



# The Climate, Community and Biodiversity Alliance (CCBA) Monitoring Plan

## Restoration of degraded areas and reforestation in Cáceres and Cravo Norte, Colombia

Developed by: Yougha von Laer and Victor David Giraldo T.

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## Summary Description of the Project

The project envisions the reforestation of grasslands and degraded ex-mining lands in Colombia. The grasslands show low soil carbon content because of soil degradation and/or climate-edaphic conditions. The forestry project activity proposes to reforest ~ 1,230 ha in the area of Cáceres/Antioquia and ~ 9,640 ha in CravoNorte/Arauca.

Since 2002, Asorpar Ltd. has been reforesting land with various tree species planted in different stand models that allow for natural regeneration of flown-in seeds on the reforestation sites. Asorpar Ltd. puts emphasis on promoting mixed stands. This differentiates their approach from other commercial plantation forestry entities active in Colombia. The management of mixed stands is far more challenging than that of monocultures. This circumstance is reinforced by the fact that little is known about several tree species planted in the project, particularly with regard to their growth performance and silvicultural management. Hence, the proposed project activity offers a unique opportunity to obtain valuable knowledge about silvicultural management practices for mixed plantation forestry and suitability of native tree species for commercial plantation forestry.

The project activity is carried out in two areas: Cáceres and Cravo Norte. The previous land use in Cáceres was extensive livestock farming due to the availability of open grass vegetation caused by historic deforestation in the area. Gold mining is considered to be a feasible commercial activity in the region. The previous land use in Cravo Norte was extensive livestock farming. That activity was favoured by open grass vegetation due to climate-edaphic conditions. Similar lands, in the vicinity of Cáceres and Cravo Norte, have similar land cover and are not expected to be used for private, large-scale native species plantations as alternative land use.

The project activity is implemented by the private company Asorpar Ltd (Asesorías en Ornato Paisajismo y Reforestación, Ltda.). The legal representative is Juan Guillermo Molina, the technical manager is Luis Gonzalo Moscoso.



## Physical and biotic Characteristics of the project area

### *Hydrology*

#### Antioquia:

Several sub-basins of the Cauca River are located within the territory including the sub-basins of the rivers Man, Corrales, Tamaná and streams Nicapá, Agua Linda and La Magdalena, among others. These waterways provide water to the municipality and the counties Jardín and Puerto Belguim.

#### Arauca:

In this area the hydrographic network is extensive. The whole river system empties in the west-east direction to the Orinoco river through the rivers Arauca, Casanare, Meta, Vichada, Guaviare and Tomo, which collect water from other tributaries of importance in the department of Arauca, such as Tocaragua, Tame, Cravo Norte, Ele, Lipa, San Miguel and all Negro-Cimaruco. The El Medio and Cumare pipes, tributaries of the Casanare River, are important means of transport in the region.

### *Climate*

#### Antioquia:

This region experiences a summer season from November to March, and winter from March to November. During the wet season rainfall reaches up to 82.3% of the annual total. The predominant climate in the region is warm. The average temperature is 28°C with varying fluctuations in the range of 4°C. The most dramatic temperature variations occur in the early hours of the day, with temperatures as low as 20°C, and at noon, with temperatures as high as 32°C.

#### Arauca:

This area falls into the category of dry or seasonal grasslands. The climatic conditions alternate annually between a wet season with high availability of water in the soil (6-9 months) and another, more or less prolonged, season characterized by a deficiency or decrease in water soil substrate. The rainfall record describes a unimodal curve. The highest rainfall occurs between April and November. December and March have low rainfall because the northeast trade winds prevent the formation of clouds in the region. When it rains the intensity is high, thus, water erosion is a common degradation process in the region. The average annual precipitation is 1,532 mm. The average annual temperature is 26.1°C, the maximum value (36.4°C) occurs during March and minimum (18.6°C) during January.

### *Soil and Topography*

#### Antioquia:

The terrain is made up of terraces, some of which are dissected as well as relief with sloping areas that are flat on top. In general the soils are from two textural families: fine with clay loam or clay skeletal, which exceed 50% of particles with diameters larger than 2 mm. Layers of pebbles exist up until one meter of depth, Structural development is regular with dark colors on the surface and brown and yellowish-red in the subsoil, which may have spots in the lower horizons. The area in Cáceres (Oxic Dystropept) consists of soils located in the oldest terraces, which are located in the high and intermediate levels. These are moderately deep



and are limited by chemical factors or by the presence of gravel in the profile and are generally well drained. Fertility varies from low to very low; the reaction ranges from very strong to strongly acidic. The cation exchange capacity is between medium and low; total bases range from low to very low; the base saturation is medium to low; the organic carbon decreases regularly from high to very low; phosphorus is low. Aluminum reaches toxic levels for plants near the surface.

Arauca:

The area consists of fluvial terraces and floodplains, which extend from the foothills of the eastern cordillera of the Andes to beyond the border with the Republic of Venezuela. Soils vary from very superficial to moderately deep, limited by stoniness. Textures are loamy sand, with quartz as the dominant material, mainly in the coarse fraction. They have moderate contents of organic matter; moderate to low cation exchange capacity; and are low in calcium, magnesium, potassium and phosphorous. The active aluminum content is high and fertility ranges from low to very low. Aluminum is the main component of the soil's exchangeable acidity, being one of the main factors contributing to poor plant growth. The pH values below 5.5 reduces crop growth by the presence of toxic amounts of aluminum.

## **Fauna and Flora**

Antioquia:

The municipality of Cáceres is located in a region of Antioquia which still has a considerable area of forest in which have been registered 49 species that are endemic for the department of Antioquia, of which 24 are unique to these forests (Table 1, including a new species of the genus *Calathea*, recently discovered in the study realized by Suarez and Robles (2007). The Regional Reserve Nechí Bajo Cauca, in the jurisdiction of the municipalities of Anori, Cáceres and Zaragoza, has 32 endemic species of Antioquia, found in tropical rain forests of the jurisdiction of which twelve are exclusive of the reserve and which one (*Geonoma chlamydostachys* of the *Arecaceae* family) is endangered.

Table 1: Endemic species from the tropical rain forests from the Magdalena Medio, Bajo Cauca, Antioquia and Northeast

<b>Family</b>	<b>Scientific Name</b>
ACANTHACEAE	<i>Aphelandra antioquiensis</i>
ANNONACEAE	<i>Crematosperma antioquense</i>
ANNONACEAE	<i>Duguetia caniflora</i>
ARACEAE	<i>Anthurium anorianum</i>
ARACEAE	<i>Spathiphyllum oblongifolium</i>
ASCLEPIADACEAE	<i>Gonolobus antioquensis</i>
BOMBACACEAE	<i>Phragmotheca rubriflora</i>
BROMELIACEAE	<i>Billbergia ambigua</i>
EUPHORBIACEAE	<i>Crotón colombianus</i>
EUPHORBIACEAE	<i>Rhodothyrsus hirsutus</i>
LECYTHIDACEAE	<i>Gustavia gentryi</i>
MAGNOLIACEAE	<i>Magnolia silvioi</i>
<b>MARANTACEAE</b>	<b><i>Calathea sp nov 2</i></b>
MELASTOMATACEAE	<i>Topobea rhodantha</i>
MIMOSACEAE	<i>Calliandra antioquiae</i>
MIMOSACEAE	<i>Inga colombiana</i>
MIMOSACEAE	<i>Zygia codonocalyx</i>
MIMOSACEAE	<i>Zygia multipunctata</i>
MYRISTICACEAE	<i>Compsonaura anoriensis</i>



Family	Scientific Name
ORCHIDACEAE	<i>Coryanthes misasii</i>
ORCHIDACEAE	<i>Epidendrum cancanae</i>
PIPERACEAE	<i>Peperomia antioquiensis</i>
STERCULIACEAE	<i>Ayenia cuatrecasae</i>
STERCULIACEAE	<i>Ayenia saligna</i>

As for birds, the municipality of Caceres belongs to the subregion of Antioquia Department that counts with 355 species of birds, 93 species of non-flying mammals, 102 species of flying mammals, 34 species of amphibians and 42 species of reptiles, which seven species are endemic amphibians and 6 correspond to reptiles.

#### Arauca:

The Colombian Orinoquia region is characterized as a biogeographic region where the fauna is associated with floodplain vegetation, this type of vegetation causes that the wildlife is less diverse than the one of the tropical rain forest. However, it is important to notice that the Orinoquia's fauna is mainly determined by climatic and physical characteristics of the region, where the main component is the floodplain with vegetation trees corridors associated with rivers, lakes and swamps.

The associated fauna with Cravo Norte and the Department of Arauca is not exclusively native from Orinoquia, but corresponds to species of which more are distributed widely in the American tropics and have reached the Orinoquia region through jungle corridors bordering watercourses (riparian forests). Table 2 shows a preliminary flora inventory developed by ASORPAR LTD in the year 2009.

In addition of marsupial species (*Monodelphis orinoci*), the armadillo (*Dasyus sabanicola*) and a pair of rodents, there are few species of mammals in the Orinoquia watershed.



Table 2: Preliminary flora inventory developed by ASORPAR LTD in the year 2009.

Family	Common name	Scientific name
FABACEAE	Aceite	<i>Copaifera pubiflora</i>
ANONACEAE	Anoncillo	<i>Desconocido</i>
FLACOURTIACEAE	Barba de Tigre	<i>Desconocido</i>
CHRYSOBALANACEAE	Cagüí	<i>Hirtella sp</i>
SAPOTACEAE	Caimitillo	<i>Pouteria sp 1</i>
SAPOTACEAE	Caimo	<i>Pouteria sp 2</i>
BURSERACEA	Caraño	<i>Protium heptaphyllum</i>
RUBIACEAE	Carutillo	<i>Desconocido</i>
INDETERMINADA	Casabe	<i>Desconocido</i>
BORRAGINACEAE	Caujaro	<i>Cordia tetrandra</i>
BOMBACACEAE	Ceiba	<i>Ceiba pentandra</i>
MALPIGHIACEAE	Chaparro de Agua	<i>Indeterminada</i>
FABACEAE	Coloradito	<i>Desconocido</i>
MELASTOMATACEAE	Cometure	<i>Mouriri guianensis</i>
FABACEAE	Falso congrio	<i>Desconocido</i>
FABACEAE	Guamo	<i>Inga sp</i>
VERBENACEAE	Guatararo	<i>Vitex orinocensis</i>
CHRYSOBALANACEAE	Guayabin	<i>Desconocido</i>
POLYGONACEAE	Guayabo Negro	<i>Desconocido</i>
MYRTACEAE	Guayabo Rebalsero	<i>Myrcia sp</i>
ANACARDIACEAE	Jobo	<i>Spondias mombim</i>
LAURACEAE	Laurel	<i>Ocotea caudata</i>
MORACEAE	Matapalo	<i>Ficus sp</i>
FABACEAE	Menudito	<i>Desconocido</i>
EUPHORBIACEAE	Palo de Agua	<i>Alchornea schomburgkii</i>
INDETERMINADA	Picapico	<i>Desconocido</i>
FABACEAE	Pionio	<i>Ormosia macrocalix</i>
EUPHORBIACEAE	Reventillo	<i>Mabea trianae</i>
CLUSIACEAE	Saladillo	<i>Caraipa llanorum</i>
VOCHYSIACEAE	Salado	<i>Vochysia lehmannii</i>
FABACEAE	Saman de Agua	<i>Pithecellobium sp</i>
POLYGONACEAE	Uvero de Agua	<i>Desconocido</i>
CECROPIACEAE	Yarumo	<i>Cecropia engleriana</i>



## Climate Impact Monitoring

### Selected carbon pools and non-CO<sub>2</sub> GHGs

Monitoring entails the utilization of all information related to project development to estimate VERs at the end of an accreditation period. Monitoring activities include gathering information directly from the field and from indirect sources. Further, monitoring involves making the required calculations and estimations to assess if the project is being developed according to the PD and management plans, with the final aim to determinate GHG removals and leakage.

Continuous monitoring of the project sites (e.g., monitoring site preparation and planting) will be done. Continuous monitoring of forest management will also take place (e.g., monitoring re-planting, pruning, thinning, harvesting, and areas affected by disturbances).

Monitoring of survival rate will be done during the early stage of the forest establishment, covering the 1-3 year period after the planting activity. After year 3 it is impossible to replant because of competitive reasons. Monitoring of firebreaks in Cravo Norte will be done during the establishment and maintenance phases. Cáceres doesn't have artificial firebreaks because there are many roads and streams that function as natural firebreaks. The use of fossil fuels and fertilizer, if applied, will be monitored continuously each year.

The monitoring of the project and strata boundaries will be done before VCS verification takes place. Part of this monitoring process is further the installation of permanent sample plots to monitor trees growth according to the forest management plan. The recollected data within the sample plots will serve another main monitoring purpose: the determination and verification of GHG removals.

Monitoring of leakage will be neglected, as no significant grazing and fuel-wood collection takes place according to the assumed baseline scenario.

Monitoring will be conducted by a professional team consisting of a forestry engineer as coordinator, technical assistants and the General Manager (GM). The coordinator will report directly to the GM.

Non-CO<sub>2</sub> gases are not anticipated to account for more than 15% of the project's net climate impact, and will therefore not be monitored.

The selection of carbon pools to be monitored is explained in below in Table 1:

Table 3: Selection and justification of carbon pools

<b>C a r b o n Pools</b>	<b>Selected (answer with yes or no)</b>	<b>Justification / Explanation</b>
A b o v e - ground	Yes	Mayor carbon pool subjected to the project activity
B e l o w - ground	Yes	Mayor carbon pool subjected to the project activity
Dead wood	No	Conservative approach under applicability condition
Litter	No	Conservative approach under applicability condition
Soil organic carbon	No	Conservative approach under applicability condition





### **Description of the monitoring plan**

The following is an overview of the monitoring plan. Measurements and sampling strategies for carbon stock monitoring are based on the methodology AR-AM0005, version 3.

**Monitoring periods and frequency:** The project monitoring is expected to cover the crediting period of 30 years, starting from 2002. It is foreseen that the monitoring process will cover periods of at least five years, however, first monitoring based on the requirements of the methodology started in the second half of 2010, and therefore some data are not available for the first verification. For further verifications the indications of the monitoring plan will be strictly followed. The project participants use the VCS buffer approach to address any loss of permanence.

**Monitoring and operational procedures:** The project participants use Standard Operation Procedures (SOPs) for data collection. All measured and experimental data are documented and archived. Operational procedures under this monitoring plan are defined as those that enable measuring and estimating net carbon stock changes associated with the plantations under the project activity, as well as general monitoring of forestry operations. The project participants keep records of all activities, like changes in the actual planted areas, site preparation and forest management. Further the use of fossil fuels and fertilizer are recorded and archived.

### **Stratification and sampling**

The *ex ante* stratification is based on geophysical characteristics of the area that probably will influence the planting scheme. Then, when found appropriate, the area is divided into strata based on planting year. Strata or sub-strata are grouped into one stratum or sub-stratum if they demonstrate similar tree composition, carbon stock, carbon stock change and spatial variation. Otherwise, new strata are defined. At the point of first verification the sub-stratification has only been elaborated for Cáceres because so far only in Cáceres plots for biomass sampling have been established.

Permanent sample plots (PSPs) are used for sampling over time to measure and monitor changes of the relevant carbon stocks. Permanent plots in Cáceres have been installed prior to the first verification. GPS readings have been taken at the centre of the plot and the radius of the plot is 8.9 m (249 m<sup>2</sup>). The sample plots are used to take measurements such as tree height, DBH and species type. The plots are treated in the same way as the rest of the stratum and/or sub-stratum, for example, in terms of site preparation, weeding, pruning, thinning and harvesting. Inside the sample plots unique number tags are assigned on all trees, when trees reach a diameter of  $\geq 2.5$  cm at DBH. The unique tree ID allows keeping track on the information concerning individual trees. For all trees the DBH measurement will be taken at a height of 1.3 m.

**Location of PSP:** The plots are systematically located with a random start in each stratum and/or sub-stratum to avoid subjective choice of plot locations. The plot location has been identified with the help of a GPS device in the field. For each plot the geographic position (GPS coordinate), administrative location and compartment series number is recorded and archived.

## ***Community Impact Monitoring***

The community monitoring plan seeks to measure the direct impacts of the project through surveys of employees. The variables to be monitored have been selected based on an evaluation of potential positive and negative direct impacts of the project activity and based on the categories of the Sustainable Livelihoods Approach including social capital, financial capital, natural capital and human capital.<sup>1</sup> These variables include income, employment, local participation, professional know-how, job security and environmental factors. The surveys will be given only to employees of Asorpar Ltd. because the community benefits the project is

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<sup>1</sup> See Annex 1: Original interview format used in monitoring community (spanish)



designed to promote are based on the training, capacity building and support given to the employees working on the reforestation project. The direct community impacts of the project will manifest through the impacts on employees and thus the employees are a sufficient sample to evaluate the positive and negative impacts.

Community monitoring will be carried out in each verification year (every 5 years after the first verification) and will include a representative sample of employees in both Caceres (Antioquia) and Cravo Norte (Arauca). The surveys will be offered in both written and oral form in order to gain the feedback and insights from the many employees who do not read and write.



ITEM to be assessed	DESCRIPTION	Company:
		Name:
		Position:
		N° Cedula:
Human Capital	Monitoring of direct impacts (workers)	
	Did you gain knowledge on reforestation and sustainable management?	
	In your work with Asorpar have you used tools and equipment that you do not know?	
	If you used machines so far, have you been trained in a proper way?	
	Is there usually enough work for local people of the region in the project area?	
Financial Capital	What kind of work have you done in the past?	
	What have you done before you have been hired by Asorpar?	
	Do you work full time for Asorpar?	
	Do you work in other places?	
	Do you earn more or less money than in your previous job? More (1), Less (0)	
Social Capital	Have you received any training working with Asorpar?	
	What was the training about?	
	The training was useful?	
	Are you from this zone?	
	Do your co-workers also come from the project area?	
Natural Capital	Have you seen more species of animals and plants?	
	Have you noticed an improvement in water quality at the project site?	
	Have soil conditions improved?	
	Have you noticed any positive changes in climate?	

NOTE: The score can be 1 bad, 2 regular, 3 good, 4 very good and 5 excellent

## High Conservation Values related to community well-being

The only HCV identified in the project zone is HCV1: significant concentration of biodiversity values. Included in the community and biodiversity monitoring plan are inventories of flora and



fauna found in the project areas. Part of the project's aim is to educate local communities about how to sustainably use forest resources and provide those resources. For that reason some of the tree species chosen for use in the reforestation project have particular traditional uses. Abarco for instance is a traditional wood for construction. For this reason, as well as the fact that it is a threatened species, Abarco is being utilized in the project activity. Other tree species provide shelter and co-benefits of other species of plants and their seeds attract animals.



## ***Biodiversity Impact Monitoring***

The monitoring plan will track biodiversity variables through forest inventories and monitoring of increased forest cover. Inventories will be made in each verification year (every five years after initial verification) of both flora and fauna species. Inventories of flora will be realized in permanent samples plots which have been established as part of the carbon stock monitoring.<sup>2</sup> These inventories will be completed by qualified personnel. The project owner plans to carry out a comprehensive inventory for one permanent sample plots per stratum per farm in Caceres (Antioquia) and one sample plots per 1000 hectares per stratum in Cravo Norte (Arauca).

Measurement date		(Sub)-Strata		
Project name		Parcel ID and radio		
Evaluator		Time		
Commun Name	Scientific Name	Number of individuals		
Comment/Observations:				

Asorpar has implemented a system to register all wildlife sightings in the project areas in order to monitor the species of fauna found. The registries for wildlife sightings are maintained at each project site. Employees are trained to write down when they see an animal, describe it and, if possible, photograph it. Cameras are provided on the job site in Cravo Norte (Arauca). We consider this to be the optimal approach for monitoring of fauna since monitoring cannot be done in a limited sample plot on a particular day. This process is continuous and seeks to take advantage of the presence of workers in order to keep a constant watch for different species of fauna. These registries will be compiled by the Asorpar central office and reported every five years after the first verification.

The increase in forest cover will be monitored in order to track the increase in habitat area that supports the wide variety of biodiversity that Colombia's forests boast. The increase in forest cover will be monitored in the permanent sample plots.

<sup>2</sup> See Annex 2: Original format for the monitoring of flora (spanish)



## ***Organizational structure, data collection & storage***

### **Organizational structure, responsibilities and competencies**

The project monitoring team consists of the Technical Manager of Asorpar, Luis Gonzalo Moscoso, forestry engineers employed by Asorpar, the Field Supervisors and the Coordinators. Mr. Moscoso oversees all implementation and monitoring both administratively and in the field. Forest engineers assist Mr. Moscoso in the general implementation of the monitoring plan. The Field Supervisors, with the support of Mr. Moscoso and the forestry engineers are responsible for the data collection based on the Standard Operating Procedures established by Mr. Moscoso and his team. Mr. Moscoso and the forest engineers also perform quality checks throughout the monitoring process.

The personnel involved in the measurement of carbon pools were fully trained in field data collection and analysis by the technical manager and Swiss Carbon Value.

### **General instructions on data collection**

Collecting reliable field measurements is an important part of quality assurance (QA). Standard procedures are followed to collect reliable data to ensure credibility in the estimation of project emissions and GHG removals.

During the monitoring process, the senior personnel (Luis Gonzalo Moscoso) overseeing the project activity verify the data collected by the field personnel. The project entity implements procedures that ensure independent verification. Should there be differences in the electronic and paper based formats, these will be clarified in the terms. Particular attention shall be paid to monitoring and measurement errors. This issue are addressed through mandatory data checks and training of field personnel.

### **Data storage**

The project entity makes necessary arrangements for data entry on the registry forms. The forms are both in paper and electronic formats on Asorpar's web-page to ensure that the information is stored in multiple ways. Generally data are collected in paper formats following the SOPs during field measurement. Data are then transferred to a web-based database. The web-based database minimizes errors that easily occur due to the circulation of different versions of data sheets. Furthermore, all data that have been stored need an approval by the technical manager. This assures the compliance with internal quality procedures. An administrative manager is responsible for data transfer and storage.

### **Information (data) management system**

The project information management links the operations of the field data collection and data web-base. Further it outlines responsibilities of staff involved in collecting field data and organization of the data web-base. The supervisory staff overseeing the field data and spreadsheet database checks and verify data as required by the web-base tool. If any changes occurred in the data collected and processed during the month, the supervisory staff provides necessary clarification.

## ***Annex***

### **Annex 1: Community Impact Monitoring (spanish version)**



ITEM A EVALUAR	DESCRIPCIÓN	Empresa:
		Nombre:
		Cargo:
		Nº Cedula:
Capital humano	Monitoreo de impactos directos(empleados)	
	¿Ha adquirido conocimientos sobre reforestación y manejo sustentable?	
	¿En su trabajo con Asorpar ha usado equipos y herramientas que no conocía? ¿Cuáles?	
	¿Si ha usado maquinas, ha recibido capacitación sobre su uso correcto?	
	En el area del proyecto, normalmente hay suficiente trabajo para la gente de la región?	
Capital financiero	¿En que areas ha trabajado?	
	¿En que trabajaba antes de ser contratado por Asorpar?	
	¿Trabaja tiempo completo para Asorpar? Si/No	
	¿Trabaja en otra cosa aparte?	
	¿Ganaba mas o menos en su empleo anterior?	
Capital social	¿Ha recibido alguna capacitación en su trabajo con Asorpar?	
	¿De que se trataba?	
	¿Le pareció útil?	
	¿Usted es local del area del proyecto?	
	¿Sus compañeros de trabajo tambien pertenecen al area del proyecto?	
Capital natural	¿Ha visto mas especies de animales y plantas?	
	¿Ha observado una mejora en la calidad del agua en el sitio del proyecto?	
	¿Ha mejorado las condiciones del suelo?	
	¿Ha notado cambios favorables en el clima?	

NOTA: La calificación puede ser 1 malo, 2 regular, 3 bueno, 4 muy bueno y 5 excelente

## Annex 2: Biodiversity Impact Monitoring (Spanish version)



Fecha de medición		(Sub)-Estrato		
Nombre del proyecto		ID de la parcela de muestra y radio (m)		
Evaluador responsable		Tiempo requerido		
Nombre común	Nombre Científico	Cantidad de individuos		
Comentario/Observaciones:				