THE MONTE PASCOAL – PAU BRASIL ECOLOGICAL CORRIDOR:

CARBON, COMMUNITY AND BIODIVERSITY INITIATIVE

CONTENTS

The Nature Conservancy — Proteger a natureza é preservar a vida.
Instituto BioAtlântica
Conservação Internacional Brasil
Instituto Cidade
Grupo Ambiental Natureza Bela

ANAC – Associação dos Nativos de Caraíva
ASCBENC Associação Comunitária Beneficente de Nova Caraíva
COOPLANTAR Cooperativa de Reflorestadores de Mata Atlântica do Extremo Sul da Bahia

Programme of Activities Design Document (PoA DD) prepared by
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List of Acronyms

Afforestation and Reforestation	A/R
Amazonian Radar Project (*Projeto Radar na Amazonia*)	RADAM
Ammonia	NH_3
Association of Native People of Caraíva *(Associação dos Nativos de Caraíva*)	ANAC
Beneficent Community Association of Nova Caraíva *(Associação Comunitária Beneficente de Nova Caraíva)*	ASCBENC
Brazilian Forest Code (*Código Florestal Brasileiro*)	BFC
Brazilian Institute for the Environment and Renewable Resources	IBAMA
Brazilian Institute for Geography and Statistics	IBGE
Carbon dioxide	CO_2
Carbon, Community and Biodiversity	CCB
Clean Development Mechanism	CDM
CDM Programme of Activities	CPA
Conservation International Brazil	CI-Brazil
Critical Ecosystem Partnership Fund	CEPF
Diameter at Breast Height	DBH
Geologic Service of Brazil	CPRM
Geographic Information System	GIS
Global Position Satellite	GPS
Good Practice Guideline	GPG
Greenhouse Gas	GHG
Human Development Index	HDI
Instituto BioAtlântica	IBio
Intergovernmental Panel on Climate Change	IPCC
Land Use, Land-Use Change and Forestry	LULUCF
Leakage	LK
Legal Reserve (*Reserva Legal*)	RL
Ministry of the Environment	MMA
Municipal Human Development Index	HDI-M
Nitrogen Oxides	NO_x
Nitrogen	N

Nitrogen, Phosphorous and Potassium	NPK
Nitrogen-Fixing Species	NFS
Nitrous oxide	N_2O
Non-Governmental Organization	NGO
Permanent Preservation Area (*Área de Preservação Permanente*)	APP
Private Natural Heritage Reserve (*Reserva Particular do Patrimônio Natural*)	RPPN
Project Design Document	PDD
Programme of Activities	PoA
Quality Assurance	QA
Quality Control	QC
Standard Operation Procedures	SOP
The Nature Conservancy	TNC
United Nations Educational, Scientific and Cultural Organization	UNESCO
United Nations Framework Convention on Climate Change	UNFCCC
World Conservation Union	IUCN

A. GENERAL DESCRIPTION OF THE PROGRAMME OF ACTIVITIES (POA)

A.1. Title of the A/R programme of activities

The Monte Pascoal - Pau Brasil Ecological Corridor: Carbon, Community & Biodiversity Initiative

A.2. Coordinating/managing entity and participants of PoA

Name of Party involved (*)	**Private and/or public entity(ies) project participants**	**The Party involved wishes to be considered as project participant** (Yes/No)
Brazil	Private Entities: The Nature Conservancy Conservation International Instituto Bioatlântica Instituto Cidade Naturezabela Associação dos Nativos de Caraíva Associação Comunitária Beneficente de Nova Caraíva Cooplantar	No

The main functions and responsibilities of the different project participants are as follows:

Instituto BioAtlântica (IBio)

- Executive coordination of the project.
- Landscape analysis and diagnostics, using GIS and remote sensing tools, in order to identify eligible areas.
- Selection of eligible areas and forest restoration methodology.
- Coordination of forest restoration activities in the selected areas.
- Coordination of contacts and contract signature with landowners of the selected areas.
- Participation in carbon sequestration monitoring.
- Participation in biodiversity monitoring and methodology.

- Direct participation in marketing and negotiation of carbon credits.
- Signature on carbon credit contracts.
- Participation in formulating strategy for prospecting new areas.

The Nature Conservancy (TNC-Brazil)

- Landscape analysis and diagnostics, using GIS (Geographic Informations Systems) and remote sensing tools, in order to identify eligible areas.
- Selection of eligible areas, forest restoration methodology, and monitoring of sequestered carbon.
- Participate in the contacts and contract signature with landowners of the selected areas.
- Follow and monitor forest restoration activities in the selected areas.
- Participation in preparing reforestation methodology.
- Coordination of carbon sequestration monitoring and methodology.
- Direct participation in marketing and negotiation of carbon credits.
- Participation in formulating a strategy for prospecting new areas.

Conservation International Brazil (CI-Brazil)

- Coordinates biodiversity monitoring methodology and the effectiveness of the corridor effect in the areas to be reforested.
- Follow and monitor forest restoration activities in the selected areas.
- Direct participation in marketing and negotiation of carbon credits.
- Participation in formulating a strategy for prospecting new areas.

Instituto Cidade

- Selection of eligible areas and monitoring methodology for social participation of local communities.
- Participate in the contacts and contract signature with landowners of the selected areas.
- Coordination of methodology and monitoring of social mobilization and participation activities related to the project.
- Coordination of monitoring procedures for community benefits and surveys regarding the opinions of local residents and social agents.
- Follow and monitor forest restoration activities in the selected areas.
- Direct participation in marketing and negotiation of carbon credits.

- Coordination of formulating a strategy for prospecting new areas.

Grupo Ambiental Naturezabela

- Participate in the contacts and contract signature with landowners of the selected areas.
- Coordinate the production of seedlings of native species to be used in forest restoration activities.
- Participate in monitoring procedures for community benefits and surveys regarding the opinions of local residents and social agents.
- Participation in monitoring and methodology of social mobilization and participation activities related to the project.
- Execute, follow and monitor forest restoration activities in the selected areas.
- Participation in formulating a strategy for prospecting new areas.
- Coordinates prospecting of areas and properties post-certification.

Associação dos Nativos de Caraíva (ANAC)

- Participate in the contacts and contract signature with landowners of the selected areas.
- Methodology and monitoring of social mobilization and participation activities related to the project.
- Participate in monitoring procedures for community benefits and surveys regarding the opinions of local residents and social agents.
- Follow and monitor forest restoration activities in the selected areas.
- Participation in biodiversity monitoring and methodology.
- Participation in prospecting of areas and properties post-certification.

Associação Comunitária Beneficente de Nova Caraíva (ASCBENC)

- Participate in the contacts and contract signature with landowners of the selected areas.
- Methodology and monitoring of social mobilization and participation activities related to the project.
- Participation in biodiversity monitoring and methodology.
- Participate in monitoring procedures for community benefits and surveys regarding the opinions of local residents and social agents.
- Participation in biodiversity monitoring and methodology.
- Participation in prospecting of areas and properties post-certification.

CooPlantar

- Forest restoration activities in the selected areas.
- Production of seedlings of native species to be used in forest restoration activities
- Participation in preparing reforestation methodology.
- Participation in carbon sequestration monitoring.

A.3. Description of the Reforestation Programme of Activities

The Central Corridor of the Atlantic Forest, which in Portuguese is called *Mata Atlântica*, is recognized as a biodiversity hotspot, the world's biologically richest and most threatened ecosystems. Today only about 12% of the area remains covered by native forest (CEPF, 2001).

The project described in this document constitutes the first stage of an overarching reforestation scheme aiming at the establishment of a corridor that will join two significant protected fragments of Atlantic Forest: the *Pau Brasil* National Park and the *Monte Pascoal* National Park.

The corridor will promote biodiversity by providing a connection path for species living in both National Parks and some other Atlantic Forest remnants in the region. The corridor will be created mostly within the Caraíva River Basin and a small area around the Frades River, a severely deforested vacuum in the middle of the two parks.

Development of a major road infrastructure and the uncontrolled growth of the timber industry in the region intensified environmental degradation in the 1960s and 1970s, and today only a few small fragments of forests can be found in the area.

The project activity proposed here will be executed by a network of institutions, each with a specific goal within the project. These institutions are The Nature Conservancy (TNC), Conservation International (CI), Instituto Bioatlântica, Instituto Cidade, Grupo Ambiental Naturezabela, Associação dos Nativos de Caraíva – ANAC (Association of Native People of Caraíva), Associação Comunitária Beneficente de Nova Caraíva – ASCBENC (Beneficent Community Association of Nova Caraíva) e Cooperativa de Reflorestadores de Mata Atlântica do Extremo Sul da Bahia – CooPlantar (Atlantic Forest Reforestation Cooperative of the Far South of Bahia). The main purpose of the project activity is to restore the environmental integrity of the area, specifically:

- To contribute to climate change mitigation by increasing carbon stocks through the growth of planted trees and the enhancement of natural regeneration;
- To provide valuable technical skills, work, and income to the local communities;
- To promote biodiversity through the creation of connected forest areas between Monte Pascoal and Pau Brasil National Parks;
- To increase the quality and stabilize the flow of the waters in the Caraíva River through the restoration and protection of springs and riparian zones;
- To reduce soil erosion.

To realize the objectives above, degraded areas will be restored through planting of native tree species and assisted natural regeneration through an unlimited number of CPAs within the Caraíva River Basin.

Local residents, landowners and the organizations involved in the implementation of the project hold a view that the proposed project activity will contribute to the affected communities (capacity building, income) and the environment (biodiversity promotion and watershed protection), thus contributing to sustainable development.

In the proposed project activity, the local landowner will yield use rights to the lands to be restored, and a local cooperative will carry out the restoration activities, including planting and maintenance.

New work opportunities will be created by the project for local community members, who will be paid for their labor inputs. These opportunities will include reforestation activities (seed collection, seedling production, planting, maintenance) conducted through the local cooperative Cooplantar, as monitoring activities (carbon, biodiversity, community). All socio-economic monitoring activities will be conducted by members of local community associations.

Background

The Atlantic Forest Biome is considered world heritage in two ways. First, the Atlantic Forest is the major biosphere reserve in forested area in the planet, as recognized by the MaB program of UNESCO[1].

Second, the Atlantic Forest is considered a World Natural Heritage Site[2]. Out of seven Brazilian world heritage sites, three lay within the Atlantic Forest Biome. One of them is the Discovery Site, which includes areas of the states of Bahia and Espírito Santo.

It is a site of relevant historical importance for Brazilian and Western cultures, since it protects the first spot in the continent sighted by the Portuguese in America. Moreover, this area also shelters one of the last native populations of *pau-brasil* (the tree that gave name to the country), as well as indigenous communities and traditional populations, many of them descendants of the peoples that first interacted with the Europeans back in the XVI century.

Besides its status as World Heritage, the Atlantic Forest domain in the state of Espírito Santo and the Southern part of the state of Bahia constitutes what is called the Central Corridor of the Atlantic Forest, considered a world biodiversity *hotspot*. It is one of the regions with the greatest concentration

[1] MaB: Man and Biosphere. The MaB-Unesco Biosphere Reserves System was established in the 1970's, under the influence of the Stockholm Conference on the Environment. Three basic priorities govern all activities developed within Biosphere Reserves: conservation of nature its biodiversity, sustainable social development of populations local to the Reserve area, emphasizing traditional communities, and the promotion of environmental education and scientific knowledge. (COSTA, 1997, p.1)

[2] According to the UNESCO convention on the protection of Cultural and Natural World Heritage, [...] all the monuments, [...] sites and natural formations that fulfil determined criteria [...] of authenticity will be considered as of "exceptional universal value" and therefore [...] their destruction or extinction would constitute an "harmful impoverishment of the heritage of all the nations in the world." (SANTOS 2006)

of biodiversity in the planet, in spite of the environmental degradation process suffered in the region since the 1500s, and accelerated in the last 60 years.

It is necessary to protect the Atlantic Forest and its remaining biodiversity in order to restore the ecological connectivity between fragments in some high priority regions such as the Central Corridor.

Extreme fragmentation of the type found in the project region, in Southern Bahia State, is a threat due to the risk of impoverishment of the genetic biodiversity of forest remnants.

The historical maps in Figure 1 show the deforestation process in the Atlantic Forest and the current state of extreme fragmentation of any remnants.

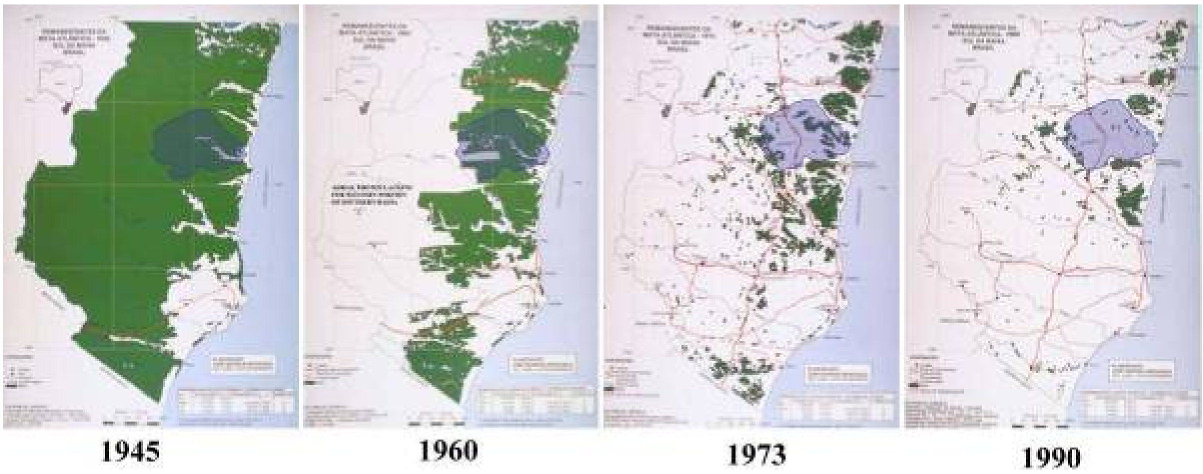

Figure 1: Deforestation in Southern Bahia State.

Source: Jose Rezende Mendonça – Comissão Executiva do Plano da Lavoura Cacaueira (CEPLAC)

The protection and restoration of the Atlantic Forest constitutes a huge challenge facing difficulties proportional to the size and importance of the region. One of the key issues is the fact that an estimated 80% of all forest remnants in the region are located in private property.

The initiative presented here aims to establish a model of how to reach those private owners and have them involved in this great and worthwhile challenge.

A.4. Description of Location and Current Conditions of the PoA

A.4.1. Location

The project described in this document constitutes the first stage of an overarching reforestation scheme that aims at the establishment of a corridor that will join two significant protected fragments of Atlantic Forest in the Central Corridor: the Pau Brasil National Park and the Monte Pascoal National Park.

With the goal of connecting the two national parks and thus establishing a biodiversity corridor, the areas selected for reforestation are located along a “S” shaped land track that starts from Pau Brasil National Park in the North, follows South-East the *Jambreiro* and *Capoeira* Rivers all the way to the Atlantic Ocean, and continues back West following the Caraíva River up to Monte Pascoal National Park (see Figures 3 to 5).

The corridor will promote biodiversity by providing a connection path for species living in both National Parks and some other Atlantic Forest remnants in the region. The corridor will be created mostly within the Caraíva River Basin and a small area around the Frades River, a severely deforested vacuum in the middle of the two parks.

The Caraíva River Basin is located between coordinates 16º 35’ South and 16º 55’ South, and 39º 07’ West and 39º 37’ West.

It has a total area of 1310 km² (131.000 ha), and drains parts of two municipalities, Porto Seguro and Itabela, in the State of Bahia. Maximum distance East-West is 55 km, and 34 km North-South in the central part. About 38% of the Basin is located in the municipality of Porto Seguro, and 62% in Itabela.

Figure 2: General location of the project areas

Figure 3: Caraíva River Basin

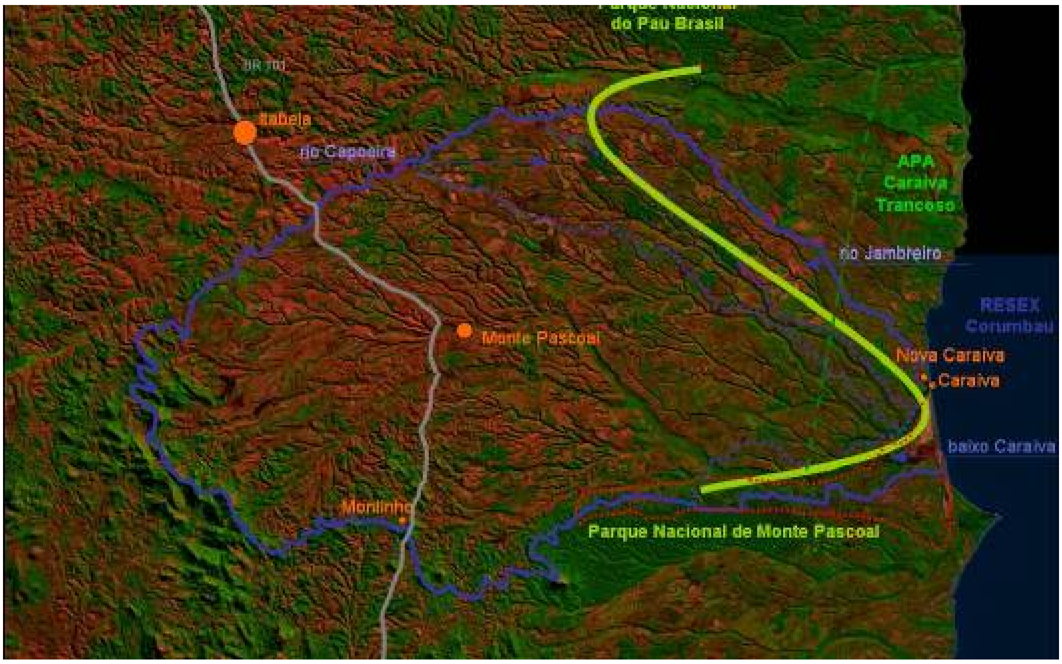

Figure 4: Location of the S-shaped biodiversity corridor

Figure 5: Aerial view of the Caraíva river mouth into the Atlantic Ocean

The Caraíva River Basin is surrounded by the major concentration of protected areas in the Central Corridor: Pau Brasil, Monte Pascoal and Descobrimento National Parks, Corumbau Marine Reserve, Caraíva-Trancoso Environmental Protection Área, and Barra Velha Indigenous Territory. Figure 5 shows an aerial view of Caraíva and Barra Velha close to the mouth of the Caraíva River.

The reforestation activities presented in this PoA constitute the first stage in the restoration of this "S" shaped corridor connecting the two National Parks. In CPA#1, all lands to be restored belong to the Monte Pascoal Farm property near the central area of the Caraíva River Basin. The Monte Pascoal Farm is located in the municipality of Itabela, which lies between Pau Brazil National Park and Monte Pascoal National Park (see Figure 2).

A.4.1.1. Host party(ies)

Brazil

A.4.1.2. Region, state, province, etc

State of Bahia, Municipalities of Porto Seguro and Itabela.

A.4.1.3. City, town, community, etc

Communities affected by the project:

Caraíva, Nova Caraíva, Monte Pascoal

Communities indirectly affected by the project:

Itabela, Montinho, Itaporanga, and the indigenous villages of Barra Velha and Imbiriba.

A.4.2. Physical parameters

A.4.2.1. Geology

Landform

The landscape is determined by sedimentary rocks of the Barreiras group Tertiary rocks. The main formation consists of plateaus crossed by valleys with steep slopes (called *boqueirões*) at the head of the rivers, and U-shaped valleys in the middle sections of the rivers, with wider lowlands formed by alluvial sediments.

There are also coastal sediments forming areas of sandy soil and specific vegetation, like the *restingas* on the coast and *muçunungas* inland.

Soils

The soil characteristics in the area are: yellow Podzol and Podzols in the coastal flake, reddish-yellow and dark-red Latosol over the crystalline soil, riverside soils, gleis and hydromorphic quartzose sands in the marine-riverside flat (Cavedon *et al*., 2000).

Hydrology

River basins show, in general, an asymmetric distribution pattern due to the neo-tectonic tilting of blocks, where tributaries on one side of the river are longer and with gentle slopes, while tributaries on the other side are shorter with steeper slopes (Cavedon *et al*., 2000).

A.4.2.2. Climate

According to the Geological Service of Brazil (CPRM) the regional climate is superhumid (Af) in the Köppen classification, with rains predominantly in fall and winter, and without dry season. There is circulation of wet winds coming from the Atlantic Ocean, more intense during the summer months (Nimer, 1989). This wind behavior influences and maintains the moisture constant along the year.

The rainfall pattern shows a decreasing gradient from the coast towards the interior: Porto Seguro has an average rainfall record around 1,800 mm, while Eunápolis' record is in the 1,300 mm (Aouad, 1998).

A.4.2.3. Vegetation cover and land use

Ecosystems

Most of the Central Corridor region, where the project will take place, was originally covered with Atlantic Rain Forest. During the settlement process in the region, wood collection (timber extraction or logging of hardwoods), cattle ranching, and agriculture, mostly coffee and papaya, led to deforestation and continues until today. Currently, about 12% of the area remains covered by native forest (CEPF, 2001).

"Pau Brasil" tree (*Caesalpinia echinata*), which was used as natural dye and reached high values in Europe during the 14th and 15th centuries, was the main activity responsible for the first deforestation cycle in the region. Deforestation today is due to cattle ranching and agriculture (coffee and papaya).

As a result of deforestation, several species that lived in the region are endangered and under threat of extinction, such as the southern brown howling monkey and the hook-billed hermit.

- Fauna

One of the most biodiverse areas of the Atlantic Forest is the southern Bahia region (Thomas & Carvalho, 1997).

But this great biodiversity is seriously endangered. There are at least 19 species of terrestrial vertebrates considered threatened in the Caraíva River Basin, where 14 are birds and five are mammals.

Considering The World Conservation Union (IUCN) Red List of Threatened Species web-site (iucnredlist.org), it is worth noting the status of six species.

First, the southern brown howling monkey (known as bugio, *Alouatta guariba*) is considered near threatened (NT), i.e. the evaluation does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

The hook-billed hermit (known as *beija-flora*, *Glaucis dohrnii*), red-billed curassow (known as mutum-do-oeste, *Crax blumenbachii*), red-browed Amazonian (known as chauá, *Amazona rhodocorytha*) and banded cotinga (*crejoá* or *Cotinga maculata*) are considered endangered (EN), i.e. their population is severely fragmented with decreasing rates of extent occurrence, area of occupancy and number of mature individuals.

Finally, the black-fronted piping-guan (*jacutinga, Pipile jacutinga*) is considered endangered but with others specifications, such as decreasing population density ≥ 50% along the last ten years, and high levels of population absolute number fluctuation. The jacutinga is considered extinct in Southern Bahia.

Figure 6: Threatened species. Clockwise from top-left: *Alouatta guariba, Crax blumenbachii, Amazona rhodocoryth, Pupile jacutinga*

- Flora

The project area biome, according to Thomas & Carvalho (1997), can be divided into beach strand, mangrove, restinga and southern Bahia wet forest.

First, the beach strand comprises the sandy area above the high-tide line as well as beach-derived sand dunes. This vegetation type can be characterized by *Ipomea*, *Remira* and *Spartina*. The mangrove is very important for marine life, although its vegetation diversity is considered low. The restinga landscape can be compared with savanna vegetation type (e.g., *Langenocarpus sp.*, *Attalea sp.*).

Finally, southern Bahia wet forest belongs to Atlantic Forest Domain and its characteristics are the very wet climate (i.e., 1,300 mm/year of rain with no dry season), very tall forest with trees around 20 meters, and poverty of the soil – which is maintained by the plants' organic matter.

As the one of the most biodiverse regions of Atlantic Forest in Brazil, Southern Bahia had 300 new plant species and 5 new genera identified and classified between 1978 and 1980 (Dean 1996).

Table 1 includes the main plants identified in Sambuichi (2001) and Sambuichi and Haridasan (2007) studies.

Taxonomic Family	Species
Anacardiaceae	*Spondias lutea*
Anacardiaceae	*Tapirira guianensis*
Annonaceae	*Rollinia mucosa*
Arecaceae	*Euterpe edulis*
Bignoniaceae	*Tabebuia cassinoides*
Caesalpinaceae	*Caesalpinia echinata*
Caesalpinaceae	*Copaifera lucens*
Caesalpinaceae	*Copaifera multijuga*
Caesalpinaceae	*Hymenaea sp.*
Euphorbiaceae	*Mabea piriri*
Lauraceae	*Nectandra sp.*
Mimosaceae	*Inga affinis*
Mimosaceae	*Inga nuda*
Moraceae	*Ficus gomelleira*
Moraceae	*Ficus clusiiflolia*
Moraceae	*Ficus insipida*
Cecropiaceae	*Cecropia sp.*

Table 1: Some of the most important plant species present in the project region

A.5. Technical description of the A/R Programme of Activities

A.5.1. Description of how the net anthropogenic GHG removals by sinks are increased above those that would have occurred in the absence of the PoA (additionality)

Deforestation in the past and subsequent use for cattle grazing has degraded the project areas over the last several decades. Currently the lands to be reforested within the PoA boundary fall into two stata: **pasture lands** and **degraded pasture lands**, which are further defined in Section C.3.2.

Under the baseline scenario presented below, due to the economic benefit generated by cattle ranching and the higher market value of lands “clean” of forest vegetation, the project areas would remain in a low carbon state in the absence of the project. There would be no increase in carbon stocks.

By carrying out the reforestation activities proposed in this project, through planting of native tree species and assisted natural regeneration of existing individuals, carbon dioxide will be sequestered from the atmosphere through the growth of trees and stored in the aboveground biomass and belowground biomass of those living trees. Emissions due to implementation activities, that is, nitrogen emissions from the fertilizer used, will occur on a small scale and are considered in the calculation of net removals.

Leakage due to fuel burning for transportation related to project activities will be monitored but it will not be considered in the calculations of anthropogenic net removals.

Therefore, the net anthropogenic greenhouse gas removals by sinks will be achieved only by the proposed reforestation project activity, and would not occur without the reforestation project activity.

A.5.2. History and background of the Programme of Activities

The proposed reforestation project is included in a broader initiative whose goal is to connect two important forest fragments (national parks of Monte Pascoal and Pau Brasil) and ultimately restore the “Mata Atlântica” in the Caraíva River Basin and adjacent areas.

Since 2002 local agents from Caraíva and other small villages began to develop a project with Instituto Cidade and Naturezabela. An effort was initiated to mobilize local citizens to protect the river and restore the forest.

In the first phase, supported by the CEPF (Critical Ecosystem Partnership Fund), it was possible to achieve important results: main problems were identified, and people from local communities were trained to perform technical tasks and educated in environmental concepts. It also provided important knowledge about the problems, the history and local natural phenomena.

A basic infrastructure for operation and planning was established, including seedling production, local GPS operation for data acquisition, a web-site (www.riocaraiva.org.br) and a GIS database. Sixty hectares of forest were restored through planting of native species seedlings. People from the entire region were contacted and a movement was ignited, mobilizing local communities, dozens of farmers and Veracel, one of the largest cellulose businesses on the planet; alliances with local associations, public entities, local government and environmental institutions were developed, and a forestation cooperative, Cooplantar, was created.

The results achieved have put Caraíva and the corridor between the Monte Pascoal and Pau Brasil National Parks in evidence and reinforced the alliance with large environmental institutions, Veracel, farmers and government.

Cooplantar was contracted by Veracel for their native forest restoration activities and the sites for this work were chosen in accordance with the planned corridor between the parks. The initial alliance network is continuously being expanded and today includes other areas and institutions: to the north in the direction to the RPPN Veracel and Estação Ecológica Pau Brasil (CEPLAC), another important forest fragment, and to the south in the direction of the Descobrimento National Park, where a similar effort is being conducted by Associação Flora Brasil, another partner organization.

The carbon option was presented and extensively discussed with the community, farmers and environmental institutions, notably Instituto Bioatlântica, Conservation International, and The Nature Conservancy. The CCB standard was chosen for the certification of this project, since it provides a perfect framework to demonstrate the value of this proposition for potential investors.

This Programme of Activities (PoA), the first stage in a larger initiative, has the goal of developing know-how and experience in the carbon market, and of supporting and facilitating subsequent initiatives to expand the effort and take the opportunity to the entire corridor and the whole watershed. The area for this first step was selected based on the good technical documentation already available and strong will from the farm owner.

Figure 7: Participation of local agents in the design of the Monte Pascoal – Pau Brasil corridor

Figure 9: Forestry restoration workshop based on technology from LERF - ESALQ

Figure 8: First working team of COOPLANTAR

A.5.3. Description of a typical A/R CDM Programme Activity (CPA)

A.5.3.1. Activities and technology to be employed by the proposed programme activity (CPA)

This project will achieve reforestation through a combination of assisted natural regeneration and direct planting. Only localized manual work will be employed (no use of machinery).

The Forest restoration methodology used in this project is based on a technology developed by the Laboratory of Ecology and Forest Restoration (LERF) of the Luiz de Queiroz College of Agriculture (ESALQ) at University of São Paulo (USP).

Seed gathering

The gathering of seeds is done in the fragments with the most biodiversity: walking through the area, identifying the individual trees that will become the seed sources, either gathering from the floor or climbing to the source to collect fruits or seeds. The sources for each species are taken from different fragments in order to avoid narrowing the genetic base.

Seedling production

Seedlings are produced in small nurseries in the region, in Trancoso and Itabela, in disposable plastic containers. Due to the great variety of species with different characteristics there will be different nursery times, from 3 to 6 months.

Cooplantar, the cooperative in charge of planting activities, is preparing its own nursery, based on reusable containers, in the Caraíva region, which would allow a better control of the seedling production process and a reduction in transportation costs.

Figure 10: Seedling production

Soil Preparation and planting

To prevent soil erosion, reduce GHG emission and protect existing carbon stocks, site burning and overall tillage will not be employed during the site and soil preparation.

The first step is a specific zoning of each project area, determining the size in hectares of sections with different initial conditions that can be found in the land. There are two typical situations:

- Pasture lands.
- Degraded pasture: low-grade pasture area with some regenerating individuals of native species.

The methodology applied varies depending on the situation.

Figure 11: Planting operations

*In Pasture areas***:**

Dense planting: planting of seedlings in a 3m x 2m grid exclusively with native species. Includes the following operations:

- Total area chemical application: a chemical spray will be applied in order to reduce the competition for light, nutrients and water. Chemical application will not occur in riparian zones, and in these cases manual slashing (at 10 cm above the soil) and mulching will be introduced.
- Crowning around the holes. The vegetation around the holes will be eliminated, in a radius of 50 cm, in order to reduce the competition for light, nutrients and water. No chemicals will be used in riparian zones. Instead vegetation will be slashed through manual crowning.
- Opening of holes for planting, 30 x 30 x 30 cm.. When necessary a small groove will be made around the crown to help with the irrigation of the planted seedlings.
- Planting fertilizing. The soil used to fill the holes will be mixed with fertilizers NPK in a proportion 6-30-6 (100g per hole) and simple superphosphate (300g per hole).
- Ant poison baits will be distributed in the restored area in case of attack of leaf-cutters, following existing regulations and under technical supervision.
- Planting of seedlings of native species.

The distribution of seedlings in the field will be made following a 3m x 2m layout, with 50% of the seedlings being of filling type (pioneer or secondary species of rapid growth and a crown architecture of great shading capacity), and 50% of the seedlings being of diversity species (climax species, and secondary with tolerance to sun exposure). Figure 12 shows a schematic display of the distribution.

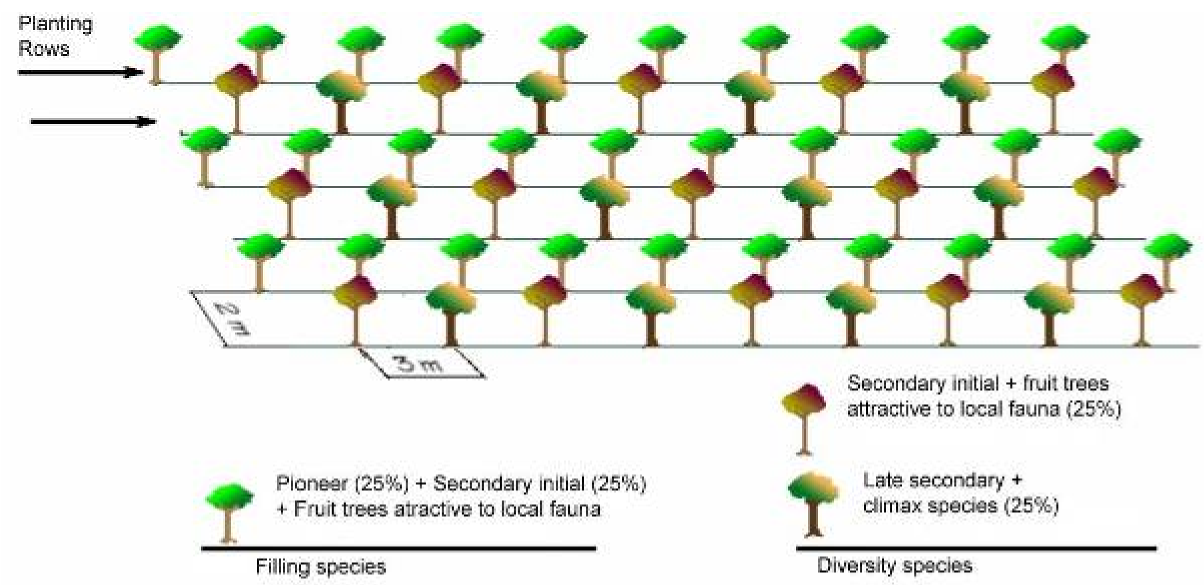

Figure 12: Planting distribution in reforested areas

This planting layout includes an average of 1666 trees per hectare. In the pasture areas, this means using 1666 seedlings.

Table 14 in Annex #1 shows a list of species native to the region that could be used in the restoration, separated by type ("filling" or "diversity"). A minimum of 10 species for filling and 60 species for diversity will be used on each restoration area.

In Degraded Pasture areas:

Assisted natural regeneration and enrichment planting: planting of seedlings in a 3m x 2m grid exclusively with native species, and use of the existing native regenerating individuals. Includes the following operations:

- Total area chemical application: a chemical spray will be applied in order to reduce the competition for light, nutrients and water. Chemical application will not occur in riparian zones, and in these cases manual slashing (at 10 cm above the soil) and mulching will be introduced.
- Identification and crowning of existing regenerating individuals: The vegetation around existing trees will be slashed manually (weeding with a hoe) in a radius of 50 cm around them to avoid competition for water, light and nutrients, aiming at the natural regeneration of the area.
- Manual fertilizing for natural regeneration: Surface application of fertilizer around the regenerating individual, over the crowned area. The fertilizer used is NPK 20-5-20, 100 grams per individual tree.
- Crowning around the holes. The vegetation around the holes will be eliminated via chemical application with glyphosate, in a radius of 50 cm, in order to reduce the competition for light, nutrients and water. No chemicals will be used in riparian zones. Instead vegetation will be slashed through manual crowning.

- Opening of holes for planting, with a 30 x 30 x 30 cm. When necessary a small groove will be made around the crown to help with the irrigation of the planted seedlings.
- Planting fertilizing. The soil used to fill the holes will be mixed with fertilizers NPK in a proportion 6-30-6 (100g per hole) and simple superphosphate (300g per hole).
- Ant poison baits will be distributed in the restored area in case of attack of leaf-cutters, following existing regulations and under technical supervision.
- Planting of seedlings of native species.

The planting layout will be the same as described above for pasture areas. Existing regenerating individuals will be kept and the area enriched with new seedlings.

Degraded pasture areas have an average of 500 regenerating individuals per hectare. Therefore these areas will need about 1166 seedlings per hectare.

Maintenance of restored areas

All areas will be visited once six months after the initial planting for maintenance operations. Pasture areas will be visited twice for maintenance (at six and twelve months after the initial planting). Maintenance operations include:

- Total area chemical application: as described above. Only manual in riparian zones.
- Crowning of existing regenerating individuals: as described above (not in pasture areas).
- Manual fertilizing for natural regeneration: as described above (not in pasture areas).
- Crowning around the seedlings. The vegetation around the holes will be eliminated via chemical application with glyphosate, in a radius of 50 cm, in order to reduce the competition for light, nutrients and water. No chemicals will be used in riparian zones. Instead vegetation will be slashed through manual crowning.
- Opening of holes for replanting. For the planting of new seedlings the project estimates a mortality rate of about 20%.
- Planting fertilizing. As described above, only for the newly planted seedlings.
- Planting of seedlings of native species to replace the ones that did not survive.
- Maintenance fertilization. Surface application of fertilizer around the seedlings, over the crowned area. The fertilizer used is NPK 20-5-20, 100 grams per individual tree.

A.5.3.2. Transfer of technology/know-how, if applicable

Any relevant transfer of technology is discussed in section E.4 under Capacity Building.

A.5.3.3. Timeframe

A detailed implementation chronogram for each CPA will be included in the CPA design document.

A.5.3.4. Summary budget and financial arrangements

BUDGET

A summary budget for each CPA will be included in the CPA design document.

Expected unit costs and total costs of each activity within the PoA are described in Table 2 below.

Expected Cost Stratum 1	**Pasture**	
Total cost per hectare	**$ 3,779.46**	
Expected Cost Stratum 2	**Degraded Pasture**	
Total cost per hectare	**$ 2,969.21**	
Expected Cost	**Carbon Monitoring**	
Cost per event (first, thereafter)	**$ 9,020.00**	**$ 8,272.00**
Total cost for PoA	**$ 58,652.00**	
Expected Cost	**Biodiversity Monitoring**	
Cost per event	**$ 8,888.89**	
Total cost for PoA	**$ 97,777.78**	
Expected Cost	**Community Monitoring**	
Cost per event	**$ 69,460.00**	
Total cost for PoA	**$ 475,082.22**	

Table 2: Expected costs of the PoA, in Present Value USD (exchange rate 1 USD = 2.25 BRL)

A.5.3.5. Documentation

The project developers commit to keep information about the project publicly available. Project proponents plan to make the documentation regarding the project publicly available through various means (e.g., web sites, magazines, journals etc.).

The available documentation will include the PoA design document, stakeholder consultation, mitigation proposals, and other relevant contents. Documents generated with each monitoring event will be stored digitally and in hard copy form. Instituto BioAtlântica will keep a digital version and will manage storage of monitoring data.

Some data may not be publicly disclosed due to its irrelevance to the project, inaccuracy, and/or consideration as classified information.

Some documents will be attached to this PoA design document: the Memorandum of Understanding between Instituto BioAtlântica and other partners, the contract between IBio/other partners and the

CPA landowner, and the contract between IBio/other partners and the buyer(s). In addition, each CPA will have attached legal documents relating to the property.

A.5.4. Eligibility criteria for inclusion of a CPA in the PoA

A.5.4.1. Eligibility of land and application to a CPA

Based on CDM rules "Annex 16, Procedures to define the eligibility of lands for afforestation and reforestation project activities"[3] no forest can be present within the project boundaries between December 31, 1989, and the start of the project activity. Proof of forest absence could take the form of aerial photographs or satellite imagery from 1989 or before, or official government documentation confirming the lack of forests. Where proof does not exist, multiple independent, officially witnessed statements by local community members are sufficient.

The Brazilian Interministerial Commission for Climate Change (Comissão Interministerial para Mudanças Climáticas), in its resolution no. 2, defines forests as lands having growing trees with:

- A minimum tree crown cover of 30%;
- A minimum area of 1 hectare; and
- A minimum potential height of 5 meters at maturity.

These threshold values of the forest definition from the Brazilian governmental agency comply with the UNFCCC definition and are used for this A/R project activity.

Following CDM procedures, it has been shown that the land where the project activities will be applied was not a forest (according to the definition above) in 1990, and is not a forest today. The methodology to assess the eligibility of the project area is described below:

<u>Evaluation of Land Use Change through Multitemporal Analysis</u>

Today, geoprocessing and remote sensing techniques are frequently used to identify and monitor landscape and environmental changes. One technique is multitemporal analysis, which consists of preparing, comparing, and interpreting images of the same area on different dates to identify land use change over time.

Multitemporal analysis is important for monitoring and managing natural resources and urban development because it provides a quantitative analysis of the spatial distribution of the population or resource of interest—forest, in this case. Remote sensing works by detecting changes in radiance values that result from land cover changes.

An individual multitemporal analysis will be performed for each CPA added to this PoA.

[3] http://cdm.unfccc.int/EB/022/eb22_repan16.pdf

Satellite Images

To perform the multitemporal study for CPA #1, images from Landsat Thematic and Enhanced Thematic Mapper were used, showing the following scenes:

215-072 - Landsat 30 meter resolution, dates 1990 and 2005

It is important to notice that quality images with little or no clouds dated closer to the dates needed for the analysis were not available. It was also not possible to obtain images from the same period of the year, which would be ideal for the mapping.

Image Classification

Landsat scenes were classified under the supervised classification method, which defines land-use classes, such as forest (different levels of degradation and succession), pasture, agriculture and water, and uses them to classify the image. The “maximum likelihood” algorithm was used for the supervised classification, and four classes were considered separately for the study: forest and open areas (agriculture, pasture and highly disturbed areas). Because clouds and shadows from the two images were removed from the analysis, an extra error is expected.

The last stage of the classification process is filtering out individual or small clumps of pixels from another class, according to a minimum mapping unit area of one pixel. The process used was similar to convolution filtering, where each pixel is compared to the pixels surrounding it. A post-classification thematic change detection allows a comparison of each class between the first time period and the second, and then labels the change (or lack thereof).

In each image, a mask was used to eliminate the areas with Eucalyptus plantations, water, shadows and clouds. The software used was ERDAS 9.1.

Figure 14 and Figure 13 show the results of the classification for 1990 and 2007.

Legend definition

The legend definition was established taking into account the information required for a carbon eligibility study, i.e.:

- Eligible
- Non-eligible
- Core Project Area (CPA #1, Monte Pascoal Farm, shown within the PoA area)
- Caraíva Watershed (PoA area)

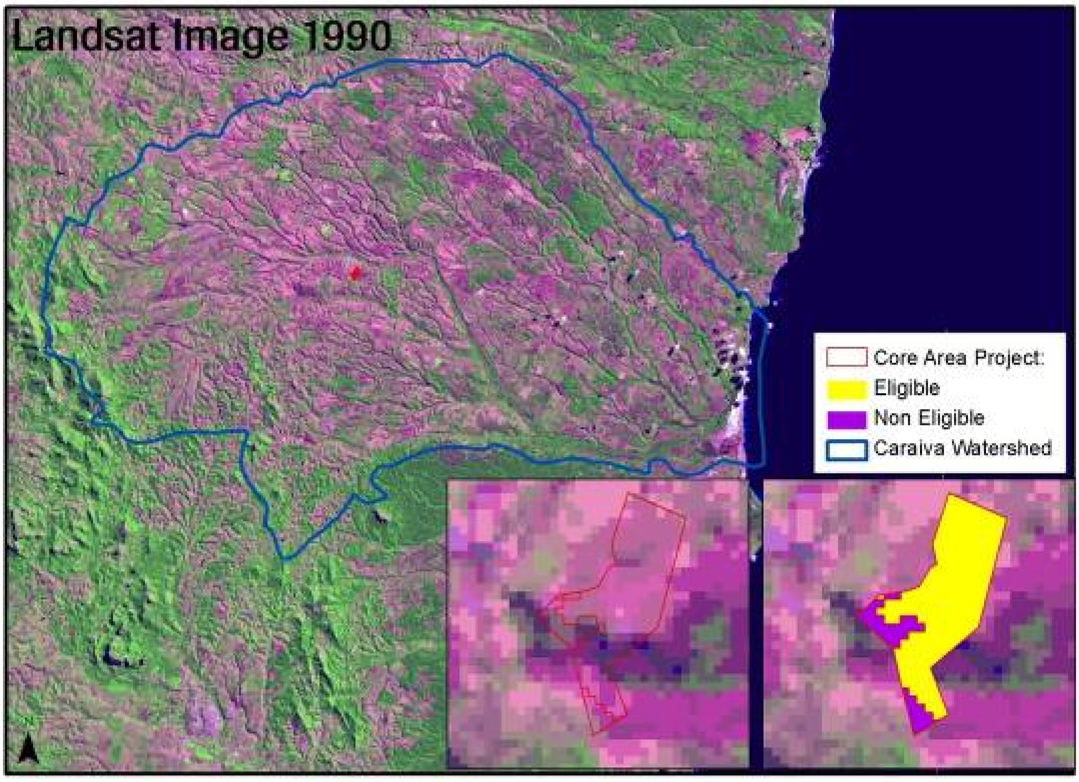

Figure 14: Land use classification – 1990. Forest areas in green

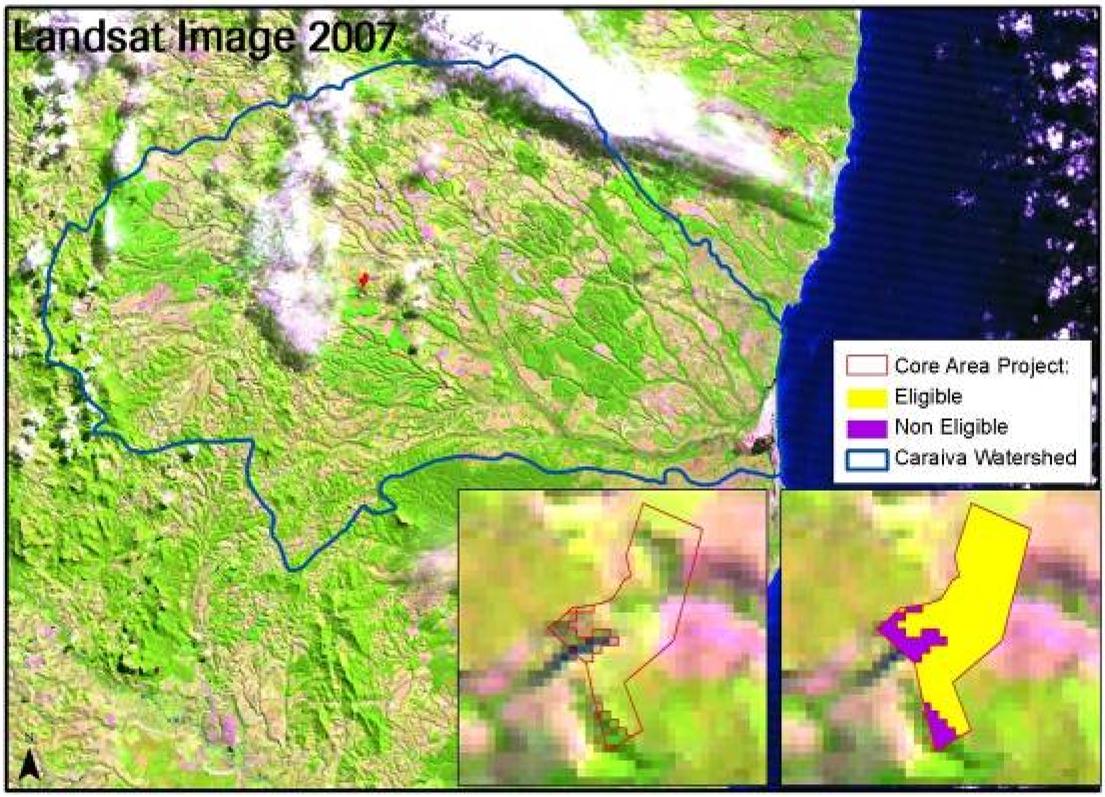

Figure 13: Land use classification – 2007. Forest areas in green

Cross Tabulation

The cross tabulation consists in the "crossing" and superposition of images with different dates (1990-2005). This procedure compares all the pixels in an image with all the pixels in the other image with different date, looking for transformations that took place between the two periods under analysis.

From the 1990-2005 cross-tabulation (multitemporal analysis), it was possible to identify CDM-eligible deforested areas between Pau-Brasil and Monte-Pascoal National Parks (Caraíva River Basin and a small area around the Frades river) (see inset image).

Figure 15: CPA#1 location within Caraíva River Basin.

The eligibility assessment of areas potentially suitable for carbon forestry projects (open areas) was made according to resolution #2 of the Brazilian Interministerial Commission for Climate Change, as explained above.

For the Caraíva River Basin as a whole, the procedure identified a total of 39,948 ha that were not forest in 1990, and remained as non-forest in 2005, and are therefore eligible. Within the areas made available by the landowner inside the Monte Pascoal Farm of CPA#1, 17.4 ha were identified as eligible.

A.5.4.2. Eligibility criteria for assessing the baseline scenario for a CPA

Baseline scenario criteria for including a CPA into the PoA are:

- The proposed CPA must be within the Caraíva River Basin.
- Current land use/cover on the CPA areas must be one or more of the types described in this PoA: pasture or degraded pasture.
- The only current commercial use of the CPA areas is cattle ranching, despite the fact that the properties can have other commercial uses as well in other areas that are not the CPA.

A.5.4.3. Eligibility criteria and parameters for assessing additionality of a CPA

Additionality assessment criteria for including a CPA into the PoA are:

- The proposed CPA must be within the Caraíva River Basin.
- Current land use/cover on the CPA areas must be one or more of the types described in this PoA: pasture or degraded pasture.
- The only current or planned commercial use of the CPA areas is cattle ranching, despite the fact that the properties can have other commercial uses as well in other areas that are not the CPA.
- The combined tool for assessing baseline and additionality described in this PoA (Section C.4) should be applied to the CPA, and the results should be within the range defined by the PoA.

A.5.4.4. Eligibility criteria for methodological choices

All methodological choices for the CPA will follow exactly the pattern described in this PoA.

A.5.5. Risks and mitigation measures

A.5.5.1. Potential risks and specific mitigation measures

RISKS	MITIGATION MEASURES
Wildfires - Arson	Wide community engagement and involvement in the project. Educational campaign: wide diffusion of global and local benefits brought about by the project. Posted signs with emergency contact numbers in case someone sees a fire.
Wildfires - Accidental	Patrols. Wildfire suppression training, equipping of community volunteer fire brigades, multiculture and ecological protection zones, forming “green fire breaks”, patrols during dry season during first five years, fire management plan, 5 m wide firebreaks
Aridity	A longer than expected dry season can lead to reduced growth. As with other risks, aridity can cause severe damage to the plants within their first three years. After that, trees are resistant enough to survive longer dry periods. The young plantations will be watered and sprayed with hydrogel in emergency situations.
Grazing, cattle invasion	Maintenance of fences, monthly patrol of fenced areas, conflict mediation with neighbors when necessary
Firewood collection	Direct communication with local communities to explain rules for reforestation areas.
Land Sale – transfer of ownership	The contract with the landowner stipulates that the obligations of the contract are transferred to the new landowner
One of the project participants undergoes organization changes	The existing Memorandum of Understanding signed between all the organizations and project oversight by IBio and the collective Management Board guarantees the duration of this project and mitigates the risk of organizational changes.
Squatters – land invasion	Support local communities in job training, employment opportunities, education, and alternative agriculture to reduce conflict in the area.

COMMUNITY RISKS	MITIGATION MEASURES
Potential feeling of loss of authorship, authority and leadership over environmental restoration processes taking place in the region, with their place taken by organizations bigger and/or foreign to the area, and by big rural landowners.	Inclusion of organizations that co-authored the original project idea in decision and knowledge production processes, especially in activities related to the monitoring of community benefits.
Potential perception by local community organizations of loss of prestige and financial resources that would go to Cooplantar.	Implementation of a project for the institutional strengthening and professionalization of the members of local organizations.
Potential feeling by inhabitants and families not directly affected by the project of being excluded from the project's benefits.	Generate, maximize and make explicit indirect community benefits

A.5.5.2. Contingency carbon credits for addressing non-permanence risks

In order to address the non-permanence risk, project participants have chosen to maintain a 20% buffer reserve of non-tradable carbon credits to cover unforeseen losses in carbon stocks. This means that 20% of the carbon credits generated by the project will not be traded.

The total number of certified emissions reductions that will be sold by project proponents is calculated by subtracting the above mentioned 20% permanence risk buffer from the total reductions generated by the project.

A.5.6. Capacity and experience of project participants

The project management is based on Instituto Bioatlântica and Instituto Cidade. Instituto Bioatlântica is a conservation NGO with strong technical capabilities in forestry and remote sensing, and more than 5 years of experience in the Caraíva region. Instituto Cidade, a social and community oriented NGO, accumulates more than 10 years of experience in the Caraiva watershed, promoting the formation of today's main local associations.

The Nature Conservancy – Brazil

Founded in 1951, The Nature Conservancy (TNC) is one of the world's oldest international NGOs. Its mission is the conservation of plants, animals, and natural communities that represent the earth's diversity by protecting the land and water necessary for their survival. TNC is present in more than 30 countries and has contributed to the protection of more than 30 million hectares in the world to date. TNC possesses profound experience in the planning and implementation of international restoration projects and reconstruction of landscapes. Since 1994, TNC-Brazil has had conservation programs in the Amazon, Atlantic Forest, Caatinga, Cerrado, and Pantanal Biomes. TNC's actions seek to reconcile social and economic development with the conservation of natural resources, integrating protected areas and productive areas at the regional scale.

Several professionals from TNC-Brazil will be dedicated to this PoA: two post-graduate level foresters (one onsite in Porto Seguro), one post-graduate level social scientist, one doctoral level agronomist, one GIS specialist, and one post-graduate level biologist.

Conservation International – Brazil

Conservation International (CI) is a private, non-profit, scientific organization dedicated to the conservation and sustained use of biodiversity. CI-Brazil seeks strategies that promote the development of sustainable economic development alternatives, compatible with the protection of natural ecosystems, always taking into consideration the local reality and the particular necessities of its communities. Since 1990, the Brazil Program has become an autonomous national entity, denominated Conservation International of Brazil (CI-Brazil). CI-Brazil has diverse projects in development in all the major Brazilian biomes: Atlantic Forest, Amazon, Cerrado, and Pantanal, which involve examining the region's biodiversity, generating biodiversity information, creating private reserves, and establishing partnerships with NGOs, universities, and the public and private sectors.

Two professional, doctoral level biologists will be the team for this PoA.

Instituto BioAtlântica

Founded in 2002, Instituto BioAtlântica (IBio) is a non-profit conserveration organization resulting from the coming together of two of the most respected and active environmental organizations of the world (Conservation International and The Nature Conservancy) and five active Brazilian businesses (Aracruz Celulose, Petrobras, Dupont Brazil, Veracel Celulose, and Furnas Centrais Elétricas). Headquartered in Rio de Janeiro, IBio develops and executes projects, through strong partnerships, in the states of Espírito Santo, Bahia, Rio de Janeiro and Minas Gerais, prioritizing the regions located within biodiversity corridors (such as the Atlantic Forest and Serra do Mar). IBio works on the planning and execution of many projects, seeking to reconcile the development of economic activities with the protection of biodiversity and the formation of ecological corridors. The premise for developing IBio projects and actions is a systematic vision of the challenges, from which they seek to identify a common agenda between the different agents (governments, businesses, academia, other organizations), catalyzing initiatives and consolidating partnerships.

Several professionals from IBio will be dedicated to this PoA: two foresters, a doctoral level biologist, and a GIS specialist.

Instituto Cidade

Founded in 1996, Instituto Cidade is a civil, non-profit organization with headquarters in Belo Horizonte, Minas Gerais. Its mission is to act for biodiversity, for the sustainability of cities, and for the autonomy and enlargement of horizons for citizens of Brazil. Instituto Cidade acts with social mobilization and articulation of networks for shared public management, catalyzing integrated processes for restoring the environment and overcoming poverty, with primary focus on water and biodiversity of the Atlantic Forest. To achieve these ends, Instituto Cidade uses and develops participative methods of social mobilization, action-research, planning, and land management.

A professional urban planner from Instituto Cidade will be dedicated to this PoA.

Grupo Ambiental Naturezabela

Naturezabela is a non-profit organization founded in 2001 with headquarters in Itabela, and it has the following objectives: the defense, preservation, and conservation of the environment, the promotion of sustainable development, environmental education, the promotion of volunteering, the production and collection of seeds for reforestation, the dissemination of information, and technical and scientific knowledge, and the encouragement culture and education. Naturezabela has two native seedling nurseries in the South of Bahia, and it has an excellent relationship with the communities of Itabela and surrounding communities. Naturezabela acts through projects and the promotion of events that aim for the promotion of sensitivity for the environment.

Associação dos Nativos de Caraíva (ANAC – Association for Natives of Caraíva)

ANAC is a non-profit, non-partisan philanthropic entity, founded in 2000, with headquarters in Caraíva, Porto Seguro, Bahia. Its basic objective is to organize the population of this village and represent its people in the solution of their fundamental problems and to render social, educational, cultural, health recreation, security and other services to the residents of this community to improve their living conditions.

Associação Comunitária Beneficente de Nova Caraíva (ASCBENC – Beneficent Community Association of Nova Caraíva)

ASCBENC is a non-profit entity with headquarters in Nova Caraíva, Porto Seguro, Bahia founded in 1997 that aims to improve the well-being of society through various involvements with the local community, such as trash collection and restoration of Atlantic Forest, especially in the Caraíva River Basin.

CooPlantar (Atlantic Forest Reforestation Cooperative of the Far South of Bahia)

Founded in 2006, CooPlantar is a cooperative with headquarters in Nova Caraíva, Porto Seguro, Bahia. Its mission is to promote the restoration of springs, native Atlantic Forest and degraded areas, to protect existing forests, biodiversity, and water, and contribute to the sustainable, socioeconomic, and cultural development of communities in the far south of Bahia in accordance with the principle ethics of solidarity, commitment and responsibility in relation to the quality of life. CooPlantar's main principle and objective is the assistance and cooperative education for its members and associates as well as the support of the development of its activities through cooperation, solidarity, ethics, and human trust.

A.5.7. Operational, management and monitoring plan for the Programme of Activities

A.5.7.1. Operational and management plan

Instituto Bioatlântica is the executive coordinator of this PoA. Instituto Bioatlântica is a conservation NGO with strong technical capabilities in forestry and remote sensing, and more than 5 years of experience in the Caraíva region.

The Management Board for this PoA consists of all the different organizations organized into a consortium as well as the landowners (or their representative) participating directly in the PoA. The landowners have a deliberate role only in the operations of the PoA occurring within the boundaries of their property; however, they do participate in the board.

The Management Board has several roles within this PoA:

- To deliberate over each carbon credit sale, expressing an opinion on the proposals previously negotiated by the institutions responsible for this component;
- To define and evaluate the strategy for commercialization of the carbon credits;
- To periodically evaluate the performance of the PoA execution, proposing and resolving the course and adequacy of the project; and
- To define the entry of new landowners and partners into the PoA.

Documentation

1. All minutes from the semiannual meetings of the board will include lessons learned (through indicators that help to accumulate lessons learned) and will include proposed alterations to the PoA.
2. All reports produced on the different themes of the PoA will be locally available in hard copy as well as on the internet.
3. Publications of all records will be published in two stages, one the fifth year and the other the 15^{th} year of the PoA.

The role of each institution in the execution of this project is clearly defined.

Instituto Bioatlântica and TNC will carry out landscape analysis and diagnostics, using GIS and remote sensing tools, in order to identify eligible areas. In the cases in which it is impossible to guarantee results only by satellite imagery, it will be necessary to consult local actors to retrieve the history of land use of these areas. The local organizations (ICidade, ANAC, and Naturezabela) have a fundamental role in this task.

Instituto Bioatlântica will coordinate the selection of eligible areas on each property to be included in this PoA and the signed contract with the landowners. ICidade, ANAC, ASCBENC and Naturezabela will participate. The contracts with the landowners will be signed by Instituto Bioatlântica. In case the buyer/investor of carbon credits prefers to sign a contract with TNC, CI, or another institution from the consortium, a contract will be necessary between Instituto Bioatlântica and this other institution.

Instituto Bioatlântica will coordinate the preparation of restoration methodology. TNC and Cooplantar will participate in preparing this methodology.

Instituto Bioatlântica will coordinate the restoration activities. Cooplantar and Naturezabela will execute these activities. Cooplantar's staff received training and has experience in the selected reforestation technology and the area, and an extended relationship with Instituto Bioatlântica. Grupo Ambiental Naturezabela will coordinate seed collection and the production of the seedlings, and will provide technical assistance on this subject.

TNC will coordinate the preparation of a methodology and the monitoring of carbon sequestration. Cooplantar and Instituto Bioatlântica will participate. The Nature Conservancy will provide technical assistance on reforestation standards and forest maintenance activities, and on carbon monitoring and verification.

Instituto Bioatlântica and TNC will coordinate and provide technical instruction and training in the measuring and monitoring of the actual GHG removals by sinks and any leakage generated by the proposed project activity, and will be responsible for monitoring reports.

Conservation International will coordinate the preparation of a methodology for measuring and monitoring of biodiversity changes due to the proposed PoA and the effectiveness of the corridor in the selected areas. Instituto Bioatlântica, ANAC, and ASCBENC will participate.

Instituto Cidade will coordinate the preparation of a methodology and the monitoring of mobilization and participation of the local communities. ANAC, ASCBENC, and Naturezabela will participate.

Instituto Cidade will coordinate the preparation of a methodology and the monitoring of local community benefits as well as surveying local actors for their opinions on the PoA. ANAC, Naturezabela, and ASCBENC will participate.

Instituto Cidade will coordinate the preparation of a strategy for prospecting new areas. Naturezabela, Instituto Bioatlântica, and TNC will participate. The Management Board will approve the new areas.

Naturezabela will coordinate the prospecting of new areas and properties to be added as CPAs after the certification of this PoA. ANAC and ASCBENC will participate. The management board will approve the new areas.

TNC will coordinate the marketing and negotiation of carbon credits. Instituto Cidade, Instituto Bioatlântica and Conservation International will directly participate. Whenever possible, the contracts for the carbon credits will be signed by Instituto Bioatlântica. The Management Board will analyze and approve the strategy and each of the carbon credit sales.

An expert team will be established if any technical issues should arise, conducting checking and verification of measured and monitored data.

A.5.7.2. Formalize a clear process for handling unresolved conflicts and grievances that arise during project planning and implementation

The process for handling unresolved conflicts and grievances begins with Instituto Bioatlântica, who will be responsible for receiving any complaints of conflicts and will have direct contact with the communities. The community populations will be informed in many different ways that there will be an open forum for any comments, suggestions, doubts, grievances or conflicts that may arise, and Instituto Bioatlântica field agents will be the first ones to be contacted in these cases. Instituto Bioatlântica will document the information received and, together with Instituto Cidade, will try to find a solution or apply the suggestion and document it. Otherwise, if a solution still needs to be found, it will be reported to the Management Board for final decision.

Any solution found or action applied needs to be documented and forwarded to Instituto Bioatlântica, which will archive all the documents. They will be available for consulting at any time, and if appropriate, they will be publicized. They can be used as lessons learned, as examples in case other similar cases appear, and as input for the annual revision of the project's operational plan. As such, lessons learned will also be documented in the board meeting reports.

A.6. Legal framework. Land title, tenure, and rights to CERs

A.6.1. Land legal title and tenure

Legal title to the land

All areas in this PoA are private lands. Specific details regarding legal status and land tenure of each participating property will be attached to the corresponding CPA Design Document.

All areas in CPA#1 belong to the Monte Pascoal Farm (Fazenda Monte Pascoal), located in the municipality of Itabela in the state of Bahia. The legal owner of Monte Pascoal Farm is Olival José Covre, who has legal title and registry to the land.

Current land tenure

The private owners have absolute title to the land. Land titles will be attached to each CPA Design Document.

Land use

In each CPA, the areas to be reforested are abandoned or are used for cattle ranching, either continuously or sporadically.

A.6.2. Rights of access to the sequestered carbon

Rights of access to the sequestered carbon

Under the carbon contract, the owner of property included in the CPA enters into a binding agreement with Instituto BioAtlântica (IBio) ceding the rights of any carbon offsets from the reforestation activities to IBio.

Under the same contract, the owners warrant IBio and its partners in this initiative access to the CPA areas within their property in order to perform all activities related to the reforestation effort.

Instituto BioAtlântica generally signs contracts with landowners. However, when investors and buyers of the PoA prefer to sign a contract with TNC, CI, or another institution from the consortium, the organization that signs this contract will also be responsible for signing the contract with the landowner. This is the case for CPA #1.

A.7. Adapting to Climate Change

Climate is the major factor controlling global patterns of vegetation structure, productivity, and plant and animal species composition and will likely affect the areas in this PoA. Changes in mean, extremes, and climate variability determine the impacts of climate change on ecosystems (IPCC, 2002).

Regional Knowledge

As the communities benefiting from this PoA are largely composed of the decendents of traditional groups whose traditional activities are fishing, extractivism and small-scale agriculture, there is a considerable amount of familiarity and knowledge about the environment, the climate, and its changes at the regional scale.

It is possible to identify nearly a consensus on the end of the former regularity of the dates of cyclical climate changes, mainly seasons, winds, and rains. Some of the more subtle aspects are explained in local conversations with fishermen and older residents, who highlight a change in the system of winds and also the changes in periods of flowering and fruit-bearing. They note a lower incidence and power of cold winds, from the south and northwest, associated with large storms (very rare today), and of the *terral*, the morning west wind.

The more frequent occurrence of warmer winds, east and southeast, for example, has been related to the drying up of flowers such as mango and mangaba (*Hancornia speciosa*) and the resulting lack of annual fruit-bearing. In one conversation, an old adage was cited as saying that when “the thunderstorm snores, it kills the flora.” *Trovoada* is the local name for strong and rapid storms, preceded by a long period of thunder and lightning, characteristic of October. Today these storms occur sparsely in a period of three months between September and November. Such a change provides grounds for the assumption of an impact similar to those observed in the fruit-bearing and in flowering periods of the forests.

Other verified changes, such as the positive and negative variations in the number and diversity of fish in the rivers and seas, are not generally attributed to climate change. They instead are attributed to other external factors such as deforestation, water pollution, the introduction of exotic species in the rivers (Tucunará, for example), the prohibition of predatory fishing, and the consolidation of the Corumbau Extractavist Marine Reserve.

In addition to the data and knowledge produced in the academic world, local knowledge of the climate and its changes will be incorporated from the start of the baseline research in the first year of the PoA implementation. Data collection will be tied to the interviews to verify opinions through the Participatory Action Research method, as described in the section E.5 Monitoring of socioeconomic impacts. In the same way, the solutions of this PoA for mitigating these impacts will be designed in conjunction with the local agents of this PoA.

Climate Change & Variability

Over the last century, annual mean temperature in Brazil has incrased by just over 0.5ºC. Global climate models generally predict a gradual warming that varies by season: the wetter December to February period warming by between 0.1º and 0.4ºC per decade and the drier June to August season warming by between 0.2º and 0.6ºC per decade (Hulme & Sheard, 1999). Warming is greatest over the Amazon rainforest and least rapid in the southeastern coastal states. Climate models predict more precipitation in the southern states and less in Amazonia. The dry Northeast is expected to become wetter from December to May and drier from June to November (Hulme & Sheard, 1999). The climate models also predict more frequent weather and climate extremes, such as floods and droughts (IPCC, 2007). Floods can increase sediment loads and degrade water quality. In addition, 100 Mha of land face desertification processes (IPCC, 2007). Low-lying habitats (coral reefs and mangroves) are also expected to suffer from the effects of rising sea levels (IPCC, 2007).The conservation of key ecosystems, early warning systems, risk management in agriculture, strategies for flood, drought and coastal management, and disease surveillance systems are some general ways to adapt to climate change effects (IPCC, 2007).

Afforestation, reforestation, and avoided deforestation projects with appropriate management, selection criteria, and involvement of local communities can enhance conservation and sustainable use of biodiversity. Planting mixed species including native species is one method used in this PoA to achieve the synergy between carbon sequestration and biodiversity (IPCC, 2002).

Minimizing potential negative impacts

Reversing deforestation trends, creating biological corridors, and improving watershed protection help to mitigate climate change impacts because healthy ecosystems are more resilient to climate variability and climate change impacts. Restoring watersheds through planting a variety of native species as proposed in this PoA reduces the risk of severe flooding, stabilizes river and stream banks to prevent severe erosion, and slows the desiccation of rivers during severe droughts. In addition, early warning systems, risk management in agriculture, strategies for flood, drought and coastal management, and disease surveillance systems are some general ways to adapt to these climate change effects (IPCC, 2007). Table 3 below shows some potential impacts on this PoA and actions to be taken to mitigate these impacts.

Climate Change Impact	Potential impact on planting	Action taken or to be taken
Severe droughts	Seedling mortality	Planting a variety of well adapted native trees, Hydrogel to be used during the restoration (increases moisture retention), and plants watered if necessary during the first 5 years
Severe droughts	Wildfires	Fire breaks, patrols during driest months, community brigades and fire training
Increased temperatures	Increased competition from weeds and grasses	Monthly visits to reforestation areas, manual removal of weeds and grasses until shade has eliminated them

Wind storms	Tree mortality, downed woody debris	Woody debris will be left in reforestation areas as part of carbon stock, dead tree seedlings will be replaced during the first 5 years
Heavy rain	Local flooding of plantation areas	Planting a variety of well adapted native trees that can withstand super-saturated soils, improving river banks by planting riparian trees along rivers
Heavy rain	Mudslides	Very few steep areas are within the areas to be planted, where hills exist, native trees will be planted to stabilize hillside.

Table 3: Actions to mitigate the impact of climate change and variability on the PoA. Table identified in Return to Forest, Rivas Province, Nicaragua PDD, Dec. 2007.

B. DURATION OF THE PROGRAMME OF ACTIVITIES

B.1. Starting date of the Programme of Activities

The starting date for the PoA is February 1, 2009.

B.2. Duration of the Programme of Activities

This PoA is considered open-ended, without a defined end date. It will be accepting new CPAs for five years after the start of the project.

Each CPA will have an operational lifetime of 30 years.

C. BASELINE AND MONITORING METHODOLOGY AND CALCULATIONS

C.1. Title and reference of the approved baseline and monitoring methodology applied to each CPA included in the PoA

Approved baseline methodology "Approved consolidated afforestation and reforestation baseline and monitoring methodology" (AR-ACM0001/Version 02)[4] was applied to the proposed reforestation programme of activities (PoA).

C.2. Justification of the choice of the methodology and why it is applicable to each CPA

Following approved baseline methodology AR-ACM0001, this PoA uses baseline approach a) from paragraph 22 of the CDM A/R modalities and procedures: "Existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary."

The reforestation project activity meets all the conditions for the applicability of methodology AR-ACM0001:

- The project activity can lead to a shift of pre-project activities outside the project boundary, e.g. a displacement of grazing and fuelwood collection activities, including charcoal production;
- Lands to be reforested will remain in a low carbon steady state;
- Environmental conditions or anthropogenic pressures do not permit the encroachment of natural tree vegetation that leads to the establishment of forests according to the threshold values of the national definition of forest for CDM purposes;
- Lands will be reforested through promotion of natural regeneration and/or direct planting;
- Site preparation does not cause significant longer term net decreases of soil carbon stocks or increases of non-CO_2 emissions from soil;
- Carbon stocks in soil organic carbon, litter and dead wood can be expected to decrease more due to soil erosion and human intervention or increase less in the absence of the project activity, relative to the project scenario;
- Flooding irrigation is not going to be applied;
- Soil drainage and disturbance are insignificant, so that non CO_2-greenhouse gas emissions from this type of activities can be neglected;
- The amount of nitrogen-fixing species (NFS) used in the project activity accounts for less than 10% of the total species to be planted, so that greenhouse gas emissions from denitrification can be neglected in the estimation of actual net greenhouse gas removals by sinks;

[4] http://cdm.unfccc.int/methodologies/ARmethodologies/approved_ar.html

- The A/R project activity is implemented on land where there are no other on-going or planned A/R activities.

Concluding, conditions over the planned project area obey assumptions required for applicability of the methodology hence, there is no barrier to application of it.

The following paragraphs, prepared by Rubens Benini (MSc, Professional Forester with TNC-Brazil), provide evidence that the lands to be restored are considered degraded and/or degrading.

In general terms, environmental degradation refers to the modifications imposed by society on natural ecosystems, altering (degrading) their physical, chemical and biological characteristics, thereby jeopardizing the quality of life of their living beings. A Degraded Area can be described conceptually as an environment that is modified for anthropic purposes or submitted to intensive erosive processes, changing the original characteristics beyond the limit of natural recuperation of the soil, thus requiring human intervention for its restoration (Noffs, et. al, 2000).

Urban and agricultural expansion bring about great changes in their environments, resulting in degraded areas. A common anthropic practice is the removal of forest cover to make way for agriculture and pasture.

For the formation of pastures, forage species made up of exotic invasive grasses, such as *Brachiaria* and *capim colonião*, among others, are generally employed.

Various studies (Rodrigues & Gandolfi, 2003, 2004) state that one of the greatest concerns in the restoration of areas occupied by pasture is the presence of invasive grasses. These grasses, furthermore, present a problem in restoration planting, especially during the period of establishment, in the early years. Although they increase the cost of restoration, practices aimed at controlling invasive plants should not be seen simply as a cost burden. If not controlled, aggressive invasive grasses may delay or even impede the development of the forest and the success of regeneration, resulting in the loss of time and resources initially spent on implanting the reforestation.

In transforming areas into pasturelands, and consequently reducing the forest cover, there occurs an increase in surface drainage, contributing to the acceleration of erosive processes. This results from the gulleys are formed during intensive grazing of cattle, which cause sedimentation of the bodies of water in the region.

In this manner, the conversion of pastures into forested areas tends to be beneficial to the environment, transforming these degraded areas into areas with forest cover that can contribute to the control and reduction of soil erosion and to an increase in the diversity of flora and fauna.

In compliance with methodology AR-ACM0001, as applied to the reforestation activity, the following elements will be monitored:

• The proposed A/R project activity including the project boundary, forest establishment, and forest management activities;

• Actual net GHG removals by sinks including changes in carbon stock in above-ground biomass and below-ground biomass (the increase in GHG emissions within the project boundary due to nitrogen fertilization will be monitored but not included in the GHG removal calculations);

• Leakage due to displacement of grazing (leakage due to vehicle use for transportation of staff, products and services will also be monitored though not included in GHG removal calculations);

• A Quality Assurance/Quality Control plan, including field measurements, data collection verification, data entry and archiving, as an integral part of the monitoring plan of the proposed A/R project activity, to ensure the integrity of data collected.

The baseline net GHG removals by sinks are assumed to be constant due to acceptance of the baseline approach 22 (a) in the related baseline methodology.

In accordance with the selected methodology, the project is stratified based on existing vegetation with the aid of land use/cover maps, satellite images, and field survey.

Permanent sample plots are used to monitor carbon stock changes in living biomass pools. Following the methodology AR-ACM0001, the first step is determining the number of plots needed in each stratum/sub-stratum to reach the targeted precision level of ±10% of the mean at the 90% confidence level. GPS located plots ensure the measuring and monitoring consistently over time.

C.3. Identification of baseline scenarios and description of the identified baseline scenario for a typical CPA: "Without the project" scenario

C.3.1. Baseline land use changes

C.3.1.1. Analysis of historical land use

The Caraíva River Basin was a relatively isolated area until the mid twentieth century, populated by indigenous peoples living on basic marine and extractive forest activities. This would explain the widespread presence of Atlantic Forest until the 1960s.

The first major impact on the local environment and culture took place at the beginning of the 1970s, with the opening of a major highway and governmental financial incentives for the lumber industry. It was then that the devastating deforestation process began. In addition to the selective extraction of wood for the lumber industry, big forest fires converted the forest into low intensity pasture lands and papaya and coffee plantations. This "conversion" process is still happening today.

By the 1990s, most of the exuberant Atlantic Forest had disappeared, as the historical maps show in Figure 1, and the pace of deforestation slowed down. At that moment, a new activity entered the area, eucalyptus silviculture, following a pattern that does not negatively impact the environment or the remaining Atlantic Forest.

Today land use in the region is dominated mainly by low intensity pasture land and eucalyptus plantations, some monocultures of coffee and papaya, and, sparingly, passion fruit, cocoa and rubber tree.

Areas in this PoA followed the same "conversion" pattern at some point in the past and, as shown in the eligibility section above, they were not forest in 1990 and they are not forest today. Some areas are degraded pastures and some are abandoned or semi-abandoned pastures that would be used for grazing when conditions are appropriate as described in the baseline scenario section below.

C.3.1.2. Relevant policies and regulations

Conceived in 1965, the Brazilian Forest Code[5] was the first law regarding natural resources in Brazil. It outlines the basic procedures for forest preservation and natural resource conservation in any forest areas in Brazil.

Considered by environmentalists to be an excellent law though poorly enforced, the Brazilian Forest Code aims to preserve and conserve the most important biodiversity spot in the globe, the Amazon Forest (Myers *et al*., 2000).

The Code also protects the Atlantic Forest regions by defining areas considered Atlantic Forest in Brazil and setting the preservation rates for land use and agricultural activities, among others.

Specifically, Federal law 4.771/65 applies to some project areas. It defines two types of protected areas:

Permanent Preservation Area (APP-*Área de preservação permanente*)

APPs are protected areas where it is not allowed to cut down any vegetation unless for very specific and limited reasons like national security, public health, or public infrastructure. The law does not require the owner to reforest the area in case it is already degraded.

Areas that are considered APPs by the law, regardless of whether they are on public or private land, and that are relevant to the project include:

- 30 meters on each side of water courses.
- Around ponds, lakes, water reservoirs, both natural and artificial.
- 50 meters around water springs.

Legal reserve (RL – *Reserva Lega*l)

RLs are protected areas located inside a rural property, excluding APPs, which are necessary for the sustainable use of natural resources, the conservation and rehabilitation of ecological processes, conservation of biodiversity, and the protection of local fauna and flora.

The law does not allow to clear cut vegetation from RLs, although it allows a sustainable commercial use of the area, including extraction of wood.

In Northeast Brazil, where the project is located, the law requires that every rural property include a minimum of 20% of RL.

The law requires that every rural property owner declares and registers what the area of the property is destined to RL.

[5] Brazilian Forest Code: Lei Federal No 4771/1965 – Código Florestal

In properties without forest cover the owner is required to restore the RL in a maximum of 30 years from the date the RL is declared and registered.

Even though the Forest Code is considered one of the most advanced environmental laws in the World that has impact on biodiversity conservation, it is well-known that the law has not been enforced since its decree in 1965. The current estimate of 7.8% forest cover in the Atlantic Forest reflects the lack of compliance and a need to seek incentives to increase the engagement of landowners and rate of compliance.

Each CPA included in this PoA may include areas considered APP and areas considered RL.

C.3.1.3. Land use alternatives

It is important to differentiate between land use alternatives for the properties and for the areas where the restoration activities will take place. Today land use in the areas where project activities will take place (CPA areas) is still dominated mainly by low intensity pasture land. Land uses such as eucalyptus plantation may be present somewhere on the property, but this will not be considered as a suitable land use for the areas to be restored because these will be limited to the Legal Reserves (RL) and Permanent Preservation Areas (APP). Eucalyptus production in the region must follow strict regulations that prohibit the use in RLs and APPs.

Alternative land uses for the CPA areas are discussed in the additionality discussion, in Section C.4 below.

C.3.2. Stratification based on current and expected land use

The starting point for stratification of the project area was the actual land cover/use information.

Specifically, in areas of this PoA there is one typical situations:

- Pasture land: Pastures with low potential for self-regeneration because of their very low natural supplies of forest propagules, due to their distance from forest fragments, their land use history, and their current state of degradation. Typically, pastures contain very few regenerating individuals of native species. These areas have very low carbon content.
- Degraded pasture: Abandoned and low-grade pastures with medium potential for self-regeneration because of their low natural supplies of forest propagules, due to their proximity to forest fragments, which can be sources of seeds, or to the existence of young regenerating individuals. The land use history and current state of degradation of degraded pastures typically causes them to contain very few regenerating individuals of native species. These are areas of low carbon content.

This results in two main strata. Details of the stratification are presented in each CPA, and Figure 16 and Figure 17 shows current pictures of each type of land use.

Figure 16: Images of current land cover in the restoration area of CPA #1, Monte Pascoal Farm: pasture (Photo by R. Benini).

Figure 17: Images of current land cover in the restoration area of CPA #1, Monte Pascoal Farm: degraded pasture (Photo by R. Benini).

C.3.3. Determination of baseline scenario for each stratum

Due to extensive cattle ranching, the higher value of "clean" land, that is, land with no forest, and the opportunity cost associated with using the land in a manner that will lead to carbon sequestration, the lands to be reforested, without the proposed reforestation activity, will continue in their current status. Therefore baseline approach 22(a), "Existing or historical, as applicable, changes in carbon stock in the carbon pools within the project boundary", is the most appropriate approach for determination of the baseline scenario, and the one used by the selected methodology, AR-ACM0001.

Areas that today are pasture lands will continue to be used for extensive cattle ranching because of the economic advantage of this use.

For currently degraded and semi-abandoned pastures, the most likely scenario is that these lands will go through cycles, being used as pasture lands for a while, for example when the price of cattle is high enough, and then abandoned for some time, letting some vegetation grow.

Typically these lands are abandoned because they are further away than other areas, or they are not as flat as other areas, or for some other reason less convenient for landowners to put their cattle there. However, when there is enough vegetation growth in them, or the price of cattle is high enough, it will be worthwhile for landowners to move the cattle to those areas.

Another major factor exists that will definitely not allow any abandoned area to grow enough to become a forest. That is the market value of land in the region. Degraded land, i.e. land mostly clean of trees and that could be potentially used for either cattle or crops, reaches a much higher value (2 or 3 times as much) than land that has not been "cleaned" yet, because it is not immediately useful for any of the traditional activities that are considered productive in the area. Keeping an indigenous forest is definitely not considered one of the productive activities.

Specifically in the region in this PoA, at the time this document was written, average values for "clean" land run around 5,000 to 6,000 Brazilian Reais (US$ 3,000 – 3,600), while land with standing forest averaged 2,000 to 2,500 Brazilian Reais (US$ 1,200 – 1500).

For this reason landowners will bring cattle into their pastures in a state of degradation before vegetation grows too much and becomes very difficult to "clean," or will even burn it. Degraded pastures never grow enough vegetation as to "ruin" their value.

Therefore carbon stocks in these lands will follow a saw tooth pattern, growing for a while up to a certain value, and then dropping (reintroduction of cattle), and a new cycle starts, repeating the pattern over and over. Over the long term, on average, the lands remain at a low carbon state, therefore with zero carbon stock changes over time.

Therefore, baseline net removal by sinks is zero for both strata.

C.3.4. Determination of baseline carbon stock changes

As explained in the previous section, baseline carbon stock changes are zero for all the baseline scenarios considered.

C.3.5. Ex-ante estimation of baseline net GHG removals by sinks

As per baseline scenarios, baseline net GHG removals by sinks are zero.

C.4. Net anthropogenic GHG removals by sinks: "With the project" scenario (assessment and demonstration of *additionality* of CPA)

In order to demonstrate the additionality of the project, the "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" [6] was followed systematically, as prescribed by the selected methodology.

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

  Does not apply to this project because the starting date of the project activity happens after the date of its registration.

- **Step 1**. Identification of alternative land use scenarios to the reforestation activity.

  Credible alternative land use scenarios are presented here differentiated by the legal status of the project areas as described in the Brazilian Forest Code, explained in section C.3.1.2 above.

Step 1a. Identify credible alternative land use scenarios to the proposed project activity.

Permanent Preservation Areas (APPs)

- Alternative 1: Continuation of pre-project land use (pasture and/or degraded pasture). This is the most likely scenario and has been selected as the baseline scenario for all the project areas.
- Alternative 2: Elimination of grazing activities and protection (fencing) of the areas in order to keep cattle out of them. Depending on the current land use/cover, regeneration would occur at different speeds (slow for degraded pasture, slower for pasture areas), but always at much lower rates and without the creation of the fully functional ecosystem that the project activity would create. The increase in carbon stocks over time would be much slower.
- Alternative 3: Reforestation of the land within the project boundary performed without being registered as a carbon sequestering reforestation activity.

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[6] CDM Executive Board. EB 35 Report, Annex 19. "A/R Methodological Tool. Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities." Version 01.

Legal Reserves (RLs)

- Alternative 1: Continuation of pre-project land use (pasture, degraded pasture, pasture and shrubs). This is the most likely scenario and has been selected as the baseline scenario for all the project areas.
- Alternative 2: Agricultural use, mainly fruit trees. Some of the project areas could potentially be dedicated to one or both of the two main crops in the area: papaya and coffee.
- Alternative 3: Elimination of grazing activities and protection (fencing) of the areas in order to keep cattle out of them. Depending on the current land use/cover, regeneration would occur at different speeds – faster for "capoeira rala", slower for pasture areas—, but always at much smaller rates and without the creation of the fully functional ecosystem that the project activity would create. The increase in carbon stocks over time would be much slower.
- Alternative 4: Reforestation of the land within the project boundary performed without being registered as a carbon sequestering reforestation activity.

Step 1-b. Consistency of alternative scenarios with enforced mandatory applicable laws and regulations.

Existing mandatory applicable laws and their enforcement is discussed here separately for the two different legal statuses of the project areas.

Permanent Preservation Areas (APPs)

The Brazilian Forest Code restricts any elimination of vegetation in APP areas only to cases of national security or specific cases of public utility (e.g. infrastructure works), which is not the case for any of the potential uses described.

Therefore, in theory, only natural regeneration in the absence of grazing or agriculture, or human-induced regeneration as proposed by this project, would be allowed in these areas.

In practice, though, there is a systematic lack of enforcement of the APP law in the area, and non-compliance with these requirements is widespread.

In the region, in general, only properties owned by eucalyptus pulp companies comply with the APP and RL laws, due to the controversy, visibility and international public sensitivity and awareness about their operations.

The Monte Pascoal Farm property (CPA#1) includes a total of 96.8 hectares: 10.4 ha devoted to coffee; 58 ha devoted to cattle grazing (total 100 head), and 8 ha are devoted eucalyptus plantations. Monte Pascoal Farm includes 9.9 ha of land classified as APP (Permanent Preservation Area), of which 4.4 ha are located within the area to be restored.

The image analysis performed in order to demonstrate the eligibility of this project activity, explained in detail in section A.5.4 above, shows that for the Caraíva River Basin, excluding the areas owned by the big eucalyptus pulp manufacturer, Veracel, approximately 55% of

APP areas had no forest cover in 2005. There are 12,964 ha of APP, of which only 5,830 ha had forest cover in 2005.

Legal Reserve areas (RLs)

As explained in section C.3.1.2 above, the Brazilian Forest Code does not allow to clear cut vegetation from RLs, which must constitute at least 20% of any rural property in the Northeast region where the project is located. The law requires that every rural property owner declares and registers what the area of the property is destined to RL, and in properties without forest cover the owner is required to restore the RL in a maximum of 30 years from the date the RL is declared and registered.

Therefore, in theory, only natural regeneration in the absence of grazing or agriculture, or human-induced regeneration as proposed by this project, would be allowed in these areas.

In practice, though, there is a systematic lack of enforcement of the RL law in Brazil in general, and in the project region in particular, and non-compliance with these requirements is widespread.

According to Oliveira and Bacha (2003), less than 10% of rural properties in Brazil have been maintaining their Legal Reserve area, and those who do, do not reach the percentage required by law. Table 4 below shows the average percentage for the whole country, as well as the values for each state. The state of Bahia shows little over 3%.

States	1972	1978	1992	1998
Rondônia	26,84	41,06	10,89	9,36
Acre	19,06	31,54	22,35	15,07
Amazonas	36,30	43,99	9,87	6,37
Roraima	12,40	49,07	1,72	2,99
Pará	29,47	30,65	31,83	24,36
Maranhão	33,70	29,70	20,40	15,91
Amapá	8,31	11,32	8,56	6,79
Piauí	0,96	1,40	2,16	1,95
Ceará	1,28	1,02	0,78	0,59
Rio Grande do Norte	0,72	0,40	1,91	1,19
Paraíba	1,14	0,93	1,11	0,84
Pernambuco	1,19	1,51	1,33	0,96
Alagoas	1,48	1,51	0,76	0,72
Sergipe	1,19	0,71	1,38	1,79
Bahia	2,55	3,59	3,11	3,26
Minas Gerais	2,69	2,87	5,28	4,92
Espírito Santo	1,51	2,27	1,73	1,20
Rio de Janeiro	6,79	5,49	2,90	2,13
São Paulo	5,59	3,46	2,64	2,70
Paraná	3,69	2,87	3,59	3,55
Santa Catarina	2,67	2,41	2,27	2,16
Rio Grande do Sul	1,64	0,94	0,57	0,57
Mato Grosso*	6,88	17,19	20,40	18,05
Goiás**	5,77	5,06	6,17	5,76
Distrito Federal	5,48	5,16	5,88	5,29
Brasil	**9,16**	**12,75**	**10,31**	**9,58**

Source: INCRA (Institute of Colonization and Agrarian Reform) Cadastrasl Statistics.
*Including Mato Grosso do Sul.
**Including Tocantins.

Table 4: Percentage of rural property areas covered with Legal Reserve, by state

A study conducted for Instituto Bioatlântica by local agents from Caraíva and Nova Caraíva in 2005 collected information for 68 rural properties in the sub-basins of rivers Jambreiro and Capoeira, part of the larger Caraíva River Basin. Of the 68 properties consulted, only 15 (~27%) affirmed that they had declared and registered their RL. The 30-year period for compulsory restoration of the areas does not start counting until the RL has been declared.

One of the provisions of the contract signed with the landowner for the implementation of the reforestation activities in each CPA requires the declaration and registration of the RL area of the property, which will include many of the restoration areas for this PoA.

The question of additionality of areas affected by the Brazilian Forest Code under the APP and RL provisions has been thoroughly discussed elsewhere. The Nature Conservancy (TNC) of Brazil supported a study and publication[7] in 2005 that concluded that "the active and controlled reforestation of APP and RL areas represents an additional action as compared to the business as usual (baseline) in Brazil, characterized by continuous deforestation, and therefore allows the inclusion of CDM activities."

It has been demonstrated that all alternative uses listed above are plausible and credible for the project areas.

- **Step 2**. Investment Analysis

It will be shown here that the project activity is economically or financially less attractive than at least one of the alternative land use scenarios presented above.

Step 2a. Analysis method.

Since there are no products to be collected from reforested areas, nor any other economic or financial benefits generated by the project (other than the carbon credits), the simple cost analysis method is applied.

Step 2b. Simple cost analysis

As stated above, there are no financial benefits generated by the project activity other than carbon credits.

Total implementation costs for the CPA#1 are shown in Table 5 below, by stratum.

Project Implementation Costs (US$)					
Stratum	**Area (ha)**	**Planting**	**First maint.**	**Second maint.**	**Total**
Pasture	9.00	27,431.60	5,486.32	1,097.26	32,917.91
Degraded Pasture	8.40	20,114.00	4,022.80	804.56	24,136.81
TOTAL	17.40	47,545.60	9,509.12	1,901.82	**57,054.72**

Table 5: Implementation costs for the project (1 USD = 2.3 BRL)

This represents an investment of US$ 3,279 per hectare for the project implementation, or a simple average of about US$109 per hectare per year for the 30 years of the crediting period proposed.

There are other costs associated with the project, including administrative costs, preparation studies, monitoring, etc. that is not necessary to detail here for the purpose of illustrating the simple cost argument.

[7] "Áreas de Preservação Permanente e Reserva Legal no contexto da mitigação de mudanças climáticas", http://www.iesb.org.br/biblioteca/apps.pdf

With these costs, and with no income (other than from carbon credits), any of the other alternatives proposed would be financially and economically more attractive than the proposed reforestation activity.

The continuation of pre-project land use is considered the most likely option and has been selected as the baseline scenario for all situations, regardless of current land use or legal status.

Step 2d. Sensitivity Analysis

The financial analysis is very simple. There is no income and there are substantial implementation expenses. Any change in the basic parameters for cost calculations might change the total amount for implementation costs, but would not change the main conclusion, i.e., that it is financially more attractive not to implement the project.

- **Step 4**. Common practice analysis.

There exist reforestation activities similar to those proposed by the project taking place in the area. All of them happen in properties owned by big eucalyptus pulp companies.

This type of silvicultural activity, as explained above, is subjected to very strict scrutiny at the local, federal, and international levels, due to the controversy, visibility and international public sensitivity and awareness about their operations.

Those responsible for these operations make a point of scrupulously comply with every law and regulation that affects their lands, including APP and RL. Actually, they often exceed legal requirements by not only protecting APP and RL areas, but even implementing full human-induced reforestation operations similar to the one proposed by this project.

Unfortunately there are no known similar reforestation activities happening in the region in properties not involved in Eucalyptus silviculture.

At a smaller scale, it is worth citing the Corredores Ecológicos initiative, focused on the Central Corridor of the Atlantic Forest, promoted by the Ministry of the Environment of Brazil (MMA) in cooperation with the governments of the states of Bahia and Espírito Santo and environmental organizations. Some of the partners of this project have presented a proposal including up to 150 ha of reforestation to the Corredores Ecológicos initiative.

Final conclusion

Through the application of the additionality tool through all its steps as described above, it has been demonstrated that the project IS ADDITIONAL.

C.5. Explanation of methodological choices provided in the approved baseline and monitoring methodology applied to a typical CPA

C.5.1. Selection of GHG, carbon pools, sources of leakage and emissions sources for a typical CPA

C.5.1.1. GHG whose emissions will be part of the proposed Programme of Activities

CO_2 (emission removals)

C.5.1.2. Carbon pools selected

Carbon Pools	Selected (answer with yes or no)
Above ground	Yes
Below ground	Yes
Dead Wood	No
Litter	No
Soil organic carbon	No

C.5.1.3. Project emissions sources

Two sources of project emissions sources are covered by methodology AR-ACM0001:

- CO_2 emissions from fossil fuel combustion (site preparation, thinning, and logging only - excluding transportation), and
- Non-CO_2 emissions due to biomass burning of existing vegetation as part of site preparation.

This PoA does not include any mechanized operations for restoration activities nor biomass burning for site preparation.

The only factor present in this PoA that results in an small increase of GHG emissions by sources within the project boundary as a result of the implementation of the A/R activity is the use of nitrogen fertilization practices which cause N_2O emissions. These emissions will not be included in the *ex-ante* estimation of GHG removals.

The *ex-ante* estimation of emissions by sources is described in section C.5.3.2 below, while the monitoring, measurement and calculation of the actual emissions is described below in section C.5.6.5.

C.5.1.4. Project leakage

Sources

Leakage (LK) represents the increase in GHG emissions by sources that occurs outside the boundary of the reforestation CPA that is measurable and attributable to the CPA activity. Two sources of leakage are covered by methodology AR-ACM0001:

- GHG emissions due to activity displacement;
- GHG emissions due to increase in use of wood posts for fencing.

The first source considered in the methodology is the displacing of pre-project activities such as grazing and wood gathering. In this case wood gathering does not happen in the project areas, but the landowner does use the areas, especially those belonging to the "pasture" stratum, for cattle ranching.

When the carbon option was presented to the property owners in the PoA, they saw reforestation based on carbon credits financing as an opportunity to adequate the property to the existing APP and RL law without any investment on their part.

The areas to be reforested are currently used for cattle operations of low productivity or are abandoned. The owners are willing to absorb the relatively small opportunity cost of eliminating cattle in those areas in exchange for a "clean environmental record" for the property.

The owners will gradually remove the cattle that are currently grazing in the CPA restoration areas, and this fact will be monitored as described in section C.5.6.6 below.

Therefore, there is no leakage related to the displacement of grazing activities. As a matter of fact, there is an additional reduction of emissions due to the elimination of some heads of cattle. In any case, to remain conservative, those reductions in emissions will not be calculated.

The second source covered by the methodology, the use of wood posts for fencing, does not apply. Although there will be some fencing in the project, all the wood posts will come from Eucalyptus from certified operations, and therefore no leakage from this source needs to be accounted for.

Prevention and mitigation of leakage from CPAs under this PoA is discussed in section C.5.6.7 below.

In this PoA, wood gathering does not happen in the CPA areas, but the landowner may use the areas, especially those belonging to the "pasture" stratum, for cattle ranching.

In addition, GHG emissions caused by vehicle fossil fuel combustion due to transportation of seedling, workers, staff and harvest products to and/or from project sites will be controlled and monitored by the project developers, but they will not be included in the calculations for net GHG removals by sinks of the CPA.

C.5.2. Equations and parameters for the calculation of the *ex-ante* baseline net GHG removals by sinks of CPA

As explained, all the most-likely baseline scenarios for lands eligible for the PoA presented herein would result in zero baseline carbon stock changes.

C.5.3. Equations and parameters for the calculation of the *ex-ante* actual net GHG removals by sinks of CPA

The actual net greenhouse gas removals by sinks represent the sum of the verifiable changes in carbon stocks in the carbon pools within the project boundary, minus the increase in non-CO_2 GHG emissions measured in CO_2 equivalents by sources that are increased as a result of the implementation of an A/R project activity, while avoiding double counting, within the project boundary, attributable to the A/R project activity.

The *ex-ante* estimation of these values is based on equation 12 as described in AR-ACM0001. The change in carbon stocks can be calculated using the formula below. Here it represents the annual changes. The values are presented in section E.3.4 of each CPA for every year of the first crediting period, as well as the totals for the whole period.

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

Where:

ΔC_{ACTUAL} = Actual net greenhouse gas removals by sinks; (tons CO_2-e)

ΔC_P = Sum of the changes in above-ground and below-ground biomass carbon stocks in the project scenario; (tons CO_2-e)

GHG_E = Increase in non-CO_2 GHG emissions by sources within the project boundary as a result of the implementation of the A/R project activity (tons CO_2-e / year).

C.5.3.1. Changes in living biomass carbon stocks

The verifiable changes in the carbon stock in tree above-ground biomass and below-ground biomass within the project boundary are estimated using the following approach:[8]

$$\Delta C_P = \sum_{t=1}^{t*} \Delta C_t * \frac{44}{12} - E_{BiomassLass}$$

Where:

ΔC_P = Sum of the changes in above-ground and below-ground biomass in the project scenario; (tons CO_2-e)

ΔC_t = Annual change in carbon stock in all selected carbon pools for year *t*; (tons C yr^{-1})

$E_{BiomassLoss}$ = Increase in CO_2 emissions from loss of existing biomass due to site-preparation (including burning), and/or to competition from forest (or other vegetation) planted as part of the A/R PoA; (tons CO_2)

t = 1,2,3, …t* years elapsed since the start of the AR project activity; (yr)

$44/12$ = Ratio of molecular weights of CO2 and carbon; (tons CO_2 t^{-1} C).

Note: In this PoA, $E_{BiomassLoss}$ = 0.

The annual change in carbon stock, ΔC_t, shall be estimated using the following equation:

$$\Delta C_t = \sum_{i=1}^{M_{PS}} (\Delta C_{AG,i,t} + \Delta C_{BG,i,t})$$

Where:

ΔC_t = Annual change in carbon stock in all selected carbon pools for year *t*; (tons C yr^{-1})

$\Delta C_{AG,i,t}$ = Annual carbon stock change in above-ground biomass of trees for stratum *i*, (possibly average over a monitoring period); (tons C yr^{-1})

$\Delta C_{BG,i,t}$ = Annual carbon stock change in below-ground biomass of trees for stratum *i*, (possibly average over a monitoring period); (tons C yr^{-1})

i = 1,2,3, …M_{PS} strata in the project scenario

t = 1,2,3, …t* years elapsed since the start of the AR project activity; (yr)

[8] IPCC GPG-LULUCF 2003, Equation 3.2.3

For the *ex-ante* estimation, the average annual change in carbon stocks in aboveground biomass in reforested areas was derived from data published in the national literature (Siqueira, 2007). The restoration areas described in Siqueira's book are under similar conditions to the restoration areas of this project (species planted, density, mode of plantation).

Siqueira estimated the annual increase in aboveground biomass using data from 26 permanents plots installed in restoration areas with different ages (3, 7, 8, 9 10, 29, 40 years old). The general moist biomass equation developed by Brown (1997) was used to estimate aboveground biomass for trees. Other equations have also been used to estimate the biomass of cecropia, palms, lianas and tree fern (see Table 6 below).

Equation (Y = biomass in kilograms)	Species	R2	DBH (cm) or height (m) range	Reference
Y = exp(-2,134 + 2,530 * ln DBH)	General Moist	0.97	4-116 cm	Brown, 1997
Y = 0.3999+7.907 * height	Palms	0.75	1-33 m	
Y = (4.48367+1.13488 * (Sqr(DBH)) * Log(DBH))^2	Cecropia	0.62	1-11 cm	
Ln(total biomass) = -7.114+2.276 * (Ln(DBH/100))	Lianas	0.73	1.0-13.8 cm	Gehring *et al*., 2004
Y = (1563.547 * EXP(0.310478 * height))/1000	Tree Fern	0.93	1.3-8.4 m	Tiepolo *et al*., 2002

Table 6: Regression equations used for estimating biomass

Based on Siqueira's study, the value used for the average annual change in aboveground biomass of trees is a conservative estimate of 2.7 tons of carbon per hectare per year. This estimate for the increase in aboveground biomass is used as an average value to estimate carbon stock for all trees planted in this PoA due to the great variability of species to be planted. Siqueira's value is considered a conservative estimate for a diverse array of species similar to the ones to be used in this PoA.

$\Delta C_{AG,i,t} = 2.7$ tons C ha^{-1} year^{-1}

In order to calculate the belowground biomass, the IPCC GPG default value[9] of the root-shoot ratio (R_j = 0.22) for "primary tropical/sub-tropical moist forest" is used.

$\Delta C_{BG,i,t} = \Delta C_{AG,i,t} * R_j = 2.7 * 0.22 = 0.594$ tons C ha^{-1} yr^{-1}

The annual change in carbon stock in all selected carbon pools (above-ground and below-ground) is therefore:

[9] Table 3A.1.8. Annex 3.A.1 IPCC Good Practice Guidance for Land Use, Land-Use Change, and Forestry.

$$\Delta C_t = \Delta C_{AG,i,t} + \Delta C_{BG,i,t} = 2.7 + 0.594 = 3.294 \text{ tons C ha}^{-1} \text{ yr}^{-1}$$

And finally, the sum of the changes in above-ground and below-ground biomass in the project scenario in terms of CO_2 equivalents is:

$$\Delta C_P = \sum_{t=1}^{t^*} \Delta C_t * \frac{44}{12} - E_{BiomassLass} = 3.294 * \frac{44}{12} = \underline{\underline{12.08 \text{ tons } CO_2\text{-e ha}^{-1} \text{ yr}^{-1}}}$$

This value will be used for all strata.

C.5.3.2. Estimation of the increase in GHG emissions by sources within the project boundary as a result of the implementation of the CPA

None of the possible factors considered by methodology AR-ACM0001 that may cause an increase of GHG emissions by sources within the project boundary as a result of the implementation of the A/R activity are present in this PoA.

Emissions of GHG due to burning fossil fuels for transportation within the project boundaries are negligible and are not part of the methodology. In any case, any emissions due to burning fossil fuel for transportation will be considered and monitored as leakage, without differentiating between whether the transportation happened outside (usual) or inside (rare) the project boundaries.

The only source of emissions present in this PoA is the N_2O emissions caused by nitrogen fertilization practices, however, these are not part of the methodology and are negligible. The estimated emissions from fertilizer for the reforestation activity are not included in the CPA calculations, but the developers of this PoA will carefully control the amount of fertilizer used during implementation and maintenance activities. Equations proposed by previous methodologies,[10] can be used to estimate annual N_2O emissions caused by nitrogen fertilization.

C.5.4. Equations and parameters for the calculation of the *ex-ante* leakage of CPA

Leakage (LK) represents the increase in GHG emissions by sources that occurs outside the boundary of the A/R CPA activity that is measurable and attributable to the A/R CPA activity. Two sources of leakage are covered by methodology AR-ACM0001: GHG emissions due to activity displacement and GHG emissions due to increase in use of wood posts for fencing.

Of these sources of leakage, not one applies to this reforestation project activity. However, GHG emissions caused by vehicle fossil fuel combustion due to transportation of seedling, workers, staff and harvest products to and/or from project sites will be carefully monitored and controlled by the

[10] Equations 22, 28, 29 and 30 in approved methodology AR-AM0003, version 03

developers of this PoA. Therefore, these emissions will be accounted for but not estimated or included in the calculation of net anthropogenic GHG removals by sinks.

This PoA will control and monitor fuel consumption for implementation, maintenance and monitoring activities. The developers of this PoA will keep track of fossil fuels used during vehicle transport to and from the CPA areas, but these GHG emissions are not part of the leakage emissions calculations. Based on the equations proposed by previous methodologies[11], annual emissions due to leakage can be calculated.

C.5.5. Equations and parameters for the calculation of *ex-ante* net anthropogenic GHG removals by sinks of CPA

The net anthropogenic GHG removals by sinks is the actual net GHG removals by sinks minus the baseline net GHG removals by sinks minus leakage. The following general formula, based on AR-ACM0001[12], can be used to calculate the net anthropogenic GHG removals by sinks of the PoA, in tons CO_2-e:

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

where

C_{AR} = Net anthropogenic greenhouse gas removals by sinks; (tons CO_2-e)

ΔC_{ACTUAL} = Actual net greenhouse gas removals by sinks –as described in section C.5.3; (tons CO_2-e)

ΔC_{BSL} = Baseline net greenhouse gas removals by sinks –as described in section C.5.2 (tons CO_2-e)

LK = Leakage –as described in section C.5.4 (tons CO_2-e)

Note: $\Delta C_{BSL} = 0$ for this PoA.

This formula is used to calculate annual values of net anthropogenic GHG removals by sinks. The values for every year of the crediting period will be shown in each CPA Design Document, as well as the totals for the whole period.

[11] Equations 31, 32, 33 and 34 in approved methodology AR-AM0003, version 03

[12] Equation 39 of the AR-ACM0001, version 02

C.5.6. Application of the monitoring methodology and description of the monitoring plan for a CPA

C.5.6.1. Monitoring boundary of CPA

The boundary of each CPA is established on the PoA area map during initiation of the project and the location of each node of the project boundary will be measured using GPS during field work. Results of these measurements will be inserted into a database and stored in electronic and paper form.

C.5.6.2. Monitoring of forest establishment to ensure the planting quality and confirm the practice described in section A.5.3 is well implemented

Planting quality and survival will be monitored by local foresters after planting. Foresters will also monitor the way of soil preparation. Results of the monitoring will be inserted into a database and stored in electronic and paper form.

C.5.6.3. Sampling design and stratification

Monitoring of Strata

Details of the initial stratification of the project area are presented in section C of this document. However, post stratification will be conducted after the first monitoring event to address the possible changes of project boundary and planting year in comparison to the project design.

Sampling Framework

a) Calculation of the number of sample plots

The initial stratification led to three strata and the number of sample plots for each stratum will be estimated as dependent on required accuracy, following the standard procedure described by methodology AR-ACM0001.

The entry data:

• Total size of all strata (A), e.g. the total project area. Initial CPA #1 projection A = 17.4 ha.

• Size of each stratum (A_i). Initial CPA #1 projection: A_1 = 9.0 ha; A_2 = 8.4 ha;

• Sample plot size (a). a = 200 m^2 (see below);

• Standard deviation (st_i) for each stratum. To be determined based on field measurements.

• Approximate value of average of the estimated quantity (Q). To be determined based on field measurements.

• Desired level of precision (p): p = 10%;

• $z_{\alpha/2}$ = value of the statistic z (normal probability density function), for α = 0.10 (implying a 90% confidence level): $z_{\alpha/2}$ = 1.645

This data will be entered in the equations proposed in AR-ACM0001:

$$N = A / a$$

$$N_i = A_i / a$$

$$E = Q \cdot P$$

where

N = Maximum possible number of sample plots in the project area

N_i = Maximum possible number of sample plots in stratum i

E = Allowable error

And the number of sampling plots would be calculated using the equations:

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

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

All necessary rounding will be made towards the nearest higher integer number.

b) Size of the sampling plots

The sampling plot area has major influence on the sampling intensity and time and resources spent in field measurements. The area of a plot depends on the stand density. Therefore, increasing the plot area decreases the variability between two samples. According to Freese (1962), the relationship between coefficient of variation and plot area can be denoted as follows:

$$CV_2^{\ 2} = CV_1^{\ 2}\sqrt{a_1/a_2}$$

where a_1 and a_2 represent different sample plot areas and their corresponding coefficient of variation (CV). Thus, by increasing the sample plot area, variation among plots can be reduced permitting the use of small sample size at the same precision level. Usually, the size of plots is between 100 m^2 for dense stands and 1000 m^2 for open stands.

The sampling plot size for the proposed reforestation project has been set at 200 m^2.

c) Random plot allocation

Following the recommendations in AR-ACM0001, the permanent sample plots shall be located systematically with a random start. This is accomplished with the help of a GIS script.

d) Monitoring frequency

Although the verification and certification shall be carried out every five years after the first verification until the end of the crediting period (paragraph 32 of decision 19/CP.9), the monitoring interval may be less than five years. However, to reduce the monitoring cost, the monitoring intervals shall coincide with verification time, i.e., five years of interval.

Monitoring will occur at years 1, 5, 10, 15, 20, 25, and 30 of the PoA.

C.5.6.4. Monitoring of the baseline net GHG removals by sinks, if required

The baseline carbon stock changes need not be monitored after the CPA is established, because the baseline approach 22(a), adopted by methodology AR-ACM0001, assumes continuation of existing changes in carbon pools within the CPA boundary from the time of project validation.

C.5.6.5. Monitoring of the actual net GHG removals by sinks

The actual net greenhouse gas removals by sinks represent the sum of the verifiable changes in carbon stocks in the carbon pools within the project boundary, minus the increase in non-CO_2 GHG emissions measured in CO_2 equivalents by sources that are increased as a result of the implementation of an A/R project activity, while avoiding double counting, within the project boundary, attributable to the A/R project activity. The calculations can be performed annually or periodically according to the monitoring plan.

Based on equation 39 as described in AR-ACM0001, the change in carbon stocks can be calculated using the formula below. It represents the annual changes and they should be summed up over the period defined in the monitoring plan, if any.

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

Where:

ΔC_{ACTUAL} = Actual net greenhouse gas removals by sinks; (tons CO_2-e)

ΔC_P = Sum of the changes in above-ground and below-ground biomass carbon stocks in the project scenario; (tons CO_2-e)

GHG_E = Increase in non-CO_2 GHG emissions by sources within the project boundary as a result of the implementation of the A/R project activity (tons CO_2-e / year).

***a)** Change of carbon stocks in the carbon pools*

For the change of carbon stock in the carbon pools, following the "stock change method" and equation 3.2.3 as described in section 3.2 of the IPCC GPG-LULUCF, the mean annual carbon stock change is obtained based on the calculations explained in section C.5.6.9:

$$\Delta C_t = \Delta C_{AG,i,t} + \Delta C_{BG,i,t} = \frac{C_{tree,i,t2} - C_{tree,i,t1}}{T}$$

Where:

ΔC_t = Annual change in carbon stock in all selected carbon pools for year *t*; (tons C yr^{-1})

$\Delta C_{AG,i,t}$ = Annual carbon stock change in above-ground biomass of trees for stratum *i*; (tons C yr^{-1})

$\Delta C_{BG,i,t}$ = Annual carbon stock change in below-ground biomass of trees for stratum *i*; (tons C yr^{-1})

$C_{tree,i,t}$ = Carbon stock in trees in stratum *i*, at time *t*; (tons C)

T = Number of years between monitoring time *t*2 and *t*1 (T= *t*2-*t*1); (yr)

i = 1, 2, 3, … M_{PS} strata in the project scenario

t = 1, 2, 3, … *t* years elapsed since the start of the A/R project activity

***b)** Increase in GHG emission by sources as a result of the implementation of the proposed A/R project activity*

None of the possible factors considered by methodology AR-ACM0001 that may cause an increase of GHG emissions by sources within the project boundary as a result of the implementation of the A/R activity are present in this PoA. However, project developers will monitor and control the N_2O emissions caused by nitrogen fertilization practices.

- **Step 1**. For the monitoring of N_2O emissions the project will monitor and record annual purchases and use of synthetic fertilizer (the only type used) at the project level.

  $N_{SN-Fert}$ = Annual amount of synthetic fertilizer nitrogen applied (tons N)

- **Step 2.** Equations proposed by previous methodologies,[13] can be used to estimate annual N_2O emissions caused by nitrogen fertilization.

[13] Equations 22, 28, 29 and 30 in approved methodology AR-AM0003, version 03

c) *Data to be collected in order to monitor the verifiable changes in carbon stocks in the carbon pools within the project boundary in CPA*

ID #	Data variable	Source of data	Data unit	Measured (c), calculated (m), or estimated (e)	Recording frequency	Proportion of data to be monitored	Archiving (electronic /paper)	Comment
8.2.01	Stratum ID	Stratification map	Alpha-numeric	m,e	Before project starts	100%	Electronic and paper	
8.2.02	Area of stratum	Stratification map & data	ha	m	5 year	100%	Electronic and paper	Actual area of each stratum
8.2.03	Sample plot	Project and plot maps	Alpha-numeric		During monitoring events	100%	Electronic and paper	Plot ID will be assigned to each permanent sample plot
8.2.04	Location of the plot	Project & plot map; GPS		m	5 years	100%	Electronic and paper	Using GPS to locate before start of the project and at time of each field measurement
8.2.05	Confidence level	CDM	%		Before project starts	100%		For the purpose of QA/QC and measuring and monitoring precision control
8.2.06	Precision level	CDM	%		Before project starts	100%		For the purpose of QA/QC and measuring and monitoring precision control
8.2.07	Tree species	Project design map			5 years	100%	Electronic and paper	
8.2.08	Age of plantation	Plot measurement	year	m	5 years	100%	Electronic and paper	Counted since the planting year
8.2.09	Number of trees by species	Plot measurement	number	m	5 years	100% trees on sampling plots	Electronic and paper	Counted in plot measurement

8.2.10	Diameter at breast height (DBH)	Plot measurement	cm	m	5 years	100% trees on sampling plots	Electronic and paper	Measuring at each monitoring time per sampling method
8.2.11	Commercial Tree height	Plot measurement	m	m	5 years	100% trees on sampling plots	Electronic and paper	Measuring at each monitoring time per sampling method
8.2.12	Canopy Tree height	Plot measurement	m	m	5 years	100% trees on sampling plots	Electronic and paper	Measuring at each monitoring time per sampling method
8.2.13	Wood density	Project data, GPG LULUCF	t d.m. / m3	e	5 years	100% of sampling plots	Electronic and paper	Species- specific
8.2.14	Carbon fraction	IPCC	t C / t d.m	e	5 year	100% of sampling plots	Electronic and paper	IPCC default value = 0.5
8.2.15	Root-to-shoot ratio	IPCC GPG	dimensio nless	e	5 year	100% of sampling plots	Electronic and paper	Species- specific
8.2.16	Mean carbon stock in above-ground biomass per strata per species per age group	Calculated from equation	t C / ha	c	5 year	100% of strata	Electronic and paper	
8.2.17	Mean carbon stock in all relevant carbon pools per stratum	Calculated from equation	t C / ha	c	5 year	100% of strata	Electronic and paper	

8.2.18	Mean annual carbon stock change per stratum	Calculated from equation	t CO_2-e / ha*Year	c	5 year	100% of strata	Electronic and paper	
8.2.19	Total annual carbon stock change	Calculated from equation	t CO_2-e / year	c	5 year	100% project area	Electronic and paper	

***d)** Data to be collected in order to monitor the verifiable changes in carbon stocks in the carbon pools within the project boundary in CPA*

ID #	Data variable	Source of data	Data unit	Measured (c), calculated (m), or estimated (e)	Recording frequency	Proportion of data to be monitored	Archiving (electronic /paper)	Comment
1	Plot ID	Project map	Alpha-numeric	m,e	Before project starts	100%	Electronic and paper	Each plot has a particular ID
2	Stratum ID	Stratification map	Alpha-numeric	m,e	Before project starts	100%	Electronic and paper	
3	Annual ammount of synthetic fertilizer applied	Project administration	Kg	m	Yearly	100%	Electronic and paper	
4	Annual increase in N_2O emissions as a result of direct nitrogen application	Calculated from equation	t CO_2-e / year	c			Electronic and paper	This value will not be included in the project calculations, but it will be controlled and monitored by project developers.

C.5.6.6. Monitoring of Leakage of the proposed CPA

Leakage (LK) represents the increase in GHGs emissions by sources which occurs outside the boundary of the A/R project activity which is measurable and attributable to the A/R project activity. Of these sources of leakage, not one applies to this reforestation project activity. However, GHG emissions caused by vehicle fossil fuel combustion due to transportation of seedling, workers, staff and harvest products to and/or from project sites will be carefully monitored and controlled by the developers of this PoA. Therefore, these emissions will be accounted for but not estimated or included in the calculation of net anthropogenic GHG removals by sinks.

The question of cattle ranching, a pre-project activity that might result in leakage, was explained in detail in section C.5.1.4 Project leakage, above.

Property owners will gradually remove the cattle currently grazing in the CPA areas, and this fact will be monitored through monthly site visits. During these site visits, the monitoring agent will also verify that the property owner is complying with the contract. In addition, indirect monitoring will be used for verification, by checking that the forest cover on the property, outside of the project areas, does not decrease, monitored every five years using satellite images. Monitoring allows the PoA developers to ensure that the plantings and assisted natural regeneration will develop into forests.

a) *Description of formulae and/or models used to estimate leakage (for each GHG, source, carbon pool, in units of CO_2 equivalent)*

Equations proposed by previous methodologies,[14] can be used to estimate annual emissions due to leakage.

Based on the equations proposed by AR-ACM0001[15], annual emissions due to leakage can be calculated as follows:

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

where

LK = Total GHG emissions due to leakage; (tons CO_2-e)

$LK_{ActivityDisplacement}$ = Leakage due to activity displacement; (tons CO_2-e)

$LK_{fencing}$ = Leakage due to increase in use of wood posts for fencing up to year t^*; (tons CO_2-e)

Note: in this PoA, both $LK_{ActivityDisplacement}$ and $LK_{fencing} = 0$.

[14] Equations 22, 28, 29 and 30 in approved methodology AR-AM0003, version 03

[15] Equations 99 in approved methodology AR-AM0003, version 03

Leakage due to fossil fuel combustion from vehicles is not part of AR-ACM0001. However, the developers of this PoA will control and monitor this fossil fuel use by using the following steps and equations proposed by previous methodologies.[16]

- **Step 1:** Collecting the traveled distance of different types of vehicles using different fuel types.
- **Step 2:** Determining emission factors for different types of vehicles using different fuel types. Country-specific emission factors shall be developed and used if possible. Default emission factors provided in the IPCC Guidelines and updated in the GPG 2000 may be used if there are no locally available data.
- **Step 3:** Estimating the GHG emissions using bottom-up approach described in GPG 2000 for energy sector[17].

[16] Equations 22, 28, 29 and 30 in approved methodology AR-AM0003, version 03

[17] Equations 100,101, and 102 described in approved methodology AR-AM0003, version 03.

b) *Data to be collected in order to monitor the GHG emissions by the sources, measured in units of CO2 equivalent, that are increased as a result of the implementation of the proposed CPA*

ID #	Data variable	Source of data	Data unit	Measured (c), calculated (m), or estimated (e)	Recording frequency	Proportion of data to be monitored	Archiving (electronic/ paper)	Comment
1	Plot ID	Project map	Alpha-numeric	m,e	Before project starts	100%	Electronic and paper	Each plot has a particular ID
2	Number of each vehicle type used	Monitoring of project activity	number		annually	100%	Electronic and paper	Monitoring number of each vehicle type used
3	Emission factors for road transportation	GPG2000 Guidelines, national inventory	Kg CO_2-e / litre	e	annually	100%	Electronic and paper	National or local value has the priority
4	Kilometers traveled by vehicles	Monitoring of project activity	Km	m	annually	100%	Electronic and paper	Monitor kilometers for each vehicle type and fuel type used
5	Fuel consumption per km	Local data, national data, IPCC	liter/km	e	5 years	100%	Electronic and paper	Estimated for each vehicle type and fuel type used
6	Fuel consumption for road transportation	Calculated using equation	Liter	c	annually	100%	Electronic and paper	
7	Leakage due to vehicle use for transportation	Calculated using equation	tons CO_2-e / year	e	annually	100%	Electronic and paper	This value will not be included in the project calculations, but it will be controlled and monitored by project developers.

C.5.6.7. Procedures for the periodic review of implementation of activities and measures to minimize leakage

The only source of leakage in this project is combustion of fossil fuels due to transportation, which is insignificant and not part of methodology AR-ACM0001. Even so, educational activities will be performed to inform project participants of the importance of minimizing fuel consumption in transportation activities for the benefit of the environment and for the PoA. Personal preference has a direct influence on the amount of GHGs emitted due to vehicle transportation.

Wood gathering that might occur within the CPA boundary during the growth of the planted trees is a minimal risk to this PoA and will be accounted for during monitoring of biomass stock. Cattle removal will be monitored during monthly site visits, community monitoring events, and indirectly through satellite images.

C.5.6.8. Calculation of ex-post net anthropogenic GHG removals by sinks of proposed CPA

The net anthropogenic GHG removals by sinks is the actual net GHG removals by sinks minus the baseline net GHG removals by sinks minus leakage. The following general formula, based on AR-ACM0001[18], can be used to calculate the net anthropogenic GHG removals by sinks of the CPA, in tons CO_2-e:

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

where

C_{AR} = Net anthropogenic greenhouse gas removals by sinks; (tons CO_2-e)

ΔC_{ACTUAL} = Actual net greenhouse gas removals by sinks –as described in section C.5.6.5; (tons CO_2-e)

ΔC_{BSL} = Baseline net greenhouse gas removals by sinks –as described in section C.5.2; (tons CO_2-e)

LK = Leakage –as described in section C.5.6.6; (tons CO_2-e)

Note: ΔC_{BSL} and $LK = 0$ for this PoA.

[18] Equation 39 of the AR-ACM0001, version 02

C.5.6.9. Description of the monitoring plan for a CPA

a) Measuring and estimating carbon stock changes over time

The growth of individual trees on plots shall be measured at each time interval. Diameter at breast height (DBH), commercial height, canopy height and species of each tree on the sampling plot will be recorded during each monitoring period. The carbon stock changes in the tree biomass will then be estimated using nationally developed equations pertinent to the region.

The monitoring procedure involves the following steps for all trees present in every sampling plot:

- **Step 1:** Measure and record the species, diameter at breast height (DBH, at 1.3 m above ground), commercial height and canopy height for each tree with a DBH greater than 5 cm.
- **Step 2:** Calculate aboveground carbon stock (in tons) in living biomass using the allometric equation developed and published by Carvalho & Scolforo (2008) for the combined watersheds of the Mucuri, São Mateus, Jucuruçu, and Buranhém Rivers in Minas Gerais bordering the south of Bahia State:

$$\ln(C) = -9.1076 + 2.0004 * \ln(DBH) + 0.1611 * \ln(H)$$

Where

C = Carbon stock, in tons;

DBH = Diameter at Breast Height, in cm;

H = Total Height, in m.

Sum the carbon stocks in the sample plot:

$$C_{AB\_tree,j,i,sp,t} = \sum_{l=1}^{N_{j,sp}} f_j(DBH, H) * CF_j$$

Where:

$C_{AB\_tree,j,i,sp,t}$ = Carbon stock in above-ground biomass of trees of species *j* on sample plot *sp* of stratum *i* at time *t*; (tons C)

CF_j = Carbon fraction of dry matter for species or type *j*; (tons C t^{-1} d.m.)

$f_j(DBH, H)$ = Allometric equation for species j linking diameter at breast height (DBH) and height (H) to above-ground biomass of living trees; (tons d.m. $tree^{-1}$)

i = 1, 2, 3, … M_{PS} strata in the project scenario

j = 1, 2, 3, … S_{PS} trees species in the project scenario

l = 1, 2, 3, … $N_{j,sp}$ sequence number of individual trees of species *j* in sample plot *sp*

t = 1, 2, 3, … *t* years elapsed since the start of the A/R project activity

- **Step 3:** Calculate below-ground carbon stock in living biomass:

  The below-ground biomass will be obtained from the estimate of the above-ground biomass via a root-shoot ratio (R_j). The value for (R_j) will be the IPCC GPG default value[19] of the root-shoot ratio for "primary tropical/sub-tropical moist forest;" that is, R_j = 0.22, as mentioned in Section C.5.3.1.

  The following formulas will be used:

  $$C_{BB\_tree,j,i,sp,t} = C_{AB\_tree,j,i,sp,t} * R_j$$

  where

  $C_{BB\_tree,j,i,sp,t}$ = Carbon stock in below-ground biomass of trees of species *j* in plot *sp* in stratum *i* at time *t*, (tons C)

  $C_{AB\_tree,j,i,sp,t}$ = Carbon stock in above-ground biomass of trees of species *j* in plot *sp* in stratum *i* at time *t*, (tons C)

  R_j = Root-shoot ratio for species *j* (dimensionless); IPCC default value for project species = 0.22

- **Step 4:** Calculate total carbon stock in the biomass of all trees present in the sample plot *sp* in stratum *i* at time *t*:

  $$C_{tree,i,sp,t} = \sum_{j=1}^{S_{PS}} (C_{AB\_tree,j,i,sp,t} + C_{BB\_tree,j,i,sp,t})$$

  Where:

  $C_{tree,j,i,sp,t}$ = Carbon stock trees on plot *sp* of stratum *i* at time *t*; (tons C)

  $C_{AB\_tree,j,i,sp,t}$ = Carbon stock in above-ground biomass of trees of species *j* on sample plot *sp* of stratum *i* at time *t*; (tons C)

  $C_{BB\_tree,j,i,sp,t}$ = Carbon stock in below-ground biomass of trees of species *j* in plot *sp* in stratum *i* at time *t*, (tons C)

  i = 1, 2, 3, … M_{PS} strata in the project scenario

  j = 1, 2, 3, … S_{PS} trees species in the project scenario

  l = 1, 2, 3, … $N_{j,sp}$ sequence number of individual trees of species *j* in sample plot *sp*

[19] Table 3A.1.8. Annex 3.A.1 IPCC Good Practice Guidance for Land Use, Land-Use Change, and Forestry.

t = 1, 2, 3, … t years elapsed since the start of the A/R project activity

- **Step 5:** Calculate the mean carbon stock in above and below-ground biomass for each stratum:

$$\Delta C_{AG,i,t} + \Delta C_{BG,i,t} = \frac{C_{tree,i,t2} - C_{tree,i,t1}}{T}$$

Where:

$\Delta C_{AG,i,t}$ = Annual carbon stock change in above-ground biomass of trees for stratum i; (tons C yr^{-1})

$\Delta C_{BG,i,t}$ = Annual carbon stock change in below-ground biomass of trees for stratum i; (tons C yr^{-1})

$C_{tree,i,t}$ = Carbon stock in trees in stratum i, at time t; (tons C)

T = Number of years between monitoring time $t2$ and $t1$ ($T= t2-t1$); (yr)

i = 1, 2, 3, … M_{PS} strata in the project scenario

t = 1, 2, 3, … t years elapsed since the start of the A/R project activity

b) Measuring and estimating GHG emissions by sources increased as a result of project activities

None of the possible factors considered by methodology AR-ACM0001 that may cause an increase of GHG emissions by sources within the project boundary as a result of the implementation of the A/R activity are present in this PoA. However, project developers will monitor and control the N_2O emissions caused by nitrogen fertilization practices.

Emissions of GHG due to burning fossil fuels for transportation within the project boundaries are negligible. In any case all the emissions due to burning fossil fuel for transportation will be accounted for as leakage, without considering whether the transportation happened outside (usual) or inside (rare) the project boundaries.

Equations proposed by previous methodologies,[20] can be used to estimate annual N_2O emissions caused by nitrogen fertilization.

c) Leakage

Leakage due to fossil fuel combustion from vehicles is not part of AR-ACM0001. However, the developers of this PoA will control and monitor this fossil fuel use by using the following steps and equations proposed by previous methodologies.[21]

[20] Equations 22, 28, 29 and 30 in approved methodology AR-AM0003, version 03

[21] Equations 22, 28, 29 and 30 in approved methodology AR-AM0003, version 03

- **Step 1:** Collecting the traveled distance of different types of vehicles using different fuel types.
- **Step 2:** Determining emission factors for different types of vehicles using different fuel types. Countryspecific emission factors shall be developed and used if possible. Default emission factors provided in the IPCC Guidelines and updated in the GPG 2000 may be used if there are no locally available data.
- **Step 3:** Estimating the GHG emissions using bottom-up approach described in GPG 2000 for energy sector[22].

d) Quality Control (QC) and Quality Assurance (QA) procedures applied to the monitoring process

To ensure the net anthropogenic GHG removals by sinks to be measured and monitored precisely, credibly, verifiably and transparently, a quality assurance and quality control (QA/QC) procedure will be implemented.

Reliable field measurements

To ensure the reliable field measurements,

- Standard Operating Procedures (SOPs) for each step of the field measurements, including all detail phases of the field measurements and provisions for documentation for verification purposes are proposed and they will be adjusted periodically.
- Training courses on the field data collection and data analysis will be held for persons involved in the field measurement process. The training courses will ensure that each field-team member is fully aware of all procedures and the importance of collecting data as accurately as possible. To achieve this, both classroom examination and field examination will be conducted, and only those that have passed the examination can join the team.

Verification of field data collection

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

- 20% of randomly selected plots will be re-measured by teams from each other
- 10% of randomly selected plots will be re-measured by independent qualified team.
- Key re-measurement elements include the location of plots, DBH and tree height.

[22] Equations 100,101, and 102 described in approved methodology AR-AM0003, version 03.

- The re-measurement data will be compared with the original measurement data. Any errors found will be corrected and recorded. Any errors discovered will be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error. If the difference between the re-measurement and original measurement is higher than 10%, all the sample plots will be measured again.

QA/QC for data entry and analysis

To minimize the possible errors in the process of data entry, the entry of field data will be reviewed by an independent expert team and compared with independent data to ensure that the data are realistic. Communication between all personnel involved in measuring and analyzing data will be used to resolve any apparent anomalies before the final analysis of the monitoring data is completed.

QA/QC for data maintenance and archiving

Due to the long-term nature of project activities, data storage and maintenance is very important. Data archiving will take both electronic and paper forms, and copies of all data will be provided to each project participant. All electronic data and reports will also be copied on durable media such as CDs and copies of the CDs are stored in multiple locations. The archives include:

- Copies of all original field measurement data and data analysis spreadsheet;
- Estimates of the carbon stock changes in all pools and non-CO_2 GHG and corresponding calculation spreadsheets;
- GIS products;
- Copies of the measuring and monitoring reports.

QC activity	Procedures
Check that assumptions and criteria for the selection of activity data, emission factors and other estimation parameters are documented.	• Cross-check descriptions of activity data, emission factors and other estimation parameters with information on source and sink categories and ensure that these are properly recorded and archived.
Check for transcription errors in data input and reference.	• Confirm that bibliographical data references are properly cited in the internal documentation • Cross-check a sample of input data from each source category (either measurements or parameters used in calculations) for transcription errors.

Check that emissions and removals are calculated correctly.	• Reproduce a representative sample of emission or removal calculations. • Selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy.
Check that parameter and units are correctly recorded and that appropriate conversion factors are used.	• Check that units are properly labeled in calculation sheets. • Check that units are correctly carried through from beginning to end of calculations. • Check that conversion factors are correct. • Check that temporal and spatial adjustment factors are used correctly.
Check the integrity of database files.	• Confirm that the appropriate data processing steps are correctly represented in the database. • Confirm that data relationships are correctly represented in the database. • Ensure that data fields are properly labeled and have the correct design specifications. • Ensure that adequate documentation of database and model structure and operation are archived.
Check for consistency in data between categories.	• Identify parameters (e.g., activity data, and constants) that are common to multiple categories of sources and sinks, and confirm that there is consistency in the values used for these parameters in the emissions calculations.
Check that the movement of inventory data among processing steps is correct	• Check that emission and removal data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries. • Check that emission and removal data are correctly transcribed between different intermediate products.
Check that uncertainties in emissions and removals are estimated or calculated correctly.	• Check that qualifications of individuals providing expert judgment for uncertainty estimates are appropriate. • Check that qualifications, assumptions and expert judgments are recorded. Check that calculated uncertainties are complete and calculated correctly. • If necessary, duplicate error calculations on a small sample of the probability distributions used by Monte Carlo analyses.

Undertake review of internal documentation	• Check that there is detailed internal documentation to support the estimates and enable reproduction of the emission and removal and uncertainty estimates. • Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review. • Check integrity of any data archiving arrangements of outside organizations involved in inventory preparation.
Check time series consistency.	• Check for temporal consistency in time series input data for each category of sources and sinks. • Check for consistency in the algorithm/method used for calculations throughout the time series.
Undertake completeness checks.	• Confirm that estimates are reported for all categories of sources and sinks and for all years. • Check that known data gaps that may result in incomplete emissions estimates are documented and treated in a conservative way.
Compare estimates to previous estimates.	• For each category, current inventory estimates should be compared to previous estimates, if available. If there are significant changes or departures from expected trends, recheck estimates and explain the difference.

C.6. Date of completion and name of person(s)/entity(ies) applying the baseline and monitoring methodology to the typical CPA

Date of completion of the current version of baseline study and monitoring methodology: January 31, 2008

The name of the responsible persons/entities:

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D. ENVIRONMENTAL IMPACTS OF PROGRAMME OF ACTIVITIES

D.1.1. Indicate the level at which environmental impact analysis is undertaken

Environmental impacts analyzed at PoA level.

The overall PoA structure and implementation plan has a general positive impact on environmental ecosystems. The reforestation activity, through assisted natural tree regeneration, will (a) improve the soil characteristics; (b) promote biodiversity through the creation of a biodiversity corridor between two national parks; (c) preserve the water supplies (aboveground and underground) and (d) restore the Atlantic Forest native landscape.

All project activities have been designed for very limited or no negative environmental impact. There is no burning or overall tillage for soil preparation and all operations will be conducted manually without the use of any mechanical means. The most sensitive areas, such as riparian zones, do not receive any chemical treatment either.

D.1.2. Biodiversity Impact

D.1.2.1. Current conditions

Southern Bahia in the context of the Central Corridor

The tropical forests of Southern Bahia, where the project activities will take place, are extraordinarily rich in biodiversity and endemism, even when compared to other biodiversity rich areas within the Atlantic Forest hotspot. For this reason, the region is one of the Focus Areas of the Central Corridor of the Atlantic Forest - one of the three biodiversity corridors of this *hotspot*. Covering about 12,280,000 ha in and around Southern Bahia, the State of Espírito Santo, and a small part of eastern Minas Gerais State, it constitutes one of the large-scale conservation initiatives in place in the biome.

A biodiversity corridor encompasses a network of protected areas mixed with areas of different degrees of human interference, subject to integrated management in order to expand the possibility of permanence of species, conserve ecological and evolutionary processes, and develop a regional economy based on the sustainable use of natural resources. The term “corridor” is used here as a unit of regional planning that encompasses a mosaic of landscape units, including protected areas and land expanses under different types of management and use intensity, altogether taken into account in conservation strategies.

The biodiversity corridor approach is used in order to consider environmental protection at different levels, from local to regional, trying to represent different ecosystems, manage systematically the network of protected areas, and preserve or increase the connectivity between the different areas. This approach tries to solve one of the main challenges of biodiversity conservation, especially in *hotspots*, i.e. the increasing isolation of natural habitats. Conserving biological diversity means not only preserving species, but also preserving the genetic diversity of different populations. Therefore, it is essential to preserve multiple populations of the same species. *Hotspots* face the threat of increasing probability of local extinctions driven by isolation and vulnerability to genetic or demographic stochastic events. Therefore, conservation strategies must take into account landscape dynamics, aiming to improve the interrelations between protected areas. In this context, the expansion of forest connectivity in the area becomes a central issue.

The Biodiversity Corridors Strategy is recognized by the Brazilian Federal Government, through its Ministry of the Environment (MMA) and the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), who adopt this strategy in their institutional programs. The major initiative in this field is the Ecological Corridors Project, directed at the establishment of ecological corridors in the Amazon and Atlantic Forest, as part of the Pilot Program for the Protection of Brazilian Tropical Forests - PPG-7, whose implementation is sponsored by the World Bank and G-7 countries in collaboration with the MMA, state environmental agencies, and NGOs.

In regards to its biological assets, the Central Corridor harbors more than 50% of the bird species endemic to the Atlantic Forest. It has exceptionally high bird diversity, with two new species (*Phylloscartes beckeri* and *Synallaxis whitneyi*) and a new genus (*Acrobatornis fonsecai*) recently described for the mountainous coastal cocoa-growing regions at the Southern Bahia state area. The communities of primates in Southern Bahia and in the highlands of neighbor Espírito Santo State are particularly interesting, for these are among the very few places where all six Atlantic Forest primate genera occur in altogether. Twelve primate species or 60% of the primates endemic to the Atlantic Forest occur in the region. Amphibians and reptiles also present high levels of endemism. Recently, no less than 12 new species of anurans (frogs and toads) were described. As for plants, Southern Bahia is home to numerous endemic species, including three genera of Leguminosae (*Brodriguesia*, *Arapatiella* and *Harleyodendron*), four genera of bamboo (*Atracantha*, *Anomochloa*, *Alvimia* and *Sucrea*), seven species of *Inga* (Leguminosae), and piaçava (*Attalea funifera*), a palm of great importance to the local economy. In a survey carried out in a privately owned reserve near Una, Bahia, 454 species of trees were found in a single plot of one hectare, a world record for plant species richness. Phytogeographically, the region is also unique because of the presence of several Amazonian *taxa* typically associated with the Atlantic coast.

The Project Region

The project region is thus located within a key center of endemism of the Atlantic Forest – the Bahia Center, as evinced by information on terrestrial vertebrates, forest butterflies, and plants. The region harbors the largest forest remnants within the northeast range of the Atlantic Forest biome, comprising different physiognomies such as the ombrophylous forests, *Tabuleiros* forest - a special typology of dense ombrophylous forest, *muçunungas* (seasonally flooded vegetation), mangroves and coastal *restinga* forest. It also hosts one of the most important clusters of protected areas in the Central Corridor, including four national parks — Descobrimento, Monte Pascoal, Pau-Brasil, and Abrolhos — protecting a total of nearly 50,000 hectares of forest and 90,000 hectares of marine areas. The small river basins protected by these national parks are extremely important not only to Atlantic Forest biodiversity, but to the coral reefs and other marine ecosystems in the Abrolhos Bank and the Abrolhos Marine National Park, the richest coral reef area in the South Atlantic.

What remains of the Atlantic Forest in the area is home to an important part of the biome's animal and vegetal species under threat of extinction. A large number of endemic species and species under threat of extinction inhabit the area (see Figure 18). Considering IUCN Red Lists and the National Red List, recent studies suggest the presence in the region of at least 15 threatened species of birds, eight primates, and eight species of fish (Table 7). In addition, 50 species of birds considered endemic. The region harbors many globally threatened and restricted range species, such as the robust tufted capuchin (*Cebus robustus*), the Brown howling monkey (*Alouatta guariba*), the thin-spined porcupine (*Chaetomys subspinosus*), the Red-billed curassow (*Crax blumenbachii*), the red-browed parrot (*Amazona rhodochorytha*), the Red-browed Amazon (*Amazona rhodocorytha*), the Banded cotinga (*Cotinga maculata*), the white-winged cotinga (*Xipholena atropurpurea*), the Black-fronted Piping-guan (*Pipile jacutinga*), the Hook-Billed Hummingbird (*Glaucis dohrnii*), and the band-tailed antwren (*Myrmotherula urosticta*), among others.

A B

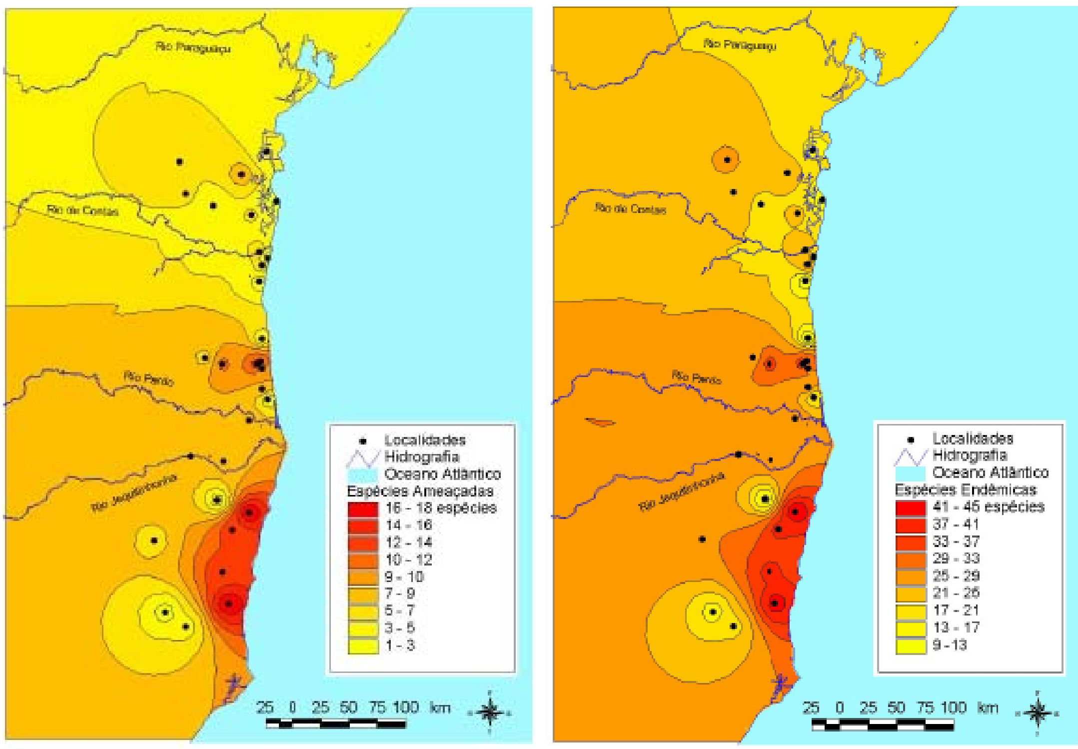

Figure 18: Geographic distribution of species of birds under threat of extinction (A) and endemic

Groups	Scientific Name	IUCN Red List (2007)	National Red List
Birds	*Amazona rhodocorytha*	EN	EN
Birds	*Amazona vinacea*	VU	VU
Birds	*Carpornis melanocephalus*	VU	VU
Birds	*Cotinga maculata*	EN	EN
Birds	*Crax blumenbachii*	EN	EN
Birds	*Glaucis dohrnii*	EN	EN

Birds	*Herpsilochmus pileatus*	VU	VU
Birds	*Leucopternis lacernulata*	VU	VU
Birds	*Myrmotherula urosticta*	VU	VU
Birds	*Onychorhynchus swainsoni*	VU	-
Birds	*Procnias nudicollis*	VU	-
Birds	*Pyrrhura cruentata*	VU	VU
Birds	*Pyrrhura leucotis*	-	VU
Birds	*Touit surda*	VU	-
Birds	*Xipholena atropurpurea*	EN	EN
Fishes	*Kalyptodoras bahiensis*	-	EN
Fishes	*Leptolebias leitaoi*	-	CR
Fishes	*Mimagoniates sylvicola*	-	VU
Fishes	*Rachoviscus graciliceps*	-	EN
Fishes	*Simpsonichthys bokermanni*	-	VU
Fishes	*Simpsonichthys myersi*	-	EN
Fishes	*Simpsonichthys perpendicularis*	-	VU
Fishes	*Simpsonichthys rosaceus*	-	VU
Mammals	*Alouatta guariba guariba*	CR	CR
Mammals	*Callicebus melanochir*	VU	VU
Mammals	*Callithrix geoffroyi*	VU	-
Mammals	*Cebus robustus*	VU	VU
Mammals	*Chaetomys subspinosus*	VU	VU
Mammals	*Leopardus pardalis*	-	VU
Mammals	*Puma concolor*	-	VU
Mammals	*Tapirus terrestris*	VU	-

Table 7: Threatened vertebrate species in the PoA region

The southern region of Bahia has many watersheds that harbor a large number of endemic fish species, many of them dependent on courses of water of good quality protected by dense forests. The removal of riparian vegetation is one of the threats to fish species of this region. Despite their importance, information on aquatic biodiversity is generally very scarce in the southern region of Bahia. Most of the published studies are on freshwater fish.

Menezes et al (2007) argue that in small streams in the south of Bahia within areas of well-preserved forests, 15 to 20 species of fish can be found, while in the streams and creeks through degraded areas, less than seven species are registered. In areas deforested to create pastures, small water courses, generally rich with species dry up during the dry season. The larger streams are more permanent, however, their composition of ichtyofauna is severely altered because these streams receive a higher intensity of light, suffer from the growth of vascular aquatic plants, and receive large inputs of sediment as a result of erosion and the movement of animals. In these streams, usually only the lambaris species (genus *Astianax*) and possibly some species of catfish (Loricariidae family or genus *Corydoras*) can persist.

Species of fish living in temporary pools of water along the margins of rivers are extremely susceptible to the removal of vegetation. Some of these species are already considered threatened with extinction. According to the Official List of Brazilian Fauna Species Threatened with Extinction (Machado et al, 2005), eight species of threatened fish species occur in the south of Bahia: *Mimagoniates sylvicola* (VU), *Rachoviscus graciliceps* (EN), *Leptolebias leitaoi* (CR); *Simpsonichthys bokermanni* (VU), *Simpsonichthys myersi* (EN), *Simpsonichthys perpendicularis* (VU), *Simpsonichthys rosaceus* (VU), *Kalyptodoras bahiensis* (EN).

D.1.2.2. Expected results of the PoA. "With the project" scenario

Net impact

The project aims to increase the chances of regional persistence of endemic and threatened species by improving the connectivity between two of the largest forest fragments remaining in the Caraíva River Basin and its environment. The effect of fragmentation on the forest structure and the remaining fauna and flora diversity has been assessed in different parts of the Atlantic Forest. It is a complex matter and the information obtained shows that fragmentation of the natural landscape affects the quality and quantity of the available habitat, and consequently the survival of species, especially those endemic and threatened. Reforestation projects contribute to forest habitat enlargement, to the buffering of forest remnants and to the improvement of forest habitat connectivity; therefore, they are essential for enhancing the resiliency of biodiversity in the area. The recuperation of connectivity between the national parks in Southern Bahia, through the Caraíva River Basin, can influence the spatial distribution of forest fragments and the permeability of the landscape matrix. The restoration efforts can also positively affect the dynamics of loss and the colonization of fauna and flora in the remainders of the Atlantic Forest, which is essential for the long-term permanence of populations of local species.

The strategy proposed in this initiative is especially valuable because the Caraíva River Basin lies in the core of the *Complexo do Descobrimento*, a set of forest zones located between Pau-Brasil National Park and Descobrimento National Park, the largest and closest fragments of protected Atlantic Forest in the Northeast of Brazil, offering a unique opportunity for re-building forest connection. These Focus Areas will receive specific actions aiming at the reduction of pressure on biodiversity, and actions directed towards the establishment of forest connectivity throughout the territory.

Water and Soils

Deforestation is the main cause of soil degradation. In the PoA area, the Caraíva River Basin in southern Bahia, deforestation goes on nowadays as a result of cattle ranching and agricultural activities. There is a lack of sustainable management of the available natural resources.

The effect of the PoA on the soils will be to improve soil stabilization with the development of native forest cover, increase root net (i.e., enlarging the minerals fixation in the sediment matrix) and promote the deposition of organic matter (e.g., litter) in the soil, enlarging the net primary production in the soil cycle and its fertility.

Although it is a widely accepted concept, the positive relationship between forests and water resources is a difficult generalization to prove, particularly in reference to the quantity (flow), quality (load of sediments and nutrients) and constancy (elimination of pulses of erratic flow). A great variety of factors in one watershed can strongly influence the final result: predominance of uses and vegetative types, including species used in forest monocultures, topography, geological and pedological aspects, rainwater cycles, and the temporal and spatial scale chosen to study the cause-effect relationship, etc. (Calder, 2002; Kiersch & Tognetti, 2002).

In the case of the areas concerned in this PoA, however, the conversion of pasture to native forest cover in the riparian areas would bring benefits more easily proven by the relationship of forests and water resources, that is, protection against erosion. Because watersheds with healthy forests export the lowest levels of sediment of any cover type (Brooks *et al.*, 1997), forests are often looked to as a means of reducing levels of downstream sediment. The high infiltration rate in natural, mixed forests reduces the incidence of surface runoff and reduces erosion transport. Also, the reduced soil water pressure and the binding effect of tree roots enhance slope stability, which tends to reduce erosion (Calder, 2002). Besides helping to stabilize stream banks, riparian forests help to reduce wastewater and chemical discharge into water bodies from upland areas and maintain cooler water temperatures, thus improving dissolved oxygen levels in water (Brooks *et al.*, 1997). These effects, in turn, are likely to bring positive effects on aquatic biodiversity.

The biological communities in riverbed environments are strongly influenced by physical and chemical characteristics of the river system along the upstream-downstream gradients (Vannote et al., 1980), such as the cycles of flow and temperature, structural characteristics of the fluvial channel and its margins, frequency and intensity of disturbances, penetration of light, etc. Thus, the state of biological communities usually reflects the environmental changes occurring in the watershed. These include, for example, the increase in nutrient load in the system, by input (point or diffuse) of nutrients, sediment input (e.g. from erosion), increased light penetration and alteration of temperature cycles in the water course (by the removal of riparian forest cover), chemical pollutants (fertilizers, pesticides), changes in flow (dams for holding water), etc. The deterioriation of the condition of the water and/or the structure of the water courses frequently leads to the loss of taxa sensitive to pollution, the domination of tolerant taxa, and the general decrease in the taxonomic richness or significant changes in the composition and functional roles of the community.

Thus, the developers of this PoA expect that the restoration of native forest cover in the vicinity of the drainage basins will have a very important role in the reconstitution of biological communities and the restoration of ecological processes typical of upstream areas. In these areas, the smaller drainage basins are typically shaded by riparian forests that, on the one hand, restricts primary productivity, but on the other hand, constitutes the main source of organic material and debris (e.g. leaf litter, branches, and riparian fruits) and of nutrients used by biological communities. Finally, in these areas the riparian forests constitute the main foundation of livelihood of an expressive diversity (and biomass) of macroinvertebrates living in the benthic zone (various organisms that live on, in, or near the substrate of bodies of water, such as aquatic insects, mollusks, annelids and crustaceans, among others) and fish.

The restoration of riparian forest cover contributes not only to the conservation of river ecosystems and their associated biodiversity, but also to the conservation of populations of animal species and terrestrial plants through the increase in available forest habitat and of the connectivity between remaining forests in the region and the restoration of key ecological processes in these environments. The role of forest remnants and riparian forest corridors in maintaining biodiversity in the local landscape should be considered essential, whether the surrounding context is predominantly pasture or eucalyptus monoculture. Many studies have shown that, while areas of native regeneration and exotic tree plantations can provide complementary conservation services, the value of primary forests remnants for biodiversity conservation is irreplaceable (Barlow et al., 2007).

The expected impact on aquatic biodiversity with the implementation of this PoA is an increase in diversity of freshwater fish, as a function of the increase in water quality of the bodies of water in the areas to be restored. Over time, the habitat-dependent species, including those threatened with extinction, will establish viable populations in the region, contributing to the regional persistence of these species.

Off-site impact

In the context of the region concerned, a likely scenario of change in soil use and occupation is the introduction of eucalyptus monocultures to substitute the pasture areas currently on the barren plateaus.

Concerning terrestrial biodiversity, the introduction of forest monocropping to substitute pasture can mean the transition to an environmentally friendlier matrix. This will be particularly effective if there are concurrent efforts to restore or protect the dense network of permanent protection areas (APP), represented by areas along the edges of local water basins, and to protect the native forest remnants.

A eucalyptus monoculture constitutes a shaded environment that, although unsuitable as forest habitat for much of the native fauna (food supply and shelter, for example), minimizes the adverse microclimatic effects typical of contact between native forest remnants and open formations such as pastures, which are inhospitable for forest fauna and flora. This contributes to the mitigation of “edge effect.”

Other negative factors of the edge effect can be equally mitigated in this scenario, such as by the reduction of forest fire risk (given the protection of forest use) and the isolation of populations of fauna averse to crossing inhospitable environments, such as open pasture areas.

On the other hand, the potential negative impacts on biodiversity with the introduction of eucalyptus are associated with the management of the planting. The application of defensive agricultural products for the control of pests can contaminate water courses and soil. The increase in transport of people and of motorized vehicles during the various phases of the planting may drive away fauna. Such impacts are local and can be easily mitigated with the adoption of appropriate techniques for management and cutting in the eucalyptus plantations.

Forest plantations have proven to provide soil protection against erosion and to reduce the damage caused by rain, wind, and solar radiation. Eucalypt also promotes soil stabilization by developing a surface layer of organic material that improves porosity and rainwater retention (Mora & Garcia, 2000).

Eucalyptus plantations established in inappropriate areas, such as land recommended for agricultural crops, steep sloping terrain, and river banks, have been known to cause interference in the quality of water and in soil conservation. With the subsequent adoption of new silviculture concepts and modern land use planning, many plantations were established in areas not recommended for agriculture, mainly because of the chemical composition of the soil (high levels of aluminum and low phosphorus). These plantations led to a significant reduction in erosion caused by strong winds. New management techniques also favor leaving a permanent cover on the soil surface by maintaining a layer of forest residues and promoting the rapid regeneration of trees after the harvest. This permanent cover protects against erosion. Using adequate soil preparation equipment and proper soil conservation techniques also brings significant gains in productivity (Mora & Garcia, 2000).

Eucalyptus trees absorb a considerable amount of nutrients from the soil, which are stored in the leaves, bark, and wood tissues. To minimize the impact of wood harvesting on the soil nutrient balance, which removes nutrients from the field, branches and bark are left at the site. Ashes from wood-fired boilers are also incorporated into the soil. The continuous balance between the the replenishment of nutrients at the site and the loss of nutrients through erosion, harvesting or burning of residues is very important, and many measures are recommended to assure nutrient recycling. These include: land-use planning with well-defined protected areas and areas to be planted; use of contour planting whenever possible; use of minimum cultivation techniques when preparing the area for planting; rational use of fertilizers; leaving all bark, leaves, and branches in the field after harvest; and using machinery and equipment that cause less negative impact on the soil (Mora & Garcia, 2000).

D.1.2.3. Monitoring of biodiversity impacts

In order to monitor the results of the reforestation activity, the project will use as indicators floral/phytosociological elements and avifauna. Both indicator groups are species rich, ecologically diversified and taxonomically well known and count with well established sampling procedures and methodological approaches to both qualitative (descriptive) and quantitative ecological studies regarding ecosystem characterization. Also, birds and plants have strong interactions – a large proportion of vascular plants in Neotropical rain forests have birds as pollinators and dispersers (Galetti *et al*., 2003) and birds are dependent on plants for the provision of a number of essential resources (e.g. feeding, nesting, shelter), and their ecological relations may provide clues on ecosystem functioning, which can be particularly useful in the conduction of the forest restoration process.

For a complete and comprehensive assessment of the state of the project areas as regards their ecological functions along the reforestation process, rather than the simple characterization of their biological condition, the communities of these indicator groups will be analyzed considering their composition (species), dominance relations (relative abundance of each *taxon*), vegetation structure (structural complexity as a proxy for associated biodiversity) and functional categories or groups (ecological roles played by different species) to which they belong.

The biodiversity monitoring, therefore, aims to provide feedback to the reforestation process, as evinced by the indicator groups and parameters, so as to eventually permit the adaptation / refinement of the reforestation actions in course. In this sense, species under threat of extinction will receive special attention, as to improve their chance to persist and thrive at the project area.

In order to facilitate and optimize resources for the monitoring operations, samplings of both indicator groups will take place at the peak of the birds' reproductive season, at representative segments of the restoration areas between September and December. Pristine areas of the neighboring Monte Pascoal National Park will be taken as control sites for the assessment of both groups, using the same monitoring methodology.

The analysis of structure and composition of the vegetation in restoration areas will include the spontaneous gathering (colonization) of native plant species, to be assessed in the same permanent sampling plots established for the monitoring of above-ground biomass stocks. Plant species spontaneously gathered along the successional process will be analyzed regarding their reproductive characteristics, taking into account their pollination systems (pollination syndromes/biological pollinator group involved), floral biology (period of anthesis, size and morphology of reproductive structures, type of reward offered to pollinators), sexual systems (monoecious, dioecious, andro-monoecious, hermafroditic, heterostily) and reproductive systems (agamospermy, self-compatible, self-incompatible, outcrossing or self-incompatible+dioecious), according to Girão *et al*. (2007) and specialized literature.

Regarding avifauna, to assist with the field assessments, previous lists of species known to potentially occur in the area will be prepared, based on the available literature, unpublished reports and museum records. Bird records will be assembled both through visual and acoustic records. The quantitative bird monitoring system will consist of the use of point count data, to document population trends and bird-habitat relationships.

Avian censuses will be conducted during the breeding seasons (September - December), with point counts conducted once per breeding season between 0600 and 1000 EST and limited to 10 min in duration. All birds detected by sight or sound within a 50-m radius will be recorded. The location of the point count stations will be evenly stratified across reforestation modality / age class and located within the middle of stands. If necessary, depending on the extension and configuration of the reforestation stands, point count stations may be clustered along transects. Additional qualitative data on species occurrence will be assembled opportunistically at the project region, outside the quantitative sampling schedule.

Data will be assembled and analyzed regarding specific composition, relative abundance and functional category (feeding guilds: insectivorous, granivorous, frugivorous, nectarivorous, omnivorous etc and foraging strata) of the bird communities.

Sampling Schedule

In the definition of a sampling schedule for monitoring biodiversity, it is important to balance the significance of the information collected with the cost of implementation. It is also important to keep in mind that the first years constitute the most important phase of the successional process. In addition, the information collected during those first years could be used, if deemed necessary, to introduce informed modifications in the planting schedule, considering that some bird species will serve as facilitators in the long forest restoration process.

Base on these considerations, the sampling schedule includes more frequent samplings during the first years and progressively more spaced afterwards.

There is an initial effort to characterize avifauna and flora in the restoration areas and the control areas inside Monte Pascoal National Park. After the initial characterization, the sampling is done exclusively in the restoration areas.

The flora characterization effort in the restoration areas will be combined with the monitoring of biomass stocks in order to optimize the use of resources.

The detailed schedule is presented below:

Year 1 – Initial characterization of avifauna and flora in restoration areas and control areas inside Monte Pascoal National Park.

Year 2 – First monitoring sampling after planting.

Year 3 – Second monitoring sampling after planting and start of bi-annual sampling.

Year 5 – Third monitoring sampling after planting.

Year 7 – Fourth monitoring sampling after planting.

Year 9 – Fifth monitoring sampling after planting and start of tri-annual sampling.

Year 12 – Sixth monitoring sampling after planting.

Year 15 – Seventh monitoring sampling after planting.

Year 20 – Eighth monitoring sampling after planting.

Year 25 – Ninth monitoring sampling after planting.

Year 30 – Tenth monitoring sampling after planting.

$R	Year 1	Year 2	Year 3	Year 5	Year 7	Year 9	Year 12	Year 15	Year 20	Year 25	Year 30	**Total**
Avifauna	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	**110,000.00**
Vegetation	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	**110,000.00**
Total	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**220,000.00**

Table 8: Expected costs for Biodiversity Monitoring over 30 years (values in Brazilian Real).

No negative impacts are considered significant by the project participants.

D.1.2.4. Monitoring of water and soils impacts

Riparian forests must be properly constructed and regularly monitored to maintain their effectiveness. One of the most important considerations is the maintenance of shallow sheet flow into and across the riparian zone. Concentrated flow paths or the accumulation of deep sediments impedes the filtering ability of riparian zones (Klapproth & Johnson, 2000).

During carbon and biodiversity monitoring events, inspectors will observe the increasing accumulation of litter in the terrain over time, which will ensure stable flow characteristics in the riparian zone and its maximum effectiveness as a pollutant filter.

E. SOCIOECONOMIC IMPACTS OF PROGRAMME OF ACTIVITIES

E.1. Level at which socioeconomic impact analysis is undertaken

Socioeconomic impacts are analyzed at PoA level. They will also be further refined at the CPA level.

E.2. Current conditions

The whole concept of the ecological corridor between Monte Pascoal National Park and Pau-Brasil National Park affects mostly the Caraíva River Basin and a small area around the Frades River just south of Pau-Brasil National Park. The area includes parts of the municipalities of Porto Seguro and Itabela.

Parts of the Caraíva River Basin are located within the Caraíva-Trancoso Environmental Protection Area and in the outskirts of Monte Pascoal and Pau Brasil National Parks. The Caraíva River meets the ocean at the Corumbau Extractivism Marine Reserve, with its southern area part of the Barra Velha Pataxó’s Indigenous Territory.

The main cities in the municipalities of Porto Seguro and Itabela are located outside the Caraíva River Basin, which includes only a few urban centers and indigenous villages. The two communities most affected by the project are the villages of Caraíva and Nova Caraíva (municipality of Porto Seguro), with a total population of 1,400. Monte Pascoal is another community that will be affected by the project, particularly by CPA#1, and it will be researched and information documented during the PoA. With each CPA added to the PoA, any new communities identified as being affected by the project will be researched accordingly.

Caraíva is one of the oldest villages in Brazil and is considered national heritage. Likely founded the same year as Porto Seguro, it was established as an advanced Jesuit post for the indoctrination of Indians. Its native population is mostly composed of indigenous descendants of the Pataxó ethnic group with strong family links to the residents of Barra Velha indigenous territory.

The recent arrival of tourism (since the 1980s), although not as strong as in neighboring Porto Seguro, Arraial d’Ajuda or Trancoso, caused enough real estate pressure to result in the creation of a new urban center, Nova Caraíva, today with a population slightly bigger than the historic village.

In the neighborhood of the project areas, within the Caraíva River Basin, the major urban center is Monte Pascoal, Itabela municipality, with 6,000 inhabitants and located 2 km from the main highway BR 101. Other urban centers in the area are Montinho (1,200 inhabitants, Itabela municipality and also close to the highway), the Indigenous villages of Barra Velha (2,400 inhabitants), Boca da Mata (1,100 inhabitants) and other smaller villages.

Outside the basin lie the city of Itabela (head of the municipality, 30,000 people), the Trancoso urban center (15,000 people, Porto Seguro municipality), and the Itaporanga and Imbiriba Indigenous villages (2,000 people combined, Porto Seguro municipality).

Both Itabela and Porto Seguro have low municipality human development indexes (HDI-M) in comparison with the Brazilian average.

Porto Seguro has an average HDI-M of 0.699 (0.651 for income HDI, 0.662 for longevity HDI, and 0.783 for educational HDI). Itabela has an average of 0.637 (0.637 for Income HDI, 0.543 for longevity HDI, and 0.717 for educational HDI).

Compared to the 5507 total Brazilian municipalities, Porto Seguro ranks in 3010th position and Itabela in 3985th position.

These low HDI indexes are reflections of the indexes in the state of Bahia, where overall HDI in 2000 was 0.688, the 22nd of the 26 states in the country. The average index for the whole country is 0.792, ranked the 63rd in the world.

By virtue of this project's demand, and in the absence of specific census data for these districts, research of primary socioeconomic data was conducted, focusing on those indicators that could suffer impacts from the projects: number of inhabitants, number of native residents, number of working people per family, family income and education. Carried out with limited resources, this research does not exclude the need for a new survey after the project's certification with more details and the inclusion of more data. This detailed survey would serve as a definitive baseline for monitoring socioeconomic impacts of the project, as presented in the monitoring plan below in Section E.5. The interviews in Caraíva and Nova Caraíva, the responsibility ofANAC and ASCBENC, were carried out by women residents from May to July 2008. The research on native residents, also the responsibility of ANAC, and on socioeconomic data of participating farms, the responsibility of Naturezabela, were carried out in October 2008.

According to data from local clinics, 155 families permanently live in Caraíva and 186 in Nova Caraíva. Ninety-two adult members of resident families were interviewed in Caraíva (59% of families) along with 147 adult family members of Nova Caraíva (79% of families). The average number of people per family is 3.7 in Caraíva and 3.5 in Nova Caraíva, which leads to a total population estimate of 1225 people in the two urban centers (580 in Caraíva and 645 in Nova Caraíva). Of these, only 295 inhabitants are native to the historic village of Caraíva, about 23% of the total population of the two districts.

All the communities include a significant percentage of families below the poverty line, defined by IBGE as those whose income per capita is lower tha 50% of the national minimum wage, or R$208 per member of the family. Also, a significant number of families in a situation of extreme poverty characterized by IBGE as those whose income per capita is lower than 25% of minimum wage, or R$104 per member of the family, as show in Table 9.

	Family Income per capita			Caraíva families nº	Caraíva families %	Nova Caraíva families nº	Nova Caraíva families %
	>	R$	830	1	1%	1	1%
	up to	R$	830	12	14%	13	9%
	up to	R$	415	44	51%	59	43%
Poverty Line	up to	R$	208	27	31%	51	37%
Extreme Poverty	up to	R$	104	3	3%	14	10%
	total			87	100%	138	100%

Table 9: Income per capita

The relatively better situation in Caraíva, with 34% of the population below the poverty line, compared to Nova Caraíva (47%), while far from comfortable, can be credited with the tourist economy, responsible for the higher number of opportunities for small businesses and workplaces, even though the majority are informal. Stark contrast exists between the neighboring communities. Also, people with high incomes exist among the local landowners and summer visitors. These strong class divisions, between natives and non-native residents, between Brazilians and foreigners, and mainly between the very rich and the very poor, generate tension that normally manifests itself through political and social conflicts, but sometimes explodes in violence.

The exposure of families and individuals to social risks is evident especially in the urban centers of Caraíva and Nova Caraíva and could be related, in its milder forms, to the precarious work conditions: low wages, informality, seasonality, lack of professional capacity. In its more acute forms, it is related to crime and the high incidence of violence, the recent incidence of thefts, murders, and armed robbery, as well as alcoholism and drug dependency, mainly crack.

Exposure to Social Risk		Caraíva	Nova Caraíva
medium risk	families	48	69
	people	180	238
high risk	famlies	5	19
	people	20	65

Table 10: Social Risk

About 30% of families in Nova Caraíva live below the extreme poverty line, the majority of these non-native residents, that is, without family connections who could cushion against social risks. The critical situation in the urban center of Nova Caraíva makes the violence there all the more visible. It is also for these reasons that the greater interest in work positions in forest restoration processes, mainly at CooPlantar, is also in Nova Caraíva. The high index of illiteracy and the low level of education reached by the adult population, shown in Table 11, are among the important obstacles to definitively overcome poverty. The number of students per family is 1.2 in Caraíva and 1.1 in Nova Caraíva.

Level of Formal Education (people interviewed)	Caraíva nº	Caraíva %	Nova Caraíva nº	Nova Caraíva %
Post-Secondary	0	0%	7	5%
High School	15	16%	26	18%
Elementary School	71	77%	100	68%
Illiterate	6	7%	14	10%
Total	92	100%	147	100%

Table 11: Formal Education

Since the research registered only the declaration of those interviewed, it is possible, if not probable, that the illiteracy index is higher than that demonsrated by the survey, as occurs in rural areas across Brazil. It is also interesting to note that, in spite of similar indices throughout the communities, where less than 25% of the population has access to secondary or higher-level education, the situation in Caraíva seems to allow economic alternatives for people of low education, probably through small tourist businesses characteristic of that village.

The small-scale tourism economy, however, is visibly affected by seasonality. Because of this, according to merchants and local service providers, income generation is concentrated within 40 days of the year and it is insufficient to sustain families during the rest of the year. This creates great difficulty for survival outside of these periods and school holidays. The size of the communities' economies can be assessed by the disposable income of resident families throughout the year.

Annual Income	Caraíva	Nova Caraíva
Average income per worker	R$ 712,34	R$ 579,40
Workers per family	1,5	1,4
Number of families	155	186
Sum of family income over 12 months	R$ 1.987.420,69	R$ 1.856.243,32

Table 12: Annual income in the communities

Local merchants said that they had noticed positive impacts on sales resulting from forest restoration activities of CooPlantar, in 2007 and 2008 (when contracts were signed with Veracel for the restoration of 207 ha of native forest). The impact of increasing the scale of forest restoration on the local economy due to this project (see Section E.4 below) could be clearly felt, and not only from a quantitative standpoint. By dealing with permanent activites throughout the year, its benefits could spread throughout the local economy, minimizing the economic effects of seasonality due to tourism, with a possible eventual benefit to existing social conflicts and the reduction of violence and crime.

E.3. Baseline projections: "Without the project" scenario

The current lack of regular job opportunities and medium-high level education for young people affects the prospects of local families, threatening the future of the local culture.

In the past, isolation and abundance of natural resources in the forests, rivers and the ocean, guaranteed the existence of local inhabitants and the survival of the traditional extractivist culture. Today, ocean and forest devastation, together with the real estate pressure brought about by tourism in a coastal region of great beauty, puts the area under a great risk of "gentrification"[23].

The displacement of some traditional families from the center of historic Caraíva to Nova Caraíva in the recent years is already a significant movement in the direction of this scenario.

In these small coastal communities the trend is the intensification and specialization of the economy based on tourism directed to the wealthy, something that has already happened in neighboring historic villages Trancoso and Arraial D'Ajuda.

The coastal area between Trancoso and Caraíva has already experienced the first luxury resorts and condominiums. In this scenario, the only alternative for the old inhabitants is to become subordinate employees of the new enterprises after selling their properties and moving to peripheral areas, or perhaps other, bigger urban centers in the area (Porto Seguro, Eunápolis, Itabela).

Two signs are already visible and perverse signals of the proletarization of the traditional communities. The first sign is the tolerance of child labor as a complement for the family income, mainly among the indigenous families specialized in selling handicraft products. The second sign is the increase of crime rates in the local communities and urban centers of Trancoso and Arraial D'Ajuda.

In rural areas, the recent trend is the replacement of cattle ranching and agricultural activities with eucalyptus plantations, especially since the recent establishment of the biggest eucalyptus pulp factory in the country, Veracel, in Eunápolis.

Mechanized silviculture, like tourism, requires qualified workers, leaving the local population with the challenge of raising their educational level, something that today can be achieved only outside of these communities. It is likely, however, that forest restoration activities in Veracel's farms provide job opportunities for the locals, but not enough to revert the risk of gentrification.

For residents and merchants in Caraíva, the tendency to substitute pastures for eucalyptus plantations on rural properties that are not owned by the region's cellulose companies can cause impacts not only on the farm workers but also on the neighboring communities. This opinion stems from occurrences of the last decade, when the first FLONIBRA[24] farms, today properties of Veracel, went through this process. This reduced the supply of jobs without qualifications in rural areas, which reduced the demand for trade in Caraíva.[25]

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23 Process of substitution of the native population due to the arrival of new enterprises and investors from the tourism and real estate sectors, increasing the price of the land, "elevating the rank" of traditional spaces and therefore expelling native peoples, and eventually converting the old inhabitants into subordinate workers of the new enterprises.

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According to these residents and merchants, the direct impact would fall on workers with low levels of schooling who are the eventual service providers on cattle and papaya farms (fence repairs, clearing pastures, etc), not residents of the rural properties. These workers would have little to no chance of being absorbed by the silviculture activities of the companies, which is almost completely based on a mechanized system of production, or by manufacturing and administrative activities, due to their low level of schooling.

If proven true, this phenomenon could be directly linked to plantations on lands of the cellulose companies themselves, since these companies do not have any other productive activity on their properties, with the exception of native forest restoration. On the other hand, the substitution of pastures with forests planted in the Monte Pascoal Pau Brasil Corridor on properties not belonging to cellulose companies has not presented these characteristics. This is because most of the time, the landowners maintain their previous economic activities, mainly ranching. This aspect may reduce, but not eliminate, the socioeconomic impacts mentioned previously.

The region's cellulose companies claim, using IBGE census data, that the rural exodus verified in the region is not significantly different from the averages of neighboring communities. In addition, they present results that actually show a positive balance in the number of jobs after the arrival of forest plantations. However, no demographic or socioeconomic studies are available to detect the small flows and impacts perceived by inhabitants of Caraíva to establish reliable information on this issue. Therefore, this should be considered a plausible hypothesis of the impacts on the supply of jobs on rural properties that opt for the implementation of forest plantations to substitute other existing productive crops, as has been the tendency recently in the Monte Pascoal Pau Brasil Corridor.

The "without the project" scenario following this trend foresees, therefore, an increase in rural unemployment and the migration of this population to the outskirts of urban centers around the Monte Pascoal Pau Brasil Corridor in the municipalities of Porto Seguro, Eunápolis, Itabela and Itamaraju. The possibility to mitigate this impact depends strongly on the social responsibility policies of the cellulose companies, to the extent that they begin to support sustainable income generating activities in the communities, such as handicraft, forest extractivism, etc. In addition, absorption and training by the outsource companies can contribute to the mitigation of the expected impacts, especially in terms of low-skilled labor for native forest restoration activities linked to environmental conditions and to the social responsibility of these companies.

The "with the project" scenario, using this trend, can contribute to the mitigation of these impacts, to the extent that the project increases jobs in forest restoration activities on rural properties not belonging to the cellulose companies. Even the issue of raising the education level can have a significant impact on cooperative activities. Aware of the legal obligation to include illiterate workers in a work cooperative (by virtue of jurisprudence of labor justice) and interested in attracting workers with extensive experience in rural services, the founders of Cooplantar, during their creation, explained their intention to direct a large part of the cooperative funds to sustain literacy courses and basic education for adults.

The possibility of permanence for the native people living with dignity in Caraíva depends on the generation of solid alternative job opportunities, on traditional inhabitants having a leading role in political and

[25] The Nova Caraíva urban center did not yet exist during the first eucalyptus plantings.

economic processes, and on finding development paths compatible with the desires of native families. These native families publicly express their will to remain in the area despite the strong pressure from the real estate market.

Both in small urban centers and rural areas, the future scenario without forest restoration projects is the disruption of social relationships in the communities, and the loss of control over traditional lands and over the evolutionary process of local history and culture.

E.4. Expected results of the PoA: “With the project” scenario

Net impact

This initiative is based on the principle that the recuperation of the Atlantic Forest will occur only if locals, traditional inhabitants, and farmers stay as actors of the reforestation activities, besides being the depositaries of projected results in the medium and long term.

In conjunction with the forest restoration activities that would build ecological corridors, the project will encourage and support the inclusion and empowering of local agents, as well as the strengthening of local organizations.

The citizens of Caraíva and Nova Caraíva are already leading actors, but rural landowners are not yet engaged in the process. This project, and especially the overall ecological corridor initiative, holds as one of its goals the inclusion of local farmers as main actors in the process of restoration and protection of the Atlantic Forest on their own properties.

The creation of job opportunities and income for communities exposed to social risks is an honest and powerful way to obtain support for environmental protection and restoration. Most of the resources obtained from the sale of carbon credits will be dedicated to the retribution of local agents involved in forest restoration and environmental and social monitoring activities. The recruitment of Cooplantar’s members for forest restoration activities and of community associations for project monitoring will be the main way of transferring income to the local people.

This option strengthens all the proposed objectives of the project, promoting the development of a production chain associated with environmental restoration, and thus reinforcing the notion that communities linked to waters and forests already have high value. This perspective reverts the logic of the recent process that assigned material value to the predation of natural resources through forest cutting and animal hunting.

A parallel fundraising effort will find complementary resources for the implementation of a continuing professional education process on the project area, giving priority to segments that value the existence of forests, such as forest restoration activities and low impact eco-tourism.

The project has as short term goals (4 years):

- The creation of 50 jobs (minimum of 25 for descendents of indigenous peoples and women) offered to cooperative members in the first 4 years of the project;
- Direct influx of R$ 3.2 million (~US$ 1.9M) for the local workers’ salaries;

- Strengthening of local community associations and capacity building for their members for planning, managing and monitoring the project;
- Expansion of eligible areas for CCB certification through the inclusion of new farmers as actors;
- Inclusion of new local agents from nearby communities in the social mobilization process for forest recovering activities focused on climate, community and biodiversity;
- Provide wide publicity/visibility to the project activities, results and generated knowledge.

Long terms goals, associated with the overarching ecological corridor initiative (10 and 30 years):

- Increase the average income of the communities involved;
- Increase the region's social capital – creation of new organizations and capacity building for their members for planning and shared management of ecological corridors;
- Raise the educational level, professional skills, and socio-environmental entrepreneurism of the local agents involved in the projects.

Risks and mitigation measures

A few potential risks for the community were identified:

1. Potential feeling of loss of authorship, authority and leadership over environmental restoration processes taking place in the region, with their place taken by organizations bigger and/or foreign to the area, and by big rural landowners.
2. Potential perception by local community organizations of loss of prestige and financial resources that would go to Cooplantar.
3. Potential feeling by inhabitants and families not directly affected by the project of being excluded from the project's benefits.

These risks will be minimized by the following mitigation plan:

1. Inclusion of organizations that co-authored the original project idea in decision and knowledge production processes, especially in activities related to the monitoring of community benefits.
2. Implementation of a project for the institutional strengthening and professionalization of the members of local organizations.
3. Generate, maximize and make explicit indirect community benefits.

Offsite impacts

The economic activities developed in the rural areas where the project will take place (mainly extensive cattle ranching and eucalyptus silviculture) do not provide many opportunities for local jobs. Other agricultural activities present in the area, such as coffee, papaya and passion fruit, are not directed towards the local market, and small family properties with subsistence agriculture will not be affected by this project.

Tourism activities, a significant provider of local jobs, will not suffer any negative impacts from the project activities. In fact, they will indirectly profit from the project due to the benefit from eco-tourism branding and activities, and from the improved international image of the region.

It is concluded, therefore, that there will not be any negative impacts outside the project areas.

The project may, however, cause negative impacts in the case of significant substitution of pasture and productive areas by new forests implemented with project resources in Legal Reserves (RL) and Permanent Preservation Areas (APP), with the eventual possibility of unemployment for the rural workers on these properties.

Data supplied by rural landowners indicate that, in the activity dominating the region, cattle-ranching, (encompassing about 80% of properties), one worker is necessary for every 300 ha of pasture, while on dairy farms this relationship is about 1 worker for every 50 ha. In this way, the most probable scenario is that the implementation of 1000 ha of forests, in cases in which they occur only in productive areas, could put four to eight jobs at risk.

The owners of the prospective farms have stated that they do not intend to eliminate any jobs due to this initiative. Even so, in the case that this occurs with the enlargement of the PoA scale, it has been proposed as a mitigation measure that Cooplantar offer jobs giving priority to these workers who became unemployed on the participating properities, if they are interested.

Capacity building

In the processes of Participatory Action Research that will be used in this project and that were used in local projects in the past, all the activities are implemented mainly by groups not considered elites, in this case native people from Caraíva and Nova Caraíva, a majority of them descendants of the Pataxó indigenous ethnic group. Local community organizations will be responsible for representing the communities in the process of participatory management of the project, without preference for the eventural direct participation of residents at the meetings to be carried out in the communities.

The participation of women in earlier projects that eventually led to this proposal was significant, if not the majority. The women are representated in supervisory roles and councils of all the local organizations, and they make up the majority of the directorship of Grupo Ambiental Naturezabela. However, there has never existed a special effort to balance the gender ratio, which has allowed the men in the organizations (with the exception of Naturezabela) to continue in the majority. While the field work has been generally directed by men of the community, the administrative work and studies of opinion and social indicators have been directed by women.

To guarantee balanced participation, all the selection processes will be by application, explicitly referring to the priority of contracting women in all the processes of research and monitoring as well as in the new seedling nursery to be built in Nova Caraíva. In the same way, 50% of the jobs offered in the capacity building courses and workshops of the project will be directed toward women.

Participatory management processes include the transfer of technology and knowledge about regional planning and shared public management instruments, focusing on the recuperation of forests in river basins and ecological corridors. Based on the expanded understanding of the regional geography, local agents will participate in future decisions regarding the selection of priority areas to be restored.

Figure 19: Community participation in project activities in the region.

Figure 21: Participation of local agents in the examination of the landscapes.

Figure 20: Participation of local agents in the design of the Monte Pascoal-Pau Brasil Corridor.

Much as earlier projects in the Caraíva River watershed, the "ecology of scholars"[26] concept will be applied, which breaks from the principle of trust and appreciation for local knowledge and promotes a productive convergence of these with modern science. In the development of these projects, the local knowledge of residents about geography, local customs, pathways, soil use, and the properties in the project area have already revealed themselves fundamental to reaching positive results in the adherence of rural properties to environmental recuperation. The local agents can demonstrate the effectiveness of their knowledge with the consolidation of the official IBGE maps (correcting names and positions of rivers on the maps), which are also fundamental in making explicit the objectives and negotiations for ceding land for restoration by the rural landowners.

The project's partner organizations will be responsible for the transfer of knowledge and capacity building for local agents through workshops, courses, and internship and exchange activities.

Instituto Cidade is responsible for promoting capacity building workshops, opinion research, and socioeconomic data surveys of beneficiaries and other interested parties, as well as land planning workshops and preparing for the prospecting of new properties. These workshops will use new participative techniques for structuring interviews to guarantee that the local demands for knowledge are incorporated in the research. Four annual workshops will be promoted, the first of which will detail the structuring of themes, while the rest will serve for updates and training of local agents.

[26] Concept created by Boaventura de Sousa Santos, See: SANTOS, B. S. *A gramática do tempo*: para uma nova cultura política. São Paulo: Cortez, 2006.

The group Ambiental Naturezabela, in conjunction with CooPlantar, will promote courses about cooperatives, with the goal of including new members, in view of the need to increase the size of the team of workers. In addition, Naturezabela will be responsible for the annual workshops to update the management of local organizations, emphasizing the administration of non-profit organizations and cooperatives.

Products	Activities Developed	Participating Organizations	Responsible Organization
Annual participative action-research workshops	Make available basic knowledge about social and opinion research	ANAC; ASCBENC; NATUREZABELA	INSTITUTO CIDADE
	Definition of themes, issues, organization of interviews, tests and corrections		
	Field interviews: data survey		
	Tabulation of data		
	Preparation and presentation of preliminary results to the beneficiaries; participative evaluation of results		
Annual monitoring reports of impacts and benefits	Preparation of final report and presentation to additional beneficiaries and interested parties	INSTITUTO CIDADE; NATUREZABELA	INSTITUTO CIDADE
Annual workshop for landscape planning and prospecting of new properties	Make available basic knowledge about landscape ecology, land planning, ecological corridors, and forest connectivity	ANAC; ASCBENC; NATUREZABELA; COOPLANTAR; IBIO	INSTITUTO CIDADE
	Study of priority pathways for connectivity		
	Definition of properties to be visited		
	Organization of the conversations with landowners, definition of responsible agents, and preparation of a work plan		
	Preparation and presentation of preliminary results to the beneficiaries; participative evaluation of results		
Annual reports of landscape design and included properties	Preparation of final report and presentation to additional beneficiaries and interested parties	INSTITUTO CIDADE; NATUREZABELA	NATUREZABELA
Annual Cooperative Workshop	Make available basic knowledge about cooperatives and their relationship to labor, tax, and social security laws	ANAC; ASCBENC; NATUREZABELA; COOPLANTAR; IINSTITUTO CIDADE; IBIO	NATUREZABELA; COOPLANTAR
	Formalization of including new cooperative members		
Annual update workshop for local organization management	Make available basic knowledge about management of non-profit organizations	ANAC; ASCBENC; NATUREZABELA; COOPLANTAR; IINSTITUTO CIDADE; IBIO	NATUREZABELA
Annual reports for strengthening of local organizations	Preparation of a final report and presentation to further beneficiaries and interested parties	INSTITUTO CIDADE; NATUREZABELA; COOPLANTAR	NATUREZABELA

Table 13: Various activities and planned products

E.5. Monitoring of socioeconomic impacts

To adequately measure impacts, collective knowledge production processes will be used during the first year of the project. These aim to establish a baseline to evaluate the qualitative and quantitative differences between the scenarios with and without the project, with the methodology used on earlier projects in this community, the participatory action-research (PAR).[27]

This method foresees the transfer of knowledge and methodological social research instruments to local agents. It guarantees their participation from the beginning of the process of defining the problem, hyptotheses, indicators, and issues to be researched. In this way, the monitoring research, transformed into an educational process, becomes an opportunity for transferring knowledge to local agents. This approach allows for the incorporation and appreciation of local knowledge in the new scientific results as opposed to the classical objectives of social research.

A participatory action-research pilot was organized for the preparation of the current project. This included preliminary surveys of basic socioeconomic data of Caraíva and Nova Caraíva and of some prospective rural properties in negotiations. In addition to the basic socioeconomic data initially suggested (such as family income and level of education), ANAC also needed information on the the number of native residents in Caraíva and Nova Caraíva. This data will be revised, detailed, and extended to the research planned during the first year of this project, which will determine the definitive baseline for monitoring impacts on the involved communities.

Once a detailed baseline is established during the first year, indicators will be monitored annually in the first five years by researchers from the local organizations that cooperatively manage the project. This period corresponds to the four years of forest restoration in the field, increased by one year for benchmarking the impact of the eventual interruption of jobs in the field, possibly manifested during the fifth year.

Further opportunities are expected from this project through the enlargement of areas available for restoration with the selling of carbon credits in the biological corridor, which would allow for continuity of the annual research in these communities and the eventual inclusion of other communities in the area. Independent of this possibility, the resources of the initial project make possible new monitoring research in years 15 and 30 of the project, to verify the medium- and long-term impacts.

The positive impacts expected from the project in the next 30 years will be monitored through three lines of indicators:

<u>Income and employment</u>

Based on the indicators and the methodology used by the Monthly Employment Research of the IBGE (Brazilian Institute of Geography and Statistics):

1. Percentage of population economically active;
2. Jobs in professional, formal, and permanent activities;

[27] About PAR, see: http://www.goshen.edu/soan/soan96p.html

3. Sectoral activities;
4. Average family income.

Social capital

1. Number of active members in local associations and cooperatives;
2. Number of local agents with a leading role in the planning and management of the project;
3. Rate of permanency of traditional families in the historic center of Caraíva village.

Education

1. Average level of education.

Opinion surveys will also be conducted in order to collect the expectations of local communities and landowners regarding:

1. Improvement of the quality of life;
2. Possibility of continuous residence in the area;
3. Job opportunities and professional development;
4. Water and forest quality in the region.

In order to obtain a good reference for future monitoring data, during the first year the project will obtain data, both qualitative and quantitative, that will set the baseline for community impacts. It will use a methodology that has been used already in these communities: Participatory Action Research[28].

After the establishment of the baseline, the indicators will be monitored by members of the local organizations involved in the project, every two years for the first four, and then every four years until the end of the crediting period, always will participation of local agents in the processes of production of knowledge.

The detailed schedule is presented below:

Year 1 – Initial characterization of social-economic situation of communities and opinion surveys about climate change, migration, conservation, and environmental recuperation.

Year 2 – First monitoring sampling.

Year 3 – Second monitoring sampling.

Year 4 – Third monitoring sampling.

Year 5 – Fourth monitoring sampling.

Year 15 – Fifth monitoring sampling.

Year 30 – Sixth monitoring sampling.

[28] http://www.goshen.edu/soan/soan96p.html

F. STAKEHOLDERS' COMMENTS

F.1. Level at which local stakeholder comments are invited and justification

This PoA is designed not only to make possible the immediate service to local demands, but also that the social, economic, cultural, and political benefits generated for the communities during the first four years of implementation endure in the project location and extend to neighboring communities during the 30 years of the project.

The contribution of about R$3.7 million over four years for the project activities, through the workers of Cooplantar, ANAC, and ASCBENC, may cause a considerable positive impact in these communities. The sum of annual family income in Caraíva and Nova Caraíva, which today reaches about R$3.8 million, could be increased by about R$925,000 per year in the first four years, an increase of 24% in the size of the communities' econonomy. In these four years, the challenge of sustaining the future of this benefit remains, through the incorporation of new properties and opportunities of forest restoration in the Monte Pascoal-Pau Brasil Corridor.

Another challenge for local sustainable development, however, cannot be resolved directly by the activities of this PoA: raising the level of formal education of the local communities. It may be expected as an indirect effect, however, that Cooplantar, in exercising its statutory functions of community support, will promote an increase in schooling for adults residing in these communities.

Immediate benefits are considered the short-term positive impacts due to the activities of this PoA:

1. Opportunities for regular jobs and and qualified formal work;
2. Increase in family income for project agents;
3. Increase in resources in the local economy of the communities;
4. Reduction of social risks for families and individuals in the communities;
5. Institutional strengthening (more resources, visibility and credibility) of partner organizations;
6. Legal and environmental compliance of the rural properties involved.

Dispersed benefits of the projects are considered to be the incidental positive impacts on the community as a whole where the project agents and other interested parties reside:

1. Increase in the quantity and quality of water in the Caraíva River and Frades River Watersheds;
2. Conservation of biodiversity;
3. Increase in personal and collective self-esteem in the organizations and involved communities;
4. Increase in social capital in the involved communities;
5. Permanence of native resident families in Caraíva and Nova Caraíva;
6. Gains in the local economy due to tourism (higher visibility in national and international media);
7. Economic alternatives for involved rural properties (certification, access to credit, etc);

8. Positive image of the properties and businesses in the region;
9. Positive image of the organizations involved;
10. Positive image of the carbon credit buyers of the project.

Three indicator categories were chosen to monitor benefits generated in the affected communities:

- **Work and income**, based on the indicators and methodology of the Monthly Employment Research from IBGE, including the communities of Caraíva, Nova Caraíva, and rural properties.

  Indicators to be researched:

  1. Average family income;
  2. Total population and economically active population in the communities and rural properties;
  3. Regular, formal jobs in the communities and rural properties;
  4. Number of unemployed in the beneficiary communities.

- **Social capital:**

  1. Number of active members in the local organizations;
  2. Number of local agents participating in the planning and management of the project;
  3. Number of new socio-environmental projects;
  4. Number of native families residing in Caraíva and Nova Caraíva.

- **Schooling, health and social risk:**

  1. Level of formal education in the families;
  2. Professional capacity building courses carried out;
  3. Number of people in school in the families;
  4. Number of cases of alcoholism, drug dependence, and depression;
  5. Number of conflicts, crimes, and violent events in the communities.

  Also, research will be carried out on the perception, opinion, and expectations of community members and rural properties about:

  1. Changes in the quality of life;
  2. Expectations for the continuation of residence in Caraíva, Nova Caraíva and rural properties;
  3. Opportunities for work and professional development;
  4. Perceived quality of water and biodiversity.

F.2. Brief description of how comments by local stakeholders have been invited and compiled

Stakeholders consulted during the project preparation included village leaders and community members through meetings with local associations and through social assessment surveys.

Local people have known and discussed a potential project like the one presented here since 2004, prompted by the perceived degradation in the quantity and quality of the waters of the Caraíva river, the major means of subsistence for many of the inhabitants of the fishing village of Caraíva.

Informal meetings and interviews were held with village leaders and residents in many of the villages involved in the project. A formal meeting about the project and the need to collect the views of the local people took place on September 27, 2007, including representatives of the major local associations: Association of the Native People of Caraíva (ANAC), Beneficent Community Association of Nova Caraíva (ASCBENC), Women's Association of Caraíva, and the Cooperative of Reforesters of Atlantic Forest of Southern Bahia (CooPlantar).

Figure 22: Public announcements of interviews for the Caraíva project

During the meeting it was decided to implement a social assessment survey with interviews conducted by two volunteers present in the meeting, Jorge Fernandes Santos, from Nova Caraíva, and Elizete dos Santos Magno Faria, from the Vila de Caraíva. In this way, interviews with local people were conducted by local people.

The social assessment survey solicited the views of 24 villagers. A few of them were targeted and the rest attended voluntarily an open invitation to provide their views and comments.

The survey was announced through event notices posted (see pictures below) in prominent and popular places. It took the form of an open desk, available for three weeks, were anyone could go to obtain further information about the project and fill out a questionnaire.

The list of interviewees included well known community leaders such as the of the above mentioned associations ANAC, ASBENC and CooPlantar, a member of the Women's Association of Caraíva, the director and several teachers of the local school, health workers, merchants, pastors of the local Evangelical Church, and local fishermen.

This allowed the analysis of levels of support at the household and community level. Interviewees were informed of key elements of the proposed project and asked to state preferences and issues of concern.

F.3. Summary of the comments received

The questionnaire filled out by the interviewees during the survey included direct questions about climate change and how it affects the region, and about the reforestation project and whether it would have a positive or negative impact on them, especially in terms of jobs and income.

The survey shows that 87% of the interviewees know what climate change is, and 70% cited specific negative effects of climate change in the region, showing their awareness on the subject.

Regarding the project, 81% had a positive opinion, while 5% was neutral and the rest said they would need more information before stating their opinion. Twenty-two out of 24 interviewees thought the project could generate jobs and income if it emphasized participation by locals.

When asked how the project could improve the area, the most popular answers were an increase in vegetation (5/24) and sustainable jobs (5/24).

F.4. Report on how due account was taken of any comments received

Given the high value placed on employment benefits, the distribution of employment will be a responsibility of Cooplantar, a local cooperative formed by members of the communities involved, which will ensure that this is done equitably.

ANNEX 1: LIST OF NATIVE SPECIES USED FOR REFORESTATION

SELECTED SPECIES FOR FILLING:

Scientific name	Common name
Acacia polyphylla	Monjoleiro
Aegiphila sellowiana Cham.	Fidalgo, tamanqueiro
Alchornea triplinervia (Spreng.) M. Arg.	Lava prato, tapiá
Apeiba tibourbou Aubl.	Pau de jangada, esponja-de-macaco
Bauhinia forficata Link	Pata de vaca
Bixa arborea Benth.	Urucum-da-mata
Croton floribundus Lund. ex Didr.	Velame, capinxigui
Croton urucurana	Sangra d'água
Enterolobium contortisiliquum	Orelha de macaco, tamboril
Guazuma ulmifolia Lam.	Mutamba, mutambo
Inga cylindrica (Vell.) Mart.	Inga feijão
Inga edulis Mart.	Ingá cipó
Inga fagifolia (L.) Wild.	Ingá mirim
Inga marginata Willd.	Inga mirim
Inga sessilis (Vell.) Mart.	Ingá ferradura
Inga sp	Brauninha
Johanesia princeps Vell.	Boleira
Luehea divaricata Mart.	Açoita cavalo
Peltophorum dubium	Canafístula
Schinus terebentifolius Raddi	Aroeirinha, pimenta-rosa
Senna multijuga	Cobi, pau-cigarra
Solanum sp.	Fumo-bravo
Trema micrantha L.	Gurindiba

SELECTED SPECIES FOR DIVERSITY:

Abarema jupunha (Willd.) Brittn & Killip	Abarema
Allophyllus edulis (St. Hill.) Radlk.	Fruta de pombo
Anacardium occidentale L.	Cajú
Anadenanthera colubrina	Angico branco
Anadenanthera peregrina	Angico vermelho
Andira anthelmia (vell.) J.F. Macbr.	Angelim amarelo
Andira fraxinifolia Benth.	Angelim da mata
Andira legalis (Vell.) Toledo	Angelim coco
Andradaea floribunda Allem.	Casca doce
Aniba firmula (Ness. & Mart.) Mez	Canela sassafrás
Annona coriacea	Araticum
Apuleia leiocarpa (Vog.) Macbr.	Jataí amarelo
Arapatiella psilophylla (Harms) Cowan	Arapati
Aspidosperma parviflorum	Pequiá marfim
Aspidosperma polyneuron	Peroba rosa
Astronium concinum Schott.	Aderne/Mucuri
Attalea funifera Mart.	Piaçava
Attalea oleifera Barb. Rodr.	Indaiá
Bactris acanthocarpa Mart.	Manê velho
Bactris bahiensis Noblick	Ouricana
Bactris ferruginea Burret.	Tucum
Bactris hirta Mart.	Tucum pequeno
Bactris horridispatha Noblick.	Tucum amarelo
Bactris setosa Mart.	Tucum bravo
Bowdichia virgilioides	Sucupira
Brosimum guianense	Conduru
Byrsonima sericea DC.	Murici
Byrsonima stipulacea A. Juss.	Murici açu

Cabralea canjerana (Vell.) Mart.	Cangerana
Caesalpinia echinata Lamark	Pau brasil
Caesalpinia ferrea Mart.	Pau ferro
Calophylum brasiliensis Camb.	Guanandi
Cariniana estrellensis (Raddi) Kuntze	Jequitibá branco
Cariniana legalis (Mart.) Kuntze	Jequitibá rosa
Carpotroche brasiliensis Endl.	Fruta de cotia
Caryocar edulis	Pequi
Casearia decandra Jacq.	Aderninho
Casearia sylvestris Sw.	Aderninho da capoeira
Cecropia glaziovi Snethalage	Embaúba roxa
Cecropia hololeuca Miq.	Embaúba prateada
Cecropia pachystachya	Embaúba folha pequena
Cedrella odorata L.	Cedro
Centrolobium microchaete	Putumuju
Centrolobium robustum	Putumuju
Centrolobium tomentosum	Putumuju
Chrysophyllum splendens Spreng.	Bapeba
Citharexylum myrianthum Cham.	Tarumã
Clarisia racemosa R. & Pav.	Oiticica
Copaifera lucens Dwyer	Óleo copaíba
Cordia magnoliifolia Cham.	Baba de boi
Cordia trichotoma	Louro Pardo
Couma rigida	Mucugê
Couratari asterotricha Prance	Imbirema
Coussapoa microcarpa	Mata pau
Cupania oblongifolia Mart.	Camboatá
Cupania vernalis Camb.	Camboatá
Cytharexyllum myrianthum Cham.	Pau viola
Dalbergia nigra Fr. All.	Jacarandá Bahia

Dialium guianensis (Aublet) Sandw.	Jitaí
Diplotropis incexis Rizz. & Matt.	Sucupira mareta
Dyctioloma incanescens DC.	Mauí
Enterolobium schomburgkii	Faveca
Eriotheca pentaphylla	Imbiruçu
Eschweilera ovata (Camb.) Miers	Biriba
Esenbeckia leiocarpa Engl.	Durão
Eugenia brasiliensis Lam.	Grumixama
Eugenia florida DC.	Murta
Eugenia leitonii Legrand	Araça pitanga
Eugenia uniflora L.	Pitanga
Euplassa cantareirae Slwmer	Carvalho berasileiro
Euterpe edulis Mart.	Palmito Jussara
Ficus enormis (Mart. Ex Miq.) Miq.	Gameleira branca
Ficus guaranitica Schodat	Gameleira branca
Ficus insipida Willd.	Gameleira branca
Gallesia integrifolia (Spreng.) harms	Pau D'alho
Genipa americana L.	Jenipapo
Genipa infudibuliformis DC.	Jenipapo do seco
Geonoma pauciflora Mart.	Ouricana
Geonoma pohliana Mart.	Ouricana de folha larga
Goniorrachis marginata Taub.	Itapicuru
Guapira opposita Vell.	Maria mole
Guarea kuntiana A. Jun.	Carrapeta
Guettarda virbuoides	Pereira
Hancornia speciosa	Mangaba
Humira balsamifera St. Hill.	Murtinha
Hyeronima alchorneoides Fr. Allem.	Licurana
Hymenaea courbaril L.	Jatobá
Jacaranda micrantha Cham.	Caroba

Jaracatia spinosa (Aubl.) A. DC.	Mamão de veado
Lafoensia glyptocarpa Koehne	Mirindiba
Lecythis lanceolata Poir.	Sapucaia mirim
Lecythis lurida (Miers) Mori	Inhaíba vermelha
Lecythis pisonis Camb.	Sapucaia
Licania kunthiana Hook.f.	Milho torrado
Luehea grandiflora M.I.Zuc.	Batinga
Machaerium scleroxylum Tulasne	Jacarandá caviúna
Machaerium aculeatum Raddi	Jacarandá sete-capotes
Machaerium nictitans (vell.) Benth.	Jacarandá bico de pato
Machaerium sp	Sete Capotes
Maclura tinctoria (l.) D. Don. Ex Steudl.	Amora
Macrolobium bifolium Pers.	Óleo comumbá
Macrosamanea pedicellaris Nielsen	Juerana branca
Manilkara bella Monach.	Parajú
Manilkara salzmanii (DC.) Lam.	Massaranduba
Melanoxylum brauna Schott.	Braúna
Metrorea nigra St. Hill.	Carrapateiro
Miconia minutiflora	Pequi de capoeira
Mimosa artemisiana	Jurema branca
Mimosa bimucronata	Maricá
Myrcia rostrata DC.	Murta folha miúda
Myrciaria sp	Jaboticaba
Myrocarpus frondosus All.	Óleo Pardo
Myroxylum peruiferum L. f.	Bálsamo
Myrsine ferruginea Spreng.	Pororoca
Myrsine umbellata Mez.	Pororoca
Nectandra menbranaceae	Louro Graveto
Nectandra rigida	Louro amarelo
Neoraputia alba	Arapoca

Ocotea odorifera (Vell.) Rohwer	Canela sassafrás
Ormosia arborea (Vell.) Harms.	Olho de cabra
Parapiptadenia pteosperma	Angico vermelho
Parkia pendula	Juerana vermelha
Peltogyne angustifolia Ducke	Roxinho
Peltogyne confertifolia	Pau roxo
Pera glabrata (Schott.) Baill.	Sete Cascas
Peschiera fuchsiaefolia Miers	Leiteira
Piptadenia paniculata Benth.	Angico
Plathypodium elegans Vogel	Jacarandá branco
Platycyanus regnelli Benth.	Pau pereira
Platymenia foliolosa Benth.	Vinhático
Polyandrococos caudescens	Buri
Pouroma guianensis Aubl.	Tararanga
Pouteria caimito (Ruiz & Pav.) Radlk.	Abiu
Pouteria grandiflora (DC.) Baehni	Bapeba
Protium heptaphyllum	Amescla
Psidium cattleianum Sabine	Araça amarelo
Psidium rufum DC.	Araça roxo
Pterigota brasiliensis Fr. All.	Pau rei
Pterocarpus violaceus Vogel	Pau sangue
Ramisia brasiliensis Oliver	Roda saia
Rheedia gardneiana Planch. et. Triana	Bacupari
Rollinia bahiensis Maas & Westre	Pinha da mata
Rollinia mucosa (Jacq.) Baill	Araticum/Conde
Rollinia mucosa (Jacquin) Baill.	Pinha da mata
Scheflera morototoni (Aubl.) B. Mg.	Matataúba
Schinus terebentifolius Raddi	Aroeirinha
Senna macranthera	Fedegoso
Simaruba amara Aubl.	Pau paraíba

Sorocea bonplandii (Baill.) Burger	Folha de serra
Sorocea guilleminiana	Amora branca
Sparattosperma leucanthum	Cinco folhas
Spondias macrocarpa Engl.	Cajazeira
Spondias venulosa Mart. exEngl.	Cajá grande
Sterculia chicha St. Hill	Arichichá
Stryphnodendron pulcherrimum	Faveiro
Styrax ferruginea	Laranjeira da mata
Swartzia euxylophora Rizz. & Matt.	Arruda
Sweetia fruticosa Spreng.	Sucupira amarela
Syagrus botryophora (Mart.) Becc.	Pati
Symphonia globulifera L.	Landirana
Tabebuia chrysotricha	Ipê tabaco
Tabebuia heptaphylla (Vell.) Toledo	Ipê roxo
Tabebuia impetiginosa	Ipê rosa
Tabebuia roseo-alba	Ipê branco
Tabebuia serratifolia (Vahl) Nichols	Ipê amarelo
Tapirira guianensis Aubl.	Pau pombo
Terminalia kuhlmannii Alwan & Stace	Araça dágua
Thyrsodium schomburgkianum	Camboatá Vermelho
Tibouchina granulosa	Quaresmeira
Toulicia oblongifolia Mart.	Cheiro de barata
Trichilia pallida Swartz	Camaçari
Trichilia silvatica DC.	Camaçari
Vataireopsis araroba	Angelim amargoso
Virola oleifera (Schott) A.C. Smith.	Bicuíba Vermelha
Vochysia sp	Cinzeiro
Xylopia brasiliensis Spreng.	Pindaíba pimenteira
Xylopia emarginata Mart.	Pindaíba
Xylopia involucrata M.C. Dias	Pindaíba

Zanthoxylum rhoifolium Lam.	Mamica de porca
Zanthoxylum riedelianum Engl.	Mamica de porca
Zeyheria tuberculosa	Ipê felpudo
Zollernia latifolia Benth.	Orelha de onça

Table 14: List of native species to be used for reforestation

ANNEX 2: CONTACT INFORMATION FOR PROJECT PARTICIPANTS

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