by multiplying the carbon content (0.05) by 44/12.

to typical secondary forest species. The total results per year of removals in baseline scenario can be found in Table 24.

4.2.1 Summary of baseline GHG sources, sinks, reservoirs

The area is covered by degraded pasture. Grass and small shrubs dominate the vegetation. Trees are spotted across the pastures. However, in accordance with guidance contained in paragraph 35 of EB 42, GHG emissions due to the loss of herbaceous vegetation are neglected in AR-AM0003 V04.

The results show that in eligible areas, there is an average of 4.61 tons of CO₂e per hectare, a very low number that reflects very well the level of degradation of this area.

Table 22 Baseline reservoirs

	Shrubs (tCO ₂ e/ha)	Saplings (tCO ₂ e/ha)	Existing trees (tCO ₂ e/ha)	Total Carbon Stocks (tCO ₂ e/ha)
2008	0.74	0	3.87	4.61

4.2.2 Estimation of the ex ante baseline net GHG removals by sinks

During the baseline analysis, an inventory of existing trees was developed in order to estimate the amount of carbon that would have been sequestered naturally in the area “in the without project scenario”. We have assumed a growth rate similar to a growth rate of typical specie of the secondary forest with the same age of the average of trees found.

Table 23 Baseline changes in existing tree biomass

Year of project	Year	Estimated Growth rate per year	Project Total t CO ₂ e/ha)	Project Total t CO ₂ e)	ΔC _{P,LBT} change in tree carbon stocks (tonnes of CO ₂ e)
	2007		3.54	3,250	
1	2008	1.11	3.87	3,560	310
2	2009	1.10	4.22	3,882	322
3	2010	1.10	4.58	4,215	333
4	2011	1.09	4.96	4,559	344
5	2012	1.09	5.35	4,915	355
6	2013	1.08	5.74	5,281	366
7	2014	1.08	6.15	5,658	377
8	2015	1.08	6.58	6,045	387
9	2016	1.07	7.01	6,443	398
10	2017	1.07	7.45	6,850	408
11	2018	1.07	7.91	7,268	418
12	2019	1.07	8.37	7,695	427
13	2020	1.06	8.85	8,132	437
14	2021	1.06	9.33	8,578	446
15	2022	1.06	9.83	9,034	456
16	2023	1.06	10.33	9,499	465
17	2024	1.06	10.85	9,973	474
18	2025	1.05	11.37	10,456	483
19	2026	1.05	11.91	10,947	492
20	2027	1.05	12.45	11,448	500
21	2028	1.05	13.01	11,956	509
22	2029	1.05	13.57	12,474	517
23	2030	1.04	14.14	12,999	526
24	2031	1.04	14.72	13,533	534
25	2032	1.04	15.31	14,075	542

Year of project	Year	Estimated Growth rate per year	Project Total t CO ₂ e/ha)	Project Total t CO ₂ e)	ΔC _{P,LBT} change in tree carbon stocks (tonnes of CO ₂ e)
26	2033	1.03	15.91	14,624	550
27	2034	1.03	16.51	15,182	558
28	2035	1.03	17.13	15,747	565
29	2036	1.02	17.75	16,320	573
30	2037	1.02	18.38	16,901	581
Total					13,651

Table 24 Ex ante baseline net GHG removals by sinks

		Shrubs (t CO ₂ e/ha)	Saplings (t CO ₂ e/ha)	Existing trees (t CO ₂ e/ha)	Total Carbon Stocks (t CO ₂ e/ha)	Annual estimation of baseline net anthropogenic GHG removals by sinks in tonnes of CO ₂ e
1	2008	0.74	0	3.9	4.61	310.1
2	2009	0.74	0	4.2	4.96	321.8
3	2010	0.74	0	4.6	5.32	333.2
4	2011	0.74	0	5.0	5.70	344.4
5	2012	0.74	0	5.3	6.09	355.4
6	2013	0.74	0	5.7	6.48	366.2
7	2014	0.74	0	6.2	6.89	376.8
8	2015	0.74	0	6.6	7.32	387.3
9	2016	0.74	0	7.0	7.75	397.5
10	2017	0.74	0	7.5	8.19	407.6
11	2018	0.74	0	7.9	8.65	417.6
12	2019	0.74	0	8.4	9.11	427.3
13	2020	0.74	0	8.8	9.59	436.9
14	2021	0.74	0	9.3	10.07	446.4
15	2022	0.74	0	9.8	10.57	455.7
16	2023	0.74	0	10.3	11.07	464.9
17	2024	0.74	0	10.8	11.59	473.9
18	2025	0.74	0	11.4	12.11	482.8
19	2026	0.74	0	11.9	12.65	491.6
20	2027	0.74	0	12.5	13.19	500.3
21	2028	0.74	0	13.0	13.75	508.8
22	2029	0.74	0	13.6	14.31	517.2
23	2030	0.74	0	14.1	14.88	525.5
24	2031	0.74	0	14.7	15.46	533.7
25	2032	0.74	0	15.3	16.05	541.8
26	2033	0.74	0	15.9	16.65	549.7
27	2034	0.74	0	16.5	17.25	557.6
28	2035	0.74	0	17.1	17.87	565.4
29	2036	0.74	0	17.8	18.49	573.0
30	2037	0.74	0	18.4	19.12	580.6
Total estimated baseline net GHG removals by sinks (tonnes of CO₂-e)						13,651
Total number of crediting years						30
Annual average over the crediting period of estimated baseline net GHG removals by sinks (tonnes of CO₂-e)						455

4.3 Quantifying GHG emissions and/or removals for the project:

4.3.1 Actual annual net GHG removals by sinks

$$C_{ACTUAL} = \Delta C_{P, LB} - GHG_E - E_{biomassloss}$$

Where:

- C_{ACTUAL} = actual net greenhouse gas removals by sinks; tons CO₂-e
 $\Delta C_{P, LB}$ = changes in living biomass carbon stocks (above- and below-ground); tons CO₂-e
 GHG_E = increases in GHG emissions by sources within the project boundary as a result of the implementation of an VCS-AR project activity; tonnes CO₂-e
 $E_{biomassloss}$ = increase in GHG emissions as a result of decrease in non-tree carbon stock, tonnes CO₂-e

Table 25: Ex Ante Project actual GHG removals by sinks.

Year of project	Year	$\Delta C_{P, LBT}$	GHG_E	$E_{biomassloss}$	C_{ACTUAL}
		change in tree carbon stocks (tonnes of CO ₂ e)	GHG emissions by sources (tonnes of CO ₂ e)	decrease in non-tree carbon stock (tonnes of CO ₂ e)	actual net GHG removals by sinks; tonnes CO ₂ -e
1	2008	61	0.29	680	-620
2	2009	1,707	8.74	0	1,699
3	2010	14,168	0	0	14,168
4	2011	42,195	0	0	42,195
5	2012	46,669	0	0	46,669
6	2013	7,970	0	0	7,970
7	2014	-17,545	0	0	-17,545
8	2015	-22,791	0	0	-22,791
9	2016	-9,275	0	0	-9,275
10	2017	606	0	0	606
11	2018	8,235	0	0	8,235
12	2019	14,487	0	0	14,487
13	2020	18,431	0	0	18,431
14	2021	22,630	0	0	22,630
15	2022	-3,360	0	0	-3,360
16	2023	-35,404	0	0	-35,404
17	2024	18,025	0	0	18,025
18	2025	20,057	0	0	20,057
19	2026	22,143	0	0	22,143
20	2027	24,277	0	0	24,277
21	2028	26,456	0	0	26,456
22	2029	28,672	0	0	28,672
23	2030	30,921	0	0	30,921
24	2031	33,199	0	0	33,199
25	2032	35,502	0	0	35,502
26	2033	37,825	0	0	37,825
27	2034	40,166	0	0	40,166
28	2035	42,519	0	0	42,519
29	2036	44,883	0	0	44,883

30	2037	47,254	0	0	47,254
Total		540,682	9	680	539,993

4.3.1.1 Tree carbon stock changes over time

According to Eq. 15 of AR-AM0003 V04,

$$\Delta C_{P,LT} = \sum_{t=1}^{t^*} \sum_{i=1}^{m_{PS}} \sum_{k=1}^K \Delta C_{LB,ikt}$$

Where:

- $\Delta C_{P,LT}$ = sum of the changes in living tree biomass carbon stocks in the project scenario (above- and below-ground); tonnes CO₂-e
- $\Delta C_{P,ikt}$ = annual carbon stock change in living biomass for stand model k , in stratum i , at time t ; tonnes CO₂-e yr⁻¹
 Note: As the same equation is used for baseline and actual removals in the following the index P is omitted (e. g. $\Delta C_{P,ikt} = \Delta C_{ikt}$)
- i = 1, 2, 3, ... m_P strata in the project scenario
- k = 1, 2, 3, ... K_P stand models in the project scenario
- t = 1, 2, 3, ... t^* years elapsed since the start of the AR project activity

In order to determine the CO₂ densities for *S. amara*, *D. odorata*, *T. serratifolia* and *S. macrophylla* use was made of the single tree allometric relationship developed for moist tropical forests by Chave *et al*⁸⁸ (2005) to estimate aboveground biomass.

$$(AGB)_{est} = \rho \times \exp(-1.499 + 2.148 \ln(D) + 0.207(\ln(D))^2 - 0.0281(\ln(D))^3)$$

Where:

AGB = above ground biomass (kg)
 ρ = basic wood density (kg/m³), and
 D = diameter at breast height

Table 26: Basic wood densities and other parameters used to calculate CO₂ density

Species	Density (t/m ³)
<i>I. edulis</i> ⁸⁹	0.30
<i>S. macrophylla</i> ⁹⁰	0.45
<i>S. amara</i> ⁹¹	0.36
<i>D. odorata</i> ⁹²	0.87

⁸⁸ Chave, J., Andalo, C., Brown S., Cairns, M. A., Chambers, J. Q., Eamus, D., Fölster, H., Fromard, F., Higuchi, N., Kira, T., Lescure, J.-P., Nelson, B. W., Ogawa, H., Puig, H., Riéra, B. and Yamakura, T. 2005. Tree allometry and improved estimation of carbon stocks and balance in tropical forests, *Oecologia*, 145: 87–99.

⁸⁹ Pennington, T.D. 1998. Growth and biomass production of *Inga* species. In *The genus Inga Utilization*. Chapter 2: 6-15. Eds: Pennington, T.D. and Fernanades, E.C.M

⁹⁰ IPCC Guidelines for National Greenhouse Gas Inventories 2006, Volume 4, Chapter 4, Table 4.3

⁹¹ TOLEDO, E.; RINCON, C. 1999. Utilización Industrial de Nuevas especies Forestales en el Perú. Organización Internacional de las Maderas Tropicales (OIMT), Cámara Nacional Foresta, Instituto Nacional de Recursos Naturales (INRENA). Lima. 240 p

⁹² ACEVEDO, M.; KIKATA, Y. 1994. Atlas de Maderas del Perú. Universidad Nacional Agraria La Molina, Universidad de Nagoya Japón. Lima. 202 p.

<i>T. serratifolia</i> ⁹³	0.92
Other parameters	
Below ground biomass: Above ground ratio ⁹⁴	0.22
Form factor (<i>I. edulis</i> only) ⁹⁵	0.78
Carbon : Mass ratio ⁹⁶	0.50
CO ₂ : carbon ratio ⁹⁷	44/12

As no growth and yield trials exist for the species and specifically for the configuration of species proposed for Campo Verde in the vicinity of project, inferences in diameter (D) and annual diameter increment have been made using best available information. This information has been based upon literature reviews, single species trials in other regions and local knowledge of site potential. Other parameters used to calculate CO₂ density are provided in Table 26.

For *S. macrophylla*, *S. amara*, *D. odorata* and *T. serratifolia* individual tree biomasses were multiplied by stocking (Table 27). Mortality, thinning and harvests are also accounted for in calculating CO₂ density. A first year mortality rate of 15% was applied. In subsequent years a mortality rate of 0.5% was used. It is planned that *S. amara* will be harvested at 12 years of age. Stand Model 1 comprises a combination of *I. edulis*, *S. macrophylla*, *S. amara* and *D. odorata* and Stand Model 2 comprises a combination of *I. edulis*, *S. macrophylla*, *S. amara* and *T. serratifolia*

Table 27: Stocking and mortality rate for the various tree species.

Species	Stems/ha	Thinning	Year 1 mortality rate (%)	Subsequent annual mortality rate (%)
<i>I. edulis</i>	1111	No	0.5	0.5
<i>S. macrophylla</i>	17	No	15	0.5
<i>S. amara</i>	555	No	15	0.5
<i>D. odorata</i>	539	No	15	0.5
<i>T. serratifolia</i>	539	No	15	0.5

With respect to *I. edulis*, growth and yield was estimated based upon studies carried out by Pennington⁹⁸ (1998) in Jatun Sacha, Ecuador. This site was most representative of the growing conditions at Campo Verde. Using three years of diameter and height measurements, volume and biomass were calculated. Thereafter as the other tree species outcompeted *I. edulis* for light and space, a decline in growth and consequent CO₂ density was projected.

The amount of regeneration that will take place in Stratum 3 is currently unknown. Although at this time it is expected that no direct planting will occur, the area will be protected from fire and grazing and seeds from proximate trees will most likely result in tree carbon stock increases over time. However, the degree of accumulation is unknown and therefore for *ex ante* estimation it is assumed that the carbon stock increases will be equivalent to the baseline carbon stock increase per hectare.

⁹³ ACEVEDO, M.; KIKATA, Y. 1994. Atlas de Maderas del Perú. Universidad Nacional Agraria La Molina, Universidad de Nagoya Japón. Lima. 202 p.

⁹⁴ IPCC Good Practice Guidance for LULUCF, 2003. Chapter 3, Table 3A.1.8

⁹⁵ Derived from Pennington, T.D. 1998. Growth and biomass production of *Inga* species. In The genus *Inga* Utilization. Chapter 2: 6-15. Eds: Pennington, T.D. and Fernanades, E.C.M.

⁹⁶ IPCC Guidelines for National Greenhouse Gas Inventories 2006, Volume 4, Chapter 4, Table 4.3

⁹⁷ Standard equation based on chemical weight of carbon and oxygen

⁹⁸ Pennington, T.D. 1998. Growth and biomass production of *Inga* species. In The genus *Inga* Utilization. Chapter 2: 6-15. Eds: Pennington, T.D. and Fernanades, E.C.M.

Table 28 Sum of the changes in living tree biomass carbon stocks in the project scenario

		Strata 1 Guaba (Inga edulis), Caoba (Swietenia macrophylla), Marupa (Simarouba amara), Shihuahuaco (Dipteryx odora)	Strata 2 Guaba (Inga edulis), Caoba (Swietenia macrophylla), Marupa (Simarouba amara), Shihuahuaco (Dipteryx odora), Tahuarí (Tabebuiaserratifolia)	Strata 3 Natural Regeneration	Sum of the changes in living tree biomass carbon stocks Project Total	$\Delta C_{P,LBT}$ change in tree carbon stocks
Year of project	Year	Total AG+BG Carbon (t CO ₂ e)	Total AG+BG Carbon (t CO ₂ e)	Total AG+BG Carbon (t CO ₂ e)	(tonnes of CO ₂ e)	(tonnes of CO ₂ e)
1	2008	0	0	696	696	61
2	2009	1,139	505	759	2,403	1,707
3	2010	10,263	5,485	824	16,571	14,168
4	2011	35,090	22,785	891	58,766	42,195
5	2012	58,823	45,651	961	105,435	46,669
6	2013	61,698	50,674	1,032	113,404	7,970
7	2014	51,110	43,643	1,106	95,859	-17,545
8	2015	39,116	32,771	1,181	73,068	-22,791
9	2016	34,395	28,138	1,259	63,793	-9,275
10	2017	35,009	28,051	1,339	64,399	606
11	2018	39,754	31,459	1,420	72,634	8,235
12	2019	47,899	37,718	1,504	87,121	14,487
13	2020	57,974	45,989	1,589	105,552	18,431
14	2021	70,808	55,697	1,677	128,182	22,630
15	2022	64,164	58,893	1,766	124,822	-3,360
16	2023	48,221	39,342	1,857	89,419	-35,404
17	2024	58,021	47,474	1,949	107,444	18,025
18	2025	68,923	56,534	2,044	127,501	20,057
19	2026	80,955	66,549	2,140	149,644	22,143
20	2027	94,143	77,541	2,237	173,921	24,277
21	2028	108,511	89,529	2,337	200,377	26,456
22	2029	124,078	102,532	2,438	229,048	28,672
23	2030	140,863	116,565	2,541	259,969	30,921
24	2031	158,881	131,642	2,645	293,169	33,199
25	2032	178,145	147,774	2,751	328,671	35,502
26	2033	198,667	164,971	2,858	366,496	37,825
27	2034	220,454	183,241	2,967	406,662	40,166
28	2035	243,514	202,589	3,078	449,181	42,519
29	2036	267,853	223,021	3,190	494,064	44,883
30	2037	293,473	244,541	3,303	541,317	47,254

4.3.1.2 Existing non-tree vegetation

The carbon stock in this non-tree vegetation was measured prior to the start of project activities during baseline data collection. A full description of the sampling that took place can be found in the baseline report. Below ground biomass was estimated based on the IPCC root-shoot ratio default⁹⁹ for shrublands. The average non-tree carbon stock was determined and the emission resulting from this

⁹⁹ Table 6.1, IPCC 2007 IPCC Guidelines for National Greenhouse Inventories. http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_06_Ch6_Grassland.pdf

reduction in non-tree carbon stock estimated using Eq. 14 of AR-AM0003 V04. In accordance with guidance contained in paragraph 35 of EB meeting report, GHG emissions due to the loss of herbaceous vegetation are neglected in AR-AM0003 V04. Therefore, non-tree vegetation estimates do not include the herbaceous vegetation.

According to Eq. 14 of AR-AM0003 V04,

$$E_{biomassloss, s, t} = \sum_{i=1}^{m_{ps}} A_i \cdot B_{non-tree, i} \cdot CF_{non-tree} \cdot \frac{44}{12}$$

Where:

- A_i = area of stratum i, ha
- $B_{non-tree, i}$ = average biomass stock of non-tree vegetation on land to be planted before the start of a proposed ARR VCS project activity for stratum i, tonnes d.m.ha-1
- $CF_{non-tree}$ = the carbon fraction of dry biomass in non-tree vegetation, tonnes C (tonne d.m.)-1
- $44/12$ = fraction of molecular weights of CO₂ and carbon, dimensionless
- i = 1,2,3 ... m_{ps} strata in the project

Table 29 Existing non-tree biomass at start of project

	t C/ha			t CO ₂ e/ha			t CO ₂ e		
	Above-ground	Below-ground	Total	Above-ground	Below-ground	Total	Above-ground	Below-ground	Total
Degraded Pasture	0.05	0.15	0.20	0.19	0.55	0.74	179	501	680

4.3.1.3 GHG emissions by sources increased as result of project activity

According to Eq. 22 of AR-AM0003 V04,

$$GHG_E = E_{FuelBurn} + E_{BiomassBurn}$$

Where:

- GHG_E = sum of the increases in GHG emissions by sources within the project boundary as a result of the implementation of an VCS-AR project activity; tonnes CO₂-e
- $E_{FuelBurn}$ = increase in GHG emission as a result of burning of fossil fuels within the project boundary; tonnes CO₂-e
- $E_{BiomassBurn}$ = increase in GHG emission as a result of biomass burning within the project boundary; tonnes CO₂-e

However, pursuant of EB 44 fossil fuel combustion in A/R project activities is insignificant and therefore may be neglected in A/R baseline and monitoring¹⁰⁰. Therefore $E_{\text{FuelBurn}} = 0$ and will not be monitored.

A small amount of emissions will result as a result of site preparation and plantation management. Additionally, in order to suppress existing vegetation, some biomass burning may take place. For ex ante estimations, it is assumed that 30 hectares are burned in 2008 and that the remaining the project area is burned in 2009 (911.05 ha). However, in accordance to paragraph 35 of EB 42 meeting report, losses from herbaceous vegetation burned have been neglected.

Table 30 Emissions resulting from biomass burning

	$E_{\text{BiomassBurn}, n, \text{CO}_2}$	$E_{\text{BiomassBurn}, \text{N}_2\text{O}}$	$E_{\text{BiomassBurn}, \text{CH}_4}$	$E_{\text{BiomassBurn}}$
t CO ₂ e/ha	(accounted for in $E_{\text{biomassloss}}$)	0.0001	0.01	0.01
t CO ₂ e		0.83	8.20	9.03

Table 31 Sum of the increases in GHG emissions by sources within the project boundary as a result of the implementation of a VCS-AR project activity

Year of project	Year	$E_{\text{biomassburn}}$	GHG_E
1	2008	0.29	0.29
2	2009	8.74	8.74
3	2010	0	0.00
4	2011	0	0.00
5	2012	0	0.00
6	2013	0	0.00
7	2014	0	0.00
8	2015	0	0.00
9	2016	0	0.00
10	2017	0	0.00
11	2018	0	0.00
12	2019	0	0.00
13	2020	0	0.00
14	2021	0	0.00
15	2022	0	0.00
16	2023	0	0.00
17	2024	0	0.00
18	2025	0	0.00
19	2026	0	0.00
20	2027	0	0.00
21	2028	0	0.00
22	2029	0	0.00
23	2030	0	0.00
24	2031	0	0.00
25	2032	0	0.00
26	2033	0	0.00
27	2034	0	0.00

¹⁰⁰ Executive Board of the Clean Development Mechanism Forty-Fourth Meeting
<http://cdm.unfccc.int/EB/044/eb44rep.pdf>

Year of project	Year	$E_{\text{biomassburn}}$	GHG_E
28	2035	0	0.00
29	2036	0	0.00
30	2037	0	0.00
Total		9.03	9.03

4.3.2 Leakage

Methodology AR-AM0003 covers two types of leakage:

- Carbon stock decreases caused by displacement of grazing and fuel-wood collection activities ($LK_{\text{ActivityDisplacement}}$); Eq 28 of AR-AM0003 V04

$$LK = LK_{\text{ActivityDisplacement}}$$

$$LK_{\text{ActivityDisplacement}} = LK_{\text{conversion}} + LK_{\text{fuelwood}}$$

However, there is no collection of firewood in the project area in the baseline. Therefore this can set to zero:

$$LK_{\text{fuel-wood}} = 0$$

Where:

- $LK_{\text{ActivityDisplacement}}$ = Leakage due to activity displacement; tonnes CO₂-e
- $LK_{\text{conversion}}$ = Leakage due to conversion of land to cropland and grassland ($LK_{\text{conv-crop}} + LK_{\text{conv-graz}}$); tonnes CO₂-e
- $LK_{\text{fuel-wood}}$ = Leakage due to the displacement of fuel-wood collection; tonnes CO₂-e

Table 32 Ex ante GHG emissions resulting from Leakage

Year of project	Year	$LK_{\text{Activity Displacement}}$	LK
1	2008	0	0
2	2009	0	0
3	2010	0	0
4	2011	0	0
5	2012	0	0
6	2013	0	0
7	2014	0	0
8	2015	0	0
9	2016	0	0
10	2017	0	0
11	2018	0	0
12	2019	0	0
13	2020	0	0
14	2021	0	0
15	2022	0	0
16	2023	0	0
17	2024	0	0
18	2025	0	0
19	2026	0	0
20	2027	0	0

21	2028	0	0
22	2029	0	0
23	2030	0	0
24	2031	0	0
25	2032	0	0
26	2033	0	0
27	2034	0	0
28	2035	0	0
29	2036	0	0
30	2037	0	0
Total		0	0

4.3.2.1 $LK_{ActivityDisplacement}$ Leakage due to activity displacement

a. $LK_{conversion}$ Leakage due to conversion of land to grazing land

There are about 500 animals that graze within the project area in the baseline. The estimated leakage resulting from the grazing animals moving from the project lands to other lands and causing emissions is estimated using the methodology described in AR-AM0003.

If based on monitoring information, we find that the existing area is not enough to sustain displaced grazing, improved techniques are known and the company is committed to implement if necessary in farmers pasturelands.

The total area of grazing land in which the displaced animal population will be maintained can be estimated using Eq. 33 of AR-AM003 V04:

$$GLA = EGL + NGL + XGL$$

Where:

- GLA = Total grazing land area outside the project boundary needed to feed the displaced animal populations; ha
- EGL = Total existing grazing land area outside the project boundary that is under the control of the animal owners (or the project participants) and that will receive part of the displaced animal populations, up to time t^* ; ha
- NGL = Total new grazing land area outside the project boundary to be converted to grazing land that is under the control of the animal owners (or the project participants) and that will receive another part of the displaced animal populations, up to time t^* ; ha
- XGL = Total unidentifiable grazing land area outside the project boundary that will receive the remaining part of displaced animal populations, e.g. when the pre-project animal owners decide to sell the animals, up to time t^* ; ha

Based on the methodology, the following steps were used to estimate EGL, NGL, and XGL.

Step 1 and 2:

Local farmers were interviewed to estimate the area of grazing land within the project area and the existing grazing area outside of the project, the number of animals, and the population size of each animal type.

Table 33: Data required to estimate grazing leakage

Type of cattle	Cow equivalence	Daily Biomass Intake (kg dm head ⁻¹ day ⁻¹)
Bull	1.5	12.75

Cow	1	8.5
Young cattle	0.75	6.375
Calves	0.25	2.125
Lamb-adult	0.25	2.125
Lamb-child	0.25	2.125

	Area Grazed (hectares)
Project	252
Existing Grazing lands	535

Number of animals grazed in project area	
Bull	11
Cows	253
Young animals	146
Calves	91
Sheep	102

Step 3:

Using Eq. 34 from AR-AM0003 V04 the data required was collected and 'annual biomass consumption of animals over the project area' was calculated.

$$\Delta C_{LPA,t} = \sum_{i=1}^I \sum_{an=1}^{An} (DBI_{an} \cdot n_{igt} \cdot a_{apl}) \cdot 30 \cdot 0,001 \cdot \frac{1}{SFR_{PAga}}$$

Where:

- $\Delta C_{LPA,t}$ = annual animal biomass consumption over the project area to be planted at time t ; tonnes d.m.yr⁻¹
- i = plot index (i = total number of plots); dimensionless
- an = animal type index (An = total number of animal types); dimensionless
- DBI_j = daily biomass intake by animal type j an ; kg d.m. head⁻¹ day⁻¹
- n_{pgt} = number of individual animals from the livestock group g at plot p at time t ; dimensionless
- a_{gpl} = number of months per annum during which animals from the livestock group g are present at plot p ; dimensionless
- 30 = average number of days in month; dimensionless
- SFR_{PAga} = Fraction of total project area sampled; dimensionless.

Since data was collected over the whole project area, $SFR_{PAga} = 1$

The number of animals that can be displaced in EGL-areas was then calculated.

Table 34 Existing grazing areas, annual biomass consumption, and additional animals that can be maintained in EGL areas

Maximum population in EGL per ha, in terms of cows	1.5
a_{gpl} number of months animals grazed in project area	7.7
a_{gpl} number of months animals grazed in EGL	4.3

N_{max} - max number of animals on EGL:	802.5
ΔC_{Lmax} - for EGL (t d.m. yr ⁻¹):	2,456
$\Delta C_{Lcurrent}$ - on EGL (t d.m. yr ⁻¹):	474
ΔC_{LPA} - annual animal biomass consumption on project lands (t d.m. yr ⁻¹):	796
$(\Delta C_{Lmax} - \Delta C_{Lcurrent})$	1,982

The difference between ΔC_{Lmax} and $\Delta C_{Lcurrent}$ is greater than ΔC_{LPA} . Based on AR-AM0003, the EGL areas are sufficient for feeding the entire population of displaced animals. Therefore, *ex ante* leakage due to activity displacement is set as zero:

$$LK_{conversion} = 0$$

Where:

$LK_{conversion}$ = leakage due to conversion of non-grassland to grassland; tonnes CO₂-e

b. $LK_{fuelwood}$ Leakage due to fuel wood collection

Firewood was not being collected within the project area prior to the initiation of the project. Therefore:

$$LK_{fuelwood} = 0$$

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

See ISO 14064-2: 5.2.k for quantifying GHG emission reductions or removal enhancements.

Table 35 Estimation of net anthropogenic GHG removals by sinks (tonnes of CO₂e) (Summary of results obtained in Sections 4.2.2, 4.3.1, and 4.3.2.)

Year of project	Year	Estimation of baseline net GHG removals by sinks (tonnes of CO ₂ e)	actual net GHG removals by sinks; tonnes CO ₂ -e	Estimation of leakage (tonnes of CO ₂ e)	Estimation of net anthropogenic GHG removals by sinks (tonnes of CO ₂ e)	Estimation of net anthropogenic GHG removals by sinks (tonnes of CO ₂ e)
			C_{ACTUAL}	LK	per year	Cummulative
1	2008	310	-620	0	-930	-930
2	2009	322	1,699	0	1,377	447
3	2010	333	14,168	0	13,835	14,282
4	2011	344	42,195	0	41,850	56,132
5	2012	355	46,669	0	46,313	102,446
6	2013	366	7,970	0	7,603	110,049
7	2014	377	-17,545	0	-17,922	92,127
8	2015	387	-22,791	0	-23,179	68,948
9	2016	398	-9,275	0	-9,673	59,276
10	2017	408	606	0	199	59,474
11	2018	418	8,235	0	7,817	67,292
12	2019	427	14,487	0	14,060	81,352
13	2020	437	18,431	0	17,994	99,345
14	2021	446	22,630	0	22,184	121,529
15	2022	456	-3,360	0	-3,815	117,714
16	2023	465	-35,404	0	-35,869	81,845
17	2024	474	18,025	0	17,552	99,397
18	2025	483	20,057	0	19,574	118,971
19	2026	492	22,143	0	21,651	140,622
20	2027	500	24,277	0	23,777	164,399

21	2028	509	26,456	0	25,947	190,346
22	2029	517	28,672	0	28,154	218,500
23	2030	526	30,921	0	30,396	248,896
24	2031	534	33,199	0	32,666	281,562
25	2032	542	35,502	0	34,960	316,522
26	2033	550	37,825	0	37,276	353,797
27	2034	558	40,166	0	39,608	393,405
28	2035	565	42,519	0	41,954	435,359
29	2036	573	44,883	0	44,310	479,669
30	2037	581	47,254	0	46,673	526,342
Total		13,653	539,993	0	526,342	
Long-Term Average						169,971

5 Environmental Impact:

An EIA was done by independent consultants in January 2008, which is available for public review. The main conclusions of the EIA are the following:

- The project is expected to have a net positive impact on biodiversity and population
- Some activities imply some level of risk over some environmental variables. The main risks identified are related with:
 - o Water availability, associated with the requirement level of the project for nursery and maintenance of field plantations
 - o Water quality, associated with the risk of contamination by the increase of human presence and disposals generated by the project activities
 - o Geo-morphologic stability, associated with the use of heavy machinery to remove and level the soil
 - o Risk of deforestation, associated with the increase of internal migration rates attracted by the job opportunities offered by the project
- SFM-BAM has designed specific strategies to minimize the probability of occurrence of these risks with specific actions and policies about hiring, health and others
- SFM-BAM will also carry out periodical analysis of quality indicators for water and soil.
- Finally, three wild life species has been selected as indicators of biodiversity health and will be monitored permanently to verify their evolution

6 Stakeholders' comments:

No communities or families live within the project area as this is a private property; all the stakeholders considered in the present chapter belong to surrounding settlements. The fully documented stakeholders' consultation process was undertaken in October 2008 after the project's start¹⁰¹. The goals of the process were to establish the socioeconomic baseline of neighbouring communities and to discover and assess their opinions and views about the Project.

A main conclusion of the stakeholder process is that many negative comments about the project came from people who didn't know the project, essentially expressing their concerns about labour exploitation, less or restricted access to the land and opposition to big companies in general. SFM-BAM SAC intends to improve the communication and promote private productive projects with these communities. On the other hand, families and leaders who were better informed about the project have a positive perception about its role. The socioeconomic baseline includes information regarding the size and composition of local families, the size and status of their land parcels, the principal

¹⁰¹ SFM BAM. Reporte del proceso de consulta social a población local e informants claves para aplicar al CS and CCBA.

productive activities developed on the parcels, and the income level of families from the sale of products and other activities.

In regard to the communities' perception of the Campo Verde Project, questions focused on the perceived impacts of the project on population and the environment, the relationship between the communities and authorities, and the expectations and concerns the communities have about the Project.

The methodology utilised questionnaires and interviews. Questionnaires were given to 92 families from 13 different neighbouring settlements and interviews were focused on local authorities. 19 people were interviewed from 10 settlements. Questionnaires used closed specific questions while interviews were open, general questions.

Below is a brief summary of conclusions and recommendations from this process:

- Local authorities

The process uncovered a large difference in perception about the company and the Project between a) those authorities who know the company directly; b) those ones who know the company through third parties; and c) those who do not know the company at all.

The first group has mostly a positive opinion about the Project and company and about the potential impacts, while the second group gave answers that reflect substantial concerns about the impacts of the Project. The concerns of this group were even greater than those who had no knowledge of the Project or company.

The first group acknowledged that the company is providing employment to local families and simultaneously restoring and protecting the surrounding forests (and the existing fauna). This group considers the relationship between the company and neighbouring settlements (and the Government) to be good and, additionally, they believe the government should support this type of initiative.

Meanwhile, a majority of the group that is aware of the project through third parties has a negative perception of the Project. They believe that the company is the primary beneficiary of the Project, not the workers or local families. They believe this is caused mainly by low salaries and by the presence of workers from outside the local area that occupy jobs that should go to local people. Others have the idea that at some level the company is appropriating lands in the area. This group is strongly opposed to any kind of governmental support because the company is a private entity. They believe the company does not have a positive relationship with local families but that it does with government (which is also perceived negatively).

Even though it is most likely that opinions formed firsthand are the most reliable, the large difference of perception between the two groups is cause for concern. The company must undertake an effort to strengthen its communication about the Project benefits to the local communities by organising visits, workshops and other strategies in order to reverse the negative perception of uninformed authorities. It also must be recognised that in Peru, the rural population has an historic distrust of large private companies that is often exploited by local political leaders.

An interesting discovery from the questionnaire resulted from questions about how authorities see their communities in the absence of the project. Most of them (independent of their perception about the company) agreed that the situation would follow the actual trend of deforestation, traditional agriculture and increasing poverty. This could help to develop a strategy to convince those in opposition to the Project about the benefits the Project will bring to the region.

- Individual families

From 92 interviews, only 16 families mentioned that they knew of the company and the Project and, significantly, 13 of them had a positive opinion; only 2 of them had a negative opinion. This gives a strong indication that those who know firsthand of the Project have a positive impression. In addition, of the 16 families who knew of the Project, only 6 of them worked for the project (one of whom had a negative impression). The primary reason that people had a positive impression of the Project was due to its potential for employment generation. 10 respondents mentioned this as the reason for their positive opinion, while the other 3 cited the environmental benefits the Project will have on surrounding forests. Two negative respondents cited the accumulation of land by the Project as the source of their opposition. Complementary to this argument is the concern that the Project will lead to the prohibition of traditional hunting in the surrounding forests and the prohibition of traditional grazing in the pasture areas of the company.

Another concern mentioned was the risk of the contamination of river water. Overall, most families believe that on balance the presence of the company and Project is positive. This is due not only to employment and income potential, but also because of the potential to learn new techniques about soil recovery, weed management, fertilisation,, reforestation, nursery production, and disease control. In some cases, they are already implementing these techniques in their own plots and have already increased their production and revenues as a result of them.

The development of these productive alternatives for local families can compensate the income loss of limiting traditional activities and can be considered a successful strategy to alleviate their concerns by providing real alternative opportunities and thus create a positive perception and relationship with the company.

7 Schedule:

The following schedule summarizes the core activities of the project distinguishing actions related with carbon issues but with timber issues too.

Table 36 Schedule of Project Activities

	2007	2008	2009	2010	...	2012	...	2017	...	2020	2021	2022	...	2027	...	2032	...	2037	2038	2039
CARBON																				
Start date		X																		
Validation			X																	
Registering				X																
Monitoring		I	I	I	I	X	X	X	X	I	I	X	I	X	I	X	I	X	I	I
End date																		X		
TIMBER																				
Nurseries	G1	G2 /T1	T2																	
Plantation		G1	G2/T1	T2																
Harvest 1										M1	M2									
Harvest 2																			T1	T2

External monitoring is planned to be done every 5 years, with the first one starting in 2012. Internal monitoring is permanent as was explained in chapters 3 and 10 of this document.

Regarding timber issues, it must be remembered that the plantation is a 2-stage-sequence (first year, for the plantation of *Inga edulis*, and the following year for the commercial timber species) and by logistic reasons, the plantation of the total area will happen in 2 years. So, in the chart, G1 gives us information about the 1st lot of *Inga edulis*; G2 represents the 2nd lot of *Inga edulis*; T1, the 1st lot of the commercial wood species; T2, the 2nd lot of the commercial species; M1, the harvest of 1st lot of *Simarouba amara* and M2, the harvest of the 2nd lot of *Simarouba amara*.

8 Ownership:

8.1 Proof of Title:

The lands are private property of SFM-BAM in 3 different titles as registered in SUNARP, the national office for ownership recording under the following references:

Table 37 References of land titles

Name	Date	File	Area	Code
Campo Verde	Sep. 14, 1992	00566-R	1.474 ha	40011349
Mirianita	Mar. 08, 1985	9684	2.289 ha	40000584
Selva Maestra	Nov. 14, 2000	000076-R	12.730 ha	40010854

A copy of the titles is available for the company hired for validation process.

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

Not applicable.

9 Baseline Report

9.1 Baseline Methods:

9.1.1 Eligibility determination, delineation of project boundary, and baseline stratification

The determination of eligible areas was done based on LandSat images with the support of Ikonos and Quickbird images, processed with ERDAS and Arc View, mainly working with a visual interpretation methodology. The results show the area and perimeter of each vegetal cover and, in the specific case of eligible areas, distinguish between workable and non-workable areas¹⁰².

The land cover (forest-nonforest) classification was based on satellite images in a 2-stage process:

- Land Sat images (30 x 30 m of resolution), years 1996 and 2006 were interpreted with the same criteria in order to make it comparable between them and make it applicable to standard requirement. The result of this work was a map and a quantification of pasture areas for both years
- Ikonos Image (1 x 1 m of resolution), year 2006 was used as a support image in order to a more accurate view of the area that was useful to distinguish eligible but now workable areas.

Materials used

i. Satellite images:

➤ Land Sat:

- 06/66 (date July 22, 1988)
- 06/66 (date October 16, 1996)
- 06/66 (date August 25, 2006)

➤ Ikonos (November 11, 2005)

¹⁰² AIDER, 2007. Resumen de Metodología de Clasificación de bosques mediante Imágenes de Satélite

➤ Quickbird (August 03, 2004)

- iv Digital cartography:
 - Digital cartography (source IGN, scale 1: 100 000)
 - Forest Map of Peru (source INRENA, year 2000, scale: 1: 250 000)
 - Ecological System Map (source IIAP, year 2000, scale: 1: 250 000)
- iii. Software:
 - ERDAS Imagine 8.7
 - Arc View GIS 3.3

Satellite images were translated to a GEOTIFF format. After that, a composition was done using bands 3, 4 and 5. Land Sat and Ikonos images were used in both cases (with spatial resolutions of 30 and 1 m, respectively). Control points were used to minimize the error margin.

Table 38 Quantity of control points and error found during the geometric adjustment process

Satellite image	Date	Quantity of control points (GCP)	RMS (metres)
Land Sat 06/66	Oct 16, 1996	50	74,979
Land Sat 06/66	Aug 25, 2006	21	43,6547
Ikonos	Nov 08, 2005	44	37.4946

Each image was manually classified and digitized. The manual classification and creation of shapefile polygons is based on the interpretation of shapes, textures, sizes, and the experience of local experts. An internal attribute database was formed for each land cover polygon with information on area, hectares and perimeter. The database structure includes following fields:

Table 39 Satellite GIS Database structure

Name	Description	Type	Length	Decimals
Shape	Type of entity	Field_shapepoly	8	0
Code	Class code of vegetation cover	Character	6	0
Cover	Class name of vegetation cover	Character	40	0
Area	Area of stratum in m2	Numeric	16	3
Perimeter	Perimeter of stratum in ml	Numeric	16	3
Hectares	Area of stratum in ha	Numeric	16	3

Based on this analysis, the land cover and land use was found to be uniform throughout the project area. Due to the small size of the project area, the climate or soil conditions do not vary significantly across the project. Therefore, it was determined that the entire project area could be classified into one baseline strata: degraded pastureland.

9.1.2 Baseline carbon field measurements

The evaluation of below and aboveground carbon stock in baseline (actual) scenario had the following main characteristics¹⁰³:

- 70 circular plots with 3 nested sub-plots of 4, 14 and 20 meters of radius per each sub-plot
- Herbaceous, shrubs, lianas, trees and soils were included in the analysis
- Additional survey was necessary to do for trees as they were very scarce and wasn't found in original plots. This consisted of 12 80 m radius plots.
- For shrubs, a site specific equation was developed through the destructive sampling of 30 shrubs.

¹⁰³ AIDER, 2008. Determinacion de la Linea Base de Carbono en el Fundo Campo Verde; AIDER, 2009. Baseline biomass measurements; AIDER, 2009. Pre existing Tree - Measurements and Calculations.

9.1.3 Leakage analysis

The leakage analysis examined the emissions resulting from the displacement of grazing animals. As pursuant of EB 44, the monitoring of fossil fuel combustion and collection of wood posts for fencing are assumed to be insignificant and therefore can be ignored¹⁰⁴. Based on the methods and parameters required by AR-AM0003, a specific survey to estimate the amount of animals per type that were grazing in the project area, the pasture area owned by cattle ranchers, available to reallocate animals was applied. The result of the survey concludes that there is no risk of clearing of new areas because the owners of animals have enough free pastureland areas to receive the displaced animals¹⁰⁵. More details about it can be found in SOP.

9.2 Results:

9.2.1 Eligibility determination and delineation of project boundary

Based on the satellite analysis, about 739.9 hectares of land are eligible and will be included within the carbon project boundary.

Table 40 Area of land eligible for inclusion in carbon project boundary

Stratum	Hectares
Eligible – direct planting areas	739.90
Eligible area – natural regeneration areas	179.68
Non eligible area	1,654.42
Total	2,596.00

9.2.2 Estimation of baseline net GHG removals by sinks

A systematically random design was used to locate the points in each stratum. For eligible pasture area, 70 plots were evaluated in a circular nested system of 3 sub-plots of 4, 14 and 20 meters of radius each one. Following the field survey it was determined that the tree plot radius used did not adequately sample the existing trees therefore 12 additional large 80 m radius plots were sampled to estimate existing tree biomass¹⁰⁶.

The following different types of vegetation were analyzed separately: small plants (herbaceous), shrubs, saplings, and trees.

In the next table, it is described which circle is used in each case:

Table 41 Design of field sampling plots

Pool of carbon	Radius of circular plot
Herbaceous	Not circular plots. In each plot, herbs were collected from 4 squares of 0.25m ² (50 cm x 50 cm) each one
Shrubs ¹	14 meters radius plots
Saplings	20 meters radius plots
Trees ²	4 meters radius plots for trees with a DBH between 5-20 cm; 14 meters radius plots for trees with a DBH between 20-50 cm;

¹⁰⁴ Executive Board of the Clean Development Mechanism Forty-Fourth Meeting
<http://cdm.unfccc.int/EB/044/eb44rep.pdf>

¹⁰⁵ La Torre, L., 2007. Inventario Físico de Ganado Existente en el Fundo Campo Verde. Informe No 002 SFM BAM SAC; AIDER, 2009. VCS PD – Tables

¹⁰⁶ AIDER, 2008. Determinacion de la Linea Base de Carbono en el Fundo Campo Verde; AIDER, 2009. Baseline biomass measurements; AIDER, 2009. Existing Trees - Base de datos Parcelas arboles remanentes pastos

	20 meters radius plots for trees with a DBH higher than 50 cm
--	---

¹ As no equation to estimate biomass from shrubs was found, 30 destructive samples were taken to estimate an equation for this kind of shrub.

² As a very few amount of trees was found, 12 additional plots were taken with a diameter of 80 meters of radius

³ Carbon content in soil was made for pasture and secondary forest plots in order to be sure that the project won't likely reduce the level

The results found are shown in following tables. As per AR-WG21¹⁰⁷, "the GHG emissions from removal of herbaceous vegetation, are insignificant in A/R CDM project activities and therefore these emissions can be neglected in A/R baseline and monitoring methodologies."

Because the existing trees in the project area are sparse and randomly distributed, sampling resulted in high variability of tree carbon stocks. Therefore, the upper bounds of the 95% confidence interval were used as a conservative estimate of existing tree biomass stocks.

Table 42: Baseline non-tree biomass

All plots	shrubs t CO ₂ e/ha	saplings t CO ₂ e/ha	Total t CO ₂ e/ha	t CO ₂ e
average	0.74	0	0.74	680
95% CI (C t/ha)	0.85	0	0.85	780

Table 43: Existing tree biomass at the start of the project

	AG t C/ha	BG t C/ha	Tree t CO ₂ /ha	Total t CO ₂ e
Mean of stratum	0.27	0.06	1.2	3,326
Upper bounds of 95% CI	0.79	0.17	3.54	

9.2.3 Leakage analysis

LK_{conversion} Leakage due to conversion of land to grazing land

There are a small number of animals grazing in the project area. The estimated leakage resulting from the grazing animals moving from the project lands to other lands and causing emissions is estimated using the methodology described in AR-AM0003 V04.

If animals move to other lands, the potential grazing land they move to is classified into three types:

EGL = existing grazing land

NGL = new grazing land

XGL = unidentifiable grazing land

Step 1 and 2: Data collection on pasture practices and animal populations

A study was conducted to determine the grazing taking place within the project area and the amount of existing grazing lands to which the animals may be moved. All households surrounding the project area were surveyed to determine which households grazed animals inside the project area. In the past, the landowners (SFM-BAM) had not prevented the surrounding community from using the project area to graze animals because it was not in use by the landowners, therefore farmers would feel no reason to hide their previous use of the project area. Since all households surrounding the project area were surveyed and no other households graze animals in the project area, the entire project area was sampled ($SFR_{PAGA} = 1$). It was found that six households grazed their animals for a portion of the year within the project area. The area of existing grazing lands each farmer owns and the number of each type of animal for each animal owner were surveyed (Table 36). The number of months animals were grazed within the project area and the number of months animals were grazed

¹⁰⁷ Report of the Twenty-First Meeting of the Afforestation and Reforestation Working Group
http://cdm.unfccc.int/Panels/ar/021/ar_021_rep.pdf

in the existing grazing lands was assumed to be proportional to the area of each since animals freely graze throughout the existing EGL and project area lands. It was determined that $Na_s = 0$ as no farmer intended on selling their animals. The area of NGL was not necessary to determine.

Table 44: EGL areas and animals grazed in project area

Individual	EGL: Area owned by farmer (ha)	Na: number of animals owned grazing in project area				
		Bull	Cows	Young animals	Calves	Sheep
Walter Castillo Malpartida	230	5	72	65	70	36
Edgar Lupaca	195	2	50	32	20	0
Alberto Pinedo	20	1	10	12	5	0
Daniel Santa María	10	1	3	4	3	0
Rafael Bernedo Sánchez	180	6	130	60	42	47
Dubal Serna Mendoza	130	1	60	38	21	55
Total	535	11	253	146	91	102

Published literature and local experts were interviewed to estimate the daily biomass intake by each animal type and the maximum population of animals that can be grazed per unit area under the current grazing system and the improved grazing management system. The daily biomass intake for cows was determined from the literature (1999, Wilfredo Da Cruz del Águila)¹⁰⁸. The daily biomass intake for all other animal types was determined from the daily biomass intake for a cow and a locally determined ‘cow equivalence’ number (Carrillo 1997¹⁰⁹) (Table 37).

Table 45: Animal type and daily biomass intake

Type of cattle	Cow equivalence	Daily Biomass Intake (kg dm head ⁻¹ day ⁻¹)
Bull	1.5	12.75
Cow	1	8.5
Young cattle	0.75	6.375
Calves	0.25	2.125
Lamb-adult	0.25	2.125
Lamb-child	0.25	2.125

Step 3: Estimate the number of animals that can be displaced in EGL-areas

Published estimates¹¹⁰ were compared to estimates of local land owners and it was found that the maximum populations of cattle, grazed for 12 months per annum, to be 1.5 head ha⁻¹. Using the collected information and Eq. 34 from AR-AM0003 ΔC_{LPA} , $\Delta C_{Lcurrent}$, and ΔC_{Lmax} were calculated:

$$\Delta C_{LPA} = \sum_{i=1}^I \sum_{an=1}^{An} (DBI_{an} \cdot n_{igt} \cdot a_{apl}) \cdot 30 \cdot 0,001 \cdot \frac{1}{SFR_{PAga}}$$

$$\Delta C_{Lcurrent} = \sum_{i=1}^I \sum_{an=1}^{An} (DBI_{an} \cdot n_{igt} \cdot a_{apl}) \cdot 30 \cdot 0,001$$

¹⁰⁸ Da Cruz Del Aguila, W. Mejoramiento de pasturas y potreros en los distritos de Juan José Crespo y Castillo y Cholón (La Morada)

¹⁰⁹ Carillo, J. 1997. Manejo de un rodeo de cría. INTA. CERBAS EEA Balcarce. Pp 402-410 and Reátegui, Kenneth. “Establecimiento manejo y productividad de Pasturas en la selva peruana”. Winrock-Acción Agraria, 1999.

¹¹⁰ Pinedo, L.A.; Arroyo, R.; Bustamante, G. Productividad animal en Brachiaria decumbens bajo pastoreo. CIAT. Cali, 1990

$$\Delta C_{Lmax} = \sum_{i=1}^I \sum_{an=1}^{An} (DBI_{an} \cdot n_{max} \cdot a) \cdot 30 \cdot 0.001$$

Where:

- $\Delta C_{LPA,t}$ = annual animal biomass consumption over the project area to be planted at time t ; tonnes d.m.yr⁻¹
- $\Delta C_{Lcurrent}$ = annual animal biomass EGL currently producing; tonnes d.m.yr⁻¹
- ΔC_{Lmax} = Maximum annual biomass that EGL areas can produce for animal feeding; tonnes d.m.yr⁻¹
- i = plot index (i = total number of plots); dimensionless
- an = animal type index (An = total number of animal types); dimensionless
- DBI_j = daily biomass intake by animal type j an ; kg d.m. head⁻¹ day⁻¹
- n_{pgt} = number of individual animals from the livestock group g at plot p at time t ; dimensionless
- a_{gpl} = number of months per annum during which animals from the livestock group g are present at plot p ; dimensionless
- n_{max} = maximum population EGL can sustain; dimensionless
- a = number of months per annum that EGL areas can sustain n_{max} animals; dimensionless
- 30 = average number of days in month; dimensionless

Since data collection covered the whole project area, the $SFR_{PAga} = 1$

Table 46: Existing grazing areas, annual biomass consumption, and additional animals that can be maintained in EGL areas

DBI _{an} daily biomass intake (kg dm head ⁻¹ day ⁻¹)	8.5
EGL (ha) - existing grazing lands	535
Maximum population in EGL per ha, in terms of cows	1.5
a _{gpl} number of months animals grazed in project area	7.6
a _{gpl} number of months animals grazed in EGL	4.4
N_{max} - max number of animals on EGL:	802.5
ΔC_{Lmax} - for EGL (t d.m. yr ⁻¹):	2,456
$\Delta C_{Lcurrent}$ - on EGL (t d.m. yr ⁻¹):	481
ΔC_{LPA} - annual animal biomass consumption on project lands (t d.m. yr ⁻¹):	789
$(\Delta C_{Lmax} - \Delta C_{Lcurrent})$	1,975

The difference between ΔC_{Lmax} and $\Delta C_{Lcurrent}$ is greater than ΔC_{LPA} . Based on AR-AM0003 V04 the EGL areas are sufficient for feeding the entire population of displaced animals. Therefore, leakage due to activity displacement is set as zero:

$$LK_{conversion} = 0$$

Even if it is assumed that the number of months the animals grazed in the project area and the EGL were both set to zero, the difference between ΔC_{Lmax} and $\Delta C_{Lcurrent}$ would still be greater than ΔC_{LPA} .

Step 4: Estimate the number of animals that can be displaced in NGL-areas:

Not needed

Step 5: Estimate the number of animals that will be displaced in XGL-areas:

Not needed

Step 6: Estimate leakage due to displacement of grazing activities as follows:

$$LK_{conversion} = 0$$

Where:

$LK_{conversion}$ = leakage due to conversion of non-grassland to grassland; tonnes CO₂-e

10 Monitoring Plan

10.1 Monitoring of the baseline net GHG removals

According to AR-AM0003 V04, the carbon stock changes in the baseline scenario do not need to be monitored unless a renewable crediting period is chosen, as is the case in this project. Relevant data for determining the renewed baseline will be collected, including annual carbon stock change in living biomass in the baseline.

10.2 Monitoring the overall performance of the proposed ARR VCS project activity

The following elements will be monitored:

- Project boundary
- Stratum and stand models boundaries
- Forest establishment
- Forest management
- Net removals of GHG: changes in stocks of AG and BG carbon and increment of emissions
- Leakage
- Quality control

The net removals of baseline of GHG by reservoirs are assumed as constant.

10.2.1 Forest Establishment and management

The following activities will be carried out in the three first years after the plantation establishment to ensure forest establishment:

Table 47: Forest Establishment activities

Activity Code	Activity	Description	Format Code	Frequency
FE-001	Seed collection registration	Register the seed collection zones to determine the precedence of the plants. Measure GPS points of zones and trees and input them in data base.	FE-001-1	When collection occurs
FE-001	Seed reception in nursery	Register the units of seed (kg) by specie that that enter to the nursery and units of seed that are rejected. Register: date, collection zone, specie, units (kg).	FE-001-2	When seed reception occurs
FE-002	Nursery registration	Register the nursery production to determine any deviation from the PDD; if some variation exists, this should be documented. This also will be done to determine the precedence of the plants that are taken	FE-002-1a	Daily
			FE-002-1b	
			FE-002-1c	

Activity Code	Activity	Description	Format Code	Frequency
		to the field. Register for each phase of nursery: date of income, number and precedence of plants by specie, code of beds, and date of outcome.	FE-002-1d	
FE-002	Nursery registration	Register all the cultural activities (pruning, pest control, fertilizing) to determine any deviation from the PDD; if some variation exists, this should be documented. Register: date, code of beds, species involved, products used and proportion.	FE-002-2	Daily
FE-003	Delimitation of stand models	Register the stand models delimited: date, code, name, UTM coordinates.	FE-003-1	Daily during plantation phases
FE-004	Site preparation registration	Register all the site preparation activities to determine any deviation from the PDD. If some variation exists, this should be documented. Register: date, stand model, slope, equipment used and area involved	FE-004-1a FE-004-1b FE-004-1c FE-004-1d	Daily during plantation phases
FE-005	Weed elimination registration	Register all the weed elimination activities to determine any deviation from the PDD. If some variation exists, this should be documented. Register: date, stand model, technique and area involved.	FE-005-1	Daily during plantation phases
FE-006	Plantation registration	Register the area planted by stand model: date, area, number of plants by specie and precedence.	FE-006-1	Daily during plantation phases
FE-006	Plantation registration	Register all the final information at the end of plantation of each stand model.	FE-006-2	Monthly during plantation phases
FE-007	Survival checking	Determine the survival rate of plantation, using temporary sample plots that will be determine randomly for each stand model area. Register all the living plants on the plots, by specie.	FE-007-1	Two times: three months and three years after the planting

According to the AR-AM003, the practices of forest management are important factors for the balance of GHG of the project, therefore they should be monitored. It is planned to monitor the following activities:

Table 48 Forest management activities

Activity Code	Activity	Description	Format Code	Frequency
FM-001	Plantation weeding registration	Register all the weed elimination activities to determine any deviation from the PDD. If some variation exists, this should be documented. Register: date, stand model, technique, products used and proportion and area	FM-001-1	When weeding occurs

Activity Code	Activity	Description	Format Code	Frequency
		involved.		
FM-002	Fertilization registration	Register the fertilization practices to check if they are being carried out according to the PDD and document any deviation. Register: date, stand model, type of fertilizer, quantity of fertilizer applied by plant, and number of plants fertilized by species.	FM-002-1	When fertilization occurs
FM-003	Pest control registration	Register all the pest control activities to determine any deviation from the PDD and document any deviation. Register: date, stand model, type of pest, technique, products used and proportion, species and area involved.	FM-003-1	When pest control occurs
FM-004	Pruning registration	Register the pruning to check if it is being carried out according to the PDD and document any deviation. Register: date, location, number of trees pruned by specie, stand model.	FM-004-1	When pruning occurs
FM-005	Firewood collection registration	Estimation of the firewood collected from the plantation: tree species and estimation of biomass removed.	FM-005-1	Monthly
FM-006	Harvesting registration	Register the thinning to check if it is being carried out according to the PDD and document any deviation. Register: date, location, area, tree species and number of trees.	FM-006-1	When harvest occurs
FM-007	Fire control registration	Register the implementation of all the fire control activities, for example, for fire breaks, register: UTM coordinates, slope, width and length.	FM-007-1	When the implementation finishes.
FM-007	Fire control registration	If fire occurs, register date, stand model, area and number of trees involved and probable cause of the fire.	FM-007-2	When fire occurs

10.3 Monitoring the actual net GHG removals

10.3.1 Project boundary and Stratification

The project boundary will be monitored periodically throughout the crediting period through the use of GIS and a GPS, including during the first monitoring event. If the forest area changes during the crediting period, this area will be delineated and evaluated to be removed from the project area or to create new strata or stand model. Changes in forest area may be due to many causes such as deforestation, forest establishment failure or fire; these disturbances will be register as part of the monitoring plan.

The stratification of the area of the project into relatively homogeneous units can increase the precision of measurement without increasing the cost, or to reduce the cost without reducing precision due to the smaller variation in each homogeneous unit.

Within a GIS database, the project area will be divided into baseline strata and project strata. Types of strata expected include:

Baseline stratum: degraded pastureland

Project activity: commercial plantation establishment

The project area will also be stratified based on the year of planting.

During the implementation of the first monitoring, the project strata will be re-evaluated. Criteria that may be used to re-evaluate strata include:

- Unexpected Disturbances (fires, pests, high mortality) that affect differently different areas within one stratum
- Differences in forest management (thinning, pruning, logging) in different areas within one stratum
- Two stratum that are determined to similar enough to be combined into one stratum.

After this evaluation, post- stratification may take place. The need to do this will be evaluated and included in monitoring reports.

The boundaries of each stratum will be monitored within a GIS database (including coordinates GPS and data of remote sensors). The monitoring of these boundaries allows transparent verification and monitoring of A_{ikt} (area of stratum i , model k , in the time t).

To do this, the following activities will be carried out:

Table 49 Project boundary monitoring activities

Activity Code	Activity	Description	Format Code	Frequency
B-001	Check the project area	At the beginning of the project, measure with GPS the vertexes of the project area, as well as the area of each stratum. Then, check the GPS points every year to determine the exclusion or inclusion of surfaces, because of disturbances or other causes. Check that the project area is consistent with the eligibility criteria given in the VCS - PDD.	B-001-1	During the year 1: semi-annual
B-002	Check disturbances	Travel through the project area for direct observation to identify disturbances that could have occurred on the boundaries of the project area and strata. If some disturbance has occurred, like fire, pest disease or plantation failure, changes carried out should be documented. Register: date, UTM coordinates of the area, type of disturbance, stand models involved.	B-002-1	From the year 2: annual

10.3.2 Sampling

10.3.2.1 Sample size

As described in the approved methodology AR-AM0003, the number of plots required to sufficiently sample the stratum will be calculated following the collection of preliminary data in an area with similar land cover found in the project area. Data will be collected using the same methods for all strata. From this field sampled data, estimated mean carbon stocks and variance will be calculated for each stratum. Because the actual variability of the project stratum will be unknown and some plots

may be lost, the number of plots will be conservatively increased by 10% from the number determined using the below methods.

With the above information, the sample size (number of sample plots to be established and measured) can be estimated according to Eq. 55 of AR AM0003 V04 as follows:

$$n_i = \frac{\sum_{i=1}^{m_p} N_i * st_i * \sqrt{C_i}}{\left(N * \frac{E}{z_{\alpha/2}} \right)^2 + \sum_{i=1}^{m_p} N_i * (st_i)^2} * \frac{N_i * st_i}{\sqrt{C_i}}$$

Where:

- n = sample size (total number of sample plots required) in the project area
- i = 1, 2, 3, ... m_p project scenario (*ex post*) strata
- α = 1- α is the probability that the estimate of the mean is within the error bound E
- $z_{\alpha/2}$ = value of the statistic z, for 1- α = 0.05 (implying a 95% confidence level) $z_{\alpha/2}$ = 1.9599

When no information on costs is available or the costs may be assumed as constant for all strata, then according to Eq. 56 and Eq. 57 of AR AM0003 V04:

$$n = \frac{\left[\sum_{i=1}^{m_p} N_i * st_i \right]^2}{\left(N * \frac{E}{z_{\alpha/2}} \right)^2 + \sum_{i=1}^{m_p} N_i * (st_i)^2}$$

$$n_i = \frac{\sum_{h=1}^{m_p} N_i * st_i}{\left(N * \frac{E}{z_{\alpha/2}} \right)^2 + \sum_{i=1}^{m_p} N_i * (st_i)^2} * N_i * st_i$$

It is possible to reasonably modify the sample size after the first monitoring event based on the actual variation of the carbon stocks determined from taking the n samples.

Permanent plots will be installed prior to the first monitoring period but may not be installed at time 0.

The sample size for monitoring of the plantation is 65 permanent growth plots, evenly distributed for all strata. This value was calculated using a maximum allowable error of 10% with $t=2$ and a coefficient of variability equal to 36.6% according to the measurement of biomass in a primary residual forest in Campo Verde. In order to ensure that error is less than 10% the number of sample

plots has been increased by 20% resulting in a total of 65 plots using the formula for calculation of sample size. The calculation used to determine the sample size is found in AIDER 2009¹¹¹.

10.3.2.2 Plot location, size, and establishment

Permanent plot locations will be determined in a GIS and will ensure random and even distribution of plots. Sample units will be located without bias and the entirety of the project site will be sampled.

The size of the plots will be determined based on the diameter classes of trees expected in the plots and the plot size needed to sufficiently sample the trees at all stages of the project. Plots containing smaller sub-plots or ‘nests’ of smaller sizes will be used as they are efficient for forest monitoring. The smallest nest will be used to measure and monitor trees of the smallest size class, the medium nest to measure the trees in the medium size class, and the large nest to measure the large size class trees. When trees have attained a minimum size class during a monitoring event, they are measured and included in that nest. When a tree exceeds the maximum size class, the tree is measured and included in the larger nest size. The exact size of the nests will be determined, however, they will be similar to the below sizes:

Stem diameter	Circular plot Radius	Area (m ²)
† Saplings	2 m	12.57
5 – 20 cm dbh	6 m	113
20 – 40 cm dbh	14 m	616
> 40 cm dbh	20 m	1257

† Saplings are defined as: stems <5 cm dbh, height >1.3 m

Permanent plots will be established and measured at each monitoring period. When trees reach a diameter of 5 cm at DBH they will be tagged and measured using standard operating procedures¹¹².

10.3.2.3 Monitoring frequency

Monitoring periods will be conducted every five years following planting time. The monitoring will avoid systematic coincidence with peaks in carbon stocks.

10.3.3 Measuring and estimating carbon stock changes

The carbon stock changes within the project area will be determined using the methods outlined in the methodology. Based on the carbon pools to be measured in AR-AM0003, the verifiable change in carbon stocks is equal to the carbon stock changes in aboveground biomass and belowground biomass.

Where:

$\Delta C_{P,LBT}$ = sum of the changes in living tree biomass carbon stocks in the project scenario (above- and below-ground); tonnes CO₂-e

$\Delta C_{P,ikt}$ = annual carbon stock change in living biomass for stand model k , in stratum i , at time t ; tonnes CO₂-e yr⁻¹

Note: As the same equation is used for baseline and actual removals in the following the index P is omitted (e. g. $\Delta C_{P,ikt} = \Delta C_{ikt}$)

i = 1, 2, 3, ... m_p strata in the project scenario

¹¹¹ AIDER. 2009. Establecimiento y Monitoreo de las Parcelas Permanentes de Crecimiento. AIDER.

¹¹² Walker, SM, Pearson, T, Harris, N., MacDicken, K, and Brown, S. 2008. Standard Operating Procedures to be used by the Campo Verde Project. Winrock International.

- k = 1, 2, 3, ... K_p stand models in the project scenario
- t = 1, 2, 3, ... t^* years elapsed since the start of the AR project activity

10.3.3.1 Live Tree Biomass

It is expected that the following allometric equations will be used estimate biomass from the measured DBH. The applicability of these equations will be verified through destructive sampling throughout the project, as the trees grow over time.. If this equation is not found to be applicable, either another equation will be used that is applicable or a site specific equation will be developed over the life of the project.

All tree plots will be measured using standard operating procedures for measurement of trees¹¹³. Destructive sampling will take place using standard operating procedures for destructive sampling of trees¹¹⁴.

Allometric equations for estimating aboveground biomass (kg of dry matter per tree)¹¹⁵

$$Y = WD * \exp(-1.499 + (2.148 * \ln(\text{dbh})) + (0.207 * (\ln(\text{dbh}))^2) - 0.0281 * (\ln(\text{dbh}))^3))$$

Where:

Y = aboveground dry matter; kg(tree)-1.

DBH = Diameter at breast height; cm

HT = total height of the tree; m

WD = wood density (g/cm³)

Below ground biomass estimate (kg of dry matter per tree)

Below ground biomass will be estimated using the IPCC default value¹¹⁶ for moist tropical forests of 0.22:

$$Y = 0.22 * \text{Aboveground tree carbon (t C/ha)}$$

Where:

Y = root biomass in t C/ha of dry matter

Aboveground tree carbon = Aboveground carbon in trees in t C/ha of dry matter

10.3.3.2 Estimating carbon stock changes over the project area

The “SOP Calculation of Tree Carbon Stock Changes with and without harvesting” will be utilized to calculate the changes in live carbon stock changes between monitoring events.

10.3.3.3 Monitoring GHG emissions from decrease in non-tree carbon stock

According to AR-AM0003 V04, it is assumed that all non-tree vegetation existing on in the project area prior to project activities will disappear. It is assumed that this occurs at the start of the project, and therefore, non-tree carbon stocks are not measured during subsequent monitoring events.

¹¹³ Walker, SM, Pearson, T, Harris, N., MacDicken, K, and Brown, S. 2008. Standard Operating Procedures to be used by the Campo Verde Project. Winrock International.

¹¹⁴ Walker, SM, Pearson, T, Harris, N., MacDicken, K, and Brown, S. 2008. Standard Operating Procedures to be used by the Campo Verde Project. Winrock International.

¹¹⁵ Chave J, Andalo C, Brown S, Cairns MA, Chambers JQ, Eamus D, Folster H, Fromard H, Higuchi N, Kira T, Lescure JP, Nelson BW, Ogawa H, Puig H, Riera B, Yamakura T (2005) Tree allometry and improved estimation of carbon stocks and balance in tropical forests. *Oecologia* 145: 87-99.

¹¹⁶ 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 4, Table 4.4

The carbon stocks in this non-tree vegetation were measured prior to the start of project activities during baseline data collection. A full description of the sampling that took place can be found in the Baseline Report. The average non-tree carbon stock was determined and the emission resulting from this reduction in non-tree carbon stock estimated using Eq. 14 of AR-AM0003:

$$E_{biomassloss,t} = \sum_{i=1}^{m_{ps}} A_i \cdot B_{non-tree,i} \cdot CF_{non-tree} \cdot \frac{44}{12}$$

Where:

- A_i = area of stratum i, ha
- $B_{non-tree,i}$ = average biomass stock of non-tree vegetation on land to be planted before the start of a proposed ARR VCS project activity for stratum i, tonnes d.m.ha-1
- $CF_{non-tree}$ = the carbon fraction of dry biomass in non-tree vegetation, tonnes C (tonne d.m.)-1
- $44/12$ = fraction of molecular weights of CO₂ and carbon, dimensionless
- i = 1,2,3 ... m_{ps} strata in the project

Table 50 Non-tree biomass at start of project

	t CO ₂ e/ha				t CO ₂ e	
	Above-ground	Below-ground	Total	Above-ground	Below-ground	Total
Degraded Pasture	0.19	0.55	0.74	179	501	680

10.3.4 Monitoring GHG emissions by sources as the result of the ARR VCS project activity

Monitoring of the GHG emissions by sources will take place according to methodology AR-AM0003 and using Eq. 82:

$$GHG_E = E_{FuelBurn} + E_{BiomassBurn}$$

Where:

- GHG_E = sum of the increases in GHG emissions by sources within the project boundary as a result of the implementation of an VCS-AR project activity; tonnes CO₂-e
- $E_{FuelBurn}$ = increase in GHG emission as a result of burning of fossil fuels within the project boundary; tonnes CO₂-e
- $E_{BiomassBurn}$ = increase in GHG emission as a result of biomass burning within the project boundary; tonnes CO₂-e

10.3.4.1 Monitoring GHG emissions from burning of fossil fuels ($E_{fuelburn}$)

Pursuant of EB 44, the monitoring of fossil fuel combustion in A/R Project Activities can assumed to be insignificant¹¹⁷ and therefore $E_{FuelBurn}$ will not be monitored and will assumed to be zero.

$$E_{FuelBurn} = 0$$

10.3.4.2 Monitoring GHG emission from biomass burning

¹¹⁷ Executive Board of the Clean Development Mechanism Forty-Fourth Meeting
<http://cdm.unfccc.int/EB/044/eb44rep.pdf>

Biomass burning is planned as a management style, so the methods outlined in AR-AM0003 and Eq. 84-87 will be used:

The mean aboveground biomass stock per hectare will need to be estimated. If the biomass burning happens accidentally, this will be done by choosing an area in the same stratum that was not burned and estimating the aboveground biomass stocks in sample plots. The mean proportion of biomass burned will be estimated by measuring the biomass after the burning.

$$E_{BiomassBurn} = E_{BiomassBurn,CO_2} + E_{BiomassBurn,N_2O} + E_{BiomassBurn,CH_4}$$

$$E_{BiomassBurn,CO_2} = \sum_{t=1}^{t^*} \sum_{i=1}^{m_p} \sum_{k=1}^{K_p} (A_{B,ikt} \cdot B_{ikt} \cdot PBB_{ikt} \cdot CE \cdot CF_j) \cdot 44/12$$

$$E_{BiomassBurn,N_2O} = E_{BiomassBurn,CO_2} \cdot 12/44 \cdot (N/C_{ratio}) \cdot ER_{N_2O} \cdot 44/28 \cdot GWP_{N_2O}$$

$$E_{BiomassBurn,CH_4} = E_{BiomassBurn,CO_2} \cdot 12/44 \cdot ER_{CH_4} \cdot 16/12 \cdot GWP_{CH_4}$$

Where¹¹⁸:

$E_{BiomassBurn}$ = total GHG emission from biomass burning in slash and burn; tonnes CO₂-e

$E_{BiomassBurn,CO_2}$ = CO₂ emission from biomass burning in slash and burn; tonnes CO₂-e

Note: In the methodology $E_{BiomassBurn,CO_2}$ is set to 0 to avoid double accounting (The effect of fire on carbon is considered a carbon stock decrease). However, $E_{BiomassBurn,CO_2}$ must be estimated because it is required for the estimation of $E_{BiomassBurn,N_2O}$ and $E_{BiomassBurn,CH_4}$

$E_{BiomassBurn,N_2O}$ = N₂O emission from biomass burning in slash and burn; tonnes CO₂-e

$E_{BiomassBurn,CH_4}$ = CH₄ emission from biomass burning in slash and burn; tonnes CO₂-e

$E_{BiomassBurn,CO_2}$ = CO₂ emission from biomass burning in slash and burn; tonnes CO₂-e

Note: In the methodology $E_{BiomassBurn,CO_2}$ is set to 0 to avoid double accounting. However, $E_{BiomassBurn,CO_2}$ must be estimated because it is required for the estimation of $E_{BiomassBurn,N_2O}$ and $E_{BiomassBurn,CH_4}$

$A_{B,ikt}$ = area of slash and burn for stand model k , stratum i , time t ; ha

B_{ikt} = average above-ground biomass stock before burning for stand model k , stratum i , time t ; tonnes d. m. ha⁻¹

PBB_{ikt} = average proportion of biomass burnt for stand model k , stratum i , time t ; dimensionless

CE = average biomass combustion efficiency; dimensionless

CF_j = carbon fraction for species j ; tonnes C (tonne d. m.)⁻¹
(IPCC default value = 0.5)

N/C_{ratio} = Nitrogen/Carbon ratio; dimensionless

12/44 = ration of molecular weights of carbon and CO₂; dimensionless

44/28 = ration of molecular weights of N₂O and nitrogen; dimensionless

16/12 = ration of molecular weights of CH₄ and carbon; dimensionless

¹¹⁸ Table 5.7 in 1996 Revised IPCC Guideline for LULUCF and Equation 3.2.19 in IPCC GPG-LULUCF

ER_{N_2O}	=	emission ratio for N_2O (IPCC default = 0.007)
ER_{CH_4}	=	emission ratio for CH_4 (IPCC default = 0.012)
GWP_{N_2O}	=	Global Warming Potential for N_2O (IPCC default = 310 for the first commitment period)
GWP_{CH_4}	=	Global Warming Potential for CH_4 (IPCC default = 21 for the first commitment period)

10.4 Monitoring Leakage

According to the approved methodology AR-AM0003 V04, leakage shall be estimated as follows using Eq 88:

$$LK = LK_{ActivityDisplacement} + LK_{fencing}$$

Where:

$LK_{ActivityDisplacement}$	=	Leakage due to activity displacement; tonnes CO_2 -e
$LK_{fencing}$	=	Leakage due to increased use of wood posts for fencing up to year t; tonnes CO_2 -e

However, per guidance of EB 44¹¹⁹, emissions from collection of wood from non-renewable sources to be used for fencing of the project area can assumed to be insignificant and therefore $LK_{fencing}$ will not be monitored and will assumed to be zero.

10.4.1 Leakage through activity displacement

According to the approved methodology AR-AM0003 V04, activity displacement leakage shall be estimated as follows using Eq 89:

$$LK_{ActivityDisplacement} = LK_{conversion} + LK_{fuelwood}$$

$LK_{ActivityDisplacement}$	=	Leakage due to activity displacement; tonnes CO_2 -e
$LK_{conversion}$	=	Leakage due to conversion of non-grassland to grassland; tonnes CO_2 -e
$LK_{ActivityDisplacement}$	=	Leakage due to the displacement of fuelwood collection; tonnes CO_2 -e

10.4.1.1 Estimation of leakage due to conversion of land to grazing land

The pre-project survey found that there are about 500 grazing animals that graze the project area at sometime during the year. As a project activity, these animals will be displaced off the project area onto other lands.

Using the Eq. 30-42, *ex ante* estimations concluded that no additional grazing areas would be required if this pasture management system is maintained and the animals are grazed on these EGL areas. However, monitoring still must occur to ensure that grazing animals have not instead been moved to other areas.

Based on methodology AR-AM0003 V04, the below steps will be followed to monitor the movement of the grazing animals and estimate the amount of leakage resulting from the displacement of grazing animals:

¹¹⁹ Executive Board of the Clean Development Mechanism Forty-Fourth Meeting
<http://cdm.unfccc.int/EB/044/eb44rep.pdf>

Step 1: Monitor grazing activities outlined in the PDD.

- 1.1 Monitor and record the date all animals are moved off the project area. Five years from this date grazing leakage monitoring will end.
- 1.2 Monitor the establishment and continued use of the improved grazing management on the EGL areas.

Step 2: For each verification period, a survey will be conducted to monitor the project area and the number of animals grazing in the project area.

In this survey the following parameters will be monitored:

Area

A_t = The total project area at year t ; ha

$Na_{AR,t}$ = monitored number of animals present in the project area at year t ; dimensionless

Based on Eq. 90 of AR-AM0003, if the number of animals grazing in the project area at the verification period is larger than the *ex ante* estimated pre-project number of animals, then it can be assumed that no animals were displaced and leakage can be set to zero ($LK_{conversion} = 0$)

$$Na_{outside,t} = Na_{BL} - Na_{AR,t} \quad Na_{outside,t} = Na_{BL} - Na_{AR,t}$$

Where:

$Na_{outside,t}$ = number of animals displaced outside the project area at year t ; dimensionless

Na_{BL} = *ex ante* estimated pre-project number of animals from the different livestock groups that would be grazing in the project area under the baseline scenario; dimensionless. This estimate is fixed for the entire crediting period and is specified in the VCS-PD.

$Na_{AR,t}$ = monitored number of animals present in the project area at year t ; dimensionless

It is expected that this will not be true, in which case, the average animal population in the EGL must be monitored.

Step3: For each verification period, the average animal population size displaced in the EGL areas will be estimated. This will take place through a survey of the owners of the grazing animals.

The following parameters will be monitored:

$dNa_{EGL,t}$ = number of animals displaced in EGL areas at time t ; dimensionless

$Na_{EGL,t}$ = number of animals present in the sampled EGL areas at time t ; dimensionless.

$Na_{EGL,t=1}$ = number of animals present in the sampled EGL areas at time $t=1$, as specified in the VCS-PD; dimensionless.

SFR_{EGL} = fraction of sampled EGL areas sampled with respect to total, as specified in the VCS PD; % (since the whole project area has been sampled, this will be equal to 1)

The average population sized displaced in the EGL areas will be estimate using Eq. 91 of AR-AM003:

$$dNa_{EGL,t} = (Na_{EGL,t} - Na_{EGL(t=1)}) \cdot 1 / SFR_{EGL}$$

Where:

- dNa_{EGLt} = number of animals displaced in *EGL* areas at time t ; dimensionless
- $Na_{EGL,t}$ = number of animals present in the sampled *EGL* areas at time t ; dimensionless.
- $Na_{EGL,t=1}$ = number of animals present in the sampled *EGL* areas at time $t=1$, as specified in the VCS-PD; dimensionless.
- SFR_{EGL} = fraction of sampled *EGL* areas sampled with respect to total, as specified in the VCS PD; % (since the whole project area has been sampled, this will be equal to 1)

If $Na_{BL} < (Na_{AR,t} + dNa_{EGL,t})$ then, it can be assumed that the animal populations displaced due to the VCS-AR project activity have not occasioned leakage due to conversion of land to grazing land ($LK_{conversion} = 0$) and no further monitoring step will be needed.

Because of the improved grazing management system being implemented in the *EGL* areas, it is expected that this will be true. If this is found to not be true, then the animal populations in *NGL* areas will need to be determined.

Step4: For each verification period, the average animal population size displaced to new grazing areas and unidentified grazing areas will be estimated.

A survey of these areas will be conducted and interviews with the animal owners conducted. The following parameters will be monitored in the survey:

- dNa_{NGLt} = number of animals displaced in *NGL* areas at time t ; dimensionless
- $Na_{NGL,t}$ = number of animals present in the sampled *NGL* areas at time t ; dimensionless.
- $Na_{NGL,t=1}$ = number of animals present in the sampled *NGL* areas at time $t=1$, as specified in the VCS-PD; dimensionless.
- SFR_{NGL} = fraction of sampled *NGL* areas sampled with respect to total, as specified in the VCS-PD; % (since the whole project area has been sampled, this will be equal to 1)
- dNa_{XGLt} = number of animals displaced in *XGL* areas at time t ; dimensionless

The average animal population size displaced to new grazing areas and unidentified grazing areas will then be estimated using Eq. 92 and 93 of AR-AM0003:

$$dNa_{NGL,t} = (Na_{NGL,t} - Na_{NGL,t=1}) \cdot 1 / SFR_{NGL}$$

$$dNa_{XGL,t} = Na_{BL} - Na_{AR,t} - dNa_{EGL,t} - dNa_{NGL,t}$$

Where:

- dNa_{NGLt} = number of animals displaced in *NGL* areas at time t ; dimensionless
- $Na_{NGL,t}$ = number of animals present in the sampled *NGL* areas at time t ; dimensionless.
- $Na_{NGL,t=1}$ = number of animals present in the sampled *NGL* areas at time $t=1$, as specified in the VCS-PD; dimensionless.
- SFR_{NGL} = fraction of sampled *NGL* areas sampled with respect to total, as specified in the VCS-PD; % (since the whole project area has been sampled, this will be equal to 1)
- dNa_{XGLt} = number of animals displaced in *XGL* areas at time t ; dimensionless

Step 5: The leakage due to displacement of grazing activities will then be estimated using Equ. 94-96 of AR-AM0003:

$$LK_{conversion} = LK_{NGL} + LK_{XGL}$$

$$LK_{NGL} = dNa_{NGL,t} \cdot aLK_{NGL}$$

$$LK_{XGL} = dNa_{XGL,t} \cdot aLK_{XGL}$$

Where:

- LK_{NGL} = leakage due to conversion of non-grassland to grassland in *NGL* areas under the control of the animal owners; tonnes CO₂-e
- LK_{XGL} = leakage due to conversion of non-grassland to grassland in unidentified *XGL* areas; tonnes CO₂-e
- LK_{NGL} = leakage due to conversion of non-grassland to grassland in *NGL* areas; tonnes CO₂-e
- dNa_{NGLt} = number of animals displaced in *NGL* areas at time *t* – as estimated in step 4; dimensionless
- aLK_{NGL} = average leakage due to conversion of non-grassland to grassland per displaced animal in *NGL* areas; tonnes CO₂-e animal⁻¹
- dNa_{XGLt} = number of animals displaced in *XGL* areas at time *t* – as estimated in step 4; dimensionless
- aLK_{XGL} = average leakage due to conversion of non-grassland to grassland per displaced animal in *XGL* areas; tonnes CO₂-e animal⁻¹

Because in the *ex ante* estimation, no leakage due to conversion was expected, the average leakage per animal due to conversion of *NGL* and *XGL* was not estimated and therefore must take place. Prior to the first verification period, this will be done based on the methods in AR-AM0003 V04.

The *NGL* areas will be stratified based on significant differences in carbon stocks. The mean carbon in the five carbon pools will be estimated for all *NGL* stratum and the for the *XGL* areas, the mean carbon stocks of mature forests will be estimated. It is expected that 2006 IPCC Guidelines for National Greenhouse Gas Inventories will be used to estimate the mean carbon stocks. Based on the methodology, the dead wood and litter pool in the mature forest will not need to be included as it is assumed to be minimal.

Through a survey of local practices of surrounding farmers or the literature, it will be determined what amount of the above-ground volume will be cut and sold as timber. If it is not possible to determine the amount of timber volume that will be removed, it will be assumed all the aboveground biomass will be burned. It is then assumed the remaining biomass will be burned. According to Eq. 39 of AR AM0003 V04,

$$LK_{NGL} = \sum_{t=1}^{t^*} (ngl_t \cdot C_{NGL\ ac,t} + E_{acBiomassB\ urnNGL,t} \cdot (1 - WB_{ht}))$$

$$aLK_{NGL} = LK_{NGL} / dNa_{NGL}$$

Where:

LK_{NGL}	=	leakage due to conversion of non-grassland to grassland in <i>NGL</i> areas under the control of the animal owners; tonnes CO ₂ -e
ngl_t	=	total area converted to grassland ¹²⁰ at time <i>t</i> ; ha
$C_{NGLac,t}$	=	mean carbon stock of the <i>NGL</i> area converted to grassland at time <i>t</i> ; tonnes CO ₂ -e
WB_{ht}	=	fraction of total above-ground biomass harvested as timber and as fuel-wood at time <i>t</i> (not burned); %
$E_{acBiomassBurnNGL,t}$	=	total non-CO ₂ emissions from biomass burning in land converted to grazing land at time <i>t</i> (calculated from 100% of the above-ground biomass); tonnes CO ₂ -e
aLK_{NGL}	=	average leakage due to conversion of non-grassland to grassland per displaced animal in <i>NGL</i> areas; tonnes CO ₂ -e animal ⁻¹
LK_{NGL}	=	leakage due to conversion of non-grassland to grassland in <i>NGL</i> areas under the control of the animal owners; tonnes CO ₂ -e
dNa_{NGL}	=	total number of animals to be displaced to <i>NGL</i> areas; dimensionless

According to Eq. 41 and Eq 42 of AR AM0003 V04

$$LK_{XGL} = \sum_{t=1}^{t^*} (xgl_t \cdot C_{XGLac,t} + E_{acBiomassBurnXGL,t} \cdot (1 - WB_{ht}))$$

$$aLK_{XGL} = LK_{XGL} / dNa_{XGL}$$

Where:

LK_{XGL}	=	leakage due to conversion of non-grassland to grassland in unidentified <i>XGL</i> areas; tonnes CO ₂ -e
xgl_t	=	total unidentifiable area converted to grassland ¹²¹ at time <i>t</i> ; ha
$C_{XGLac,t}$	=	mean carbon stock of the <i>XGL</i> area converted to grassland at time <i>t</i> ; tonnes CO ₂ -e
WB_{ht}	=	fraction of total above-ground biomass not-burned at time <i>t</i> (not burned); %
$E_{acBiomassBurnXGL,t}$	=	total non-CO ₂ emissions from biomass burning in unidentifiable land converted to grazing land at time <i>t</i> (assuming 100% burning of above-ground biomass); tonnes CO ₂ -e
aLK_{XGL}	=	average leakage due to conversion of non-grassland to grassland per displaced animal in <i>XGL</i> areas; tonnes CO ₂ -e animal ⁻¹
LK_{XGL}	=	leakage due to conversion of non-grassland to grassland in unidentified <i>XGL</i> areas; tonnes CO ₂ -e
dNa_{XGL}	=	total number of animals to be displaced to <i>XGL</i> areas; dimensionless

Non-CO₂ emissions from biomass burning ($E_{acBiomassBurnNGL,t}$) will be estimated using equation 24 in AR-AM0003.

¹²⁰It is possible that not all *NGL* areas will be converted to grazing land in the first project year; ngl_t shall be estimated as a proportion of the area annually afforested or reforested. The proportion shall be calculated as the ratio *NGL* relative to (*EGL+NGL+XGL*).

¹²¹It is possible that not all *XGL* areas will be converted to grazing land in the first project year; ngl_t shall be estimated as a proportion of the area annually afforested or reforested. The proportion shall be calculated as the ratio *XGL* relative to (*EGL+NGL+XGL*).

10.4.1.2 Estimation of leakage due to displacement of fuel wood collection

Based on pre-project surveys, it was determined that no fuel wood collection took place inside the project area and therefore can be ignored.

10.5 Quality Assurance and Quality Control (QA/QC)

To ensure net anthropogenic GHG removals by sinks are to be measured and monitored precisely, credibly, verifiably, and transparently, a QA/QC procedure will be implemented and the use of these procedures monitored.

Standard Operating Procedures have been established for all procedures such as: GIS analysis, field measurements, laboratory methods, data entry, data documentation, and data storage. Training courses will be held for all relevant personnel on all data collection and analysis procedures¹²².

10.5.1 Verification of data:

10.5.1.1 Verification of GIS analysis

A minimum of 10% of sampling units will be randomly selected for re-measurement by an independent measurement team. Any errors found will be corrected and recorded. The level of errors recorded will be calculated using the below equation and reported:

$$\text{Measurement Error (\%)} = \frac{(\text{Estimate 1} - \text{Estimate 2})}{\text{Estimate 2}} \times 100$$

10.5.1.2 Field data collection

To verify that plots have been installed and the measurements taken correctly:

- A minimum of 10% of randomly selected plots will be re-measured by a supervisor with a team not involved in the initial measurement sampling
- A minimum of 10% of randomly selected plots will be re-measured by independent quality-control team.
- The re-measurement data will be compared with the original measurement data. Any errors found will be corrected and recorded. The level of errors recorded will be calculated and reported using this equation:

$$\text{Measurement Error (\%)} = \frac{(\text{Estimate 1} - \text{Estimate 2})}{\text{Estimate 2}} \times 100$$

10.5.1.3 Laboratory methodology

- A minimum of 10% of laboratory samples will be randomly selected for re-measurement by an independent, qualified measurement team.
- Any errors found will be corrected and recorded. The level of errors recorded will be calculated using the below equation and reported:

$$\text{Measurement Error (\%)} = \frac{(\text{Estimate 1} - \text{Estimate 2})}{\text{Estimate 2}} \times 100$$

10.5.1.4 Data entry

To produce reliable carbon estimates the proper entry of data into the data analyses spreadsheets is required. All data sheets will include a 'Data recorded by' field. Communication between all personnel involved in measuring and analyzing data will be used to resolve any apparent anomalies before final analysis of the monitoring data can be completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot will not be used in the analysis. Expert judgment and comparison with independent data will be used to ensure data results are inline with expectations. Additionally, field and laboratory data will be reviewed by an independent trained team further ensuring the data and analyze are realistic.

- A minimum of 10% of data entry records will be randomly selected for re-entry by a qualified team member and both sets of data compared with each other
- Incorporate checks in the programs used to analyze the data such as upper limits for dbh

¹²² AIDER. 2009. Procedimientos de aseguramiento y control de calidad del monitoreo del Proyecto Campo Verde.

- Any errors found will be corrected and recorded. The level of errors recorded will be calculated using the below equation and reported:

$$\text{Measurement Error (\%)} = \frac{(\text{Estimate 1} - \text{Estimate 2})}{\text{Estimate 2}} \times 100$$

10.5.1.5 Data maintenance and archiving

Due to the long length of the project and the speed at which technology changes data archiving will be an essential component. Data will be archived in several forms and copies of all data will be provided to each project participant.

- Original copies of the field measurement (data sheets and electronic files) and laboratory data will be stored in a secure location
- Copies of all data analyses, and models; the final estimate of the amount of carbon sequestered; any GIS products; and a copy of the measuring and monitoring reports will be stored in a dedicated and safe place, preferably offsite.
- Electronic copies of all data and reports will be updated periodically and converted to any new format required by future software or hardware. A specific project participant field member will be responsible for this updating.

10.6 Uncertainty assessment

Estimated emissions and removals will all have uncertainties associated with them. To estimate the total level of uncertainty, error propagation will be used according to Eq. 51 and 52 of AR-AM0003:

$$U_{total} = \sqrt{U_1^2 + U_2^2 + \dots + U_n^2}$$

$$U_E = \frac{\sqrt{(U_1 * E_1)^2 + (U_2 * E_2)^2 + \dots + (U_n * E_n)^2}}{|E_1 + E_2 + \dots + E_n|}$$

Where:

U_{total}	=	percentage uncertainty in the product of the quantities (half the 95% confidence interval divided by the total and expressed as a percentage);
U_i	=	percentage uncertainties associated with each of the quantities,
1, 2, 3, ... n	=	number of quantities
U_E	=	percentage uncertainty of the sum
U_i	=	percentage uncertainty associated with source/sink i
E_i	=	emission/removal estimate for source/sink i

The maximum permissible error following methodology AR-AM0003 is +/- 10%.