ACR Greenhouse Gas Project Plan

Boa Vista AR project

F.I.T. Timber Ltd.

Version 03 April 25, 2012

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A.
PROJECT OVERVIEW

A1. PROJECT TITLE

Boa Vista AR project

A2. PROJECT TYPE

The project is classified as an Afforestation/Reforestation (AR) project under the ACR Standard. The project proponent establishes and maintains a forest through planting and human-assisted natural regeneration of woody vegetation.

A3. PROOF OF PROJECT ELIGIBILITY

Demonstrate, with reference to the American Carbon Registry Standard and relevant ACR sector standard if applicable, that the project activity is eligible.

According to the ACR Standard 2.1 and Forest Carbon Project Standard 2.1, the eligibility criteria listed in Table A3.1 apply. The table also lists a short description, and references to proof of eligibility.

Table A3.1: Project Eligibility Criteria according to ACR FCPS 2.1

Criterion	Proof of eligibility	Reference
Start date	The project start date of May 14, 1999 complies with the ACR Forest Carbon Project Standard 2.1 start date of November 1, 1997 or later.	see also section H1. START DATE
Minimum project term	The project proponent commits to maintain planted tree stock on the project area at least for the required Project Term of 40 years.	see also section H2. PROJECT TIMELINE
Crediting period	In compliance with the ACR Forest Carbon Project Standard 2.1, the crediting period for the AR project is 40 years.	see also section H2. PROJECT TIMELINE
Real	GHG removals are quantified based on inventory of planted stock in the project area at time of verification. It is thus ensured that only after-the-fact quantifiable and verifiable GHG removals are accounted for.	see also sections D. MONITORING PLAN and E. QUANTIFICATION
Direct emissions	The project proponent has control over the relevant project activity, i.e. tree planting and maintenance, through its subsidiary company who is managing all forests. The project only accounts for emissions	see also sections B4. IDENTIFICATION OF GHG SOURCES AND SINKS, B7. REDUCTIONS AND ENHANCED

	reductions directly related to these activities.	REMOVALS as well as A7. PARTIES and appendix I1. Project Parties
Offset title	All rights to offset titles have been contractually transferred to the project proponent. No offsets have been sold prior to registration.	see also appendix I2. Land Owner and Contracts
Land title	All areas included in the project, long term land titles have been issued and ownership is thus clear, unique and uncontested. For land not owned by the project proponent long term lease contracts have been signed.	see also appendix I2. Land Owner and Contracts
Land eligibility	All areas included in the project fulfill eligibility criteria according to the ACR Standard 2.1 and Forest Carbon Project Standard 2.1.	see also section B3. PROJECT BOUNDARIES and E. QUANTIFICATION
Additional	Additionality for the project has been shown through a barrier analysis, using the CDM "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" (Version 01)	see also section C. ADDITIONALITY
Permanent	The long term setup as well as the risk analysis, mitigation approach and buffer establishment assure permanence of the project benefits.	see also section B8. PERMANENCE
Net of leakage	Possible leakage effects due to activity shifts are quantified and deducted from the GHG benefits	see also section E3. LEAKAGE
Independently verified	According to ACR rules, the project benefits will be verified by SCS Scientific Certification Systems, 2000 Powell St., Suite 600 | Emeryville, CA 94608 USA, an independent auditor.	
Community and environmental impacts	Impacts on community and environment were carefully analyzed and, in accordance with the ACR Standard 2.1 and Forest Carbon Project Standard 2.1, net positive impacts were confirmed.	see also section F. COMMUNITY & ENVIRONMENTAL IMPACTS

Furthermore, the project also fulfills all eligibility criteria set by the applied methodology (see section B2. METHODOLOGY JUSTIFICATION for details).

A3. LOCATION

Describe project location, including geographic and physical information allowing for unique identification and delineation of the specific extent of the project. GPS coordinates should be provided.

The Boa Vista AR project areas are located around the City of Boa Vista, Roraima, in northern Brazil, within 100 km of the city. The plantation project area is organized in three management units (so called nuclei): Serra da Lua (Southeast), Jacitara (North and Northwest), Mucajai (Southwest) summing up to 23,057 ha in total. Figure A3.1 shows an overview of the Boa Vista AR project areas and the management units.

GPS coordinates of the project area: longitude: 61° 16' 34" W – 60° W, latitude: 3° 20' 28 N – 2° 34' 34" N

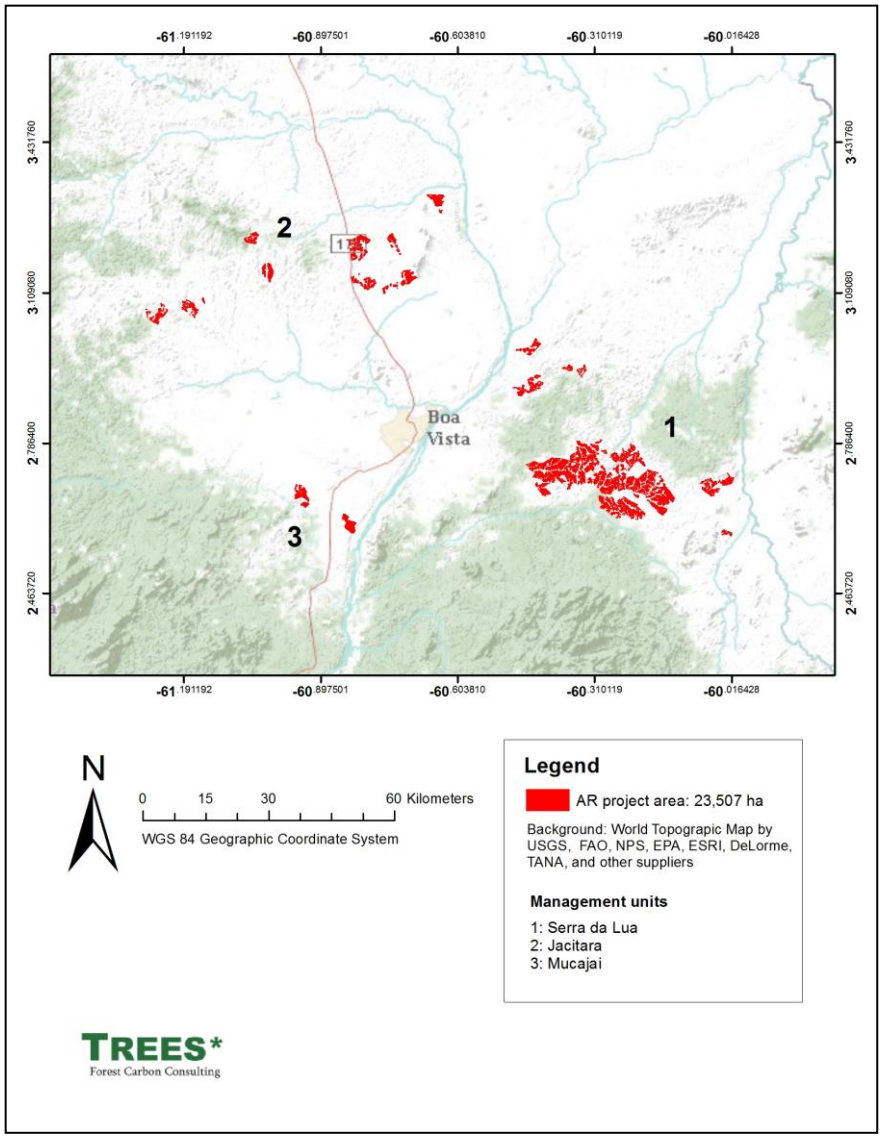

Fig. A3.1: Location and distribution of AR project areas around the City of Boa Vista, Roraima, Brazil

A4. BRIEF SUMMARY OF PROJECT

Provide a brief description of the project including:

Description of project activity

The Boa Vista AR Project encompasses an area of 23,507 ha of former degraded pasture land which has been gradually planted with *Acacia mangium Willd.* trees since 1999. The project ensures long-term sustainable management of these plantation forests for a multitude of purposes, including timber and energy wood production, conservation of existing remnants of natural forests and riparian areas.

Background information:

The plantation was initiated for commercial timber production with the goal to primarily finance it through revenues from timber sales. However, poor site quality on large areas impacts wood volumes and quality. The expected lower production and the increased efforts for forest maintenance, as well as several other implementation barriers (see section B5. BASELINE) require an additional source of income. Thus, within the original plantation covering an area of 29,991 ha, the Boa Vista AR project encompasses 23,507 ha for which long term tenure was established. The remaining "sister plantations" with short term leases will reverse to other land uses after the first rotation period or, if long term leases can still be established, will be set up as an separate project (see section C2. COMMON PRACTICE TEST). The revenues from sale of ERT for the Boa Vista AR Project shall ensure long-term maintenance of the plantation forests in the project and finance a sustainable, socially accepted multipurpose forest management.

Project purpose(s) and objective(s):

The main purpose of the afforestation project remains sustainable wood production in compliance with the Forest Stewardship Council (FSC) standard. This also implies protection and rehabilitation of natural forests in designated reserves (not included in the Boa Vista AR Project area). The establishment of the plantations as a renewable source of wood also results in various additional benefits, e.g. increase of carbon stocks and of greenhouse gas (GHG) removals by carbon sinks, creation of stable employment and social benefits for the local staff, conservation of natural forest patches and reduction of threats to surrounding natural forests. Aim of the AR carbon project is to ensure the long-term continuance of all benefits.

A5. PROJECT ACTION

Describe the project action(s), including:

Description of prior physical conditions

Climate

According to the Köppen climate classification the Boa Vista AR project area is located in the tropical monsoon climate type AM with distinct seasonality: the dry summer lasts from about September to about April, the start of the rainy winter. Average temperatures per month vary between 27°C and 30°C throughout the year. Three climate stations located in the project region have been recording temperature and precipitation since 2006 (station Araçá B was stolen in 2008 and thus only recorded data in 2006-2007). Annual average temperature is around 28.4 °C and annual average precipitation between 2271-2713 mm (compare Table A5.1).

Table A5.1: Annual average temperature and precipitation 2006-2010 for project region

Station name	Management Unit	Annual average temperature 2006-2010 [°C]	Annual average precipitation 2006-2010 [mm]
Jacitara	Jacitara	28.60	2270.6
Poçâo	Mucajai	28.38	2549.8
Araçá B	Serra da Lua	28.35	2712.5

Relief and Soils

The project area is characterized by flat topography with an average altitude of about 100 m AMSL. Soil analysis realized on plantation and savanna areas showed that these soils are mainly Latossolo Amarelo and Latossolo Vermelho-Amarelo (compare Figure A5.1 and footnote 1) and are highly degraded and extremely poor in basic cations, with Cation Exchange Capacity (CEC) below 5 and base saturation of under 30%. Soils are furthermore very acidic with pH values of around 4.5 and contain high aluminum levels which further inhibits plant nutrient uptake[1].

[1] Haas, M., Glauner ,R., 2004: Soil and foliar nutrients of *Acacia mangium* Willd. plantations in Roraima, Northern Brazil, Bundesforschungsanstalt für Forst- und Holzwirtschaft and University of Hamburg

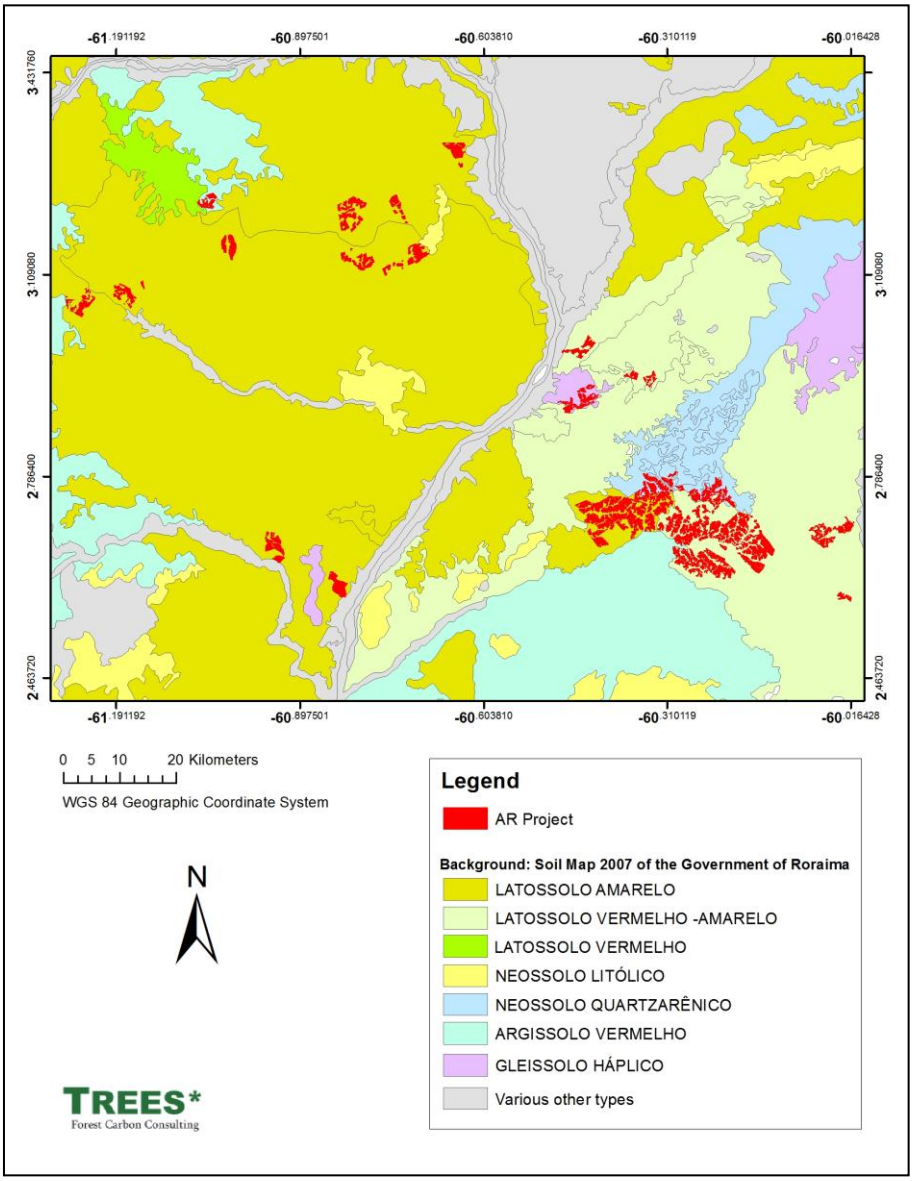

Fig. A5.1: Soil types in project region

Ecosystem

According to the Holdridge Life Zone model, the project area is located in the "Tropical Moist Forest" zone (indicated in Fig A5.2 with a red star).

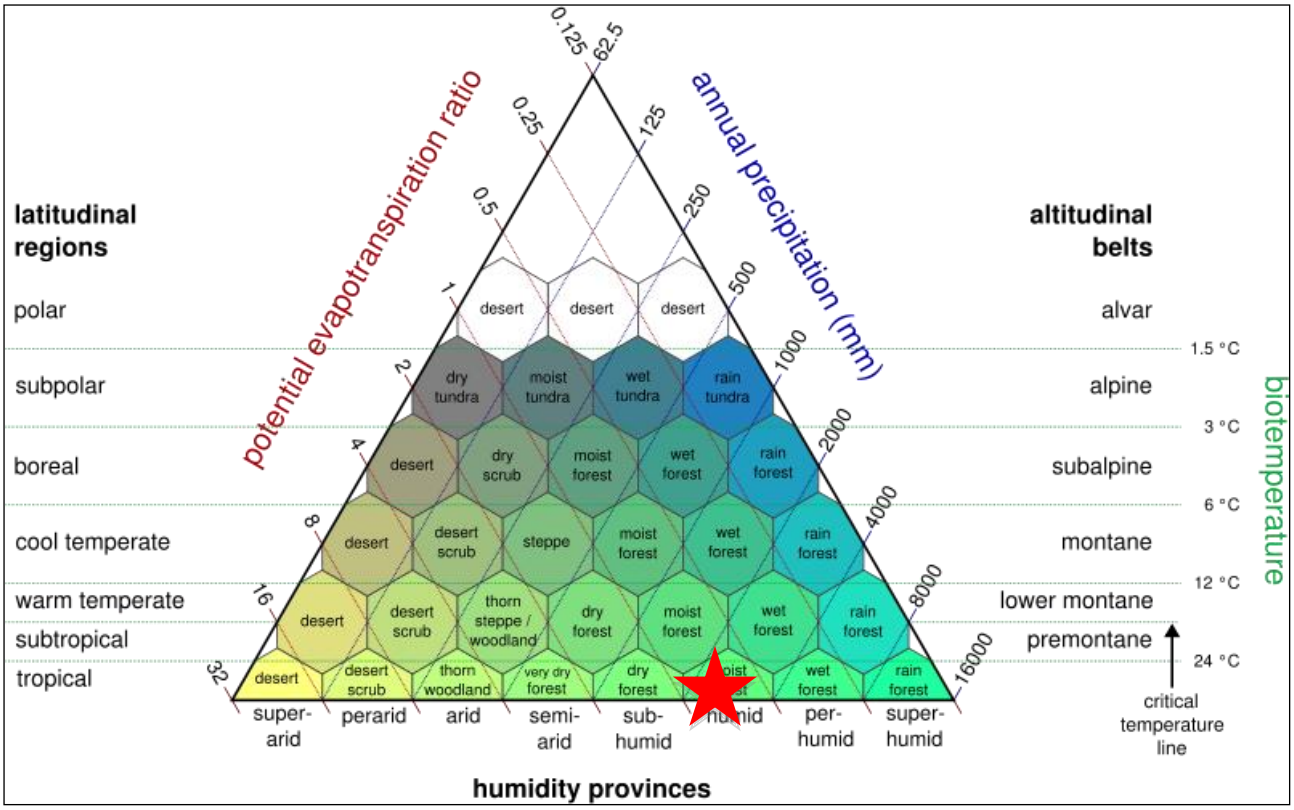

Fig. A5.2: Project area land classification according to Holdridge Life Zone System. Red star indicating project area land classification.

Vegetation and Land Use

The natural vegetation in this area, which still surrounds the plantations, is called Lavrado. It is a mosaic of savanna, marshy lakes, rivers and gallery forests. The savanna is mostly open grassland, sometimes loosely covered with small trees or scrub. 30% of the plantation area is classified as Savanna Graminosa, 68% as Savanna Parque vegetation land. The remaining 2% are split between different vegetation types (compare Figure A5.3). For a detailed description of the vegetation please refer to the Environmental Impact Assessment (supporting document F1-3 EIA-RIMA.zip). The Savanna Graminosa land is dominated by grasses, the Savanna Parque land by grasses and single scattered shrubs and trees (mainly Curatella americana L., Byrsonima crassifolia, and Byrsonima coccolobifolia), with palm trees (Mauritia flexuosa) along rivers. The primary land use is grazing land, which is regularly burned. Although this burning practice is forbidden by law, it is indeed still widely practiced in the area.

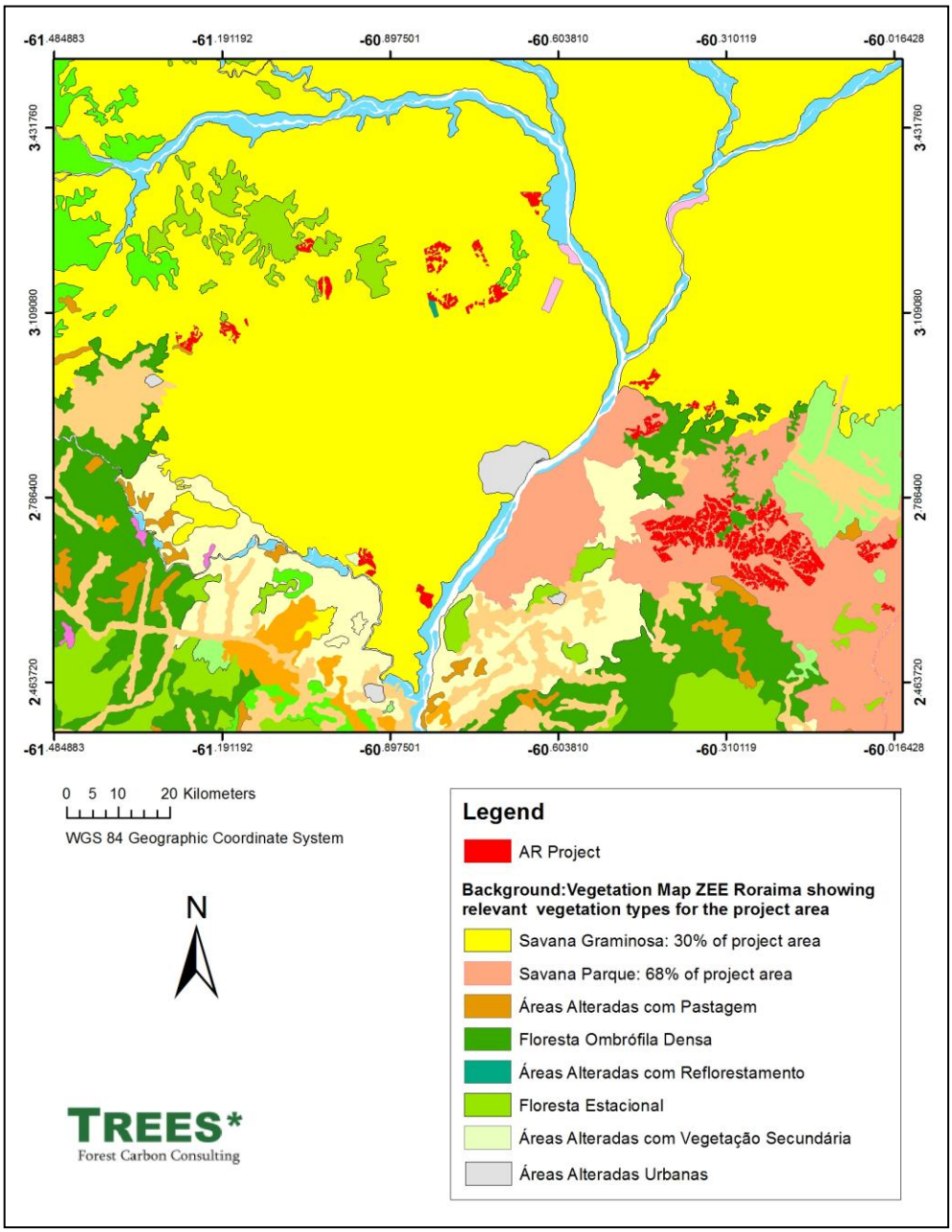

Fig. A5.3: Ecological zones (vegetation types) in the project region

Description of how the project will achieve GHG reductions and/or removal enhancements

The project achieves greenhouse gas emission reductions through afforestation/reforestation with *Acacia mangium* on lands that prior have been degraded due to cattle grazing. The planting of seedlings and growth of trees sequester carbon dioxide from the atmosphere in above and below ground biomass of the trees. The lands surrounding the project boundary continue to be extensively grazed and regularly burned (although this is forbidden), therefore the carbon stocks in these lands will continue to deteriorate or remain in a steady state. The AR project will achieve greenhouse gas removals through sequestration of CO_2 in the tree plantations which thus act as carbon sinks.

Description of project technologies, products, services and expected level of activity

The following activities take place during the establishment and management of the Acacia plantations. For a more detailed description of forest planning and management activities, please refer to the current version of the forest management plan (supporting document A5-1 Plano de Manejo_FIT Manejo Florestal do Brasil Ltda 2011.pdf).

Species choice for afforestation/reforestation

Afforestation/reforestation is achieved with the establishment of *Acacia mangium Willd.* plantations. *Acacia mangium* originates from Australia, Papua New Guinea and the Indonesian provinces Papua and the Malukus. There it is mostly found in the coast-near tropical lowlands (0-300 m AMSL). It is a fast growing pioneer species which is well adapted to acid soil conditions as for example it has the ability to exclude aluminum ions. This is why *Acacia mangium* is often used on degraded acid and nutrient-poor soils to improve the soil quality. As the soils in the project region are very acid, highly degraded and extremely poor in basic cations (compare soil conditions of the savanna land in paragraph relief and soils) as well as based on the similarities in climatic and altitude regime of the project region with the native *Acacia mangium* tree region, *Acacia mangium* is considered a suitable tree to reforest the degraded savanna lands in the region of Boa Vista. Also, *Acacia mangium* is a drought resilient species and thus well adapted to the Lavrado climate of the project region. No experience with large scale cultivation of native trees is available in the project region. However, in collaboration with EMPRAPA (Empresa Brasileira de Pesquisa Agropecuária), future tests with other tree species are planned.

Nursery practice

A nursery in the project was in operation until 2008 when the last area was planted. For the next rotation period the goal is to work with as much natural regeneration of *Acacia mangium* as possible. In patches with insufficient natural regeneration in terms of number or quality, single tree seedlings will be planted using no-till techniques with minimal soil disturbance. A nursery (for about 2,000,000 seedlings per year) is being re-established on the neighboring Farm Santa Cecilia for this purpose.

Site preparation and establishment

For any plantation establishment, all existing forest patches and riparian areas, especially palm belts (Buriti) along river and creek beds are excluded from the plantation area and protected. These areas, while part of the area controlled by the project proponent, remain protected and unchanged. Buffer zones have been established between the plantation area and existing vegetation.
Before the initial planting, all land was surveyed and marked. Shrub vegetation – where existing – was cleared and different soil preparation techniques such as ploghing ,ripping, and harrowing were applied to reduce competition from herbaceous vegetation and to prepare for planting of the seedlings. Fertilizer is applied to balance soil nutrient levels.

Planting configurations and regimes

After initial trials with planting densities from 1515 trees per ha (spacing of 3.3 x 2 m) in 1999 and 2000, 1250 trees per hectare (4 x 2 m) in 2001 and 840 trees per ha (3.6 x 3.3 m) in 2002, a standard planting density in the Boa Vista AR Project of 1010 trees per ha (initial spacing of 3.3 by 3 meters) has been used since 2003. The envisaged final stock will be 600-800 per ha. For new plantations, seedlings are planted manually early in the wet season between April and August.
For subsequent rotation periods, natural *Acacia mangium* regeneration will be used wherever reasonable. First experiences with natural regeneration show very promising results (Figure A5.4).

Fig. A5.4: Natural regeneration of *Acacia mangium* on Boa Vista project area, 1.5 years old

Maintenance

Experience from the past years shows that the initial economic goal of the plantation, the production of high quality timber for sawnwood, is feasible. However, on a part of the planted area due to both economic and tree quality related restraints, these objectives are not met. As part of the Boa Vista project, all *Acacia mangium* stands are thus maintained for multiple purposes. The final purpose of each stand is defined based on growth and quality criteria.

Table A5.2 describes the general measures taken in all plantations as well as the specific activities for "timber" and "biomass" areas.

TableA5.2: Maintenance activity by plantation type

Activity	**Timber**	**Biomass**
Fertilizing at planting if necessary	x	x
Weeding of herbaceous competition to seedlings (6 to 8 months after planting)	x	x
Control of leave-cutting ants with contained, non-volatile pesticides (6 to 8 months after planting) allowed by FSC	x	x
Low pruning (6 to 8 months after planting)	x	
Fertilizer (Dolomite and Phosphor mix) application (12-24 and 36-48 months after planting) if necessary	x	x
Second pruning up to 2.5m (12 to 15 months after planting)	x	
High pruning up to 5m (3 - 4 years after planting)	x	
Thinning after 3 to 4 years removing about 20% (when basal area is 9-12m^2/ha (), only in highest quality stands	x	(x)
Pest monitoring and control (with FSC allowed products)	x	x

Fire prevention and combat[2]	x	x
Monitoring and removal of *A. mangium* natural regeneration outside planted areas	x	x

Timber harvesting
For timber production, a rotation cycle of 8 to 12 years is planned (target DBH of 22 cm). Experience has shown that *Acacia mangium* growth can peak quite early in some sites of the Boa Vista AR project. For biomass production, a short rotation time of around 5 to 8 years is envisaged. All tree felling is mechanized, with the high quality trunks being separated from the branch material. The latter will be used as biomass for further processing (see below for potential products). Removing the wood is done using a skidder or forwarder on designated tracks to avoid soil compaction and degradation.

Products
The products generated in the Boa Vista AR Project can be categorized into saw logs and biomass. Wherever possible, saw logs are produced from high-quality stands. In addition, three options are currently being evaluated for the use of biomass (electricity, charcoal, biofuel).

Health and Safety
The project fulfills all health and safety requirements by Brazilian legislation as well as the requirements by FSC, e.g.

- Provision of appropriate equipment to workers
- Supply of first aid kits
- Prohibit the consumption of alcoholic beverages during work hours
- Ensure that vehicles are available for emergencies
- Maintain list of emergency telephone numbers
- Emergency action plan
- Training concept

A6. *EX ANTE* OFFSET PROJECTION

List estimated GHG emission reductions and removal enhancements by year, stated in metric tons of CO_2e.

Total projected GHG removal is 4,031,075 tCO2e (without risk buffer deduction) over the first crediting period of 40 years (including GHG removal from long-term wood products). Table A6.1 lists the emissions and removals, differentiating between GHG removals in carbon stocks in trees (incorporating biomass losses due to harvest) and in long-term wood products:

[2] See section B8. PERMANENCE and supporting document A5-2 (fire concept) for details

Table A6.1: Projected GHG benefits (removals and emissions; in tCO_2e) for the first crediting period of 40 years, without buffer deduction.

Project year	Year	GHG removal in tree biomass (tCO_2e)	GHG removal in long-term wood products (tCO_2e)	GHG emissions from project activity* (tCO_2e)	Annual Net Benefits (tCO_2e)	Cumulated Net Benefits (tCO_2e)
0	1999	0	0	1335	-1335	-1335
1	2000	8596	0	3767	4829	3495
2	2001	34295	0	5069	29226	32720
3	2002	68204	0	8119	60085	92806
4	2003	102754	0	20347	82407	175213
5	2004	186293	0	17406	168887	344100
6	2005	281192	0	16349	264843	608943
7	2006	389396	0	8298	381098	990041
8	2007	458502	0	2614	455888	1445929
9	2008	546088	0	3469	542618	1988547
10	2009	599556	0	0	599556	2588103
11	2010	599556	0	0	599556	3187659
12	2011	553035	0	0	553035	3740694
13	2012	9079	5528	0	14608	3755302
14	2013	0	5528	0	5528	3760830
15	2014	0	10394	0	10394	3771224
16	2015	0	10394	0	10394	3781618
17	2016	0	10394	0	10394	3792012
18	2017	0	10394	0	10394	3802406
19	2018	0	10394	0	10394	3812800
20	2019	0	10394	0	10394	3823194
21	2020	0	10394	0	10394	3833588
22	2021	0	10394	0	10394	3843982
23	2022	0	10394	0	10394	3854376
24	2023	0	10394	0	10394	3864770
25	2024	0	10394	0	10394	3875164
26	2025	0	10394	0	10394	3885558
27	2026	0	10394	0	10394	3895953
28	2027	0	10394	0	10394	3906347
29	2028	0	10394	0	10394	3916741
30	2029	0	10394	0	10394	3927135
31	2030	0	10394	0	10394	3937529
32	2031	0	10394	0	10394	3947923
33	2032	0	10394	0	10394	3958317
34	2033	0	10394	0	10394	3968711
35	2034	0	10394	0	10394	3979105
36	2035	0	10394	0	10394	3989499
37	2036	0	10394	0	10394	3999893
38	2037	0	10394	0	10394	4010287
39	2038	0	10394	0	10394	4020681
40	2039	0	10394	0	10394	4031075
TOTAL		**3836547**	**281302**	**86774**		**4031075**

* emissions from removal of pre-project scrub vegetation (no burning)

A7. PARTIES

List full contact information, roles, and responsibilities for project proponent, other project participants, relevant regulator(s) and/or administrators of any GHG Program(s) in which the project is already enrolled, and the entities holding offset and land title (if applicable).

The project proponent for the Boa Vista AR Project is F.I.T. Timber Ltd. which, through its subsidiaries, owns the planted trees and operates the plantations and surrounding farmlands (see org chart in Appendix I.1 Project Parties). Land titles are partially held by subsidiaries, partially by other entities in which the funding institution (F.I.T. Timber Growth Fund Ltd.) holds majority shares[3], and partially by third party owners. For all project land, including areas not owned by the proponent, long term leases have been established and transfer of carbon rights secured contractually (see section G1. PROOF OF TITLE and confidential Appendix I2. Land Owners and Contracts).

The Project Proponent retains full responsibility for planning, implementing and maintaining the Boa Vista AR Project. Main contact for the Project Proponent is:

Mr. John Edwards
F.I.T. Timber Ltd.
The Financial Services Centre
P.O. Box 1823
Stoney Ground
Kingstown
St. Vincent and the Grenadines
+41 43 336 77 99, carbon@fit-tgf.com

On site manager responsible for implementation, maintenance and monitoring is:

Mr. Yves Suelzle
F.I.T. Manejo Florestal Ltda,
Av Capitão Júlio Bezerra 1721 s 01 - Trinta E Um Marco
Boa Vista, RR, 69305-294
Brasil
+55 95 3212 4307 , y.suelzle@fit-tgf.com

[3] Agricultural land in Brazil is commonly held by corporations rather than individuals. Ownership is assigned through the shares of the respective corporations.

The plantation activities of the Boa Vista AR Project are regulated by the Fundação Estadual do Meio Ambiente e Recursos Hídricos – FEMARH (formerly FEMACT), supervising land use, licensing and environmental impacts:

Fundação Estadual do Meio Ambiente e Recursos Hídricos- FEMARH
Diretoria de Licenciamento e Gestão Ambiental (DLGA)
Divisão de Controle de Florestas
Chefe - Robério dos Santos Mangabeira
Av. Ville Roy, 4935
São Pedro - Boa Vista, RR 69306-665

Furthermore, the plantation forest management actvitivities in the project area are voluntarily subject to the rules of the Forest Stewardship Council (FSC, Certificate No. GFA-FM/COC-001981):

Conselho Brasileiro de Manejo Florestal (FSC Brasil)
Rua Luis Coelho, 320 - Cj. 82
Bairro Consolação
São Paulo, SP 01309-000

Telefone 55 11 3884-4482
info@fsc.org.br

The certification body auditing this license is:

GFA Consulting Group GmbH
GFA Certification
Eulenkrugstraße 82
22359 Hamburg
Germany

Contact person: Mr. Carsten Huljus, Program Director
Phone: +49-40-60306 147
Fax: +49-40-60306 149
E-mail: certification@gfa-group.de

The Boa Vista AR project is not enrolled in any other GHG Program.

B.
METHODOLOGY

B1. APPROVED METHODOLOGY

Reference the ACR approved methodology being applied to the project

The methodology used for the Boa Vista AR Project is the ACR A/R published methodology: Afforestation and Reforestation of Degraded Lands, version 1.0, March 2011.

B2. METHODOLOGY JUSTIFICATION

Describe why the chosen methodology is the most appropriate methodology for the project.

All applicability criteria of the selected methodology are fulfilled by the Boa Vista AR Project:

- The project activity is taking place on degraded and degrading savanna lands. Without the project, the lands would continue to remain at a low carbon steady state or continue to degrade due to cattle grazing and regularly burning. Due to grazing and fires natural regeneration is prevented. Evaluation of aerial imagery / historical maps shows no change in the area of forest cover in the project area. Soil degradation of project land was demonstrated according to the "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities" (Version 01); compare section A5: Relief and Soils).
- The project activity does not take place on organic soils (compare section A5: Relief and Soils);
- The project land does not fall into wetland category (compare section A5: Vegetation and Land Use);
- Fine litter remains on site and is not removed in the project activity;
- Parts of the project area were ploughed prior to planting. However, it was done in accordance with appropriate soil conservation practices, e.g. following the land contour. Later, this approach was improved towards minimal soil disturbance and no-till treatment. Thus the rate of loss of carbon stocks in soils in the project area was not increased above baseline rates for more than five years after the initial site preparation. The ploughing was not repeated since and will not be done at least within a period of 20 years. No-till techniques will be used for preparation of replanting. The goal is to work with natural regeneration. Where necessary, single tree seedlings will be planted without plowing.

B3. PROJECT BOUNDARIES

Identify the physical and temporal boundaries of the project.

For physical project boundaries refer to section A3 and the shapefile "Boa Vista AR Project Boundary".

Project land history:

The Boa Vista AR Project encompasses afforestation of former grassland covered partially with spare woody biomass (shrubs and single trees). The forest cover in the project region has been reduced over centuries to gain short-term agricultural land which – as its nutrient supply was depleted – was later used for extensive cattle ranging. As still practiced in the surrounding areas, regular animal grazing as well as burning of grassland and clearing of remaining trees as fuelwood or to "clean up" the lands prevented any natural forest structure from forming.

The eligibility analysis (see supporting documents B3-1 part1 Eligibility Analysis.pdf B3-1 part 2 Relatório Técnico – Uso do Solo.pdf for details) determined that all vegetation on the project land within ten years prior to the project start date was below the thresholds for minimum tree crown cover, minimum land area, and minimum tree height as communicated by the Comissao Interministerial de Mudança Global do Clima, the DNA of Brazil. Existing forest formation were put under protection and excluded from the management units.

B4. IDENTIFICATION OF GHG SOURCES AND SINKS

Identify the GHG sources and sinks within the project boundaries. If any sources or sinks will be considered de minimis*, include a justification.*

Above and below ground biomass will be measured and monitored in the proposed project. Standing deadwood is measured and monitored, lying deadwood is conservatively omitted (compare section E2. PROJECT SCENARIO). The changes in stocks of soil organic carbon will be assessed applying the tool prescribed by the selected methodology.

The carbon pools included in or excluded from accounting are shown in Table B4.1. The emission sources and associated GHGs included in or excluded from accounting are shown in Table B4.2.

Table B4.1: Carbon pools accounted for in the project boundary

Carbon Pools	**Selected (Yes/No)**	**Justification/Explanation**
Above-ground biomass	Yes	Major carbon pool subjected to the project activity.
Below-ground biomass	Yes	Below-ground biomass stock is expected to increase due to the implementation of the AR project activity.
Dead wood	Yes	Dead wood is expected to increase due to the implementation of the AR project activity if compared to the pre-project degraded grassland savannas.
Litter	No	Considered insignificant a priori for forest carbon projects according to the ACR Forest Carbon Project Standard, version 2.1
Soil organic carbon (SOC)	Yes	Will be assessed using the CDM "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" (Version 1) according to ACR methodology Afforestation and Reforestation of Degraded Lands, version 1.0.
Wood products	Yes	This stock will increase (when compared to baseline) due to implementation of the project activity.

Table B4.2: Emission sources and GHGs included in or excluded from accounting

Sources	**Gas**	**Included/Excluded**	**Justification/Explanation**
Burning of woody Biomass	CO_2	Excluded	Carbon stock decreases due to burning are accounted as a change in carbon stock
	CH_4	Included	Burning of woody biomass for the purpose of site preparation or as part of forest management can lead to significant levels of emissions of methane
	N_2O	Excluded	Potential emissions are negligibly small

B5. BASELINE

Describe the baseline scenario, how the baseline was identified and chosen, and why it is the most appropriate baseline for the project. Address all baseline-related topics required by the chosen methodology, ACR Standard, and relevant ACR sector standard if applicable.

Baseline selection was done using the CDM "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" (Version 01) as required by the chosen methodology. Step 0 in the tool was omitted as, according to the tool, it is required for projects starting after December 31, 1999 and the starting date for the Boa Vista AR project was before this date. Results from step 1 and 2 (Baseline scenario) of the tool are listed below. (Note: Step 4 "Common practice analysis" is documented in section C2. COMMON PRACTICE TEST)

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

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

The area on which the plantations were established is degraded and degrading pasture land with grassland vegetation, a few dispersed shrubs and remaining patches of forest. Under continuation of the current land use, it is likely to remain in its current condition, which has remained largely unchanged over the past decades. Livestock grazing is the traditional use in the area, as soils are mostly poor and thus not ideally suited for crop production. Also, repeated burning and soil compaction by cattle are hampering the use of land for crop production.

Yet, commercial soy production was established around Boa Vista in the 1990s. However, due to high production and transportation costs, lack of local processing facilities as well as difficulties with the envisaged export to Venezuela, the production was quickly abandoned again in the project area. However, there is still ongoing soy production in other areas around Boa Vista.

The following alternative land use scenarios have therefore been identified:

Land use scenario I) Continuation of pre-project land use as cattle pasture

The traditional land use in the project area and the surrounding land remains extensive cattle ranching. In many areas, repeated burning of the pastures to rejuvenate the grass for feed (although illegal) can still be observed.

Land use scenario II) Crop production

As mentioned above, production of soybeans has been attempted in the project area and large scale crop production must thus be considered a possible scenario. It requires major investment both in land improvement (i.e. fertilizing, soil restoration) and processing facilities. Another crop being discussed for production in Roraima is sugarcane, although no large scale operations have been implemented at this time (2011).

Land use scenario III) Fish farming

Commercial fish farming (pisciculture) is an activity currently (as of 2011) performed in the immediate vicinity of the project area, although on a much smaller scale. Even though it was not yet considered at time of project start in 1999, fish farming including potential land use for feed production (e.g. soy) is regarded as a possible scenario.

Land use scenario IV) Forestation without being registered as a GHG project

There is no legal requirement to reforest in the project area. Also, no specific incentives for afforestation or reforestation are given in the project area and

no such activity is observed besides the project. A commercial afforestation/reforestation is still considered a possible scenario.

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 CDM project activity.*

Land use scenario I) Continuation of pre-project land use as cattle pasture

Land use scenario II) Crop production

Land use scenario III) Fish farming

Land use scenario IV) Forestation without being registered as a GHG project

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

Land use scenario I) Continuation of pre-project land use as cattle pasture

Pre-project land use is in compliance with existing laws and regulations, with the exception of pasture burning for rejuvenation. However, the latter is not effectively enforced, especially on lands belonging to the indigenous population.

Land use scenario II) Crop production

No law or regulation prohibits crop production as long as it fulfills environmental criteria.

Land use scenario III) Fish farming

Fish farming is in compliance with existing laws and regulations, provided that the necessary environmental impact assessment (and mitigation of potential negative effects) is done.

Land use scenario IV) Forestation without being registered as a GHG project

Afforestation of land in the project region is not mandated by and fully compliant with laws and regulations (see also Section C1. REGULATORY SURPLUS TEST for regulatory compliance of afforestation).

Outcome of Sub-step 1b: *List of plausible alternative land use scenarios to the A/R CDM 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 I) Continuation of pre-project land use as cattle pasture

Land use scenario II) Crop production

Land use scenario III) Fish farming

Land use scenario IV) Forestation without being registered as a GHG project

STEP 2. Barrier analysis

This step serves to identify barriers and to assess which of the land use scenarios identified in the sub-step 1b are not prevented by these barriers.

Sub-step 2a. Identification of barriers that would prevent the implementation of at least one alternative land use scenario

A barrier analysis has been performed for each scenario, and, with the exception of scenario I), all scenarios face barriers for implementation. The following barriers have been identified to prevent at least one of the alternative land use scenarios:

Investment barriers: At the time of project start, access to private investment capital was very limited due to the high country risk (rated "B" in 1999; compare supporting document B5-1 Fitch sovereign_ratings_history.xls). Also, due to the high (perceived) risks for land use projects, as well as the remote situation of the state of Roraima, debt funding was not available from commercial banks at the time.

The resulting investment barrier was thus a major obstacle to implement any large project (relevant for all scenarios with the exception of continuing the pre-project land use, which would not require additional investments). For afforestation or reforestation, access to capital is further impeded by the fact that revenues are only expected almost a decade after planting (compare supporting document B5-2 FIT Simplified Plan_071111.xlsx), thus accruing operational cost in addition to the cost of establishing a plantation.

Barriers due to ecological conditions: Degraded soil in the project area from long-term pasture use as well as high risk of both human induced and natural fires represents a barrier for cultivation of crops or trees. This is reinforced by climatic fluctuations (“El Ninjo”), including droughts and floods. These barriers can only be overcome with significant additional efforts (soil preparation, fertilizer, maintenance, fire prevention and combat).

Barriers relating to markets, transport and storage: Local markets for crops and wood products are limited in region and could not absorb the products from large projects. Roraima, as the northernmost state in Brazil, is isolated from the Brazilian land-based trading routes by the Amazon region. Furthermore, Boa Vista has no direct navigable fluvial connection to Manaus as the Rio Branco is only navigable from about 130 km south of the city (near Caracaraí). Long road transport either towards Manaus or into Venezuela is the consequence. With the latter, customs delays pose an additional problem and have led to losses due to perished goods in the past. These market and transport factors negatively impact the competitiveness and profitability of the products from alternative land uses.

Technological barriers &barriers due to prevailing practice: For new approaches not yet established in the area ("first of its kind" activities, e.g. new crops, tree plantations) there are barriers relating to the availability of skilled personnel as well as material. Staff has to be recruited from other regions of Brazil and higher incentives usually have to be provided to attract them to Roraima. Obtaining the material needed for alternative land uses (e.g. fish feed, wood harvesting and processing machinery) also poses a significant barrier, especially due to the long transport distances of material brought into Roraima as well as high prices of specialized machinery. Combined with the market and transport barriers, this reduces profit margins to the level of factually preventing such alternative land uses.

Outcome of Step 2a: *List of barriers that may prevent one or more land use scenarios identified in the Step 1b.*

Investment barriers

Barriers due to ecological conditions

Barriers relating to markets, transport and storage

Technological barriers

Barriers due to prevailing practice

Sub-step 2b. Elimination of land use scenarios that are prevented by the identified barriers

Land use scenario I) Continuation of pre-project land use as cattle pasture

No barriers prevent the continuation of the pre-project land use as cattle pasture. Even the barriers relating to markets, transport and storage do not

apply to cattle pasture scenario as the products are sold for local consumption or processing.

Land use scenario II) Crop production

The key economic barrier to crop production is the risk involved from price fluctuations, especially in light of long transport distances (and thus high expenditures) and the absence of local processing facilities. For large scale projects, for which access to investment capital is insufficient, this also amplifies the financial barriers. For the project area, another barrier is the local ecological conditions, especially the degraded soil requiring higher effort and expenditure for improvement, as well as risk of fire which is prevalent in the project region (both human induced and natural). See supporting document A5-2 Fire Concept.pdf.

Land use scenario III) Fish farming

Fish farming, while technically possible at a moderate scale, faces significant barriers for large scale implementation. Key aspects are ecological feasibility (access to water, impact on surrounding areas) and the acceptance of a respective environmental impact analysis. A key technological barrier is the lack of feed for fish available in the area. Setup of a major feed source (e.g. soy production) faces the barriers mentioned above under "crop production", especially the financial barrier to establish the production areas.

Land use scenario IV) Forestation without being registered as a GHG project

Key barrier to forestation is the investment barrier, i.e. lack of affordable credit access and/or private financing. Especially financing for sustained maintenance is not secured due to the (perceived) long term risks. This is reinforced by other barriers to be overcome, i.e. unfavorable ecological conditions, especially degraded soil (see section A5. PROJECT ACTION) and risk of fire (see supporting document A5-2 Fire Concept.pdf), as well as the large transportation expenditures given by the remoteness of the project area. Combined with the high maintenance cost, this reduces competitiveness and profitability of products from the land use. Alternatively, processing facilities in the region have to be set up with additional investment (cf. investment barrier) to improve profit margin.

Outcome of Sub-step 2b: *List of land use scenarios that are not prevented by any barrier.*

Land use scenario I) Continuation of pre-project land use as cattle pasture

Sub-step 2c. *Determination of baseline scenario (if allowed by the barrier analysis)*

Land use scenario I) "Continuation of pre-project land use as cattle pasture" is the only scenario not facing an implementation barrier and thus selected as the baseline scenario.

(Note: According to the "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" (Version 01), the next step after baseline selection is the "common practice test". This is covered in section C2. COMMON PRACTICE TEST.)

B6. PROJECT SCENARIO

Describe the project scenario, including the project actions that will take place and any additional information required by the ACR Standard, the chosen methodology, and the relevant ACR sector standard if applicable.

Please refer to section A5. PROJECT ACTION for description of project actions.

B7. REDUCTIONS AND ENHANCED REMOVALS

Describe how the project reduces GHG emissions or enhances the removal of GHGs from the atmosphere beyond what would have taken place in the baseline scenario.

The project will achieve greenhouse gas emission reductions through afforestation/reforestation with *Acacia mangium* trees on lands that have been degraded due to cattle grazing. 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. The lands within the project boundary are currently degraded and expected to remain so, therefore the carbon stocks in these lands will continue to deteriorate or remain in a steady state. The AR project will achieve greenhouse gas removals by sequestration activity in sinks.

B8. PERMANENCE

Demonstrate whether the project offsets face any risk of reversal by identifying any risks that may substantially affect the project's GHG emission reductions or removal enhancements. If the offsets do face a risk of reversal, describe what method of permanence assurance will be used.

The VCS Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination (Version November 18 2008) was applied to assess the buffer determination of the Boa Vista AR project (Table B8-1 and B8-2).

Table B8.1: Risk rating applying to the Boa Vista AR project

Risk Factor	**Risk Rating**	**Boa Vista Project**
Project risk		
Risk of unclear land tenure and potential for disputes	Low	All project land is either privately owned by a subsidiary of the project proponent or is secured with a long term lease. All project land has titles and is uncontested (compare section G. OWNERSHIP AND TITLE).
Risk of financial failure	Low	The project proponent has completed thorough financial modeling in order to mitigate any potential financial risks to the project[4]. The project has established the afforestation and maintained the trees with first revenues from harvest coming up. Also, carbon revenues will provide required income to bridge expenses until revenues from timber and other products ensure long-term financing.
Risk of technical failure	Low	The project proponent and its staff have demonstrated technical expertise in several years of managing the project lands, developing relationships with nearby communities, performing remote sensing analysis and stock inventories / forest monitoring.
Risk of management failure	Low	The managers of the project have extensive experience in managing such a large scale plantation in a remote area as demonstrated by the CVs submitted to the third party validator/ verifier. The managers are further backed by the project proponents Operational Committee which consists of international experts.

[4] Integrated operating plan available to validator/verifier upon request

Economic risk		
Risk of rising land opportunity costs that cause reversal of sequestration and/or protection	low	The lands within the project boundary are grazing lands that are becoming increasingly more degraded due to the pressure caused by grazing and regular burning. Due to the degraded nature of the entire project area, these lands cannot support crop production without applying expensive fertilizer (see also section C3. IMPLEMENTATION BARRIERS TEST). In addition, the remoteness of the area increases transport efforts and thus make it not profitable.
Regulatory and social risk		
Risk of political instability	low	Brazil is a stable democracy. Since two decades of military rule ended in 1985, transitions between elected governments have been smooth. This was again demonstrated in January 2011 when the new president Dilma Rousseff took over from former president Luiz Inacio Lula da Silva. Executive power is exercised by the government. Legislative power is vested in both the government and the two chambers of the National Congress. The Judiciary is independent of the executive and the legislature.
Risk of social instability	low	The former president Luiz Inácio Lula da Silva has been credited with implementing policies that promoted upward social mobility by addressing inequality and raising living standards. Consequently during the last several years, poverty reduction and income distribution indicators have improved. The income inequality index value also came down, thanks to low inflation and economic growth, targeted transfer programs and improvements in labor productivity due to improved schooling. Brazil's greatest revolution in the past few years was to bring 35 million people from poverty into the ranks of the middle class. It is expected that the new president will press ahead this development.

Natural disturbance risk		
Risk of devastating fire	low	Forest fires (natural and human induced) are common in the Lavrado ecosystem in the project area. However, as *Acacia mangium* is a fire tolerant species after canopy closure (approximately 7 cm BHD) and the project proponent has taken successful measures to prevent fire from affecting the plantation area the risk is rated low[5].
Risk of pest and disease attacks	Low-medium	Monocultures per se can be considered susceptible to insect or fungus attacks and therefore need to be managed accordingly. Currently, it is known that heartrot diseases (caused by a fungus after incorrect branching) sometimes followed by some secondary pests (e.g. Lecanodiaspis sp) can significantly reduce growth or even lead to mortality of *Acacia mangium*. This is why the updated Management Plan will include specific measures to prevent, identify, treat, and control the spread of such attacks.
Risk of extreme weather events (e.g. floods, drought, winds)	low	The most extreme weather event in the project area is drought (sometimes compounded by El Niño's presence) which is occurring annually during four to six months. As *Acacia mangium* is a drought resilient species the impact for the project is considered low.
Geological risk (e.g. volcanoes, earthquakes, landslides)	low	▪ The project is not located in a region of seismic activity; the USGS rates in its seismic hazard map the probability for a peak ground acceleration (m/s2) with 10% probability of exceedance in 50 years in the project region as 0[6]. ▪ No active or inactive volcanoes are present in the project region.

[5] Compare supporting document A5-2 fire concept.pdf for precaution and combating measures.
[6] http://earthquake.usgs.gov/earthquakes/world/brazil/gshap.php

		▪ Landslides do not pose a risk to the project activity because the project is implemented on flat to moderately sloping lands only. Also, there is no history of landslide activities in the project region.

Table B8-2: Risk rating applying to all AFOLU projects

Risk Factor	**Risk Rating**	**Boa Vista Project**
Risk factors applicable to ARR projects		
Project longevity/ commitment period	High	The projects has rotation periods of less than 25 years, but with a commitment to replant after harvesting and thus qualifies as having a medium-term commitment period.
Ownership type and user rights	Low-medium	As described in section G1. PROOF OF TITLE, most of the project activity land is owned by the project proponent. The rest is secured with a long term lease until 2035 with the intention to extend the lease agreed with landowners, thus covering the full crediting period in good faith.
Technical capability	Low	The project proponent has proven over a period of more than 10 years that he has proven technologies and ready access to relevant expertise in order to run the plantation.
Financial capacity	Low	The project has the full support and financial backup of its parent company, a well-established forest fund.
Management capacity of project developer	Low	As noted in the 'risk of management failure' section above, the project proponent has an experienced on-site management team with a wide range of expertise. A majority of existing personnel are long-term staff of the company. Their experience includes work on various other afforestation and forest management projects.

Future income	Low	The management plan and financial analysis demonstrate that likely income streams from the sale of processed *A. mangium* wood and the carbon credits will finance the future management activities ("Integrated operating plan" available to validator/verifier upon request) .
Future/current opportunity costs	Low	As described in section C3. IMPLEMENTATION BARRIERS TEST, the low fertility and degraded state and remoteness of the project lands render them unattractive for alternative land uses besides the previous use as cattle pasture. With the benefits from the carbon project and revenues from timber, it is unlikely that the alternative land use (i.e. pasture) will become overly competitive.
Endorsement of project or land-use activity by local population and local/national political establishment	Low	Endorsement is given as reflected by the results from the stakeholder consultation process (see section F2. STAKEHOLDER COMMENTS). Also the project proponent is one of the most important private employers in the region and is in regular contact with all the local government and its various agencies.

Based on above assessment, the overall project risk is considered to be "medium" with the following rationale:

- 16 out of 19 risk categories are classified as "low" risks.
- The "medium" and "low-medium" risks (pests and land ownership, respectively) are of considerable importance for the project longevity.
- The only "high" risk listed is required by the tool due to the rotation period <25 years. However, both the business plan and the organizational setup prove a long-term commitment.
- The experience gained since the start of the project also proves stability of the activities.

A medium risk classification with a 30% buffer is thus considered adequate for the Boa Vista AR Project.

C.
ADDITIONALITY

ACR requires that every project either pass an approved performance standard and a regulatory additionality test, or pass a three-pronged test to demonstrate that the project activity is beyond regulatory requirements, beyond common practice, and faces at least one of three implementation barriers.

In accordance with ACR recommendations, the three-pronged additionality test is done under the guidance of the CDM "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" (Version 01). The results from the baseline analysis (steps 1 and 2 of the tool) are listed in Section B5. BASELINE. The paragraphs below list the results with reference to the three-pronged additionality test.

C1. REGULATORY SURPLUS TEST

Demonstrate how the project passes the regulatory surplus additionality test described in the ACR Standard v2.1. Include a summary and references to any relevant local laws and regulations related to the project and provide of demonstration of compliance with them.

Relevant laws, regulations, statues, legal rulings, and other regulatory frameworks that affect the project activity (also compare supporting A5-1 Plano de Manejo_FIT Manejo Florestal do Brasil Ltda 2011.pdf and F1-3 EIA-RIMA.zip):

National laws, regulations and policies:

- Federal Constitution (Constituição da Republica Federativa do Brasil, extended the 5th of October 1988);
- Environment legislation (Legislação Ambiental da Republica Federativa do Brasil);
- Resolutions of the Conselho Nacional do Meio Ambiente CONAMA, especially n°001/86, 005/89, 003/90, 09/93, 257/99, 313/02 and most recent ones;
- Forest regulations (Código Florestal Brasileiro), laws and complementary IBAMA most recent instructive norms;
- Law number 5.197 for fauna protection;
- Law 9.974 for agrochemicals;
- Law 9.605/98 for environmental crimes;
- Workers legislation (CLT – Consolidação das Leis Trabalhistas);
- Regulation and norms for Health and Rural Work Safety;
- National policy for water resources: Law 9433/97.

Local laws:

- Constitution of Roraima state (Constituição Estadual de Roraima), especially the articles n°124 and 125 of the "Lei Maior do Estado";
- Complementary state legislation, especially n°007, decree n°252 and normative instruction n°001/92;
- Código de Proteção ao Meio Ambiente do Estado de Roraima.

Binding International Agreements:

- International Tropical Timber Agreement, 1994;
- United Nations Framework Convention on Climate Change, 1992;
- United Nations Convention on Biological Diversity, 1992;
- Tratado de Cooperação Amazônica. Brasília 1978;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973;
- UNESCO World Heritage Convention, 1972
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (RAMSAR), 1971;
- International Labour Organization (ILO) Conventions signed by Brazil: 11, 12, 13, 14, 19, 26, 29, 81, 88,87, 89, 95,98, 99, 100, 101, 105, 111, 119, 138, 141, 148, 155, 161, 169, 170 and 171;
- Convenção da União Pan-Americana para a Proteção da Flora, da Fauna e das Belezas Cênicas Naturais dos Países da América, 1940 enacted in Brazil 1966.

None of the above or any other existing law, regulation, statute, legal ruling, or other regulatory framework in effect as of the Start Date in 1999 effectively requires the forest carbon project activity and its associated GHG emissions reductions/removal enhancements. Consequently, the project passes the Regulatory Surplus test.

C2. COMMON PRACTICE TEST

Demonstrate how the project passes the common practice additionality test described in the ACR Standard v2.1. (If the project is using the regulatory surplus + performance standard approach to additionality, skip this step.)

This section follows the CDM “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities” (Version 01) as required by the chosen methodology. Results from step 1 and 2 (Baseline scenario) have been listed in section B5. BASELINE). The following paragraphs list the outcome from STEP 4 "Common practice analysis".

According to information gained from interviews with local stakeholders and from a regional remote sensing analysis, no similar forestation activity was present before the Boa Vista A/R project. The only trees planted in the area were for fruit production (e.g. cashews) at a much smaller scale.

Also, there are 6,484 ha of “sister plantations” established along with the Boa Vista A/R project that are no longer within the scope of activities included in this GHG project plan. Reason for excluding these areas from the project are either that the land tenure could not be secured in the long term, either due to lack of official titles on so-called “posse” land (537 ha, cf. Figure C2.1) or due to unwillingness of land owners to continue the lease agreement and plantation beyond the first rotation period which will end in 2018/2020 (5,947 ha, cf. Figure C2.1). According to the land owners, this land will not be replanted after harvest but instead be converted back to pasture or crop use or, in specific cases, used for pisciculture. The “posse” land which remains under management by the project proponent is facing the same barriers as the areas included in the project and therefore the long-term continuation as tree plantation is also not secured. Yet, the project proponent intends to prevent conversion to other land

uses also for the “posse” lands and to continue with the plantations. Therefore, as soon as titles can be secured for these areas by the project proponent, an additional GHG project is planned to be set up for these areas to ensure funding. Until then, operations for these areas will be subsidized by the project proponent through revenues from the Boa Vista A/R project.

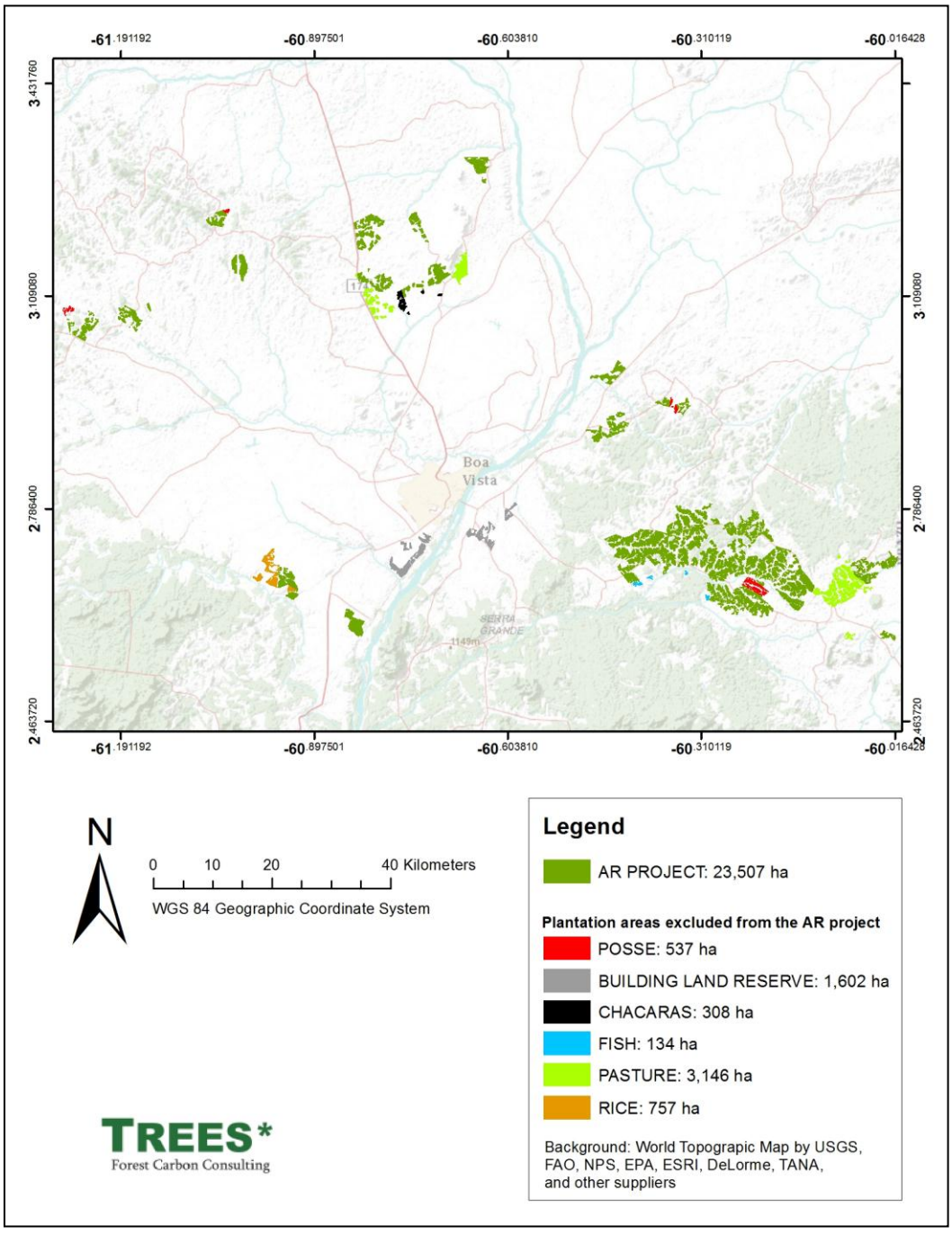

Figure C2.1: Plantation areas excluded from the AR Project (by future land use)

With no plantations by other actors and the currently existing "sister plantations" being reconverted to non-forest land use (land with short term lease) or de-facto depending on funding from the greenhouse gas project (for the "posse" land), it can be concluded that no comparable afforestation activity is present in the project region.

The project thus passes the common practice test.

C3. IMPLEMENTATION BARRIERS TEST

Demonstrate how the project passes at least one of the following implementation barriers tests described in the ACR Standard v2.1 and allowed by the chosen methodology. (If the project is using the regulatory surplus + performance standard approach to additionality, skip this step.)

- *Financial*
- *Technological*
- *Institutional*

Results from the barrier analysis for "Land use scenario IV) Forestation without being registered as a GHG project" according to the CDM "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" (Version 01) are listed in section B5. BASELINE.

The barriers listed in the additionality analysis above lead to increased operational cost, which will be covered at least partially with carbon revenues. The carbon revenues will increase IRR for total investments from 8.9% without carbon revenues[7] to 9.1% , and more importantly, they provide the financial liquidity to cover operational cost and investments (e.g. skilled staff and machinery) before revenues from harvested timber can be generated. Carbon revenues are thus a key element to maintaining the project action's ongoing economic viability after its implementation, which is one of the key questions the ACR Forest Carbon Project Standard (Version 2.1) lists under the financial implementation barrier test. Specifics on the operational cost, IRR and the contribution of the carbon revenues are documented in supporting document B5-2 FIT Simplified Plan_071111.xlsx.

C4. PERFORMANCE STANDARD TEST

Demonstrate how the project activity exceeds an approved performance standard by showing that the GHG emissions generated per unit output by the project are below the level (or GHG removals are above the level) defined as business-as-usual for the product, service, sector or industry in which the project takes place. (If the project is using the three-prong approach to additionality, skip this step.)

As the project uses the three-pronged approach, this step is skipped.

[7] IRR includes value-add from wood processing as part of the project proponent's operations.

D.
MONITORING PLAN

D1. MONITORED DATA AND PARAMETERS

List all relevant data and parameters that will be monitored using the table below.

The following tables list the parameters to be monitored in the project according to the requirements given by the methodology. For parameters using defaults or potentially measured once, refer to the methodology and Section E.
QUANTIFICATION.

Data or Parameter Monitored	A_i
Unit of Measurement	ha
Description	Area of tree biomass stratum i
Data Source	Monitoring of strata and stand boundaries shall be done preferably using a Geographical Information System (GIS), which allows for integrating data from different sources (including GPS coordinates and Remote Sensing data)
Measurement Methodology	GIS analysis based on management plan, field observations and remote sensing data (according to IPCC 2003 GPG LULUCF, Chapter 2)
Monitoring Frequency	Every five years since the year of the initial verification
QA/QC Procedure	QA/QC procedure according to IPCC 2003 GPG LULUCF, Chapter 5

Data or Parameter Monitored	$A_{BSL,j}$
Unit of Measurement	ha
Description	Area under trees of species j in baseline
Data Source	GPS coordinates and/or remote sensing data
Measurement Methodology	GIS analysis based on field observations and remote sensing data (according to IPCC 2003 GPG LULUCF, Chapter 2)
QA/QC Procedure	QA/QC procedure according to IPCC 2003 GPG LULUCF, Chapter 5

Data or Parameter Monitored	$a_{i,p}$
Unit of Measurement	m^2
Description	Area of sampling frame for plot p in stratum i
Data Source	Simple measurement or manufacturer's data
Measurement Methodology	GIS data based on field protocols (physical measurement of sampling plot) according to IPCC 2003 GPG LULUCF, Chapter 2
Monitoring Frequency	Every five years since the year of the initial verification

QA/QC Procedure	QA/QC procedure according to IPCC 2003 GPG LULUCF, Chapter 5
Notes	Once selected, the size of the sampling frame shall be fixed until the end of the last crediting period

Data or Parameter Monitored	$A_{p,i}$
Unit of Measurement	ha
Description	Total area of all sample plots in stratum i
Data Source	Field measurement
Measurement Methodology	GIS data based on field protocols (according to IPCC 2003 GPG LULUCF, Chapter 2)
Monitoring Frequency	Every five years since the year of the initial verification
QA/QC Procedure	QA/QC procedure according to IPCC 2003 GPG LULUCF, Chapter 5

Data or Parameter Monitored	DBH
Unit of Measurement	inch/cm or any unit of length used in the model or data source used
Description	Usually the diameter at breast height of the tree; but it could be any other diameter or dimensional measurement used in the model or data source used, e.g. basal diameter, root-collar diameter, basal area, etc.
Data Source	Field measurements in sample plots. For *ex ante* estimations, *DBH* values should be estimated using a growth curve, a growth model, or a yield table that gives the expected tree dimensions as a function of tree age
Measurement Methodology	DBH is measured applying project SOPs (see supporting document D1-1 FIT Manual do Inventário CO2.pdf and D1-1 FIT Manual adicional para Invetário CO2 2010.pdf)
Monitoring Frequency	Every five years since the year of the initial verification
QA/QC Procedure	QA/QC procedure according to IPCC 2003 GPG LULUCF, Chapter 5

Data or Parameter Monitored	H
Unit of Measurement	m or any other unit of length
Description	Height of tree
Data Source	Field measurements in sample plots. For *ex ante* estimations, *H* values should be estimated using a growth curve, a growth model, or a yield table that gives the expected tree dimensions as a function of tree age

Measurement Methodology	Height is measured applying project SOPs (see supporting document D1-1 FIT Manual do Inventário CO2.pdf and D1-1 FIT Manual adicional para Invetário CO2 2010.pdf)
Monitoring Frequency	Every five years since the year of the initial verification
QA/QC Procedure	QA/QC procedure according to IPCC 2003 GPG LULUCF, Chapter 5
Notes	Models used may be based on units of length other than metre (e.g. feet), in which case the appropriate unit of length only should be used

Data or Parameter Monitored	T
Unit of Measurement	*Year*
Description	Time period elapsed between two successive estimations of carbon stock in a carbon pool
Data Source	Recorded time
Measurement Methodology	N/A
Notes	If the two successive estimations of carbon stock in a carbon pool are carried out at different points of time in year t_2 and t_1, (e.g. in the month of April in year t_1 and in the month of September in year t_2), then a fractional value shall be assigned to *T*

Description of monitoring activities

Monitoring of project boundaries and strata

A GIS system has been set up to manage spatial geographical information. The system is managed by a dedicated staff and includes information on all plantation areas. Besides the area and plantation plot boundaries, the team maintains information on ownership of land and trees, silvicultural information and inventories. Additional data used for stratification such as vegetation zones or soil maps is also structured in the GIS system.

Monitoring of plantation management/biomass stocks

All operational work as well as field monitoring of stocks (both from a carbon and silivicultural side) is conducted by qualified teams. Field work is done following Standard Operating Procedures (SOPs) which are regularly updated.

A manual and field instructions have been developed for the inventory activities (see supporting documents D1-1 FIT Manual do Inventário CO2.pdf, D1-1 FIT Manual adicional para Invetário CO2 2010.pdf and D1-1 FIT field protocol.pdf). All personnel involved undergo regular trainings to ensure that consistently high quality data is obtained.

Information is collected and managed centrally and key model parameters (e.g. mean annual increment) are verified with each sampling round and improved as new knowledge is gained.

Monitoring of environmental and community impacts

Environmental and community impacts will be monitored annually and annual attestations will disclose any negative environmental or community impacts or claims of negative environmental and community impacts, along with plans to mitigate these impacts. Special attention is thereby given to the migration of Acacia trees outside the planted areas, water consumption by Acacia, and project impacts if any on habitat for the great anteater (Myrmecophaga tridactyla L.) as well as any other vulnerable or endangered species in the project area.

Description of area stratification

For ex ante estimations, the area is stratified according to pre-project land cover based on the ecological zones map and published biomass stock for each vegetation type (for respective parameters see Section E2, paragraph "Changes in above-ground and below-ground tree biomass").

For ex post calculations, the planting area will in addition be stratified by planting year (cf. Section E2, paragraph "Changes in above-ground and below-ground tree biomass") and by site preparation and soil type (to calculate soil disturbance and SOC change; cf. Section E2, paragraph "Soil organic carbon").

E.
QUANTIFICATION

E1. BASELINE

Detail the GHG quantification methodology for the baseline scenario including all relevant emissions or removals. Provide sample calculations wherever possible.

According to the methodology (see section B1. APPROVED METHODOLOGY), the following pools are assumed zero in the baseline scenario:

- Changes in carbon stock of above-ground and below-ground biomass of non tree vegetation are conservatively assumed to be zero for all strata in the baseline scenario;
- It is expected that the baseline dead wood and litter carbon pools will not show a permanent net increase. It is therefore conservative to assume that the sum of the changes in the carbon stocks of dead wood and litter carbon pools is zero for all strata in the baseline scenario;
- Since carbon stock in soil organic carbon (SOC) is unlikely to increase in the baseline, the change in carbon stock in SOC is conservatively assumed to be zero for all strata in the baseline scenario.
- Under the applicability conditions of this afforestation/reforestation methodology, it can be assumed that there is no commercial timber produced on the degraded lands in the absence of the project activities. Carbon stock in long-term wood products can be assumed to be zero for the baseline scenario.

According to equation 1 in methodology, baseline net GHG removals are determined as:

$$\Delta C_{BSL} = \Delta C_{TREE\_BSL} + (\Delta C_{WP\_BSL}) \quad (1)$$

As mentioned above, change in wood products is assumed to be zero in the baseline, thus only leaving potential change in tree biomass stock in the baseline. Under the conditions found in the project area (degraded land, pasture use, burning) tree biomass in the baseline scenario is not expected to increase significantly. Furthermore, all areas with pre-existing trees are excluded from the project area (see also section B3. PROJECT BOUNDARIES and supporting document B3-1 part1 Eligibility Analysis.pdf and the shapefile "Boa Vista AR Project Boundary"). Consequently, ΔC_{BSL} is considered to be zero.

E2. PROJECT SCENARIO

Detail the GHG quantification methodology for the project scenario including all relevant emissions or removals. Provide sample calculations wherever possible.

According to the methodology (see section B1. APPROVED METHODOLOGY), the actual net GHG removals by sinks shall be calculated as:

$$\Delta C_{ACTUAL} = \Delta C_P - GHG_E \quad (9)$$

where:

ΔC_{ACTUAL}	Actual net GHG removals by sinks; t CO_2-e
ΔC_P	Sum of the changes the carbon stock in the selected carbon pools within the project boundary; t CO_2-e
GHG_E	Increase in non-CO_2 GHG emissions within the project boundary as a result of the implementation of the AR ACR project activity; t CO_2-e

Changes in carbon stocks

The verifiable changes in the carbon stock in the selected carbon pools within the project boundary are estimated using the following equation:

$$\Delta C_P = \frac{44}{12} * \sum_{t=1}^{t^*} \Delta C_t \quad (10)$$

where:

ΔC_P	Sum of the changes in carbon stock in all selected carbon pools in stratum *i,* since start of the project; t CO_2-e
ΔC_t	Change in carbon stock in all selected carbon pools, in year *t*; t C
t	*1, 2, 3, … t^** years elapsed since the start of the A/R project activity; yr
44/12	Ratio of molecular weights of CO_2 and carbon; dimensionless

Change in carbon stock in all selected carbon pools in year t is calculated as:

$$\Delta C_t = \sum_{i=1}^{M_{PS}} (\Delta C_{TREE,i,t} + \Delta C_{DW,i,t} + \Delta C_{LI,i,t} + \Delta C_{SOC,i,t} + \Delta C_{WP,i,t}) \quad (11)$$

where:

ΔC_t	Change in carbon stock in all selected carbon pools, in year *t*; t C
$\Delta C_{TREE,i,t}$	Change in carbon stock in above-ground and below-ground biomass of trees in stratum *i*, in year *t*; t C
$\Delta C_{DW,i,t}$	Change in carbon stock in the dead wood carbon pool in stratum *i*, in year *t*; t C
$\Delta C_{LI,i,t}$	Change in carbon stock in the litter carbon pool in stratum *i*, in year *t*; t C
$\Delta C_{SOC,i,t}$	Change in carbon stock in the soil organic carbon pool in stratum *i*, in year *t*; t C
$\Delta C_{WP,i,t}$	Change in the wood products carbon pool for stratum *i*, in year *t* (possibly average over a monitoring period); t C
i	*1, 2, 3, …* M_{PS} strata in the project scenario
t	*1, 2, 3, …* t^* years elapsed since the start of the AR ACR project activity

Calculation of each of the above pools is described below.

Changes in above-ground and below-ground tree biomass

$\Delta C_{TREE,i,t}$ is calculated as the carbon stock change in the planted trees. In accordance with ACR FCPS 2.1, losses in pre-project non-tree woody biomass due to planting are deducted (note: this is a deviation from the chosen methodology which would allow neglecting all changes in non-tree biomass).

Pre-project woody biomass:

As shrubs were cleared from plantation areas during site preparation, pre-project woody carbon stocks have to be quantified. This is done according to equation 3a and 4 in the methodology, using published data.

$$C_{TREE\_BSL} = \frac{44}{12} * B_{TREE\_BSL} * CF_{TREE\_BSL} \quad (3a)$$

$$B_{TREE\_BSL} = BD_{TREE\_BSL} * A_{TREE\_BSL} \quad (4)$$

where:

B_{TREE_BSL}	Biomass of living trees in the baseline at the start of the project activity; t d.m.
BD_{TREE_BSL}	Tree biomass density per unit area of the project area (obtained from published literature); t d.m. ha^{-1}
A_{TREE_BSL}	Area of land within the project boundary where living trees are standing at the start of the project activity; ha

Barbosa and Fearnside[8] provide above-ground biomass and carbon stock calculations for all savanna types in Roraima. Below-ground biomass will be calculated using the appropriate root/shoot factor (IPCC 2006, Table 4.4). Table E2.1 lists the above-ground biomass stocks and carbon fractions for the different savanna types, Table E2.2 the ecological zones in the project area. Note that for areas shown as forest in the vegetation map (compare Figure A5.3), the savanna figures are used to estimate carbon stocks at pre-project (non-forested) state.

Table E2.1: Above-ground biomass and carbon fraction CF for trees and shrubs in open savanna types in Roraima in kg/ha with standard deviation in parenthesis (source: Barbosa and Fearnside 2005[7], tables 3 and 5)

Ecological zone (abbreviation)	**Savanna Graminosa "clean field" (Sg CF)**		**Savanna Graminosa "dirty field" (Sg DF)**		**Savanna Parque (Sp)**	
	Biomass (kg/ha)	CF (%)	Biomass (kg/ha)	CF (%)	Biomass (kg/ha)	CF (%)
Leaves	8.0	50.3 (2.7)	84.6	50.0 (3.3)	355.7	48.2 (3.6)
Wood (above ground)	27.9	46.3 (2.7)	514.7	46.1 (2.5)	3288.2	46.2 (1.8)
Total (above ground)	35.9 (1.1)	47.3 (2.7)	599.3 (13.5)	46.7 (2.9)	3643.8 (161.7)	46.4 (2.8)

Table E2.2: Ecological zones and size of respective strata in the project area. Ecological zones used for calculation refer to figures in Table E1.1. (savanna types also apply to previously deforested areas).

Ecological zone	**Area of stratum (ha)**	**Ecological zone used for calculation**	**Explanation**
Floresta Estacional	8	Sg DF	Areas were deforested before project start. Some woody biomass present ("look" of Sg DF).
Floresta Ombrofila Densa	106	Sg DF	Areas were deforested before project start. Some woody biomass present ("look" of Sg DF).
Contato Floresta Estacional / Floresta Ombrofila Densa	22	Sg DF	Areas were deforested before project start. Some woody biomass present ("look" of Sg DF).
Savanna Graminosa	7103	Average of Sg CF and Sg DF	CF and DF subtypes were not distinguished in pre-project land description. As most areas were likely Sg CF, using the average stock is conservative.

[8] Barbosa, I.R. and Fearnside P.M , 2005: Above-ground biomass and the fate of carbon after burning in the savannas of Roraima, Brazilian Amazonia. Forest Ecology and Management 216 (2005) 295–316

Savanna Parque	15894	Average of Sg DF and Sp	All tree groups in Sp area remain standing (excluded from project plantation area), i.e. not the full stock is removed. Using the average between Sg DF and Sp is taking into account that shrub vegetation in Sp may be more abundant than in Sg DF.
Areas Alteradas com Vegetacao Secundaria	98	Sg DF	Some woody biomass present ("look" of Sg DF).
Areas Alteradas com Pastagem	217	Sg CF	Managed pasture land. Very little woody biomass present.
Areas Alteradas com Reflorestamento	59	Average of Sg CF and Sg DF	Classification as “Reflorestamento” was done after project start. Sg values are used as previous land cover.

Above-ground and below-ground biomass of trees

The BEF method according to the methodology is used to calculate change of carbon stock in tree biomass. Stem volume is calculated based on field measurements of diameter at breast height (DBH) and average height. Species are recorded as well as tree vitality and stand-level parameters for silvicultural purposes (e.g. presence of secondary growth, natural regeneration, pests)

In 2010, a thorough sampling series involving more than 3900 sampling plots was done to assess stocks in detail (and to refine the management approach). This data will also be used for the first verification. Future inventories will be done using a sampling raster of approximately 500 plots (see supporting documents D1-1 FIT Manual do Inventário CO2.pdf, D1-1 FIT Manual adicional para Invetário CO2 2010.pdf and D1-1 FIT field protocol.pdf) .

From field data, stem volume for each Acacia tree in the sampling plot was derived using the diameter (DBH), tree height and a form factor using the following formulas:

(a) Tree basal area: $g = (dbh/100)^2 * Pi/4$ (m^2)

(b) Tree Volume: v = g * height * FF (form factor)

Local form factors for *Acacia mangium* have been developed in 2008 based on comprehensive measurements using felled Acacia trees from the plantations (see supporting document D1-2 Form Factors Acacia Mangium.pdf). The stem volume is expanded to the above-ground tree biomass using a biomass expansion factor (BEF) and basic wood density (D). Total tree biomass is then obtained by multiplying the above-ground tree biomass by (1+R) where R is the root-shoot ratio. Table E2.3 lists the parameters used and the respective sources.

Table E2.3: Parameters used for calculation of carbon stock change in tree biomass using the BEF method

Parameter	Abbr	Unit	Value	Source
Biomass Expansion Factor	BEF	dimensionless	1.3	Miyakuni et al. 2004[9]
Density	D	g/cm^3	0.62	Local measurement and analysis by University of Hamburg[10]
Root/Shoot-Ratio AM	R	dimensionless	0.175	Miyakuni et al. 2004[8]

Dead wood

Standing dead wood is registered in the field inventory and calculated according to the methodology. In addition to the parameters listed for the living tree biomass above, a decomposition class according to the ACR methodology is recorded in the field inventory.

Lying dead wood is conservatively neglected, i.e. not measured nor calculated. As this pool is bound to increase in the plantation, omitting it is considered conservative.

Litter

In accordance with ACR FCPS V2.1, changes in the litter pool are a priori considered insignificant.

Soil organic carbon

The changes in stocks of soil organic carbon are estimated using the approved methodological tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" (Version 01.1.0).

In accordance with the tool, the area will be stratified for SOC calculation based on soil type, using the Roraima soil map (see Fig.A5.1). A stratification according to pre-project management activities is not necessary as all planted areas were previously used as pasture (grassland).

The tool requires that *"the values of* $SOC_{REF,i}$ *,* $f_{LU,i}$*,* $f_{MG,i}$*,* and $f_{IN,i}$ *are taken from the Tables 3-6 of this tool, unless transparent and verifiable information can be provided to justify different values".* Table E2.4 matches the soil types on the Roraima map to the WRB and IPCC type and lists the respective defaults for soil organic carbon reference stocks according to the tool. Table E2.5 summarizes the relative stock change factors from Table 6 in the tool.

[9] Miyakuni et al. 2004: Allometric biomass equations, biomass expansion factors, and root-to-shoot ratios of planted Acacia mangium Willd. forests in West Java, Indonesia. Journal of Forest Planning 10:69-76 (2004)

[10] Sievert, U., 2006: Bestimmung der elastomechanischen Eigenschaften von Acacia mangium Willd. aus Plantagenanbau, Diploma thesis, University of Hamburg, Germany.

Table E2.4: Climate, soil type and reference stocks SOC_{REF} in tC per ha in 0-30 cm depth (source: "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" (Version 01.1.0) Table 3)

Climate	**Soil type**	**WRB type**	**IPCC Soil type**	**SOC_{REF}**
Tropical, moist	Latossolo	Ferralsol	LAC soils	47
Tropical, moist	Argissolo	Acrisol	LAC soils	47
Tropical, moist	Neossolo	Arenosol	Sandy soils	39
Tropical, moist	Gleissolo	Gleysol	Sandy soils	39

Table E2.5: Relative stock change factors f_{LU}, f_{MG}, and f_{IN} (source: "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" (Version 01.1.0) Table 6):

Factor type	**Level**	**Factor value**
Land use (f_{LU})	All	1.00
Management (f_{MG})	Severely degraded	0.70
Input (f_{IN})	Low/Medium	1.00

Calculations of SOC change, including SOC losses due to site preparation, will be done applying the equations in the tool and the default parameters listed in the tables above. Where data from local scientific measurements is available, the corresponding results from these studies may be used instead.

Long term wood products

Carbon sequestration in wood products (long-lived fraction) is estimated using the "Winjum et al." method according to the methodology. Table E2.6 shows the parameters used to quantify the long-term fraction of harvested timber for sawn wood. From the harvested volume used for biomass, no long term products are produced and thus no additional sequestration is achieved.

Table E2.6: Parameters used for calculation of carbon stock in long-lived wood products using the Winjum et al method.

Wood waste factor (wf)	0.24	Methodology (Winjum et al. 1998)
Short lived proportion (slp)	0.2	Methodology (Winjum et al. 1998)
Fraction oxidized (fo)	0.84	Methodology (Winjum et al. 1998)

Estimation of GHG emissions within the project boundary

The methodology requires the quantification of non-CO2 emissions from burning of biomass of existing woody vegetation as part of site preparation. However, no biomass was burned as part of the project activity or for site preparation. Non-CO_2 emissions by the project are thus considered 0.

E3. LEAKAGE

Describe how leakage is accounted for and quantified. Provide sample calculations wherever possible.

Under applicability conditions of the methodology leakage emissions due to displacement of agricultural activities can occur. According to the methodology, leakage due to the displacement of agricultural activities in year t must be assessed applying the CDM tool "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity" (Version 01). In the first paragraph, the tool (Version 01) refers to the "Guidelines on conditions under which increase in GHG emissions related to displacement of pre-project grazing activities in A/R CDM project activity is insignificant" to determine if leakage is significant. Section III of these guidelines (Version 01) requires the following procedure:

"4.The increase in GHG emissions due to displacement of pre-project grazing activities attributable to the A/R CDM project activity is insignificant if at least one of the conditions (a) to (d) below is met:

(a)Total area subjected to pre-project grazing activities to be displaced is less than 5% of the area of the entire A/R CDM project activity, or less than 50 ha;

(b) The total area expected to be displaced is more than 5% of the entire A/R CDM project activity or more than 50 ha, and the n-a ha (where "n" is the area in ha expected to be displaced and "a" is 5% of the total project area or 50 ha) are displaced to:

- *(i) Areas of land that can be identified as degraded or degrading. The identification shall be conducted using the most recent version of the "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities" (Version 01); and/or*
- *(ii) Existing grasslands with the carrying capacity that allows for accommodation of the displaced animals during the entire period of displacement;*

(c) Total number of animals expected to be displaced is not more than 40 LSU;

(d) The total number of animals expected to be displaced is more than 40 LSU, and the n-40 LSU (where: "n" is the total number of animals, expressed in LSU, which are expected to be displaced) are displaced to:

- *(i) Areas of land that can be identified as degraded or degrading. The identification shall be conducted using the most recent version of the "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities" (Version 01); and/or*
- *(ii) Existing grasslands with the carrying capacity that allows for accommodation of the displaced animals during the entire period of displacement; and/or*
- *(iii) Existing tree plantations, where at least 60% of trees are expected to have DBH greater than 10 cm at the time of displacement and with the carrying capacity that allows for accommodation of the displaced animals during the entire period of displacement; and/or*

(iv) Feed-lots or other zero-grazing systems; and/or
(v) Slaughterhouses."

Application of this procedure to the Boa Vista AR project leads to the following results:

On some farms (e.g. "Acacia magnifica" and "Nova Cintra III") cattle was kept on the remaining (i.e. non-reforested) areas of the farm which had previously been used below capacity, thus fulfilling criteria (b) (ii) above.

In addition, livestock in the Boa Vista AR project area was reduced by about 1000 head of cattle, all of which were sold to third parties before the land was transferred for the Boa Vista AR project. A relevant portion of these cattle was sold for slaughter and would thus fulfill criteria (d) (v). However, as no documentation of direct sale to slaughterhouses is currently available, the following analysis was done assuming displacement to the surrounding areas instead:

According to data from the Brazilian Institute of Geography and Statistics IBGE, cattle numbers in the municipalities surrounding the project area stagnated or even decreased in the years following the project start before rising again around 2004 in the Brazilian cattle boom (see Figure E3.1). The reduction of cattle numbers in the project area actually took place in the municipality of Bonfim, which underwent a significant reduction in number of cattle not related to the project in the subsequent years until a new increase in 2005.

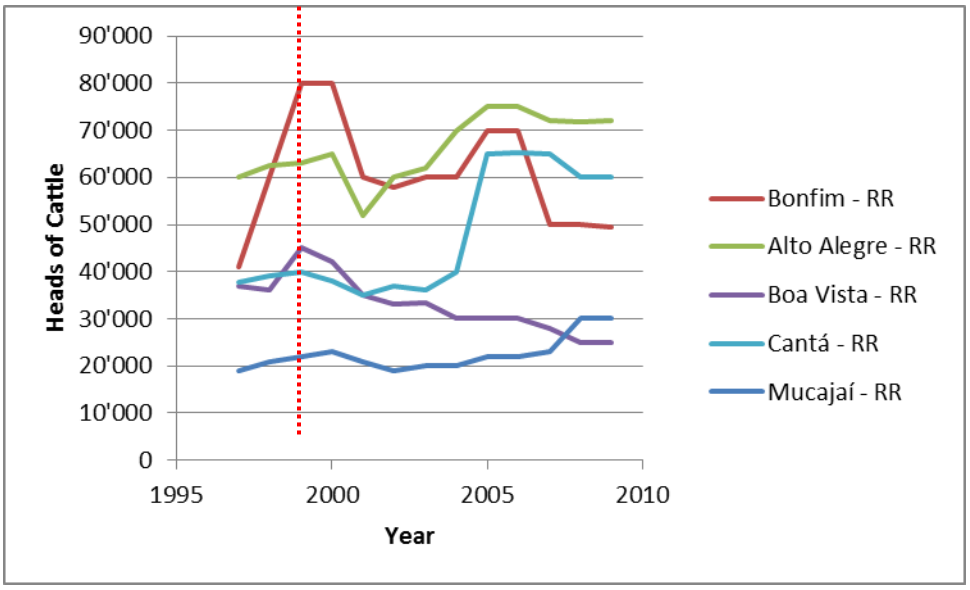

Figure E3.1: Number of cattle in the municipalities surrounding the project area (Data source: IBGE SIDRA database[11]). Red dotted line indicates project start of Boa Vista AR project.

According to the ZEE Roraima data (compare figure A5.3) the total savanna area in Roraima is just under 3 million hectares. An additional 580,000 hectares of land are categorized as "altered for pastures".

[11] http://www.sidra.ibge.gov.br/bda/tabela/listabl.asp?c=73&z=p&o=22 (accessed August 2011)

With a total cattle population of 480,500 in 1999 (source IBGE SIDRA database[8]) this averages 14.6 ha of potential grazing land per head of cattle, a value well above the carrying capacity for extensive grazing.

Criterion (d) (ii) of the guidelines is thus fulfilled, even under the assumption that all 1000 head of cattle were displaced and not slaughtered.

In accordance with the guidelines described above, emissions from displacement of grazing activities due to the Boa Vista AR project activity are hence considered insignificant.

E4. UNCERTAINTY

Describe how ex post *uncertainty is accounted for and quantified. Provide sample calculations wherever possible.*

ACR requires that the 90% statistical confidence interval of sampling be no more than 10% of the mean estimated amount of emission reduction/removal. Uncertainty of calculated benefits will follow standard statistical procedures.

Table E4.1: Uncertainty considerations for different data types

Data type	**Uncertainty assessment**	**Mitigation / Uncertainty control**
Field measurements	• Measurement biases are estimated through re-measurement of an adequate subset of sampling points • Statistical standard error of the mean (unbiased) is calculated from measured data.	• Field teams are intensively trained and monitored. Documentation and field manuals are provided. • Number of sample plots is adapted to achieve desired accuracy.
Parameters from literature (including on-site scientific measurements)	• Whenever available, uncertainty information (standard deviation) from the respective literature is considered	• Parameters from reliable literature are to be applied
Geographical information	• Underlying data uncertainties follow the same rules as parameters and measurements described above. • Technical errors (e.g. intersecting polygons) are detected and corrected.	• Data generated by the project (models and remote sensing analysis) are verified through ground truthing.

E5. REDUCTIONS AND REMOVAL ENHANCEMENTS

Show how net reductions and removals enhancements are quantified, taking into account leakage and uncertainty. Provide sample calculations wherever possible.

Calculation of net removals

Net anthropogenic GHG removals by sinks of the AR ACR project activity ($C_{AR\text{-}ACR}$), in t CO2-e are calculated using formula 28 from the methodology.

$$C_{AR-ACR} = \Delta C_{ACTUAL} - \Delta C_{BSL} - LK \quad (28)$$

where:

C_{AR-ACR}	Net anthropogenic GHG removals by sinks; t CO_2-e
ΔC_{ACTUAL}	Actual net GHG removals by sinks; t CO_2-e
ΔC_{BSL}	Baseline net GHG removals by sinks; t CO_2-e
LK	Total GHG emissions due to leakage; t CO_2-e

Should the final calculation not achieve the precision target of ±10% of the mean at 90% confidence, $C_{AR\text{-}ACR}$ will be adjusted accordingly (i.e. using the mean minus the lower bound of the 90% confidence interval, as required by ACR FCPS 2.1).

Calculation of ERTs

ERTs shall be calculated by applying the buffer deduction according to equation 29 of the methodology:

$$ERT_t = \left(C_{AR-ACR,t_2} - C_{AR-ACR,t_1}\right) * \left(1 - BUF\right) \quad (29)$$

where:

ERT_t	Number of Emission Reduction Tonnes at time *t=t2-t1*
C_{AR-ACR,t_2}	Cumulative total net GHG emission reductions up to time t_2; t CO_2-e
C_{AR-ACR,t_1}	Cumulative total net GHG emission reductions up to time t_1; t CO_2-e
BUF	Percentage of project ERTs contributed to the ACR buffer pool, if applicable

According to the Forest Carbon Project Standard, BUF is determined using an ACR-approved risk assessment tool (see section B8. PERMANENCE).

E6. EX-ANTE ESTIMATION METHODS

Describe the methods that are to be used to create the ex ante *projection of net GHG emission reductions and removals.*

Ex-ante calculations generally follow the description in sections E1 to E3 above. The following paragraphs describe the simplified ex-ante approach in more detail. A calculation spreadsheet is available for review (supporting document E6-1 Ex Ante Calculation.xlsx).

Baseline scenario

As described in section E1, net change in the baseline scenario is considered zero.

Project scenario

Above-ground and below-ground tree biomass

Carbon stock in pre-project woody biomass is calculated using the literature values described in tables E1.1 and E1.2.

Carbon stock in planted trees is calculated based on first results from 2010 inventory. The mean annual increment (MAI) calculated from this inventory is used to model growth to target mean stock (100 m3 per ha). For the ex-ante calculations, only *Acacia mangium* trees are included. Omission of ingrowth of other species is considered conservative.

Net change is calculated as the difference between pre-project woody biomass and average planted stock.

Long-term wood products

Harvested wood products are calculated based on the targeted saw log volume of around 50,000 m3 per year until 2013 (matching the expected capacity of the sawmill – see also supporting document A5-1 Plano de Manejo_FIT Manejo Florestal do Brasil Ltda 2011.pdf), subsequently increasing to 100,000 m3 with the planned introduction of two-shift operations in 2014. To calculate carbon stocks in long-term wood products, the “Winjum et al.” method described in section E2 is applied.
Note: The remainder of the approximately 340,000 m3 expected to be available for harvest annually will be used as biomass for energy or left on-site, thus not resulting in any long-term wood products.

Dead wood & Soil organic carbon

In accordance with the Methodology, dead wood and soil organic carbon pools are conservatively neglected for ex-ante calculations.

Litter

Litter pool is considered a priori insignificant according to ACR FCPS 2.1.

Leakage

As described in section E3, leakage is considered insignificant.

Reduction and removal enhancements

Net removals are calculated applying equation 28 represented in section E5 above.

F.
COMMUNITY & ENVIRONMENTAL IMPACTS

F1. NET POSITIVE IMPACTS

Provide an assessment of net positive community and environmental impacts, and a mitigation plan for any unforeseen negative community or environmental impacts.

Community impacts

The project proponent has become one of the most important private employers in the Boa Vista area. As of June 2011, the Boa Vista A/R Project employs 165 staff including management, administration, field workers and other technical staff (see supporting document F1-1 FIT employees 01.06.2011.xlsx).

In a partnership with SESI (Serviço Social da Indústria), within their project "For a Literate Brazil", the project proponent maintains an itinerant school located on the farms where the field workers are stationed. The school provides education to the rural workers and currently has four classes: adult literacy, elementary 1st to 4th grade, elementary 5th to 8th grade and secondary school. In December 2010, a full term of 1st to 4th grade was concluded. For this project, the project proponent received the SESI Award of Quality in Work (PSQT) in the category "Education and Development".

The project proponent also works with SENAC and SENAI to provide apprenticeships and educational classes for apprentices and interns, providing opportunities to gain experience and professional training for young people.

Aside from employment and education, the project proponent further maintains a series of social programs to improve livelihoods of both employees and the local population, including indigenous communities. Current social programs include (see also supporting document F1-2 ENG-Apresentação projetos sociais externos.pdf):

- *Production of honey* in the *Acacia mangium* plantations in cooperation with Northern Beekeepers Association of Roraima – ASA. In 2011, 33 tons of this honey were donated to the state's public schools.
- *Handicraft Projects* to avoid waste of potential quality wood in cooperation with CASAI (House of Indians), the Agricultural Penitentiary and the "Clube Eterna Juventude coordinated by SETRABES (Roraima Department of Labor and Social Welfare).
- *Indigenous Environmental Agent Project* to increase awareness of impacts of out-of-control fires and promote the safe use of fire. This project is being presented at various meetings of the neighboring indigenous communities. The project also offers support in combating potential fires in the indigenous areas.
- *Indigenous Educational Support Project* donating a series of books and periodicals to the adjacent community of Moskow.
- *Project PAIS*[12] *(Produção Agroecológica Integrada e Sustentável)* in cooperation with Sebrae (Serviço Brasileiro de Apoio às Micro e Pequenas Empresas), aims at improving livelihoods and encourages

[12] http://www.sebrae.com.br/customizado/tv-sebrae/inovacao-tecnologica/producao-agroecologica-integrada-e-sustentavel-pais

the practice of organic agriculture through the production process without the use of pesticides. The project proponent is currently supporting 55 families in this project in the communities of PA Nova Amazônia.

- *Research*: Several collaborations with research and teaching institutions, such as Cathedral College, Estácio Atual College, Federal University of Roraima, EMBRAPA (Brazilian Agricultural Research Corporation), ensure an open communication with the research community and more than 50 research reports have been published. Being the only large scale afforestation/reforestation activity in Roraima, the project provides a unique platform for research and teaching in many fields, even beyond the core areas of biology and forestry. For example, there are a number of old cemeteries within the project area which are protected as areas of high conservation value. Currently, students from UFRR (Federal University of Roraima) are researching the area's history linking the historic graves with the verbally related histories of the relatives still living in the area.

Special attention is given to the neighboring indigenous communities, the Comunidade Inígena Barata Livramento, Truaru, Serra da Moça, Moskow, Canauanim, Tabalascada and Malacacheta. In the setup of the project, it was ensured that the indigenous peoples retain the right to collect non-timber materials, especially "buriti" palm leaves to build their traditional huts, in the "palmares" (riparian forests) protected within the project area. Representatives of the project proponent also participate regularly in community meetings to maintain an open dialogue. The project is in regular contact with FUNAI (National Indian Foundation), CIR (Indigenous Council of Roraima) and Secretaria Municipal de Gestão Ambiental e Assuntos Indígenas (Boa Vista Department of Environmental Management and Indigenous Affairs).

To manage social activities and prevent any negative impacts the project proponent maintains a position dedicated to these tasks ("Coordenadora de Projetos Sociais", currently held by Elioenai C. da Fonseca).

Environmental impacts

An extensive environmental impact analysis (EIA) was conducted for the project in 2001 and 2002 (see supporting document F1-3 EIA-RIMA.zip). Situation and impact of the project activities on abiotic/physical and biotic environment (flora and fauna) as well as socio-economic effects were analyzed for the directly impacted area (AID) as well as indirectly impacted areas (AII). A series of measures was defined to mitigate negative environmental impacts. Conclusions from the EIA for environmental impacts were:

- The major negative impacts on the physical environment occur during the implementation phase of the project on the environmental factors water, soil, and air. The monitoring of air quality and water, the establishment of legal reserves and areas of ecological interest will be fundamental to balance the changes in the physical environment. The soil is expected to improve its physical and chemical structure during the growth of the forest. The groundwater level and soil moisture are also expected to increase, improving their characteristics.
- In the biotic environment, the project implementation causes negative effects due to replacement of native non-tree vegetation (e.g. grass species) with *Acacia mangium* monoculture. The environmental balance in the biotic environment is achieved by adopting a series of measures and

programs such as the establishment of legal reserves containing remaining native forests and wildlife corridors, as well as the initiation of various research programs in flora and fauna, which will increase the knowledge of biodiversity issues in the AID.

Direct mitigation activities to prevent negative impacts or reinforce positive impacts include:

- *Prevention of the spreading of Acacia mangium* outside of the project area: Surrounding areas are patrolled and all saplings outside the designated planting areas are manually removed.
- *Conservation of natural forests*: Remaining natural forest patches and riparian forests were put under protection. These areas equal to 15,475 ha in the vicinity of the plantations (compare supporting document F1-4 Descrição das Fisionomias Florestais.pdf).

Furthermore, based on the EIA, several environmental programs ("Programas Básicos Ambientais") were set up and maintained (see supporting documents F1-5 Relatorio manejo solo 2007.pdf and F1-6 Relatorio PBAs 2007.pdf). These programs incorporate mitigation activities ranging from water and microclimate monitoring, management of waste and hazardous materials to soil management (erosion control) and restoration of degraded areas.

Several publications from monitoring and research activities describe positive impacts of the afforestation activities, e.g. on the habitat for the giant anteater[13] or the increasing diversity of secondary native flora in the planted areas (see supporting document F1-7 Relatorio Regeneraçao nativa 2007.pdf).

F2. STAKEHOLDER COMMENTS

Describe relevant outcomes from stakeholder consultations and mechanisms for ongoing communication, as applicable.

An ongoing stakeholder management process ensures that potential issues are identified early and mitigation is sought (see supporting document F2-1 Politica Relacionamento e Resolução de Conflitos.pdf, updated in June 2011). Key channels for stakeholder management are:

- *Web site mailbox*: A contact/feedback form is available on the website where any suggestions or complaints can be registered.
- *Ombudsman ("Ouvadoria")*: The project proponent provides an ombudsman acting as a physical recipient for complaints, denunciations, suggestions or compliments.
- *Field Day*: The project proponent invites stakeholders to a field day, where the plantation operations are shown, and potential issues are discussed.
- *Phone contact*: A phone (and email) contact is supplied to all stakeholders, especially the surrounding indigenous communities.

[13] Kreutz, K. 2007: Timber Plantations as Favourite Habitat for the Giant Anteater (Myrmecophaga tridactyla L., 1758) in Northern Brazil. Diploma thesis, University of Würzburg, Germany.
Möcklinghoff, L. 2008: Social Organization and Habitat Use of the Giant Anteater (Myrmecophaga tridactyla L., 1758) in Timber Plantations in Northern Brazil. Diploma thesis, University of Würzburg, Germany.

- *Proactive stakeholder meetings*: The project proponent proactively participates in meetings with stakeholders (e.g. community or governmental meetings).

The project proponent's Social Project Coordinator and the Committee for Social Management (Comitê de Gestão Social) collect all feedback coming through these channels and provide answers and/or propose mitigation actions within 2 to 30 days.

Below are some key remarks received from stakeholders and – where applicable - mitigation activities undertaken by the project proponent.

Comments from recent meetings with indigenous communities:

Indigenous Community Malacacheta:

- The community requested a forest management course for high school students.
- Another issue that was raised is the dispersion of Acacias.

→ FIT is setting up a schedule of lectures to help the community with forest management, and a plan of action is being invoked to prevent the spread of *Acacia mangium* where it is not already contained by the current program.

Indigenous community Serra da Moça :

- The topic of hunting in the project areas was brought up.

→ FIT alerted the community members about the prohibition of hunting in the project areas by law and the importance of protecting the flora and fauna of the project area.

Comments from stakeholder consultation June 2010[14]:
(unaltered comments extracted from GFA report)

A representative of SENAC made the following comments:

- SENAC together with SEBRAE has developed and implemented projects with FIT Manejo Florestal do Brasil Ltda.
- There are schoolchildren who pass an internship with FIT Manejo Florestal do Brasil Ltda.
- SENAC is working with FIT on thematic issues related to the training of field workers and other employees (e. g. training course in management (national certificate)).
- FIT Manejo Florestal do Brasil Ltda. takes its social and environmental commitment seriously.

A representative of the indigenous community Moskow made the following comments:

- We do not have any problems with FIT.
- They pass with their vehicles through our village to reach their forests. Vehicles pass with controlled (slow) velocity.

[14] Stakeholder consultation conducted by GFA for FIT; stakeholder comments are extracts from the GFA report.

- In our reserve there is little invasion of *Acacia mangium* trees.
- FIT explained to us what they are doing in the *A. mangium* plantations.
- We have good contact with the local supervisor of FIT.

A representative of EMBRAPA made the following comments:

- EMBRAPA has research partnerships with FIT (e.g. on an energy wood project and a project on fast growing tree species).
- EMBRAPA works also together with FIT on different issues related to the management of A. Mangium plantations.
- In general, *A. mangium* is not welcomed by most stakeholders in Roraima State due to being an exotic species and having possible negative impacts on the hydrologic regime.
- There is no territorial planning in Roraima State which defines where to plant trees for production purposes and where not.

Two representatives of the indigenous community Malacacheta made the following comments:

- Until now, we have not had much contact with FIT.
- We do not know the CEO of FIT, only the local personal.
- FIT is in the position to support the community in technical issues.
- FIT respects the limits between FIT fazendas and the indigenous community.
- In the regional meeting of all indigenous communities of Roraima State, many representatives expressed that they are anxious about the water consumption of A. Mangium trees.
- Members of Malacacheta community would like to fish and hunt on the FIT fazendas.
- Representatives of Malacacheta community and other indigenous communities would like to organize a meeting with FIT to dialog many issues of their concern and interest.

→ FIT alerted the community members about the prohibition of hunting in the project areas by law and the importance of protecting the flora and fauna of the project area.
Participation in the community meetings is welcomed and has been implemented.

Five representatives of the indigenous council of Roraima State made the following comments:

- In the past there were some problems with aggressive bees on fazendas near Malacacheta community.
- In several indigenous communities in the vicinity to fazendas of FIT there is *A. mangium* invasion.
- *Acacia mangium* alters the hydrological regime.
- In different fazendas of FIT they have fish farming which contaminates nearby rivers and creeks and causes the death of many fish.
- There is no clarity on which fazendas FIT is working. The representative invites FIT to participate in the next annual meeting in November 2010.
- They would like FIT to explain the social work the company would like to do in the indigenous communities.
- In many indigenous communities the dwellers would like to collect leaves of a palm (Buriti) for protecting their roofs.

→ Aggressive bees have been removed from the plantation (or moved to other, more remote locations).
A plan of action is being invoked to prevent the spread of *Acacia mangium* where it is not already contained by the current program.
Participation in the community meetings is welcomed and has been implemented.
Collection of buriti palm leaves has been allowed in the protected areas.
(Note: the fish farming project is outside of the project area und not under control by the project proponent.)

A representative of SESI made the following comments:

- SESI established a partnership with FIT for primary education of forest workers with mobile schools.
- We note the commitment of FIT with education and training of its forest workers.
- FIT is always in the position and interested in improving forest workers' conditions.
- We have the impression that FIT supervisors and managers have a good relation with the forest workers.

A representative of the Secretaria Municipal de Meio Ambiente (SMMA) of Boa Vista city made the following comments:

- The SMMA role is to carry out actions related to the environmental quality in Boa Vista city
- FIT Manejo Florestal do Brasil Ltda. keeps a good relationship with SMMA and supports some activities as a partner.
- No formal partnership or relationship between SMMA and FIT Manejo Florestal do Brasil Ltda. was mentioned.

A representative of the Fundação Estadual de Meio Ambiente, Ciência e Tecnologia (FEMACT) of Roraima State made the following comments:

- FEMACT is a state government organization responsible for the environmental policy of Roraima (licensing, environmental controlling)
- The relationship between FIT Manejo Florestal do Brasil Ltda. and FEMACT is about obtaining all authorization needed for forest management, like harvesting, and follow the environmental laws.
- According to interviewed people of FEMACT, there isn't any kind of partnership between FEMACT and FIT Manejo Florestal do Brasil Ltda. in order to keep impartiality. However, mutual interests such as fire prevention programs and trainings are developed jointly.
- FIT Manejo Florestal do Brasil Ltda. follows the rules to get and keep all authorizations and licenses related to its purposes and has a pro-active position about environmental protection and legal requirements to develop its activities.

G.
OWNERSHIP AND TITLE

G1. PROOF OF TITLE

Describe how title to the reductions or enhanced removals created by the project is established and attach Proof of Title documents containing one or more of the following:

- *A legislative right*
- *A right under common law*
- *Ownership of the plant, land, equipment and/or process generating the reductions/removals*
- *A contractual arrangement with the owner of the plant, land, equipment or process that grants all reductions/removals to the Project Proponent*

Lands included in the project can be categorized into two tenure groups (see appendix I2. Land Owners and Contracts, for land owners, tenure group and contract references. Titles and contracts are available for review by validator: supporting document G1-1 Land lease and carbon contracts.zip).):

- **Tenure Group 1:** Land owned directly or indirectly by the project proponent or its parent company: For this land, the project proponent (and sister companies) hold full legal titles and thus have long term control of the land.

- **Tenure Group 2:** Third party land secured through long term lease contracts: For project areas belonging to parties not related to the project proponent, long term lease contracts (valid at least until 2035) have been signed. A clause was further added to the lease contracts stating the intention of both parties to extend the lease beyond this date to cover the full duration of the crediting period of 40 years. This statement of intention – while not legally binding – was agreed on by landowners and the project proponent to make the project possible and can be relied on in good faith.

Table G1.1 below summarizes the area planted under the project for each Tenure Group.

Table G1.1: Area planted under the project for each Tenure Group

Tenure Group	Area planted (ha)	% of total area
1	12,410	53%
2	11,097	47%
Total	23,507	100%

G2. CHAIN OF CUSTODY

If the offsets have been bought or sold previously, or if the project has a forward option contract, the Project Proponent must include documentation establishing chain of custody. Documentation may include:

- *Delivery of Confirmation Notice*
- *Emission Reduction Purchase Agreement*
- *Signed Attestation of Ownership*
- *Forward Option Purchase Agreement*

No sale or buy of offsets is conducted previous to project registration. All rights to carbon offsets have been transferred to the project proponent (see offset contract references in appendix I2. Land Owners and Contracts), and will be registered in the project proponent's name.

G3. PRIOR APPLICATION

Describe whether or not the project proponent has applied for GHG emission reduction or removal credits for this project through any other GHG emissions trading system or program and the success of any of these applications. If the project has previously been rejected by another GHG emissions trading system or program, provide the reasons why.

The Boa Vista AR project has not previously applied or been registered under any GHG emission trading system or program.

H.
PROJECT TIMELINE

H1. START DATE

Provide the project start date, and describe how it was determined and why it is appropriate and consistent with the requirements of the ACR Standard v2.1, any relevant ACR sector standard, and the chosen methodology.

The first trees were planted on May 14, 1999 and thus this is considered the Start Date of the project. This is consistent with the ACR Forest Carbon Project Standard v2.1 which defines the Start Date for AR projects as the date when the project proponent began planting or site preparation. The project Start Date of May 14, 1999 thus complies with ACR Standard which states that forest projects with a Start Date of November 1, 1997 or later are eligible for registration.

H2. PROJECT TIMELINE

Provide a timeline for project activities including:

Initiation of project activities
The project was initiated on May 14, 1999 when the first trees were planted.

Project term
The Project Term is forty (40) years, beginning at the Start Date (May 14, 1999) and lasting until 2039.

Crediting period
The project Crediting Period is forty (40) years. The first Crediting Period runs from May 14, 1999 until May 13, 2039.

Frequency of monitoring, reporting and verification
The project interval of monitoring, reporting and verification is every five years. The first verification is planned for 2011.

Relevant project activities in each step of the GHG project cycle

Planting:

Table H2.1: Planting areas and year of (initial) planting

Year	Area (ha)
1999	626
2000	2114
2001	1283
2002	2199
2003	4021
2004	4104
2005	3231
2006	2099
2007	1990
2008	1840
Total	23507

Maintenance:

In all planted areas, maintenance activities are done starting in the year of planting. Detailed activities are listed in section A5. PROJECT ACTION.

Harvesting:

No significant harvesting was done before 2011 (a total area of 43 ha was cleared in 2010 and 2011 for phytosanitary and testing purposes). As stands reach maturity, harvesting intensity is increased from 2012 to allow sustainable management of plantation (planned annual harvest volume is up to 340,000 m^3, maintaining a sustainable average stock of approximately 100 m^3 per ha). Harvested areas are restocked using suitable natural regeneration where available or by replanting in the year after harvest.

Development of GHG Project Plan

The GHG Project Plan was developed in 2010/2011 and submitted for registration on September 6, 2011.

Verification

The first verification of the emission reductions is planned for late 2011. Subsequent verifications are planned at 5 year intervals.