

## GROUPED PROJECT FOR COMMERCIAL FOREST PLANTATIONS INITIATIVES IN THE DEPARTMENT OF VICHADA



Document Prepared By

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## COVER PAGE

<b>Project name</b>	Grouped project for commercial forest plantations initiatives in the department of Vichada
<b>Project location</b>	The Project area for the first instance corresponds to the properties of La Pedregoza, El Toro, Canapro, El Diamante and Horizonte Verde, located at the veredas Caño Negro, Aceito, La Esmeralda and Campo Alegre, in the municipality of Puerto Carreño (Department of Vichada, Colombia).
<b>Project Proponent</b>	Fundación Natura Alexandra Ochoa Fax: (57+1) 285 4550 aochoa@natura.org.co
<b>Auditor</b>	Instituto Colombiano de Normas Técnicas. ICONTEC Tel: (571) 607 88 88 Ext.: 1381
<b>Project lifetime</b>	Project start date: June 15th 2011 Project lifetime: 30 years and 0 months. GHG accounting period: June 15, 2011, and ends on June 14, 2041.
<b>CCB History</b>	Full Validation
<b>Edition of CCB Standard Being Used</b>	Third Edition
<b>Summary of Climate, Community and Biodiversity Benefits Generated</b>	<p>The project aims to promote investments in new sustainable commercial forest plantations in Puerto Carreño's Municipality, based on changing the land use from extensive cattle ranching to sustainable forest productive systems.</p> <p>The expected climate benefits are the mitigation of climate change, increases in carbon sequestration (CO<sub>2</sub>) and regulation of waterways (which encourages adaptation to climate change impacts).</p> <p>The expected benefits on biodiversity are an increases in forest covers and enhancement of connectivity of forest ecosystems, as well as the conservation of the flora and fauna in the region.</p> <p>Locally, the benefits for the community include the direct and indirect creation of employment, technical</p>

	training in forestry tasks, and development of social and productive infrastructure, which affects the quality of life of the population.
<b>Date of Completion of this Version and Version Number:</b>	February 16th, 2016 Version 01

## GENERAL SECTION

### G1. Project Goals, Design and Long-term Viability

#### Project Overview

**G1.1.** Identify the primary Project Proponent which is responsible for the project’s design and implementation and provide contact details.

The Project Proponent is **Fundación Natura**, which is a non-profit and non-governmental organization (NGO) whose mission is to promote the conservation of biodiversity and the sustainable use of natural resources. Since its creation in 1984 researchers and scientists working for this NGO have been interested in generating spaces for environmental research, sustainable land use planning and mitigation of carbon emissions. They have also promoted tools and incentives for land conservation, policymaking, the creation of protected areas and the integrated management of watersheds.

Through the Agreement No. 02 of 2015<sup>1</sup>, Fundación Natura established an alliance with the landowners and project owners, in order to co-finance and collaborate with the development of the project design for carbon markets and eventually with other related activities. The owners and legal representatives of the first instance agreed that Fundación Natura could act as project proponent, as they move towards the establishment of a formal figure that represents them<sup>2</sup>.

#### Contact details

Organization name	Fundación Natura
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**G1.2.** Define the project’s climate, community and biodiversity objectives.

The project aims to promote investments in new sustainable commercial forest plantations in Puerto Carreño’s Municipality. The project is based on changing the land use from extensive cattle ranching

<sup>1</sup> Agreement No. 02 of 2015. Fundación Natura and Otrosi 01\_Agreement No. 02 of 2015.

<sup>2</sup> Commitment letters landowners

to sustainable forest productive systems, restoring natural forest covers, and creating a landscape of biological and productive corridors that produce financial, social and environmental services for the region. These services include the mitigation of climate change, increases in carbon sequestration (CO<sub>2</sub>), regulation of waterways (which encourages adaptation to climate change impacts), increases in forest covers and enhancement of connectivity of forest ecosystems, as well as the conservation of the flora and fauna in the region.

Locally, the benefits for the community include the direct and indirect creation of employment, technical training in forestry tasks, and development of social and productive infrastructure, which affects the quality of life of the population.

**G1.3.** Provide the location (country, sub-national jurisdictions(s)) and a brief overview of the basic physical and social parameters of the project.

The Project area for the first instance corresponds to the properties of La Pedregosa, El Toro, Canapro, El Diamante and Horizonte Verde, located at the veredas Caño Negro, Aceito, La Esmeralda and Campo Alegre, in the municipality of Puerto Carreño (Department of Vichada, Colombia).

### **Physical conditions<sup>3</sup>**

The grouped project is located in Puerto Carreño, capital of the department of Vichada. It has an area of 12,409 km<sup>2</sup> and is located at a height of 50 meters above the sea level. It borders by the North and east with the Republic of Venezuela (confluence of the Meta and Orinoco rivers respectively), by the South with the Tomo River and by the West with the municipality of La Primavera. Puerto Carreño is located between the coordinates X: 1,185,745.99 and 1,342,465.99; Y: 704,608.41 and 590,548.41 (UTM coordinates).

According to Holdridge life zones, the project zone corresponds to moist tropical forest (Bh-T in Spanish).

#### Temperature

Records of temperature provided by different climatic stations, qualify the department as presenting a warm climate, with maximum temperatures occurring in the months of February and March with ranges between 25 - 36 °C and the minimum in July varying between 23 - 31 °C. The average temperature is of about 28, 8 °C.

#### Precipitation

Annual precipitation is of about 2,366 mm, with an average monthly rainfall of 197.18 mm. In wintertime, the rains are heterogeneous (prolonged rainy periods of low intensity and periods of heavy

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<sup>3</sup> EOT Puerto Carreño. 2010a

rain locally called *chubascos*). It has a unimodal rainfall regime, with a dry season from December to April and a wet season from April to November.

- Macro rain Time: From December to March the weather is extremely dry, while from April to November is highly wet and rainy. The prevailing winds come from the east, and are especially noticeable during the day as they cause huge clouds of dust in the summers above the bare soils.
- Macro Fluvial Time: Due to the south origin, the Orinoco River begins to grow normally before the Meta River.

### Relative Humidity

Relative humidity shows a tendency toward dryness, with higher rates in the months of June, July and August; and smaller percentages of moisture in the months of February and March.

### Solar brightness

Annually, the area receives approximately 2,215 hours, a condition that favors the establishment of fruit trees and the phenological development of different plant species of the ecosystem. The months with more available sunlight per year are December to April, with a monthly maximum of 292 hours in January.

### Winds

Local winds and light breezes are present. The northeast trade winds contribute to the distribution of rainfall and to the origination of microclimates. They are presented with greater intensity during the dry season and can reach average speeds of 3.3 meters per second. Sporadically, during dry periods, strong winds can occur, causing extensive damage in the few crops present in the area.

### Soils

The soils of the Colombian high plains have a moderate to rapid drainage, with thin loamy textures and thick loamy textures. Soils are limited by their low fertility. Soils have high aluminum concentrations and low contents of organic carbon. They are classified as Ferralsols, and regularly are yellow to brown.

The soils are generally located on the banks of the tables, its relief is flat to slightly undulated, with slopes ranging from 1 to 5%. Soils present laminar hydric erosion, slight to moderate and in some sectors, they present zurales and termite mounds.

The rainy season, influences the loss of the few soluble or interchangeable elements generating high soil acidity. Soil pH is generally less than 5.0; and during dry periods, the temperatures favor the polymerization of humic substances giving as a result the hardening of horizons and the cementation coming from the dehydration of iron compounds.

Generally, the soils of Vichada's department are classified in the order of Oxisols characterized by the presence of the Oxic horizon. Soils are sandy and rocky (Guyana Shield) and present hardened

levels in the soil profile or face problems of acidity, low fertility (lowland transition to the Amazon region). The largest soils correspond to the floodplain. The region present flat reliefs, deep and well drained, and developed from clay and thin sediments. Soils are developed and present very low fertility and low contents of nitrogen, phosphorus, potassium, calcium and magnesium while present medium contents of organic carbon and high concentrations of aluminum.

### Geomorphology

The geomorphology of the Orinoco region is divided into two contrasting morpho-structural units: mountain region that corresponds to the eastern flank of the east range and the other, the Orinoqués domain represented by plains and savannahs. The high plains of the commonly named Llanos Orientales (eastern llanos) present a combined relief: 30% is occupied by the mountainous structure, and 70% is made of flat structures which are subdivided into: high plains that do not exceed 150 m and the rich alluvial plains in forests, diverse crops, livestock and local fauna.

The Altillanura (high plains), as a particular landscape, is located at the south of the Meta River and includes much of the department of Vichada. It is covered by materials accumulated by the winds, leading to landscapes formed by thin sand dunes. The relief is gentle with dissectional process. Extensive where rivers deposit sediments in a quasi-horizontally way. In the landscape of the high plains can be found small erosional valleys around the gallery forests; Broad and elongated erosional depressions of colluvial-kind, can also be found in the region, leading to estuaries.

Because the drainage is imperfect in large areas, flooding events occur during the rainy season, causing waterlogging of the soil, especially where water has a slow penetration. Each of these environments determine the vegetation and a greater or lesser development of the common species, especially trees and shrubs

Soils are geologically formed by sedimentary materials accumulated in marine and coastal environments, redeposited when emerged the Eastern range, where they have been subjected to processes of weathering and deeply washing, reducing its mineralogical composition and therefore, impoverishing soils. The altillanura (high plains) consists of alluvial Plio Pleistocenic materials, which were affected by the great fault line that runs and induces the flow of the Meta River and it has drains that go to the east and south. Therefore, the altillanura do not only belongs to the savannas of the Meta-Orinoco region, but also they integrate the transitional area of the Orinoco and the Amazon.

### Hydrography

The municipality of Puerto Carreño has different mainstreams as the Orinoco, Meta, Bitá and Tomo rivers; as well as rivers of second order such as, Juriepe, Dagua, Negro, Avion, Muco, Chiquichaque, Terecay and Murciélago; and streams of third order that drain the previously mentioned rivers.

The scheme of territorial organization of Puerto Carreño (2010)<sup>4</sup> describe the following basins:

- Orinoco's Basin

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<sup>4</sup> EOT Puerto Carreño. 2010b



The Orinoco basin is geopolitically shared by Venezuela and Colombia, with an area of 1,080,000 km<sup>2</sup>. Among the main Colombian tributaries are the Guaviare, Vichada, Tuparro, Volume, Meta and Arauca rivers, as they provide most of the Orinoco's Flow. The river network and basin surface, as well as the great length of the Orinoco River (> 2,000 km), allow distinguishing the existence of many different landscapes, landforms and biotypes along its course. These same characteristics in conjunction with the average slope (<0.01%) determine a transit time of water of significant biological importance. The average flow of the Orinoco River is calculated in 36,000 m<sup>3</sup>/s (1.1X10<sup>12</sup> m<sup>3</sup> / year) which places it as the third in the world, after the Amazon.

- Meta River

The Meta River rises in the eastern cordillera (range). Its hydrological attribute depends on sudden changes in rainfall patterns from one period to another; the strong erosion in the mountains and the limited capacity of the river for water drainage; plus the fact that it serves as a collector of many other rivers in the plains, generates an underground layer whose level is found in wells and lowlands. This river gives the Orinoco River an annual average of 4000m<sup>3</sup> / s.

It has a navigable length of 730 km between Puerto Lopez and Puerto Carreño, with a fairly straight course without many meanders and ramifications, unlike other rivers in the department. Its West-East course forms the border between Casanare and Vichada and Colombia with Venezuela.

- Tomo River

The Tomo River originates in the department of Meta. The main tributaries are the Tuparro and Tuparrito rivers and the Tuparro spout. There are other spouts such as the Urimica, Grande, Guairapali, Caviona, the Boral and the Negro. The river goes over about 606 km.

- The Bitá River

The river originates from several streams that born in the high plains, by the west of Puerto Carreño. On its way from west to east, more than 200 km can be identified as navigable, mostly by small boats.

## Ecosystems

Parra-O, C (2006)<sup>5</sup> describes de native plant cover of Puerto Carreño, according to the formed ecosystems, explained as follows:

a) Flooded Forest

These forests are located on the sides of the Orinoco, Bitá and Meta rivers, which generate seasonal flooding's, letting them submerged during the rainy season. However, there are two types of flooded forest, which differ by their position in the floodplain of rivers. The first one is located in the lower part of the floodplain and develops near the coast of the rivers, remaining flooded for several months throughout the year. The dominant species of these forests are *Campsiandra amplexicaulis*, *Simira*

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<sup>5</sup> Parra-O, C. 2006. Estudio General de la Vegetación Nativa de Puerto Carreño (Vichada, Colombia). Disponible en: <http://www.scielo.org.co/pdf/cal/v28n2/v28n2a2>

*rubescens*, *Zygia cataractae* and *Symmeria paniculata*. The second type of flooded forest is located in the highest part of the floodplain of rivers and near to the edge of the rocky outcrop where the dominant species are *Eschweilera tenuifolia* and *Licania heteromorpha* and in less proportion *Zygia cataractae*.

a) Gallery Forest

Corresponds to an uniform strip of forest vegetation with continuous canopy, with a variable width ranging from a few meters to 500 meters, located on the edge of water bodies and that are characterized by presenting a dense undergrowth forest with numerous lianas, palms and large trees. Soils are sandy and the pipes or spouts surrounding these forests are clear and dark. They are divided into flooded forests, gallery forests and well drained gallery forest.

- Well-drained gallery forest: Corresponds to the strip of gallery forest bordering with areas of well-drained savannas. It presents an underwood, more or less dense, with few palms, trees of at least 25 meters high and 90 cm in diameter, as the following species: *Siparuna guianensis*, *Astrocaryum acaule*, *Parinari sp*, *Andira surinamensis*, *Erythroxylum cf amazonicum*, *Garcinia madruno*, *Virola cf elongata*, *Matayba elegans*, *Heisteria cf acuminata*, *Olyra latifolia*, *Ouratea castaneifolia*, *Hirtella elongata*, *Pera arborea*, *Abuta grandiflora*, *Socratea exorrhiza*, *Brosimum guianense*, *B. lactescens*, *Tachigali guianensis*, *Aspidosperma excelsum*, *Licania kunthiana*, *Himatanthus articulatus*, *Jacaranda copaia*, *Licania subarachnophylla*, *Erisma uncinatum*, among others.
- Flooded gallery forest: It is located in the floodplain of the streams and rivers that remain flooded in the Orinoco region for more than 6 months. Inside the Pedregosa reserve, the most representative forest is the Bitá Gallery forest and the most common species of this ecosystem are: *Ocotea cymbarum*, *Licania mollis*, *Licania apetala*, *Mouriri acutifolia*, *Campsiandra implexicaulis*, *Duroia micrantha*, *Zygia cf inequalis*, *Leopoldinia pulchra*, *Virola surinamensis*, *Parahancornia oblonga*, *Xylopia emarginata*, *Bactris brongniartii*, *Astrocaryum jauari*, *Tachigali sp*, *Simaba orinocense*, *Acosmium nitens*, *Buchenavia viridiflora*, *Tabebuia barbata*, *Maclobium limbatum*, *Maclobium multijugum*, *Vochysia obscura*, *Miconia aplostachya*, *Maquira coriacea*, *Quiina macrophylla*, *Copaifera pubiflora*, *Inga sp*, *Byrsonima japurensis*, *Mabea nitida*, *Licania apetala*, *Garcinia madruno*, *Scleria sp*, among others.

b) Savannas

They are characterized by presenting a flat to undulated relief, with sandy loamy soils, with Eolic influence and can be separated from very well-drained soils and wet soils to slightly flooded. Around Puerto Carreño are two types of savannas whose physiognomy is mainly determined by the flooding regime to which they are subjected. Within these two types can be found the following types:

Open Savannas: They are found mainly by the west of the Cerro El Bitá (small mountain). The herbaceous component dominates in these savannas and it has numerous species of grasses, as the *Axonopus anceps*, *Axonopus fissifolius* and *Hyparrehnia rufa*. The shrub component is scarce and is represented by *Mimosa microcephala* that grows isolated between the herbaceous matrixes. The presence of trees is almost null, showing only some individuals of the *American Curatella* that grows scattered into the bush.

Wooded savannah: It borders the gallery forest and due to its topographic position, remains flooded during the rainy season longer than the open savannas. Therefore, besides the herbaceous component dominated by grasses, it develops a dense shrub component in the limits of the gallery forest (scattered in the savannah) dominated by *Mimosa microcephala* and *Tibouchina spruceana*. In addition, it presents a greater quantity of tree species (and larger) than the open savannah, where the common species are *Caraipa llanorum* and to a lesser extent *Vochysia venezuelana* and *Mabea trianae*.

c) *Dwarf trees*

It is a well-drained savanna ecosystem, covered by grasses and dicotyledonous forbs, but with predominance of tree and shrub species, such as *Curatella Americana* and *Byrsonima crassifolia*.

d) *Morichales and Saladillales*

They are almost pure or mixed associations with predominance of *Mauritia flexuosa* present in moist or phreatic soils, with organic and acid soils. Morichales are dominated by species such as *Cecropia Metensis*, *Mauritia flexuosa*, *Parahancornia oblonga*, *Xylopia emarginata*, *Xylopia plowmanii*, *Viola surinamensis*, *Socratea exorrhiza*, *Calophyllum brasiliensis*, among others. These morichales are located at the headwaters of the gallery forests.

The saladillal is an association of *Caraipa llanorum*, mainly with other herbaceous species and some bushes, which grow on slightly flooded soils in the Orinoquia platform. The most important species that are associated with Saladillales: *Eriocaulon humboldtii*, *Syngonanthus caulescens*, *Limnosipanea palustris*, *Acisanthera uniflora*, *Byrsonima aff coccolobifolia*, *Chaunochiton angustifolium*, *Mandevilla scabra*, *Eriosema simplicifolium*, *Crotalaria sagitalis*, *Ipomoea schomburgkii*, *Curtia tenuifolia*, *Hyptis conferta*, *Ocotea sanariapensis*, *Cuphea odonelli*, *Rhynchanthera grandiflora*, *Pterogastra minor*, *Tibouchina aspera*, *Sauvagesia erecta*, *Andropogon virgatus*, *Panicum caricoides*, *Sacciolepis angustissima*, *Limnosipanea spruceana*, *Xyris savannarum*, *Poteranthera pusilla*, among others.

## Reserve areas

**Reserva Biósfera de Tuparro (RBT)** was declared in 1982, in recognition of its potential for conservation, research, sustainable development and binational coordination.

The reserve is located in jurisdiction of the municipalities of Cumaribo, La Primavera and Puerto Carreño (Vichada). The RBT has an area of 918,000 hectares and has the only protected area that maintains a nationwide sample of ecosystems of the eastern plains of Colombia<sup>6</sup>.

**El Parque Nacional Natural (PNN) Tuparro** is a public protected area that belongs to the national system. It is located in the municipality of Puerto Carreño (Figure 1), covering an area of 548,000 hectares that was created to preserve the flora, fauna, natural scenic beauty and complex geomorphological manifestations with scientific, cultural, educational, creative and aesthetic

<sup>6</sup> www.omacha.org

purposes. Vegetation is composed by natural savannas that cover 75% of the protected area, gallery forests, high plains forests, morichales and several communities of granite outcrops.

In addition, it is important to highlight the existence of two reserves of civil society within the RBT, which are the **Reserva Natural Bojanawi** and the **Reserva Natural Ventanas**<sup>7</sup>.



Figure 1. Location of Reserva de Biósfera El Tuparro  
Source: Fundación Omacha

## Social conditions

### Population

According to DANE (2005), Puerto Carreño has a population of 13,288 inhabitants, of which approximately 77% is located in urban areas, and the remaining in rural areas of the municipality. Of the total population, 50.5% are men and 49.5% women (Figure 2) and their distribution presents a pyramidal population structure (Figure 3). In addition, 78.3% of households have electricity connection and 70.1% have aqueduct.

<sup>7</sup> Gómez-Camelo, I. 2011. Reserva de Biósfera El Tuparro: un reto para la conservación de la Orinoquía colombiana. Disponible en: <http://revistas.javeriana.edu.co/index.php/ambienteydesarrollo/article/view/3167/2409>

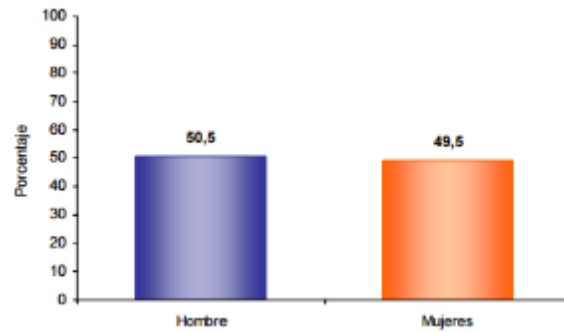


Figure 2. Population by sex in Puerto Carreño.

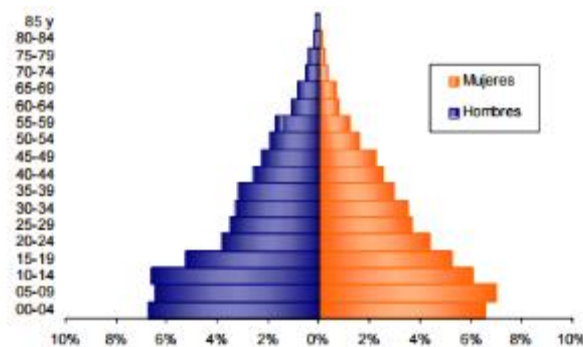


Figure 3. Population structure by sex and age group

37.5% of the resident population in Puerto Carreño, has reached the basic primary level and 28.9% the secondary; 4.3% has reached the professional level and 1.1% had undergone specialization, masters or doctorate programs. The resident population with no education is equivalent to 14.2%. In addition, 23.8% of the population living in Puerto Carreño recognizes itself as Indigenous peoples.

Among the indicators of life quality, life expectancy at birth for these areas vary between 22 and 25 years with respect to the country, ranking among the 60.4 years for the municipal head and 55.5 years for rural areas: 69.8 and 67.6 vs. years respectively are the national averages.

According to DANE, the 45.35% of the population of Puerto Carreño has Unsatisfied Basic Needs (IBN), while a 54.35% live in extreme poverty.

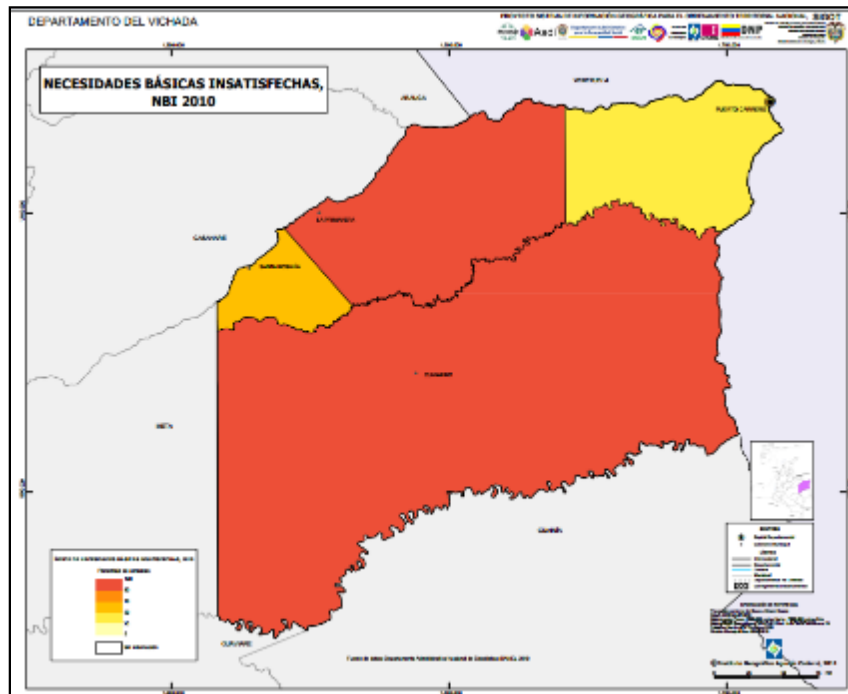


Figure 4. Unsatisfied Basic Needs (2010) in Puerto Carreño.

Collective held lands (Indigenous reservations)

The Vichada's department presents indigenous reserves (Figure 5), distributed in the project area as follows: Spout Caño Dagua, Spout Hormiga, Spout Guaripa, Cachicamo, Bachaco, Guacamaya Maipore and indigenous settlements: The Mayera and Puerto Colombia.

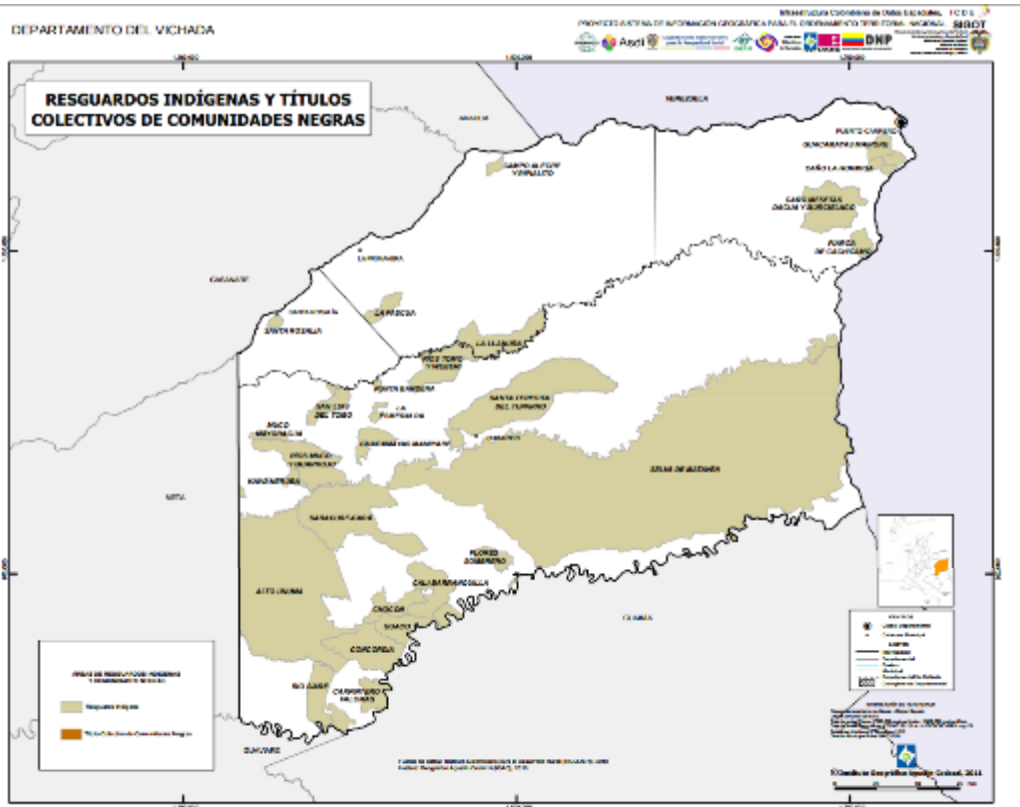


Figure 5. Indigenous reservations in the Department of Vichada. Source: SIGOT<sup>8</sup>.

Furthermore, regarding to the border area of Colombia, the project area has 16.1% (Table 1) of the total indigenous population. The Sikuani are the predominant ethnic group, followed by the Piaroa. It also holds 45% of the half-caste population and 16.1% of African descents in the border area of Vichada (Table 2).

Table 1. Indigenous Population, Puerto Carreño, La Primavera y Cumaribo – Vichada, 2010.

Municipality	Indigenous Population	%
Puerto Carreño	2,753	16.01
La Primavera	519	3.4
Cumaribo	13,778	80.8
<b>Total</b>	<b>17,050</b>	<b>100</b>

Source: Analysis of the health situation of borders (ASIS) Vichada (Puerto Carreño, La Primavera and Cumaribo)<sup>9</sup>.

<sup>8</sup> Geographic Information System for land planning. SIGOT. Available at [http://sigotn.igac.gov.co/sigotn/EXPEDIENTE/PDF/Vichada\\_Resguardos\\_Negras\\_V2\\_2012\\_01\\_18.pdf](http://sigotn.igac.gov.co/sigotn/EXPEDIENTE/PDF/Vichada_Resguardos_Negras_V2_2012_01_18.pdf)

<sup>9</sup> Acevedo, J. 2012. Analysis of the health situation of borders (ASIS) Vichada (Puerto Carreño, La Primavera and Cumaribo) Available at: <http://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/VS/ED/PSP/ASIS%20Vichada.pdf>



Table 2. Racial composition, Puerto Carreño, La Primavera and Cumaribo – Vichada

Municipality	Mixed-race (mestizos)	%	Afro-descendant	%
Puerto Carreño	8,603	45	1,522	16.1
La Primavera	2,534	13.3	2,948	30.6
Cumaribo	7,962	14.2	5,143	53.3
<b>Total</b>	<b>19,099</b>	<b>100</b>	<b>9,643</b>	<b>100</b>

Fuente: Análisis de la situación de salud de fronteras (ASIS) Vichada (Puerto Carreño, La Primavera y Cumaribo)<sup>10</sup>.

The municipal health plan of Puerto Carreño (2008)<sup>11</sup> states that the living conditions of the indigenous population is affected by the few job opportunities with low incomes, which does not allow them to access the basic elements to sustain and improve their quality of life.

The municipality of Puerto Carreño within its priority actions has classified the following groups as vulnerable population groups: displaced people, the disabled, single mothers, the elderly, indigenous peoples, children and adolescents. Special emphasis is given to indigenous communities for being a large group (11.25% of the municipality's population and 4.8% compared to the population of the department), where the loss of cultural identity is perceived. Their habits, customs and traditions area being lost due to the displacement of their reserves to urban areas in search of basic needs such as food, clothing, housing and basic sanitation (Municipality of Puerto Carreño, 2012<sup>12</sup>). By 2010, the percentage of unsatisfied basic needs was 45.6%.

#### Displaced Population

The municipality of Puerto Carreño is characterized as a receiving municipality of displaced population, with 2,694 people by 2012 who conform 721 families.

#### Transport infrastructure.

The population of the municipality, indigenous communities or clusters of settlers are located in remote farms, with roads that are in poor condition mainly passable in summer. These conditions qualify them as semi grouped rural communities and rural dispersed populations.

The primary road infrastructure corresponds to the Juriepe - Puerto Carreño stretch, with a total length of 97 km of which only 14 km are unpaved. Regarding the secondary network, it covers 2,438 km of which 1,563 km belong to the department of Vichada. Only 25 km of the previously mentioned network, have pavement. Although there are not detailed inventories of the tertiary network, according

<sup>10</sup> Acevedo, J. 2012. Análisis de la situación de salud de fronteras (ASIS) Vichada (Puerto Carreño, La Primavera y Cumaribo. Disponible en:

<http://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/VS/ED/PSP/ASIS%20Vichada.pdf>

<sup>11</sup> Plan de salud pública. 2008. Plan municipal de salud pública de Puerto Carreño 2.008 – 2.011.

<sup>12</sup> Municipio de Puerto Carreño. 2012. Plan de Desarrollo Municipal 2012-2015.



to the estimate of the National Roads Institute – (Instituto Nacional de Vías – INVÍAS), there are 1,463 km in Vichada. (Conpes, 2014<sup>13</sup>). The maintenance of these kilometers of track is done slowly due to low availability of resources of the municipality, and the lack of machinery.

In summer the trail has good conditions for the passage of vehicles, allowing the transit of the bus service from Villavicencio to Puerto Carreño. The trading activity of the regional population and regional supply generates a significant flow of heavy vehicles and passengers, through the roads of integration with the Andean region. In winter predominates carrying capacity of rivers, but there is still lack of ground transportation from their docks, that allows continuous and assured marketing. The vehicle operating costs are high due to the poor conditions of changes and lengthy travel times, which do not allow returns for producers but only in a few products<sup>14</sup>.

Fluvial transport is an alternative in the winter time, however, there are deficiencies in the port infrastructure. The commercial and administrative relationship with the towns of the region is especially done throughout the Meta River.

**G1.4. Define the boundaries of the Project Area where project activities aim to generate net climate benefits and the Project Zone where project activities are implemented.**

The Project area for the first instance, corresponds to the properties of La Pedregoza, El Toro, Canapro, El Diamante and Horizonte Verde, located at the veredas Caño Negro, Aceito, La Esperanza and Campo Alegre, in the of Puerto Carreño (see Project Boundary folder).

Table 3. Geodetic coordinates of the central point, within the nucleus.

Nucleus	Farm	Coordinate X	Coordinate Y
Canapro	Bitá	1,040,338.61	1,172,503.33
	Caño Negro	1,033,726.78	1,145,425.19
El Toro	La Esperanza	1,004,503.46	1,150,573.95
	Las Maravillas	1,003,557.44	1,154,285.04
	El Toro 1	978,189.56	1,171,384.59
	El Toro Sur	978,216.79	1,168,405.35
La Pedregoza	La Pedregoza	1,038,893.26	1,163,248.50
El Diamante	El Diamante	992,586.52	1,134,837.61
Nuevo Horizonte	El Sinaí	970,745.19	1,105,251.76
	El Reflejo	968,276.26	1,106,465.08
	La Fenicia	965,269.87	1,107,016.73

<sup>13</sup> National Council for Economic and Social Policy – CONPES. 2014. Policy for the integral development of the Orinoco: Highland - Phase I. Available at:

<https://colaboracion.dnp.gov.co/CDT/Conpes/Econ%C3%B3micos/3797.pdf>

<sup>14</sup>Municipal Center for Documentation and Information. Zoning scheme. Available at:

[http://cdim.esap.edu.co/BancoMedios/Documentos%20PDF/diagnostico\\_pto\\_carre%C3%B1o\\_\(59\\_pag\\_126\\_k b\).pdf](http://cdim.esap.edu.co/BancoMedios/Documentos%20PDF/diagnostico_pto_carre%C3%B1o_(59_pag_126_k b).pdf)

Nucleus	Farm	Coordinate X	Coordinate Y
	San José	972,230.04	1,114,629.04
	El Silencio	977,677.24	1,116,001.90
	Pozo Azul	974,690.02	1,115,035.41
	La Agonía	968,596.37	1,118,274.97
	La Estaca	969,996.24	1,115,742.06
	El Triunfo	983,664.04	1,114,753.83
	La Payara	987,784.69	1,149,968.49
	La concordia	986,765.04	1,115,441.17
	Los Eucaliptos	965,479.28	1,116,924.84
	El Pretesto	985,038.06	1,123,535.53
	La Diversión	984,102.26	1,120,523.56

The project area has a total of 30,000 ha. The expansion area of the grouped project corresponds to the savannas of the eastern plains of Colombia, in the Vichada's department.

**G1.5. Explain the process of stakeholder identification and analysis used to identify Communities, Community Groups and Other Stakeholders.**

Stakeholders were identified with the help of the landowners who were responsible for summoning the workers and their families, and other people present on neighboring farms. However, the population living close to the properties is limited since most of the settlements are concentrated in the urban area of the municipality of Puerto Carreño.

In addition, the environmental and governmental entities and organizations that have a potential interest in the project were also identified.

- **Community**

Workers of the farms

Table 4. Stakeholders: community

Rights	Interests	Pertinence
To develop in a laboral environment that assures the minimal conditions of welfare.	The livelihood of the actors and their families depend directly on the project activities	Direct participation in the project activities.
Opine, review, report and suggest improvements in their working environment.	Protect the community's interests about the development of projects that	Direct and indirect receivers of impacts of the project on climate, biodiversity and communities.

<b>Rights</b>	<b>Interests</b>	<b>Pertinence</b>
<p>To be subject of training on topics related to the project activities.</p> <p>To emit opinions concerning the direct or indirect project impacts on the community interests.</p>	<p>impact directly or indirectly the environmental, economic or social conditions of the area of influence.</p>	

- **Communitary group**

Group of indigenous

Table 5. Stakeholders: communitary groups

<b>Rights</b>	<b>Interests</b>	<b>Pertinence</b>
<p>To Develop in an environment that assures the minimal conditions of welfare.</p> <p>To have equal rights to participate and run for employment opportunities in their environment.</p>	<p>The livelihood of the actors and their families depend directly on the project activities.</p>	<p>Direct participation in the project activities</p>

- **Other actors**

Project owners

Table 6. Stakeholders: Project owners

<b>Rights</b>	<b>Interests</b>	<b>Pertinence</b>
<p>To coordinate all the aspects related to the project's implementation</p>	<p>Successfully conclude all project activities and proposals and to fully comply with the objectives set in terms of the climate components, biodiversity and communities</p>	<p>Direct participation in the project</p>

Majoral office of the municipality of Puerto Carreño

Table 7. Stakeholders: Majoral office of the municipality of Puerto Carreño

<b>Rights</b>	<b>Interests</b>	<b>Pertinence</b>

Regulation of land use in the project area.	Ensure compliance with current regulations regarding land use.	local authority in charge of the planification of the territory where the project is taking place
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CORPORINOQUIA

Table 8. Stakeholders: Environmental authority

Rights	Interests	Pertinence
To Regulate the interventions on associated ecosystems and make sure about the compliance of the environmental regulations related to the development of projects.	Ensure the sustainable development of their jurisdiction starting from the verification of compliance with existing environmental regulations for the different interventions on ecosystems and associated resources.	Local environmental authority

Project owners; Majoral office of the municipality of Puerto Carreño; CORPORINOQUIA <sup>15</sup>; AGAF <sup>16</sup>; Parques Nacionales Naturales (PNN); Fundación Omacha; Fundación Orinoquia Bio Diversa; Fundación Etnollano.

Rights	Interests	Pertinence
Contribute with knowledge and experience in order to improve the implementation of the various project activities	Contribute from the generation of knowledge to the economic, social and environmental development of the region.	Institutions with presence in the project area that have implemented projects consistent with the regional needs.

The stakeholders were called to attend the meetings via email correspondence, phone calls and posting the invitation in the bulletin boards of the municipal office of Puerto Carreño (see Stakeholder consultation folder).

**G1.6. List all Communities, Community Groups and Other Stakeholders identified using the process**

- Communities: Workers of the farms
- Community Groups: Group of indigenous

<sup>15</sup> Regional autonomous corporation and environmental authority in the Orinoco Region.

<sup>16</sup> Asociación Gremial Agroforestal Vichadense.

- Other Stakeholders: Project owners; Majoral office of the municipality of Puerto Carreño; CORPORINOQUIA; AGAF; Parques Nacionales; Fundación Omacha; Fundación Orinoquia Bio Diversa; Fundación Etnollano.

**G1.7.** Provide a map identifying the location of Communities and the boundaries of the Project Area(s), of the Project Zone, including any High Conservation Value areas (identified in CM1 and B1), and of additional areas that are predicted to be impacted by project activities identified in CL3, CM3 and B3.

Population living in the vicinity of the properties is limited, since most of the population is concentrated in the municipality of Puerto Carreño (Figure 6). Due to the long distances that exists between the urban settlements and the properties, workers live in camps located inside the farms; many of them are also people from other regions who moved to the area to find a job.

Indigenous groups are located within the project zone but outside the boundary of the instance 1.

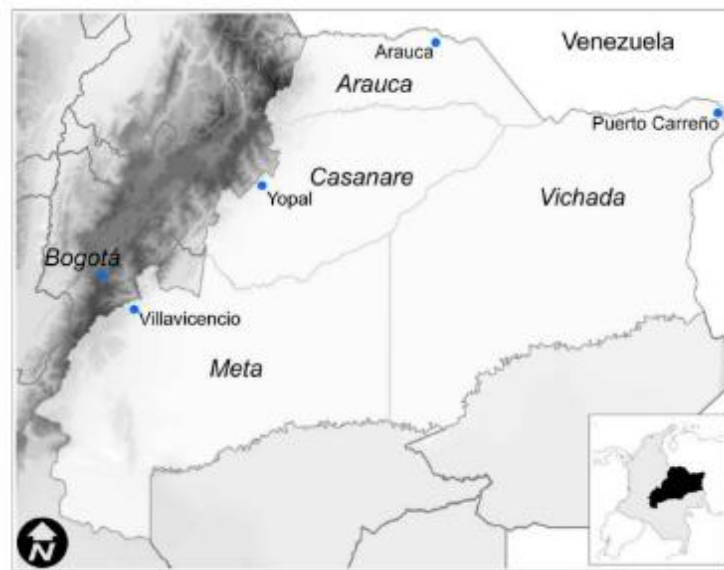


Figure 6. Project zone: Orinoquia region. Population centers (blue dots)

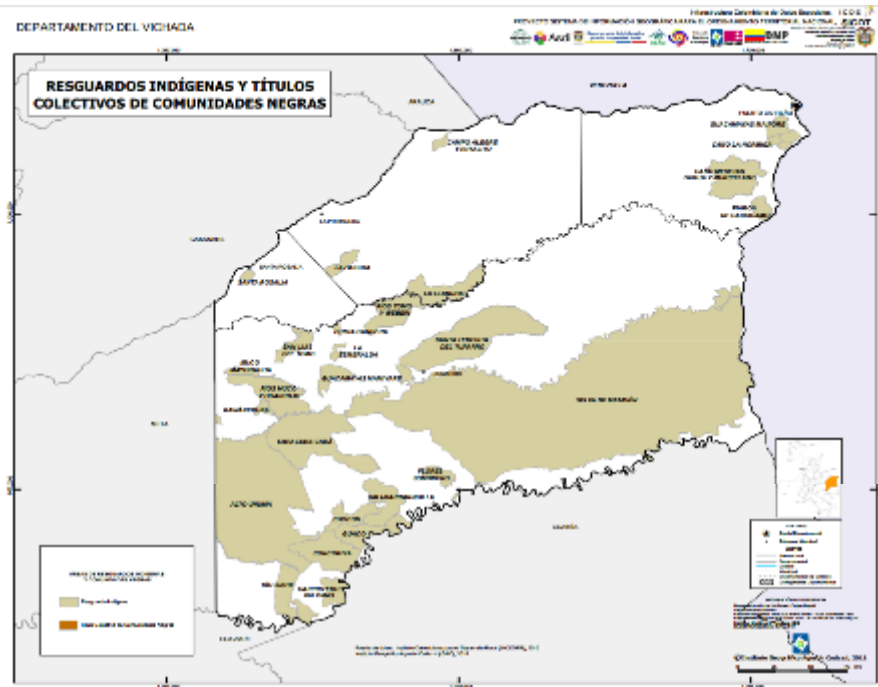


Figure 7. Project zone: Department of Vichada. Indigenous reservations. Source: SIGOT 2011<sup>17</sup>.

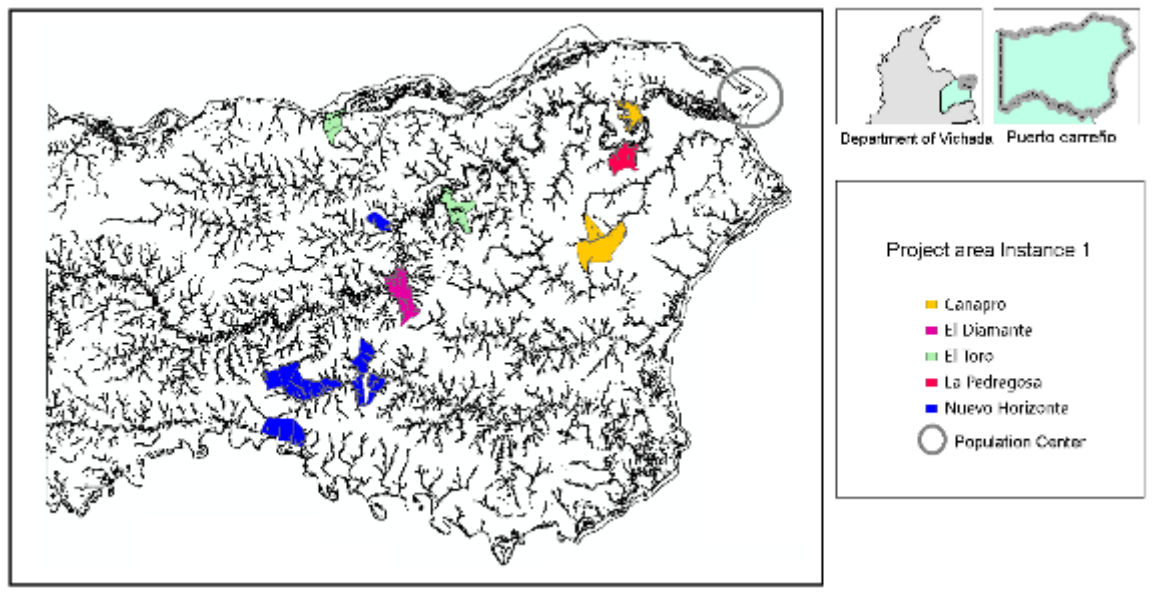


Figure 8. Project area

The high conservation values in the project zone are the gallery forests and the *morichales*.

<sup>17</sup> Geographic Information System for land planning. SIGOT. Available at [http://sigotn.igac.gov.co/sigotn/EXPEDIENTE/PDF/Vichada\\_Resguardos\\_Negras\\_V2\\_2012\\_01\\_18.pdf?](http://sigotn.igac.gov.co/sigotn/EXPEDIENTE/PDF/Vichada_Resguardos_Negras_V2_2012_01_18.pdf?)

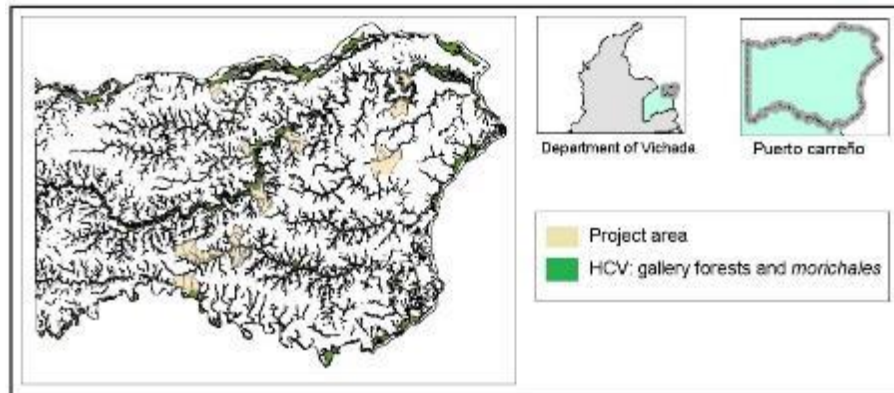


Figure 9. High conservation values for the biodiversity in the project zone.

The ecosystems in the Orinoco region, significantly contribute to the country's natural wealth since they meet basic ecological functions for the hydrological cycle of the basin. The ecosystems *morichales*, gallery forests and wetlands were recognized such as environmentally fragile areas.

The project area consists of elements characteristic of savannas, forests and floodplains. Below is the description of the main strategic environmental areas:

- *Lotic systems*

The project zone has a great abundance of water, where water recharge is high, due to heavy rainfall and the existence of forests, morichales, floodplain and other systems, which create different types of landscapes formed in the micro-rivers The Cimarron and La Fortaleza, which feed the Caño Lolo watershed.

In the savannas, the drainage pattern is parallel and the flows decrease in the summer time, but still, these streams and morichales maintain a good flow, bringing its waters to Caño Lolo, which finally discharges its waters into the Rio Tomo.

- *Estuaries, lagoons, morichales and floodplains*

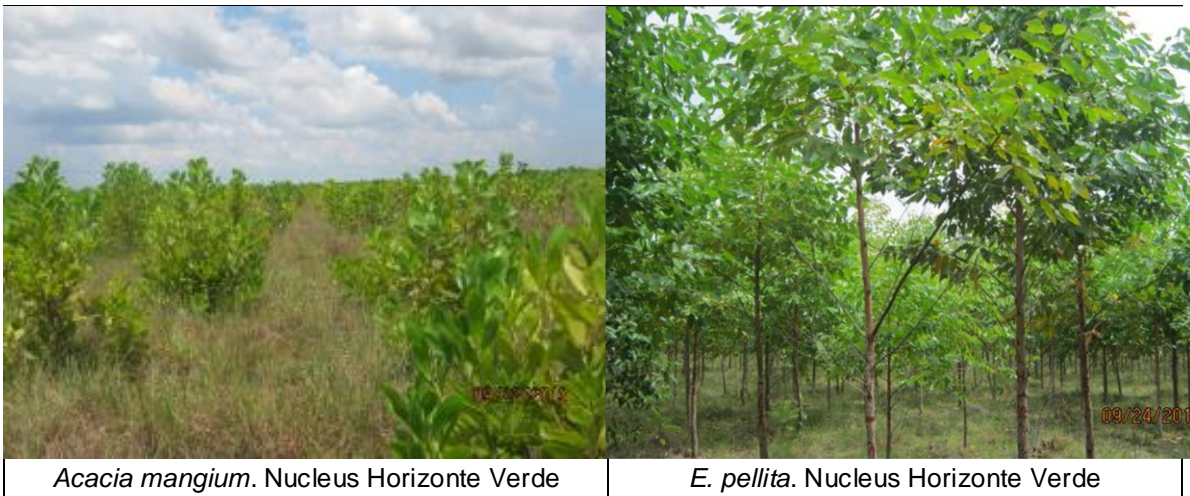
The morichales are basic constituents of flood zones, as they are a type of permanent lentic wetland type, with vegetation cover composed primarily by individuals of the moriche palm. They usually are located in streams, in swampy areas, and in transition zones between the savannas and gallery forests. The main characteristics of this ecosystem is their large capacity to hold water during dry seasons because of their high contents of organic matter. They also provide shelter and food for mammals, birds, reptiles, amphibians and some fish (Corporinoquia, 2010).

**G1.8.** Briefly describe each project activity and the expected outputs, outcomes and impacts of the activities identifying the causal relationships that explain how the activities will achieve the project's predicted climate, community and biodiversity benefits.



**Project activities**

- *Forest Reforestation and Restoration :*  
Every project owner has developed a sustainable forest management plan. These include information about the technical aspects of reforestation as well as all procedures necessary to prepare the land, germinate and cultivate the seedlings, transplant the trees, perform regular maintenance, harvest and replant after harvest.
- *Monitoring:*  
A coherent monitoring plan for every area will be established and applied across all project area. This monitoring plan includes monitoring for carbon stock changes as well as community and biodiversity parameters. The carbon stock monitoring allows for accurate measurement of carbon capture in the reforestation project, project emissions and leakage. The community monitoring will be carried out through surveys of project employees in order to gauge the direct benefits of the project. For biodiversity monitoring, inventories will be carried out of both flora and fauna found in the project area. These monitoring activities will be realized in each verification year.
- *Capacitation and Education:*  
Continuous training and workshops are executed for each worker, according to the activities established by the management plan. In addition, workshops about industrial safety are also included.







*P. caribaea*. Nucleus Horizonte Verde



*P. oocarpa*. Nucleus Horizonte Verde



*Ochroma piramydale*  
[www.verarboles.com](http://www.verarboles.com)  
<http://floraerverde.catec.upr.edu/>



*Pachira quinata*  
[www.saber.ula.ve](http://www.saber.ula.ve)  
[ambientejunin.blogspot.com](http://ambientejunin.blogspot.com)



Figure 10. Used species in the project for reforestation and restoration activities.

Table 9. Native species used in the project for restoration activities.

<i>Ochroma pyramidale</i>	<i>Pseudosamanea guachapele</i>
<i>Calophyllum lucidum</i>	<i>Rheedia madruno</i>
<i>Hymenaea courbaril</i>	<i>Jacaranda copaia</i>
<i>Hura crepitans</i>	<i>Parahancornia oblonga</i>
<i>Pachira quinata</i>	<i>Dipteryx panamensis</i>
<i>Copaifera aromatica</i>	<i>Calophyllum lucidum</i>
<i>Cassia moschata</i>	<i>Samanea saman</i>
<i>Swietenia macrophylla</i>	<i>Clorophora tinctoria</i>
<i>Cedrela odorata</i>	<i>Vochysia obscura</i>
<i>Acosmium nitens</i>	<i>Enterolobium cyclocarpum</i>
<i>Jacaranda obtusifolia</i>	<i>Anacardium occidentale</i>
<i>Anadenanthera peregrina</i>	
<i>Ocotea cymbarum</i>	

Table 10 describes the expected outputs, outcomes and impacts of the activities and the project's predicted climate, community and biodiversity benefits.

Table 10. Expected benefits: climate, community and biodiversity, due to the project implementation.

Activity	Products	Results	Expected impacts	Expected benefits: climate, community and biodiversity
<b>Reforestation and restoration with introduced and native species.</b>	Training courses, number of trained people, number of used species, number of plants in field, planted area, research on native species.	Revenues from the sale of carbon credits, income from alternative activities, increase of timber stocks, increase of local and regional employment, trained workers in plantation management, publications and / or research activities.	Restored areas with native and introduced tree species	Climate: CO2 sequestration; Biodiversity: Wildlife increase due to the restoration of landscapes, soil and water conservation; Community: increase of the employment, development of family business, recreation and tourism, revitalization of the economy.
<b>Monitoring</b>	Training courses in the monitoring of climate, communities and biodiversity, research on plantations with native and introduced species in the region.	Additional income from the sale of carbon credits, people trained in monitoring climate, community and biodiversity indicators, publications and / or publications resulted from the monitoring's.	Increase of the biodiversity in the project area, improvement of the life quality inside the project area,	Climate: CO2 sequestration; Biodiversity and Communities: quantitative and qualifying studies about changes in the biodiversity, climate and community over the time.
<b>Training and education</b>	Courses / workshops on forest management, environmental education, safety and health at work.	People trained in the proper management of forest plantations, environmental education and implementation of sustainable practices; awareness in occupational safety and health.	People with practical and sustainable actions in the project area. People trained in forest management. Social empowerment.	Climate: CO2 sequestration. Sustainable development of activities; Biodiversity: increase of biodiversity through sustainable practices. Community: People trained on each activity related to sustainable forest management and industrial safety and health to prevent accidents and/or risks to the direct and indirect staff.



**G1.9.** Define the project start date and lifetime, and GHG accounting period and biodiversity and community benefits assessment period if relevant, and explain and justify any differences between them. Define an implementation schedule, indicating key dates and milestones in the project's development.

The Project start date is June 15th, 2011<sup>18</sup>. For the current grouped project, the crediting period will be of 30 years and 0 months. The period starts on June 15, 2011, and ends on June 14, 2041. There are not differences between the start of the project and the crediting period.

New instances have not been yet included in the project to the date.

### **Risk Management and Long-term Viability**

**G1.10.** Identify likely natural and human-induced risks to the expected climate, community and biodiversity benefits during the project lifetime and outline measures needed and taken to mitigate these risks.

No human-induced risks have been identified on climate, community and biodiversity, as the forest plantings occurring on each instance, promote the sequestration of carbon dioxide and other air pollutants and regulate the micro climates of each region. In addition, none communities live inside the project areas or in places surrounding the farms, therefore there is minimal risks on affecting their wellbeing in a negative way. Biodiversity will only be positive impacted by the plantings as the establishment of forest promotes the creation of natural corridors and the return of previously displaced fauna by the cattle and extensive pastures.

#### *Natural risks*

- Risk of fires are common in the region especially during the dry season. However, the nuclei have their own management plan for fires and diseases.
- There have not been important attacks of pests and diseases inside the planted area. Biological control, along with organic pesticides are used mostly to prevent outbreaks. Chemical pesticides are also considered but they will be used only if necessary.
- Unusual winds can be present during the dry season, but this does not means a risk for the planted area. No harms or loss has occurred inside the planted area as a result of an extreme weather.

#### *Measures taken to mitigate risk of fire*

- Identification of critical sectors

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<sup>18</sup> On this date started the reforestation activities in the nucleus La Pedregoza. See support document: Annual Planting Report, 2011. Finca La Pedregoza.

- Training to the operating staff in preventive measures and how to act when fires occur. The *Asociación Gremial Agroforestal Vichadense* (AGAF) supports the formation of volunteer firefighters able to act quickly in case of a fire.
- Development of firewall barriers.
- As a replacement to the firewalls, is possible to establish a plant cover of fire retardant species, herbaceous, dense and with succulent leaves. These plants should not dry out during the months of highest probability of occurrence of fire.
- Provide the right elements such as water tanks, hoses, extinguishers, blankets, etc.



Figure 11. Firewall barriers.

**G1.11.** Describe the measures needed and taken to maintain and enhance the climate, community and biodiversity benefits beyond the project lifetime.

Among the main measures needed and taken to maintain and enhance the climate, community and biodiversity benefits beyond the project lifetime, are:

- Species planted have previously proven to be adapted to the agro-ecological conditions of the project (see sections B2.5 and B2.6).
- No ongoing enforcement or disputes have raised now or in the past, related to the protection of the planting area, as there are none communities living close to the project area. In addition the farms are delimited by strong fences, and is well designed and properly marked as private land. Most of the staff, remains permanently in the project area, and there is permanent vigilance executed by one designed person.
- Management teams include individuals con significant experience in all skills necessary to perform the duties related to the planting of the selected species, and also experience in staff

management, human resources, among others. Records of the experience can be found in the supporting documents (see NPRT<sup>19</sup> folder).

- Project is protected by legally binding commitment to continue management practices that protect the credited carbon stocks over the length of the project crediting period<sup>20</sup>.
- Because the financial profitability projected (see G1.12), it is expected that strong commitment will also be generated in the community and investors to continue management practices that protect the credited carbon stocks over the length of the project crediting period.
- All communities and actors directly involved and affected by the project, have been consulted and records of the consultation can be found in the supporting documents (see Stakeholder consultation).

**G1.12.** Demonstrate that financial mechanisms adopted, including actual and projected revenues from GHG emissions reductions or removals and other sources, provide an adequate actual and projected flow of funds for project implementation and to achieve the project's climate, community and biodiversity benefits.

Description of the project finance will be done for each instance as each one has its own finance structure depending on the species and the planted area (see NPRT folder). In general:

Each owner (farm) has secured 40% to less than 80% of funding needed to cover the total cash out required before the project reaches breakeven.

Project has available as callable financial resources at least 50% of total cash out before project reaches breakeven.

**G1.13.** Specify the Project Area(s) and Communities that may be included under the programmatic approach, and identify any new Project Area(s) and Communities that have been included in the project since the last validation or verification against the CCB Standards.

Project areas that may be included, should be located in the region of the eastern plains of Colombia, in coverages of degraded savannas. All owners and communities who meet the eligibility criteria specified below (G1.14), may be part of the project; in the case of community groups, farmers, partners or other authorities, these should be organized under some form of association.

New instances have not been yet included in the project to the date.

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<sup>19</sup> VCS Non-Permanence Risk and supports for all the nuclei.

<sup>20</sup> See commitment letters

**G1.14.** Specify the eligibility criteria and process for project expansion under the programmatic approach and demonstrate that these have been met for any new Project Areas and Communities that have been included in the project since the last validation or verification against the CCB Standards.

Eligibility criteria:

- Covers of degraded savannahs.
- Operational capacity of the operator
- Demonstrate proper environmental practices consistent with the silvicultural requirements of the species planted
- Demonstrate that the project promotes gender equity and that do not incur in any kind discrimination
- Unrestricted species and arrangements
- Establishment of baseline conditions of the project in order to identify and quantify the social and biodiversity benefits of the implemented activities.

It is expected that the expansion of the project will occur during the monitoring and verification of the previously validated instances. Meaning that at the time of the first project's monitoring, it may be possible to validate other instances, that comply with the eligibility, additionality and baseline conditions.

New instances have not been yet included in the project.

**G1.15.** Establish scalability limits if applicable, and describe measures needed and taken to address any risks to climate, community and biodiversity benefits if the project expands beyond those limits.

The scalability of the project is limited to the savannas of the eastern plains of Colombia. Each owner is responsible for performing management activities and ensuring the sustainability of the plantations as well as the monitoring.

Risks associated with the non-continuation of benefits, will be minimized by involving areas with owners committed to the project objectives and that meet the eligibility criteria.

## **G2. Without-project Land Use Scenario and Additionality**

**G2.1.** Describe the most likely land-use scenario within the Project Zone in the absence of the project, describing the range of potential land-use scenarios and the associated drivers of land use changes and justifying why the land-use scenario selected is most likely. It is allowable for different locations within the Project Zone to have different without-project land use scenarios.

The land within the project boundary is degraded grassland for all cases of the grouped instances, as they all occur in the same department and municipality. Such grasslands have historically been



subject to burning activities that took place with the objective to reduce tree covers and expand grasslands in order to develop extensive cattle ranching activities. However, all instances conserve remnants of gallery forest and natural areas as shown in the following aerial photograph (Figure 12). This landscape corresponds to the land prior to the project start date, for the case La Pedregoza farm.



Figure 12. Aerial photograph of the Pedregoza farm, in the municipality of Puerto Carreño<sup>21</sup>.

It is evident in the last image, that within the project boundary (shaped with yellow dots), only degraded areas existed, but also some patches of natural forest bordering the main water streams. However, the dominant cover are the grasslands.

<sup>21</sup> Photo taken by the project owner prior starting the project activities.



Figure 13. Photograph of the farm Toro 1 taken before the project start date<sup>22</sup>.

On the other hand, the instance of Reforestadora El Toro, took the last photo, prior to the project start date, in order to evidence the lack of natural forest and the presence of degraded and extensive grasslands. Few isolated trees could be found in the project area, but none of them were classified as endangered.

Considering the “Tool for the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities Version 3.0<sup>23</sup>” the identified alternative land uses in absence of the VCS forestry proposal are:

- Cattle farming
- Forest plantations (without being registered as a carbon project)

Table 11. Potential land-use scenarios in the project zone and project area

Land use	Justification
Cattle farming	<ul style="list-style-type: none"> <li>• Is the ancestral most widespread form of land use in the project zone<sup>24, 25</sup>, and the department of Vichada has more than 138,000 heads of cattle<sup>26</sup>, with an average of 0,3 head of cattle per ha<sup>27</sup>.</li> </ul>

<sup>22</sup> Photo taken by the Project coordinator Luis Miguel Navarro in July 15th of 2012.

<sup>23</sup> <http://www.v-c-s.org/sites/v-c-s.org/files/VT0001%20VCS%20AFOLU%20Additionality%20Tool%20v3.0.pdf>

<sup>24</sup> Pacheco et al., 2014. Manejo Forestal Sostenible en plantaciones en la cuenca del rio Bitá, Vichada, Colombia.

<sup>25</sup> Andrade et al. 2009. La mejor Orinoquia que podemos construir.

<sup>26</sup> Gobernación del Vichada 2011. Plan vial Departamental Vichada 2011-2019.

<sup>27</sup> CONPES 3797, 2014. Política para el Desarrollo Integral de la Orinoquia: Altillanura - Fase I.

Land use	Justification
	<ul style="list-style-type: none"> <li>• The beef cattle's farming has been a historical adaptation to the communities' culture and to the conditions of regional ecosystems. Cattle's farming is done by 90% on land with that kind of vocation, while cultivated areas occupy 32% of the land with agricultural potential. In 2008, 9.75 million hectares held a stock of 5,727,131 cattle heads, in the region equivalent to 21.3% of the national total (26,877,824 head)<sup>28</sup>. About the production value and its value-added component, it is estimated that cattle farming represents 3.6% of the national Gross Domestic Product (GDP), a significant percentage for an individual activity and especially for a rural activity in the country. This activity also represents 27% of the GDP in the agricultural sector and 64% of the livestock sector at the national level<sup>29</sup>.</li> <li>• The firsts instances are located in the municipality of Puerto Carreño, close to the Bitá's river. Among the main economic activities present along the Bitá's basin (like the rest of the municipality), are the extensive cattle ranching and the agriculture<sup>30</sup>, constituting the second largest source of employment followed by the state jobs<sup>31</sup>.</li> <li>• This land use is legal and enforced by mandatory applicable laws and regulations in Colombia and Orinoco's region (project zone)<sup>32</sup>.</li> </ul>
Forest plantations (without being registered as a carbon project)	<ul style="list-style-type: none"> <li>• Colombia has a huge potential to develop commercial reforestation programs (around 17 million of hectares suitable for forestry plantations establishment distributed in different regions of the country<sup>33</sup>). This country benefits from excellent climatic, geographic and topographic conditions for tree growth, and has the potential for forest plantations and also possesses the necessary geostrategic conditions to potentiate foreign trade, especially with the increase of treaties for free trade signed during the last 10 years<sup>34</sup>.</li> <li>• For over 30 years, there have been trials of forest plantations in the high plains in the Orinoco region<sup>35</sup>, but until now only very few, mainly non-native species have been promoted in the country such as <i>Eucalyptus pellita</i>, <i>E. tereticornis</i>, <i>Pinus caribea</i>, <i>Pinus oocarpa</i>, and <i>Anacardium occidentale</i>. Corporinoquia, Universidad de los Andes, The National Corporation for Forestry Research and Development of Colombia (CONIF), the Colombian Corporation for Agricultural Research (CORPOICA), the International</li> </ul>

<sup>28</sup> Universidad Nacional de Colombia. 2013. Caracterización Región Orinoquía.

<sup>29</sup> Cuenca et al. 2008. El sector de ganadería bovina en Colombia. Aplicación de modelos de series de tiempo al inventario ganadero.

<sup>30</sup> Pacheco et al., 2014. Manejo Forestal Sostenible en plantaciones en la cuenca del río Bitá, Vichada, Colombia.

<sup>31</sup> Municipio de Puerto Carreño, 2012. Plan de Desarrollo Puerto Carreño 2012-2015.

<sup>32</sup> See Plan de Desarrollo del Vichada 2012 – 2015 and Plan Estratégico de la Ganadería Colombiana 2019 (PEGA 2019).

<sup>33</sup> MICT, 2009. Invierta en Colombia. Trabajo, compromiso, ingenio.

<sup>34</sup> Departamento Nacional de Planeación, 2015. COLOMBIA: Potencial de Reforestación Comercial.

<sup>35</sup> MADR, IICA. 2005. La cadena forestal y madera en Colombia una mirada global de su estructura y dinámica 1991-2005.

Land use	Justification
	<p>Center for Tropical Agriculture (CIAT), and the Gaviotas Research Center have carried out research on the silviculture of this species<sup>36</sup>.</p> <ul style="list-style-type: none"> <li>• The increase of the forestry activity has also been present in the municipality of Puerto Carreño in recent years, with the establishment of introduced tree species such as the Acacia, Eucalyptus and Pine, registering 3,247 ha planted in 2012<sup>37</sup>. On the other hand, according al Ministerio de Agricultura, forest plantations composed by only foreign species, are being supported by national regulations that attempt to finance forestry projects through the forestry incentive certificate (CIF). In 2012, the municipality of Puerto Carreño counted with 49 CIF registering, covering an area of 9,179 hectares all covered by introduced tree species, including <i>Pinus caribea</i>, <i>Acacia mangium</i>, <i>Tectona grandis</i>, <i>Gmelina arborea</i>, and <i>Eucalyptus pellita</i><sup>38</sup>.</li> <li>• This land use is legal and enforced by mandatory applicable laws and regulations in Colombia and Orinoco's region (project zone)<sup>39</sup>.</li> </ul>

**G2.2.** Document that project benefits including climate, community and biodiversity benefits would not have occurred in the absence of the project, explaining how existing laws, regulations and governance arrangements, or lack of laws and regulations and their enforcement, would likely affect land use and justifying that the benefits being claimed by the project are truly 'additional' and would not have occurred without the project. Identify any distinct climate, community and biodiversity benefits intended for use as offsets and specify how additionality is established for each of these benefits.

Despite the aspects previously mentioned, forest activities in the region face the following barriers:

**Investment barrier**

- 17 million of hectares are identified in Colombia with potential to establish commercial forest plantation, however only 253,066 hectares (1.5%) have been planted<sup>40</sup>. WWF, 2015 concluded that 80% of wood and wood products are derived from the exploitation of natural forests, given that commercial reforestation is neither economically attractive nor consolidated as a profitable activity<sup>41</sup>.

<sup>36</sup> Andrade et al. 2009. La mejor Orinoquia que podemos construir.

<sup>37</sup> Municipio de Puerto Carreño, 2012. Plan de Desarrollo Puerto Carreño 2012-2015.

<sup>38</sup> Pacheco et al., 2014. Manejo Forestal Sostenible en plantaciones en la cuenca del rio Bitá, Vichada, Colombia.

<sup>39</sup> See Law 139 from 1994; National Plan of forestry development (2000); Law 1377 from 2010; Resolution number 200.41-11.1130 from 2011, among others.

<sup>40</sup> MICT, 2009. Invierta en Colombia. Trabajo, compromiso, ingenio.

<sup>41</sup> WWF, 2015. Informe: causas de la ilegalidad de la madera en Colombia un estudio sobre los flujos del comercio de la madera, los actores y los impactos de la tala ilegal.

- The very low level of economic activity in the commercial forestry sector is attributed to several factors, among them: low rates of return, the high number of intermediaries<sup>42</sup>, long production cycle, long periods between cash flow disbursements, high concentration of costs in the first years of production, long wait for economic returns and difficulties in obtaining bank credits for these types of activities<sup>43,44</sup>.
- There are no commercial bank lines of credit<sup>45</sup> for long-term investments such as reforestation projects<sup>46</sup>. Banks perceive the investment risk for this type of project as very high due to market limitations, the lack of cash flow, and the long wait for a return on the investment<sup>47</sup>. There are multilateral banking credit sources, but processing is quite complex.
- About 90% of commercial reforestations are supported by incentives and tax benefits given by the government. These incentives are not enough to stimulate the reforestation adequately. For example, the government created a risk capital in the Fund for Agricultural Financing- Finagro (with more than 30,000 million COP) to invest directly in the commercial forestry sector, however only 514 million COP<sup>48</sup> were used for forestry projects (0.99%)<sup>49</sup>.
- Further, the level of the incentive is relatively low in terms of the positive externalities generated by reforestation and the high opportunity cost associated with other uses of the land. Second, government deficits often abort the supply of the incentive, even when projects have been approved to receive it<sup>50</sup>. There is no appropriate information to identify the effectiveness of incentives and it is not possible to determine the real impacts over investors. If a project receives the CIF, it must decline the right to get more incentives or tax exemptions that law gives for forestry sector<sup>51</sup>.

#### **Infrastructure barrier (routes of transportation)**

- In general, the departments of the Orinoco region have remained isolated from the rest of the country due to a lack of access by land routes. Infrastructure is thus one of the factors that have disadvantaged the development of the country's forestry potential. On one hand, there is a tremendous lack of highways and railways in areas with forest resources, and on the other hand the nearby rivers are not, or not sufficiently navigable or they do not connect towards centers of consumption. Transportation costs represent 34% of the value of forest products in the market<sup>52</sup>.

<sup>42</sup> WWF, 2014. Datos básicos y elementos de contexto sobre el sector Forestal en Colombia.

<sup>43</sup> Aldana, C. (2004): Sector forestal Colombiano; fuente de vida, trabajo y bienestar. Serie de documentación no. 50. Corporación nacional de Investigación y Fomento Forestal (CONIF), Bogotá.

<sup>44</sup> CONIF y FAO, 2004. Análisis del Mercado Crediticio para el Sector Forestal Colombiano.

<sup>45</sup> CONIF y FAO, 2004 conclude that in Colombia we have no lines of credit that can be called forestry credit lines, with the exception of two very limited lines from the Banco Agrario (a state Bank) which specifically limit activities to "plantation and maintenance" and "harvest of trees" but are not focused to reforestation activities.

<sup>46</sup> Aldana, C. (2004): Sector forestal Colombiano; fuente de vida, trabajo y bienestar. Serie de documentación no. 50. Corporación nacional de Investigación y Fomento Forestal (CONIF), Bogotá.

<sup>47</sup> FAO, 2006. Tendencias y perspectivas del sector forestal en América Latina Documento de Trabajo. Informe Nacional Colombia. Available at: <http://www.fao.org/docrep/009/a0470s/a0470s00.htm>

<sup>48</sup> Currently about 183,000 USD

<sup>49</sup> Marín, 2010. Financiación forestal, estímulos y exenciones.

<sup>50</sup> Marín, 2010. Financiación forestal, estímulos y exenciones.

<sup>51</sup> Marín, 2010. Financiación forestal, estímulos y exenciones.

<sup>52</sup> Refocosta, 2007. Comercialización de Madera en Colombia y sus oportunidades.



- A large percentage of forestry products in the Colombian market is transported by roads, which is a negative factor given its high costs. According to the calculations of CORMAGDALENA, the cost of transportation by waterway is nine times lower than roads. The poor transportation infrastructure constitutes a costly constraint to the project activity because it hinders and prevents displacement of personnel, increases the costs of all silvicultural practices and timber harvesting, and increases the travel time of all access routes.
- According to the observed on field, transportation is very difficult especially during rainy seasons as the current roads, have been created by the cars themselves and they tend to flood and collapse in winter. Only full-equipped cars can move on the roads of the area. As exposed in Table 12, only 10.44 of roads have been paved and 386 kilometers are dirt packed road (unpaved road) within the department.

Table 12. Kilometers of roads in the Department of Vichada

Classification of Roadway	Paved road	Dirt packed road	Dirt road	Total
Primary way	9.3	60.95	15.70	85.95
Secondary way	1.14	298.32	1,263.21	1,562.67
Terciary way		27.40	1,007.17	1,034.57
<b>TOTAL</b>	<b>10.44</b>	<b>386.67</b>	<b>2,286.08</b>	<b>2,683.19</b>

Source: Secretaria de Planeación y Desarrollo Territorial del Vichada, tomado de Gobernación del Vichada 2011.

- According to the zoning study for forest plantations with commercial purposes in Colombia (UPRA, 2015), despite that the departments of Vichada and Meta have large surfaces for commercial forestry activities, the aptitude for this activity is low (dominant aptitude, according to the stablished classification). This qualification is attributed to the lack of road infrastructure and logistics in forestry, as well as soil limitations and ecosystemic restrictions, issues that affect the development of competitive markets<sup>53</sup>.
- The project owner has to invest in infrastructure or in the maintenance of the existent roads to reach the plantations area and transport any equipment, materials, technology and tools needed for the work. These adverse conditions represent an important barrier that must be overcome by the technical team to guarantee the competitiveness in the national and international markets.

### Social barriers

- The few communities that inhabit the project area do not have experience in reforestation. Their economic activity is based primarily subsistence farming and subsistence fishing. There is no local supply of labor with experience in forestry, so training is more costly and skilled labor must be paid a higher wage to move them from other regions of the country to this

<sup>53</sup> Unidad de planificación de tierras rurales, adecuación de tierras y usos agropecuarios, UPRA, 2015. Zonificación para plantaciones forestales con fines comerciales – Colombia.

remote region, mostly from regions such as Cordoba, Meta, Antioquia, and Boyacá. The population density in the department of Vichada is very low (1.8 inhabitants per km<sup>2</sup>) and therefore insufficient to supply the labor requirements of the project activity.

- The project owner has to recognize all these obstacles and has to overcome these technical barriers. Part of the capacity work could be financed by the income of the carbon credits.
- Forestry plantations in the region of Puerto Carreño, commonly lack of financial and technical planning as they have not clarity in relation to the markets, species, forestry development, sustainable use of soils, and more important, they did not have clarity about their objectives of production, among others. Which means that in most cases, activities are being coordinated by people without professional or technical background in forestry in addition to the lack of technical assistance from the local authority CORPORINOQUIA. Around 80% of the projects being executed in the municipality, don't have knowledge or experience in areas related to ecosystem services and they don't count with formal procedures related to industrial safety, waste management or labor regulations (Pacheco et al., 2014).

Due to these conditions, most of the planted area in the project zone has been developed without following technical procedures and methodologies avoiding the full development of this sector. Unplanned harvesting, poor growth of species, lack of interest about the conservation of natural resources are among the main characteristic of these areas<sup>54</sup>.

On the other hand, extensive cattle farming does not face any of the identified barriers. For example, if there are not investors even private or public, cattle ranching becomes the most popular activities, as it requires in most cases, only money to obtain the animals.

The proposed project activity aims to change the current land use to reforestation, and plant about 8,000 ha in the remote region of the Orinoco, where the dominant economic and cultural activity has been and continues to be extensive cattle ranching. Financial revenues from carbon sequestration will help investors to offset the risks of investing in the area and the high costs of accessing distant markets for the future sale of timber. The sale of certificates of emission reduction is part of the main sources of additional income to the project and it will allow reaching the expected biodiversity and social benefits previously mentioned (see G1.8).

### G3. Stakeholder Engagement

#### Access to information

**G3.1.** Describe how full project documentation has been made accessible to Communities and Other Stakeholders, how summary project documentation (including how to access full documentation) has been actively disseminated to Communities in relevant local or regional languages, and how widely publicized information meetings have been held with Communities and Other Stakeholders.

Three sessions for stakeholder consultation were carried out in Puerto Carreño, in order to explain the main goals and expected impacts of the project as well as obtain community perceptions and key aspects in improving the design of the project.

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<sup>54</sup> Pacheco et al., 2014. Manejo Forestal Sostenible en plantaciones en la cuenca del río Bitá, Vichada, Colombia.

During the local consultation the aspects of climate change and carbon markets were addressed by providing information and general concepts in simple language that could be understood by all participants. Furthermore, the presentation of the project included the description of the instances considered for the first validation, as well as the strengths of each one, and general aspects such as the area, planted species, forest conservation, among others.



Figure 14. Stakeholder consultation.

The documentation and information regarding the project was made available to the community through the following mechanisms:

- At the beginning of each meeting, participants received a summary sheet of the project for them to understand the project (Figure 14).
- During the meetings aspects related to forest carbon projects, specific project activities and participants were explained (see Stakeholder Consultation Report).
- There were question and answer sessions after the talks. The questions of the participants were resolved and all observations were heard and taken into consideration (Stakeholder Consultation Report).
- The information provided, included contacts (phone number and email) of the people in charge of the project documentation (project developers), in order to give the attendants, the possibility to permanently communicate their concerns or comments.
- At the end of the local consultation, attendees were informed about the process to follow up on questions, concerns and / or comments raised at the workshops; which consist in incorporate the relevant comments to the design of the project development.
- Once the project document is ready, it will be published on the website of the CCB for public comments.



**G3.2.** Explain how relevant and adequate information about potential costs, risks and benefits to Communities has been provided to them in a form they understand and in a timely manner prior to any decision they may be asked to make with respect to participation in the project.

In addition to the topics mentioned above, during the local consultation were analyzed the possible impacts that the project might have on individual or collective actors in terms of economic, social and biodiversity aspects. This analysis was performed through the use questions, comments and opinions regarding to the exposed topics. The result of the evaluation, assigned to each impact a rating of positive, negative or neutral according to the effect on the quality of life of each participant (see Stakeholder Consultation Report).

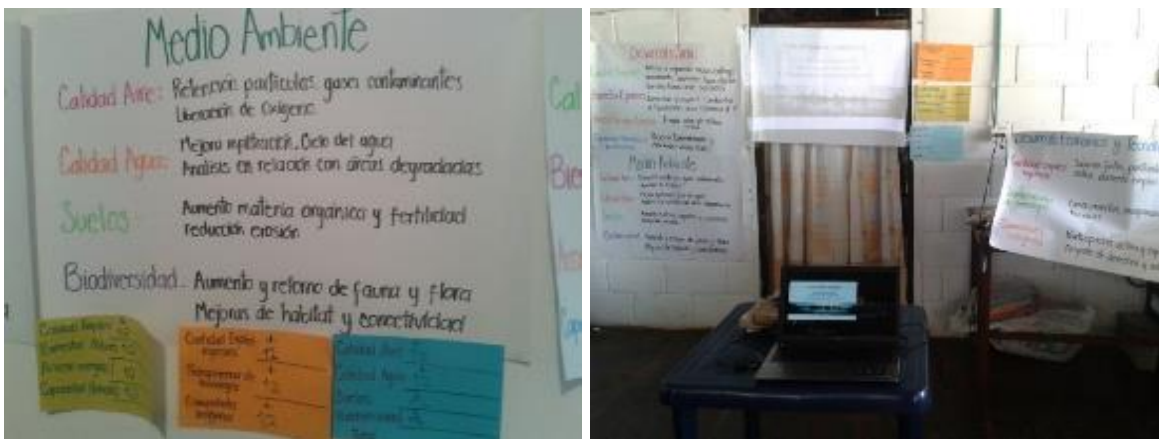


Figure 15. Impact assessment exercise during the local consultation

**G3.3.** Describe the measures taken, and communications methods used, to explain to Communities and Other Stakeholders the process for validation and/or verification against the CCB Standards by an independent Auditor, providing them with timely information about the Auditor's site visit before the site visit occurs and facilitating direct and independent communication between them or their representatives and the Auditor.

During the local consultation, all participants were informed about the validation and registry process while pointing out that an external auditor (a validation and verification body) who visits the area of influence executes this process, interacts with stakeholders, evaluates the project information and issues a report of the evaluation.

Referring to the project owners, Fundación Natura (as project proponent) has maintained constant and direct communication with the current project owners (instance 1), in order to give the guidelines and clarity aspects related to the project cycle, including validation, registration and project monitoring.

## Consultation

**G3.4.** Describe how Communities including all the Community Groups and Other Stakeholders have influenced project design and implementation through Effective Consultation, particularly with a view to optimizing Community and Other Stakeholder benefits, respecting local customs, values and institutions and maintaining high conservation values. Project proponents must document consultations and indicate if and how the project design and implementation has been revised based on such input. A plan must be developed and implemented to continue communication and consultation between the project proponents and Communities, including all the Community Groups, and Other Stakeholders about the project and its impacts to facilitate adaptive management throughout the life of the project.

Through local consultations, were assessed the possible impacts of the project and the perceptions of stakeholders were identified (see Registro de Percepciones file).

So far, the design and implementation project have not been modified, as the comments received do not affect the design of the project (see Registro de Percepciones file).

The plan to maintain continuous communication with communities includes a communication channel that addresses possible suggestions and complaints, training activities, dissemination of monitoring reports achievements, etc.

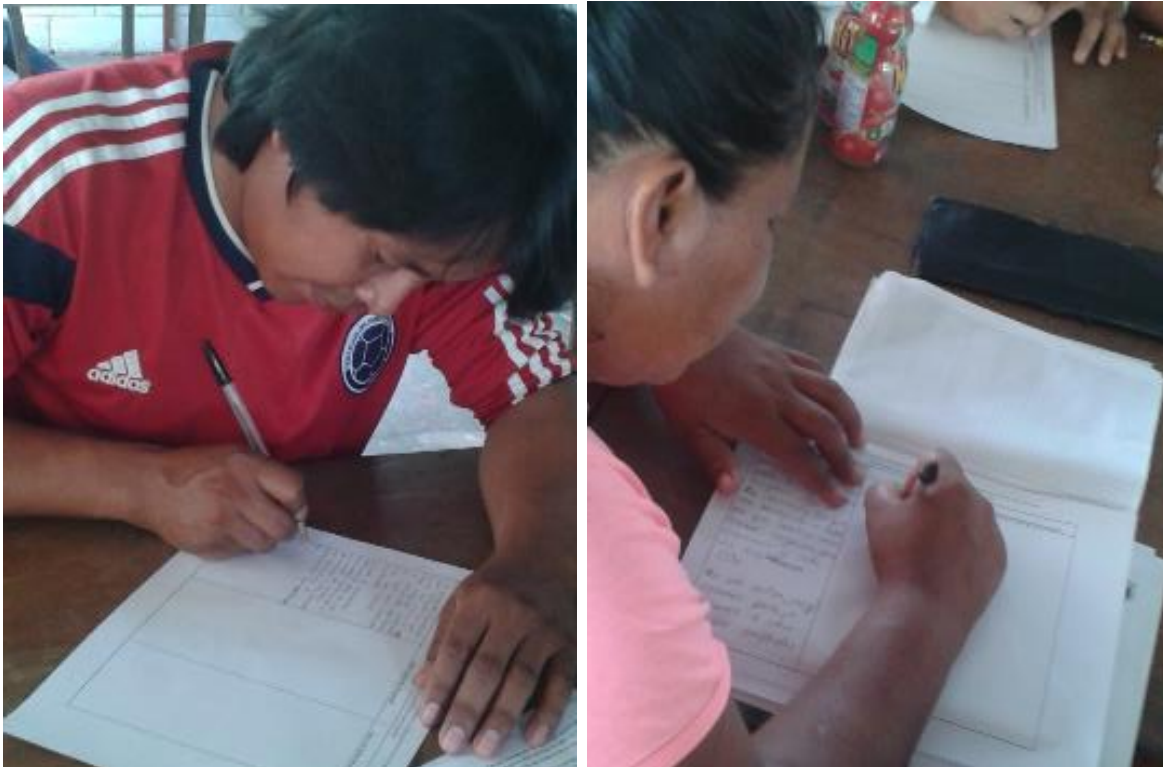


Figure 16. Community perception exercise regarding the project.

**G3.5.** Demonstrate that all consultations and participatory processes have been undertaken directly with Communities and Other Stakeholders or through their legitimate representatives, ensuring adequate levels of information sharing with the members of the groups.

The stakeholders identified were invited to report and comment in reference to the project implementation through local consultations. The invitation to these events was conducted electronically and addressed to various governmental and nongovernmental organizations such as Corporinoquia, AGAF, Parques Nacionales Naturales de Colombia and others like Fundación Omacha, Fundación Orinoquía Diversa and Fundación Etnollano. Furthermore, the invitation was printed and posted in the bulletin boards of the municipal office of Puerto Carreño. In Addition, coordinators of each nucleus reported and provided technical assistance to the meetings.

To facilitate the participation of all stakeholders, three meetings were organized: one for the urban area, where attendants represented mainly the stakeholders of the project zone; and two in the rural areas, where the attendants were the neighbors of the properties and the workers of each farm (see Registro de Asistencia file).



Figure 17. Local consultations. one for the urban area (a), where attendants represented mainly the stakeholders of the project zone; and two in the rural areas (b and c), where the attendants were the neighbors of the properties and the workers of each farm.

### **Participation in decision-making and implementation**

**G3.6.** Describe the measures needed and taken to enable effective participation, as appropriate, of all Communities, including all the Community Groups, that want and need to be involved in project design, implementation, monitoring and evaluation throughout the project lifetime, and describe how they have been implemented in a culturally appropriate and gender sensitive manner.

The necessary measures to facilitate the participation are:

- Local consultations, where the participation of as many people as possible was encouraged. In addition, contact information was provided for future consultations. Participants were allowed to present their comments anonymously, in order to feel free when expressing their disagreements.
- The constant monitoring guarantees the participation of communities and the reassessment of goals and objectives during the development of the project.
- Plans for the dissemination of information (design document, monitoring reports, etc.). The publication of the results, allows the stakeholders to remain updated about the project status, in order to ensure that their participation is effective when required.
- Plans for conflict resolution (see G3.8) and training sessions, facilitate and promote the understanding and participation of employees.

All these measures have been and will continue to be implemented without gender discrimination and respecting the cultural customs of the stakeholders.

### **Anti-Discrimination**

**G3.7.** Describe the measures needed and taken to ensure that the project proponent and all other entities involved in project design and implementation are not involved in or complicit in any form of discrimination or sexual harassment with respect to the project.

Both the project proponent and the project owner have excellent reputation and are not involved in or complicit in any form of discrimination or sexual harassment with respect to the project.

The community involvement in the project has been inclusive, according to individual capabilities and independent of gender, cultural identity and religion. Recruiting managers have as a principle employ qualified and reliable staff whose skills are in line with the requirements and objectives of the project, through technical, transparent and non-discriminatory procedures based on merit and excellence.

### **Feedback and Grievance Redress Procedure**

**G3.8.** Demonstrate that a clear grievance redress procedure has been formalized to address disputes with Communities and Other Stakeholders that may arise during project planning, implementation and evaluation with respect but not limited to, Free, Prior and Informed Consent, rights to lands, territories and resources, benefit sharing, and participation. The project shall include a process for receiving, hearing, responding to and attempting to resolve Grievances within a reasonable time period. The Feedback and Grievance Redress Procedure shall take into account traditional methods that Communities and Other Stakeholders use to resolve conflicts.

For being in constant contact with the community and workers, field technicians are the first responsible for responding to requests from the community. According to the internal procedures of each company (in each nucleus), the technician must climb the observation to the area of human resources and must address the affected to a discussion room, in order to handle the complaint.

On the other hand, managers of each nucleus, maintain constant contact with the institutions and project leaders, in order to verify that externally, the project operations are not negatively impacting the surrounding communities.

### **Worker Relations**

**G3.9.** Describe measures needed and taken to provide orientation and training for the project's workers and relevant people from the Communities with an objective of building locally useful skills and knowledge to increase local participation in project implementation. These capacity building efforts should target a wide range of people in the Communities, with special attention to women and vulnerable and/or marginalized people. Identify how training is passed on to new workers when there is staff turnover, so that local capacity will not be lost.

All nucleus execute training activities to the staff. In particular, priority has been given to the following training strategies:

Canapro: The project has designed training plans for the staff. The topics are varied, and included aspects related to the specific work, dynamic and needs of the project, personal growth, among others.

La Pedregoza: Trainings were executed on snake venom, pruning, fertilization and natural silviculture. Quarterly trainings are executed to new employees about organic fertilization.

In addition, every six months are executed trainings about general issues including prevention and control of fires, first aid and waste management. Currently new trainings are being planned on occupational hazards and occupational health.

El Diamante: This instance trains workers in different activities, becoming a different alternative for land use (forest culture).

El Toro: They train technicians and forest workers in upgrade courses about management and prevention in the use of forestry tools, industrial safety, handling and use of protective clothing, first aid, handling of materials, mineral, non-mineral and organic waste, assessments and periodically reminders about the degree of learning in different subjects, among others.



In addition, the project proponents receive permanent support from AGAF, an association that will implement the system of monthly trainings for the Vichada's region, which will include topics such as first aid, use of heavy machinery, hazardous waste and more. As part of these activities, AGAF is preparing certificates for each type of training in the field of industrial safety and occupational health, that are going to be distributed among the attendants. Certificates will be attached to the resumes to support the worker's experience and they will also serve to mitigate occupational hazards of the employer.

**G3.10.** Demonstrate that people from the Communities are given an equal opportunity to fill all work positions (including management) if the job requirements are met. Explain how workers are selected for positions and where relevant, describe the measures needed and taken to ensure Community members, including women and vulnerable and/or marginalized people, are given a fair chance to fill positions for which they can be trained.

For hiring staff, recruiting managers verify that the person meets the hiring profile established for the vacant position, without any discrimination of age, sex, marital status, ethnicity, social status or religious convictions, political ideas and / or sexual orientation. It is not allowed to employ under-age young people (18 for Colombia).

To fulfill their responsibilities, the recruiting managers is responsible for integrating and managing confidential personnel information, verify information provided and drawing up contracts. Once hired, the staff goes through a trial period.

For the selection of officials, the human resources team will have the principle to find qualified and reliable staff whose skills are in line with the requirements and objectives of the company, through technical, transparent and non-discriminatory procedures, based on merits and excellence.

**G3.11.** Submit a list of all relevant laws and regulations covering worker's rights in the host country. Describe measures needed and taken to inform workers about their rights. Provide assurance that the project meets or exceeds all applicable laws and/or regulations covering worker rights and, where relevant, demonstrate how compliance is achieved.

Colombia has ratified international conventions that protect the welfare and rights of workers<sup>55</sup>. Among these, the ILO (International Labour Organization) Conventions highlights the following as fundamental conventions:

- Agreement for Freedom of Association and Protection of the Right to Organise, 1948 (num. 87).
- Agreement about the Right to Organise and Collective Bargaining, 1949 (num. 98).
- Agreement about forced labour, 1930 (num. 29).

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<sup>55</sup> Organización Internacional del Trabajo –OIT-. 2005. Derechos Fundamentales en el Trabajo – Colombia. [http://www.oit.org.pe/WDMS/bib/publ/libros/derechos\\_fundamentales\\_colombia.pdf](http://www.oit.org.pe/WDMS/bib/publ/libros/derechos_fundamentales_colombia.pdf)



- Agreement about Abolition of Forced labor, 1957 (num. 105).
- Agreement about Minimum Age, 1973 (num. 138).
- Agreement about the Worst Forms of Child Labour, 1999 (num. 182).
- Agreement about Equal Remuneration, 1951 (num. 100).
- Agreement about Discrimination (Employment and Occupation), 1958 (num. 111).

Additionally, Colombia has a labour code, which aims to achieve justice in the relations arising between employers and workers, under a spirit of economic coordination and social balance. All hiring processes that occur inside the project are governed by the labour code, in addition to the internal quality system that has processes and procedures associated with the management of human resources.

As mentioned before, all workers have a contract, in which its duties, rights and laws that protect them are reported.

**G3.12.** Comprehensively assess situations and occupations that might arise through the implementation of the project and pose a substantial risk to worker safety. Describe measures needed and taken to inform workers of risks and to explain how to minimize such risks. Where worker safety cannot be guaranteed, project proponents must show how the risks are minimized using best work practices in line with the culture and customary practices of the communities.

The only activities that endanger workers are those related to logging, due to the use of dangerous machinery that require qualified personnel and basic supplies and uniforms to prevent accidents. All farms have the tools, uniforms and necessary equipment to prevent accidents of workers while performing activities on field.

None of the farms have conducted yet logging activities that involve handling dangerous machinery. By the time these activities are planned, training sessions will take place, in order to provide the workers, information and practical exercises to make them expert (see G3.9).

#### **G4. Management Capacity**

**G4.1.** Describe the project's governance structures, and roles and responsibilities of all the entities involved in project design and implementation. For projects using a programmatic approach, identify any new entities included in the project since the last validation or verification against the CCB Standards.

##### **Project Proponent:**

- **Fundación Natura** through the Agreement No. 02 of 2015<sup>56</sup>, Fundación Natura established an alliance with the landowners and project owners, in order to co-finance and collaborate

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<sup>56</sup> Agreement No. 02 of 2015. Fundación Natura

with the development of the project design for carbon markets and eventually with other related activities. The owners and legal representatives of the first instance agreed that Fundación Natura could act as project proponent, as they move towards the establishment of a formal figure that represents the project<sup>57</sup>.

**Project owners**

- Cooperativa Casa Nacional del Profesor-Canapro
- Plantación Amazonia El Vita S.A.S.
- Unión Temporal Agroindustria Horizonte Verde
- Ecoforestal de Colombia
- Reforestadora El Toro

Besides being the owners of the land where the first instance of the project is taking place, these companies are responsible for the administration, implementation of operational tasks, monitoring and harvesting of the planted areas.

**Project developers**

- South Pole Carbon Asset Management SAS
- Centro de Investigación Carbono & Bosques

Elaborate and oversee the development of appropriate project design and monitoring techniques in line with the guidelines of the VCS and CCBS.

New instances have not been yet included in the project.

**G4.2.** Document key technical skills required to implement the project successfully, including community engagement, biodiversity assessment and carbon measurement and monitoring skills. Document the management team's expertise and prior experience implementing land management and carbon projects at the scale of this project. If relevant experience is lacking, the proponents must either demonstrate how other organizations are partnered with to support the project or have a recruitment strategy to fill the gaps.

Fundación Natura have been interested in generating spaces for environmental research, sustainable land use planning and mitigation of carbon emissions. They have promoted tools and incentives for land conservation, policymaking, the creation of protected areas and the integrated management of watersheds. Therefore, Fundación Natura has a solid experience and capacity to leader the project<sup>58</sup>.

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<sup>57</sup> Commitment letters landowners

<sup>58</sup> Detailed information of the entity can be found at [www.natura.org.co/](http://www.natura.org.co/)

The project owners and management teams include individuals with significant experience in all skills necessary to perform the duties related to the planting of the selected species, and also experience in staff management, human resources, among others.

The team of the project developer group (South Pole Carbon and Carbono & Bosques) has a large and very important experience related to carbon markets and AFOLU projects, nationally and internationally<sup>59</sup>.

**G4.3.** Document the financial health of the implementing organization(s). Provide assurance that the Project Proponent and any of the other entities involved in project design and implementation are not involved in or are not complicit in any form of corruption such as bribery, embezzlement, fraud, favoritism, cronyism, nepotism, extortion, and collusion, and describe any measures needed and taken to be able to provide this assurance.

A comprehensive online search was performed and as a result, there are no reports that demonstrate that the Project Participants (project proponent, project owners and project developers) are involved or complicit in any form of corruption. Similarly, the various project participants and professionals linked to Fundación Natura, Cooperativa Casa Nacional del Profesor-Canapro, Plantación Amazonia El Vita S.A.S., Unión Temporal Agroindustria Horizonte Verde, Ecoforestal de Colombia, Reforestadora El Toro, South Pole Carbon and Carbono & Bosques, report no judicial, disciplinary or tax records in the databases of the Colombia's National Police, the General Attorney and the Comptroller General's Office. Such proofs are available for public consultation.

## **G5. Legal Status and Property Rights**

### **Respect for rights to lands, territories and resources, and Free, Prior and Informed Consent**

**G5.1.** Describe and map statutory and customary tenure/use/access/management rights to lands, territories and resources in the Project Zone including individual and collective rights and including overlapping or conflicting rights. If applicable, describe measures needed and taken by the project to help to secure statutory rights. Demonstrate that all Property Rights are recognized, respected, and supported.

#### **Proof of Title**

There are not ongoing or unresolved disputes or conflicts regarding land. Even though that historically this area had been influenced by armed conflict, today such illegal or armed organizations do not play an important role inside the project area as they are being controlled by the national government.

The proof of title documentation can be found on the attached document information (see Proof of title folder).

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<sup>59</sup> Detailed information of these companies can be found at [www.thesouthpolegroup.com](http://www.thesouthpolegroup.com) and [www.carbonoybosques.org](http://www.carbonoybosques.org).

**G5.2.** Demonstrate with documented consultations and agreements that

- a. the project will not encroach uninvited on private property, community property, or government property,
- b. the Free, Prior, and Informed Consent has been obtained of those whose property rights are affected by the project through a transparent, agreed process.
- c. appropriate restitution or compensation has been allocated to any parties whose lands have been or will be affected by the project.

According to the previously exposed it can be demonstrated that the will be developed at the properties of the project owners and that the project will not invade any other private property, any communitarian property or any governmental property. The Project owners have the right over the land and over the Certified Emission Reductions to be generated by the project activities taking place in these properties.

**G5.3.** Demonstrate that project activities do not lead to involuntary removal or relocation of Property Rights Holders from their lands or territories, and does not force them to relocate activities important to their culture or livelihood. If any relocation of habitation or activities is undertaken within the terms of an agreement, the project proponents must demonstrate that the agreement was made with the Free, Prior, and Informed Consent of those concerned and includes provisions for just and fair compensation.

The project will not be complicit of involuntary relocation as within the project areas there are not communities living or depending of the resources located inside the farms. The local environmental authorities knew about the project before the project start date and gave approval for the establishment of the plantations for all instances.

**G5.4.** Identify any illegal activities that could affect the project's climate, community or biodiversity impacts (e.g. illegal logging) taking place in the Project Zone and describe measures needed and taken to reduce these activities so that project benefits are not derived from illegal activities.

There are not significant illegal activities occurring inside the project area or in neighboring areas. The area has been considered for being calm and excluded from the social and armed conflict commonly present in other areas of the country.

**G5.5.** Identify any ongoing or unresolved conflicts or disputes over rights to lands, territories and resources and also any disputes that were resolved during the last twenty years where such records exist, or at least during the last ten years. If applicable, describe measures needed and taken to resolve conflicts or disputes. Demonstrate that no activity is undertaken by the project that could prejudice the outcome of an unresolved dispute relevant to the project over lands, territories and resources in the Project Zone.

There are not ongoing or unresolved disputes or conflicts regarding land. Even though that historically this area had been influenced by armed conflict, today such illegal or armed organizations do not play an important role inside the project area as they are being controlled by the national government.

### Legal status

**G5.6.** Submit a list of all national and local laws and regulations in the host country that are relevant to the project activities. Provide assurance that the project is complying with these and, where relevant, demonstrate how compliance is achieved.

Colombian forestry legislation provides incentives to commercial reforestation through the Forestry Incentive Certificate (CIF) under Law 139 of 1994. However, the impact of this incentive has not been significant and effective in its aim to promote reforestation, due to high transaction costs and fact that the effectiveness of the incentive depends mainly on the availability of budgetary resources<sup>60</sup>. When national fiscal resources become scarce, the CIF is often not funded due to other priorities.

Colombia is also a party of the UNFCCC (United Nations Framework Convention on Climate Change) and an active member of the ITTO (International Tropical Timber Organization). Colombia has also signed and adopted the following conventions and agreements:

1. Agreement for the Protection of the World Cultural and Natural Heritage. Paris, 1972
2. Convention on International Trade of Endangered Species: wild fauna and flora. Washington, 1973
3. Convention on Biological Diversity. Rio de Janeiro, 1992
4. Colombia is active in the UNFCCC REDD+ negotiations where it supports market-based mechanisms and has been a vocal proponent of the idea that REDD+ should accommodate a stepped subnational approach, not only to Reference levels and MRV (Government of Colombia 2012) but also in terms of eligibility for phase 3 of REDD+ (results-based payments). This interest in subnational processes is reflected by the fact that Colombia is a member of the advisory committee of the Jurisdictional and Nested Requirements (JNR) working group of the Voluntary Carbon Standard (VCS) (VCS 2013). Colombia has ratified the UNFCCC (1995) and the Kyoto Protocol (2005) and has submitted two National Communications to the UNFCCC (in 2001 and

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<sup>60</sup> Aldana 2004.

2010) (UNFCCC 2013). Colombia is a member of the World Bank Forest Carbon Partnership Facility (FCPF) and became a UN-REDD+ partner country in 2013<sup>61,62</sup>. Colombia has an established Designated National Authority under the CDM and has at has more than one registered CDM Afforestation/Reforestation project<sup>63</sup>.

### **Nacional Legislation**

- Act 139 of 1994 through which creates the forestry incentive certificate (Certificado de Incentivo Forestal - CIF) among others.
- Regulatory Decree 1824 of 1994 through which Act 139 of 1994 is regulated
- Regulatory Decree 900 of 1997 through which CIF for conservation regulated.
- National development forest plan (Plan Nacional de Desarrollo Forestal, 2000).
- Resolution No. 182 of 2008 of MARD, by which are fixed the procedures and requirements for the registration of agroforestry systems or forest crops for commercial purposes, and by which is adopted the format for mobilization.
- Resolution 240 of 2008, by which the resolution 182 of 2008 is amended.
- Act 1377 of 2010 that regulates the activity for commercial reforestation
- Regulatory Decree No. 2803 of 2010, by which is regulated the Ac 1377 of 2010 about registration of forest crops and agroforestry systems for commercial purposes, protective-productive plantations and the mobilization of primary processing products, among others.
- Resolution 058 of 2011, through which a delegation is created and formats are adopted for the registration and updating of the registration certificate, for the mobilization of wood and for the instructions for filling out the products from forestry crops, agroforestry and productive-protective plantations.
- Resolution No. 000319 of 2011, by which are set the national average values of total net costs of establishing and maintaining per hectare of planted forest, as well as the maximum amount to be recognized in respect to the CIF ,and the incentive per tree for 2012.

### **Departmental legislation**

- Resolution 200.41-11.1130 of June 22, 2011. This resolution defines the regional criteria for the development of forestry, agricultural and agro-industrial projects within the jurisdiction of CORPORINOQUIA. It also defines the environmental management measures (Medidas de Manejo Ambiental MMA) for the development of projects in the region.
- Resolution No. 500.41-13.1571 from November 6, 2013, which makes some changes to the resolution No.200.41-11.1130 which did not consider the regulation of projects under 5000 hectares, that execute irrigation and drainage activities and that due to its ecosystemic importance, required to be regulated; subject to the regulations contained in resolution 1130 of June 22, 2011.

<sup>61</sup> <http://theredddesk.org/countries/colombia>

<sup>62</sup> <https://www.minambiente.gov.co/index.php/ambientes-y-desarrollos-sostenibles/cambio-climatico>

<sup>63</sup> <https://cdm.unfccc.int/Projects/MapApp/index.html?state=Registered>



## **Municipal legislation**

- Land management scheme (Esquema de Ordenamiento Territorial EOT, 2010) of the Municipality of Puerto Carreño.

All instances comply with the legislation previously described as they promote reforestation in areas suitable for this purpose, and also promote the soil preparation practices and proper handling of the land, contribute to the mitigation of climate change by reducing GHG emissions, generate sustainable development through their activities and generate social, climatic and environmental co-benefits.

**G5.7.** Document that the project has approval from the appropriate authorities, including the established formal and/or traditional authorities customarily required by the Communities.

The activities will be developed at the properties of the project owners and the project will not invade any other private property, any communitarian property or any governmental property.

**G5.8.** Demonstrate that the Project Proponent(s) has the unconditional, undisputed and unencumbered ability to claim that the project will or did generate or cause the project's climate, community and biodiversity benefits.

See G5.1.

## **CLIMATE SECTION**

This section is used to demonstrate a project's net positive climate benefits and not for claiming greenhouse gas (GHG) emissions reductions and removals units that may be used as offsets. This section is not required for projects that have met the requirements of a recognized GHG Program.

## COMMUNITY SECTION

### CM1. Without-Project Community Scenario

**CM1.1.** Describe the Communities at the start of the project and significant community changes in the past, including well-being information, and any community characteristics. Describe the social, economic and cultural diversity within the Communities and the differences and interactions between the Community Groups.

Since its founding in 1924, and for national sovereignty reasons, Puerto Carreño, acts as an intermedia te port of trade and movement of people and products (livestock, natural resources) to the exterior and interior of the country. Puerto Carreño has fulfilled its role as international control point, supply center and marketing of extractive economy products, border trade center and curatorial administration (Municipio de Puerto Carreño 2012).

#### **Population**

According to DANE (2005), Puerto Carreño has a population of 13,288 inhabitants, of which approximately 77% is located in urban areas, and the remaining in rural areas of the municipality. 37.5% of the resident population in Puerto Carreño, has reached the basic primary level and 28.9% the secondary; 4.3% has reached the professional level and 1.1% had undergone specialization, masters or doctorate programs. The resident population with no education is equivalent to 14.2%. In addition, 23.8% of the population living in Puerto Carreño recognizes itself as Indigenous peoples.

Among the indicators of life quality, life expectancy at birth for these areas vary between 22 and 25 years with respect to the country, ranking among the 60.4 years for the municipal head and 55.5 years for rural areas: 69.8 and 67.6 vs. years respectively are the national averages.

According to DANE, the IBN (Unsatisfied Basic Needs index) is 45.35% of the population of Puerto Carreño, while a 54.35% of the population live in extreme poverty.

The municipal health plan of Puerto Carreño (2008)<sup>64</sup> states that the living conditions of the indigenous population is affected by the few job opportunities with low incomes, which does not allow them to access the basic elements to sustain and improve their quality of life.

The municipality of Puerto Carreño within its priority actions has classified the following groups as vulnerable population groups: **displaced people, the disabled, single mothers, the elderly, indigenous people, children and adolescents**. Special emphasis is given to indigenous communities for being a large group (11.25% of the municipality's population and 4.8% compared to the population of the department), where the loss of cultural identity is perceived. Their habits, customs and traditions area being lost due to the displacement of their reserves to urban areas in search of basic needs such as food, clothing, housing and basic sanitation (Municipio de Puerto Carreño 2012).

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<sup>64</sup> Plan de Salud pública. 2008

The municipality of Puerto Carreño is characterized as a receiving municipality of displaced population, with 2,694 people by 2012 who conform 721 families.

In an effort to ensure their survival (self-consumption), both, settlers and Indigenous peoples, have been using small plots "conucos" resulting from logging, an action that predisposes soil loss due to its highly ecosystemic fragility.

### **Health**

The main causes of morbidity in Vichada, are diseases related to poor sanitation conditions, nutrition, preventive health and hygiene, dental and respiratory problems, malaria, pregnancy problems and skin diseases.

At the departmental level, provisions for primary health and services of second level are basically covered according to an institutional system that is based on the articulation of different types of establishments: local hospitals, health centers with beds, health posts and primary care units. Referrals to centers of greater complexity for health care are done in Villavicencio and Bogota (more than two hours away by plain).

Deficiencies are commonly present related to the coverage of services throughout the departmental territory that warrant its reinforcement. There is also lack of coverage (infrastructure, and staff) and plans to develop preventive health schemes (PMFS La Pedregoza 2014).

**CM1.2.** Evaluate whether the Project Zone includes any of the following High Conservation Values (HCVs) related to community well-being and describe the qualifying attributes for any identified HCVs.

The ecosystems in the Orinoco region, significantly contribute to the country's natural wealth since they meet basic ecological functions for the hydrological cycle of the basin. The ecosystems morichales, gallery forests and wetlands were recognized such as strategic and environmentally fragile areas.

These ecosystems generate different ecosystemic services that benefit the society in various spatial scales (local, regional and national). The direct and indirect use of these services is the basis of the economic growth and regional development.

The services provided by these ecosystems can be grouped into services related to *provisioning* such as the production of food and water; *regulation*, such as climate and disease control; *supporting*, such as nutrient cycles and crop pollination, and *cultural*, such as spiritual and recreational benefits.

The scenic beauty of the savanna landscape is one of the cultural ecosystemic services as well as the cultural richness and diversity of this region, inhabited by indigenous groups and traditional farmers. These inhabitants base their worldview, their management of the environment, social relationships and artistic expressions, on the natural environment of this landscape (Pacheco et al, 2014).

**CM1.3.** Describe the expected changes in the well-being conditions and other characteristics of Communities under the without-project land use scenario, including the impact of likely changes on all ecosystem services in the Project Zone identified as important to Communities.

As described in section G2.1, in the without project scenario, the most likely use of soil is the continuity of livestock under conventional conditions of low productivity. In this scenario the social conditions of the surrounding community will continue to get worse (as well as the ecosystems around them) and will not benefit from the topics described in Table 13 (see CM2.1).

## CM2. Net Positive Community Impacts

**CM2.1.** Use appropriate methodologies to assess the impacts, including predicted and actual, direct and indirect benefits, costs and risks, on each of the identified Community Groups (identified in G1.5) resulting from project activities under the with-project scenario. The assessment of impacts must include changes in well-being due to project activities and an evaluation of the impacts by the affected Community Groups. This assessment must be based on clearly defined and defensible assumptions about changes in well-being of the Community Groups under the with-project scenario, including potential impacts of changes in all ecosystem services identified as important for the Communities (including water and soil resources), over the project lifetime.

The positive and negative community impacts described below correspond to the project area of the first instance.

Without the project scenario, the pasturelands for cattle pollute water sources and compact soil which decreases fertility. Without the project scenario, and along with the national and local circumstances, establishing pastures for the development of cattle requires cleaning vegetation. Such cleaning activities are usually done by burning extensive areas of forest and natural savannahs reducing the fertility and degrading soil and savannas ecosystems.

With the project scenario, the activities of *Forest Reforestation and Restoration, Monitoring and Capacitation and Education*, are being implemented.

The analysis of the net benefits to the communities resulting from the project activity has been organized around the Sustainable Livelihoods Approach (SLA). The SLA includes a framework for understanding the complexities of poverty and guiding principles for action. This framework is designed to center around people and the influences that affect how they can support themselves and their families. The basic units of analysis are *livelihood assets*, which are divided into five categories: human capital, social capital, physical capital, natural capital and financial capital. One of the key factors that affect access to livelihood assets is the *vulnerability context*. This idea incorporates an analysis of economic and political aspects, as well as technological trends, shocks and seasonality.

The guiding principles of the SLA are:

- **Be people-centred.** SLA begins by analyzing people's livelihoods and how they change over time. The people themselves actively participate throughout the project cycle.
- **Be holistic.** SLA acknowledges that people adopt many strategies to secure their livelihoods, and that many actors are involved; for example the private sector, ministries, community-based organizations and international organizations.
- **Be dynamic.** SLA seeks to understand the dynamic nature of livelihoods and what influences them.

- **Build on strengths.** SLA builds on people's perceived strengths and opportunities rather than focusing on their problems and needs. It supports existing livelihood strategies.
- **Promote micro-macro links.** SLA examines the influence of policies and institutions on livelihood options and highlights the need for policies to be informed by insights from the local level and by the priorities of the poor.
- **Encourage broad partnerships.** SLA counts on broad partnerships drawing on both the public and private sectors.
- **Aim for sustainability.** Sustainability is important if poverty reduction is to be lasting<sup>65</sup>.

Project activities, particularly commercial plantations are one of the key development factors of the Vichada's Department; different investments in infrastructure will take place (roads, education, among others) if more companies or projects like this replicate in the region.

The impacts are described for each of the first instances that compose the project area.

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<sup>65</sup> International Fund for Agricultural Development. "The sustainable livelihoods approach"  
<http://www.ifad.org/sla/index.htm>.



Table 13. Expected community impacts due to project activities implementation

Livelihood Asset	Expected impacts	Description	Expected benefits for the areas of the first instance
Human Capital	Increased life expectancy	The project proponent are developing a project that achieves to improve the health of the employees.	<p>Canapro has an occupational health program that aims to preserve the physical and mental condition of the personnel linked to the project, including periodic reviews, training and games sessions in order to teach self-care and risk prevention practices. To do so, Canapro relies on institutions that cover the service as the occupational risk insurance company and the EPS, as well as professional individuals</p> <p>La Pedregoza: The occupational health program is being prepared. The human resources area is responsible for its consolidation.</p> <p>El Toro: At each stage of forest management, occupational health programs are implemented in the relevant topics.</p>
	Increase in perception/ recognition of the value of forest resources	Project employees have executed educational activities and specific training for the workers. Several workshops were implemented about ecology and conservation of the biodiversity, focused on all project staff. In addition, trainings are expected, to people who have responsibilities in monitoring the use of methodologies and materials / equipment, samples and the use of the notebook and field formats.	Continued education and environmental awareness. Conservation of forests and fragile areas. Sustainable management of plantations. Protection and security for workers.

Livelihood Asset	Expected impacts	Description	Expected benefits for the areas of the first instance
	Improvement in <b>skills and knowledge</b> in forest management	The project activities include trained of all workers in techniques of reforestation and maintenance of forest plantations. This training includes all steps from site preparation to establishment of the plantations, plant production, maintenance of the plantations, weed control, fertilization, sawing, dilution, acidification and lamination and drying and pressing.	Canapro: Industrial safety is a priority for each of the processes as it provides training and necessary security elements for the implementation of specific activities.
			La Pedregoza: Each new worker is trained in occupational safety and health. The industrial safety manual is under construction
			El Diamante: Training according to the activities performed by the worker and in general activities such as health and safety.
			El Toro: The company meets all the requirements for forest management of the <b>OME</b> in each forest stages, emphasizing in all risks to health and the integrity of workers.
			Reminders are posted over the project area about the use of garments for industrial safety and the appropriate use of forest tools and records of signatures of each worker. The company is working on the implementation of a first aid system as required by the rules for such cases.
<b>Social Capital</b>	Relations of <b>trust and mutual support</b>	Policy work: ensure the quality of life of workers in the project area. They have guarantees of legal character and prerogatives of each property.	Implementation of a workers policy.
			On the other hand, El Toro financially supports educational institutions and collaborates in expanding the number of hours of electric light and provides the health center with drugs.
<b>Physical Capital</b>	New or improved <b>transportation infrastructure</b>	Project activities will improve the infrastructure of the properties of the first instance.	Project activities generate income to improve the infrastructure for both workers and inhabitants of the region (roads, bridges, etc.).
	Improved <b>access to markets</b> (due to new or improved	Easy access to local markets	To improve the road infrastructure, more people will have access to markets in the city in lesser time.

Livelihood Asset	Expected impacts	Description	Expected benefits for the areas of the first instance
	roads/infrastructure)		
	<b>Ecotourism facilities</b> developed or improved	Implement ecotourism activities in the project areas	The conditions of the project area (biodiversity, forestry strategy, protection of water resources - Bitá's river, etc.) drive the eco-tourism sector.
<b>Financial Capital</b>	<b>Employment</b> (direct and indirect)	Project proponent and entities involved in the project design and implementation are not involved in or complicit in any form of discrimination (Including discrimination based on gender, race, religion, sexual orientation or other habits) or sexual harassment with respect to the project.	Canapro: The permanent staff of the Canapro's Agroforestry project consists of 52 permanent people, hired for an indefinite term and with all the legal benefits and stimuli proper of the company.
			La Pedregoza: This company generates employment for the local community of Puerto Carreño and for other places in Colombia. Currently the company has 8 employees working under permanent contracts and about 10 people working in the form of delivered services. Different employment opportunities are Indirectly generated, such as financial management and statutory audit, personnel providing services to the company as well as the restaurant service, which is independently provided by a lady.
		El Diamante and El Toro will generate an important amount of employments in subsequent stages of the project.	
	Increase in <b>cash income from carbon payments</b> to individuals	Increases in the investment for implementation and monitoring of the project activities	The properties within the carbon project may have additional income to improve the quality of workers, quality of plantations, monitoring and sustainable actions in the project area.
	<b>New income from ecotourism</b>	Revenues from ecotourism activities in the region	Revenues from ecotourism: ecologic walks, fishing, beekeeping, river navigation, among others.

Livelihood Asset	Expected impacts	Description	Expected benefits for the areas of the first instance
	Increase in income or new <b>income from the sale of timber</b>	Revenues from the sale of wood	Wood for poles and sawing, timber for tables and laminated beams, biochar, chipped wood for pellets. <b>Horizonte Verde:</b> The company is projecting to set a portable sawmill to move semi processed wood.
<b>Natural Capital</b>	<b>Tools and technology</b>	Locals will benefit from the capacity-buildings that refer among others to the improved reforestation activities.	<b>Canapro:</b> The project has staff training plans. The topics are varied, and include aspects related to the specific work, dynamic and needs of the project, personal growth, among others.
			<b>La Pedregoza:</b> Trainings were executed on snake venom, pruning, fertilization and natural silviculture. Quarterly trainings are executed to new employees about organic fertilization. In addition, every six months are executed trainings about general issues including prevention and control of fires, first aid and waste management. Currently new trainings are being planned on occupational hazards and occupational health.
			<b>El Diamante:</b> Will train workers in a different job, becoming a different alternative for land use (forest culture).
			<b>El Toro:</b> They train technicians and forest workers in upgrade courses about management and prevention in the use of forestry tools, industrial safety, handling and use of protective clothing, first aid, handling of materials, mineral, non-mineral and organic waste, assessments and periodically reminders about the degree of learning in different subjects, among others.
	<b>Increased in the availability of timber</b>	Production and local sourcing of wood	The first harvest or thinning and the final harvest will increase the availability of wood in the area, as well as byproducts such as biochar.
	<b>Forest and non forest products</b>	Forest plantations generate income, both, from the sale of	<b>Canapro:</b> Research and technical experiences are executed to develop products such as bee-keeping, the use of cellulose in the edible fungus production and the use of biomass as an energy and heat source, among others.

Livelihood Asset	Expected impacts	Description	Expected benefits for the areas of the first instance
		timber and of non-timber products.	<p><b>La Pedregoza:</b> Income generation from the sale of agroforestry products, aromatic oils from Eucalyptus and honey.</p> <p><b>EI Diamante:</b> Production of wood from planted areas, decreases the pressure on natural forests and promotes the conservation of forest through the implementation of sustainable management practices. Wood procurement and indirect products such as cashew (marañon) fruit.</p> <p><b>EI Toro:</b> income generation from the sale of forest products and the use of high-technology manufacturing processes</p>
	Increased in <b>land prices</b>	The development of forestry activities affects the social and economic context.	Increase in the valuation of properties, both in the project area and the project zone.
	Increase or <b>stabilization of water flows and/or quality</b> for local people	The project activities can improve water resources in the project area. The infiltration rate of water into the soil under the plantations are more gradual. Reforestation also improves the watersheds and water resources, thus improving the natural environment for aquatic life.	Conservation of riparian forests.

Livelihood Asset	Expected impacts	Description	Expected benefits for the areas of the first instance
	Increase in <b>wildlife populations</b> due to increased forest cover or protection	Reforestation contributes to the protection and expansion of native wildlife habitats and to the reduction of pressure on native forest, increases the populations of endemic and endangered species, the creation of shelterbelts in waterways with native species and to the restoration of micro fauna and increases in the biomass.	All properties have fauna and flora inventories
	Damage to crops or plants due to increased in wildlife inhabiting new nearby forest cover	Damage to the planted area, associated with activities related to invasion of wildlife, development of burrows and displacement of fauna	Protection of areas likely to be attacked; through methods not harmful to wildlife.
	Increased in <b>soil conservation</b> and soil fertility/ productivity	Soil conservation due to the forest cover; and higher productivity as a result of fertilization	The properties use organic fertilizers and chemicals in lower proportion for the management of the forest plantation.
	Increased in <b>erosion</b> due to logging and/or road building	The final harvest could cause erosion and / or soil compaction	Activity executed according to the management plans. All necessary measures shall be taken into account to mitigate environmental and social impacts, through proper planning of harvest. In addition, harvest plans involve replanting to maintain soil cover and carbon sequestration.



Livelihood Asset	Expected impacts	Description	Expected benefits for the areas of the first instance
	Increased in <b>availability of fuel-wood</b>	Production of biochar	One of the expected products by the properties is the production of biochar or charcoal for both energy use and compost and / or mulch.

Table 14. Expected impacts on stakeholder groups.

Livelihood asset	Expected impact	Medium /Long term	Direct/ Indirect	Effect (+) / (-)	Stakeholder groups
Human capital	Increased <b>life expectancy</b>	Long	Indirect	+	Workers of the farms / Group of indigenous
	Increase in perception/recognition of the <b>value of forest resources</b>	Med	Direct	+	Workers of the farms / Group of indigenous
	Improvement in <b>skills and knowledge</b> in forest management	Med	Direct	+	Workers of the farms / Group of indigenous
Social capital	Relations of <b>trust and mutual support</b>	Med	Direct	+	Workers of the farms / Group of indigenous/ Project owners
Physical capital	New or improved <b>transportation infrastructure</b>	Long	Direct	+	Workers of the farms / Group of indigenous/ Project owners
	Improved <b>access to markets</b> (due to new or improved roads/infrastructure)	Med	Indirect	+	Workers of the farms / Group of indigenous/ Project owners
	<b>Ecotourism facilities</b> developed or improved	Med	Direct	+	Group of indigenous/ Project owners
Financial capital	<b>Employment</b> (direct and indirect)	Med	Direct	+	Workers of the farms / Group of indigenous
	Increase in <b>cash income from carbon payments</b> to individuals	Med	Direct	+	Project owners
	New income from <b>ecotourism</b>	Med	Direct	+	Group of indigenous/ Project owners
	Increase in income or new <b>income from the sale of timber</b>	Med	Direct	+	Project owners
Natural capital	<b>Tools and technology</b>	Med	Direct	+	Workers of the farms / Project owners
	Increased in the <b>availability of timber</b>	Med	Direct	+	Workers of the farms / Group of

Livelihood asset	Expected impact	Medium /Long term	Direct/ Indirect	Effect (+) / (-)	Stakeholder groups
					indigenous/ Project owners
	<b>Forest and Non forest products</b>	Med	Direct	+	Workers of the farms / Group of indigenous/ Project owners
	Increased in <b>land prices</b>	Long	Indirect	+	Workers of the farms / Group of indigenous/ Project owners
	Increase or <b>stabilization of water flows and/or quality</b> for local people	Med	Direct	+	Workers of the farms / Group of indigenous/ Project owners
	Increase in <b>wildlife populations</b> due to increased forest cover or protection	Med	Indirect	+	Workers of the farms / Group of indigenous/ Project owners
	<b>Damage to crops or plants</b> due to increased in wildlife inhabiting new nearby forest cover	Med	Indirect	-	Workers of the farms / Group of indigenous/ Project owners
	Increased in <b>soil conservation</b> and soil fertility/ productivity	Med	Direct	+	Workers of the farms / Project owners
	Increased in <b>erosion</b> due to logging and/or road building	Med	Direct	-	Workers of the farms / Project owners
	Increased in <b>availability of fuel-wood</b>	Med	Direct	+	Workers of the farms / Group of indigenous/ Project owners

**CM2.2.** Describe measures needed and taken to mitigate any negative well-being impacts on Community Groups and for maintenance or enhancement of the High Conservation Value attributes (identified in CM1.2) consistent with the precautionary principle.

The measures taken to avoid and mitigate the possible impact: *Increased in **erosion** due to logging and/or road building*, are:

- Segmentation of large lots into separate blocks by ridges permanently constructed according

to the slope, reducing erosional processes caused by rainwater.

- Establishment of live barriers or dams in strategic locations.
- Improve the physical, chemical and microbiological soil conditions, through the management of soil compaction by using a deep vibratory chisel for plowing prior to planting. Proper management using drainages to reduce the velocity of the runoff.
- Improve the physical and microbiological soil conditions, through the implementation of environmentally friendly and natural practices, such as applying natural fertilizers and mycorrhizae.
- Allow the surface of the exposed soil to keep its natural cover in order to reduce the incidence of direct sunlight, reducing the evaporation of water. This allows the thermal amplitude variability to be lower, favoring the plantations and the activity of soil microorganisms.
- Use more appropriate technologies to continually and progressively reduce significant environmental impacts of forest operations.
- Train the staff and provide adequate means, to work with a responsible attitude towards the protection of the environment. In addition, promote environmental awareness among staff and the community itself.
- Follow the harvesting plan of each species, responding to the needs of forest products.
- The harvesting plan involves immediate replanting to maintain the soil cover and the sequestration of carbon. Roots, branches and other parts that are not useful during the harvest will be converted into chips or rolled pieces and then reintegrated to the soil to maintain the contents of organic material.

**CM2.3.** Demonstrate that the net well-being impacts of the project are positive for all identified Community Groups compared with their anticipated well-being conditions under the without project land use scenario (described in CM1).

As described in Section CM1.1 the project will generate positive changes in the identified community groups. The project areas are degraded pastures with severe soil erosion and do not generate income to local communities, as a result under the without-project scenario, the ecosystem services, livelihood of communities and cultural values provided by the project lands is weak. Therefore, net impact of the project are positive for local communities.

**CM2.4.** Demonstrate that no High Conservation Values (identified in CM1.2) are negatively affected by the project

The project owners have internalized environmental and social sustainability criteria into their projects, including but not limited to respect for native species, prohibitions on logging in natural forests and hunting, preservation of natural ecosystems and aquifer systems and implementation of productive systems under good practices.

Therefore, it is expected that natural ecosystems such as gallery forests, morichales and wetlands:

- These ecosystems are not affected (projects are not carried out in such areas)

- It is hoped that forestry plantations (both commercial and restoration) becomes a buffer area. These ecosystems will therefore continue to contribute to community the provisioning, regulating, supporting and cultural services.

### **CM3. Other Stakeholder Impacts**

**CM3.1.** Identify any potential positive and negative impacts that the project activities are likely to cause on the well-being of Other Stakeholders.

No critical ecosystem services are going to be negatively affected by the project activities to people who live in the project zone, as there are not settlements located inside the project zone. Communities located inside the project area, live far away from the project zone and therefore no significant impacts have been identified for them.

**CM3.2.** Describe the measures needed and taken to mitigate the negative well-being impacts on Other Stakeholders.

No negative impacts have been identified on other stakeholders, and therefore no measures or activities have been developed

**CM3.3.** Demonstrate that the project activities do not result in net negative impacts on the well-being of Other Stakeholders.

NA

### **CM 4. Community Impact Monitoring**

**CM4.1.** Develop and implement a monitoring plan that identifies community variables to be monitored, Communities, Community Groups and Other Stakeholders to be monitored, the types of measurements, the sampling methods, and the frequency of monitoring and reporting. Monitoring variables must be directly linked to the project's objectives for Communities and Community Groups and to predicted outputs, outcomes and impacts identified in the project's causal model related to the well-being of Communities (described in G1.8). Monitoring must assess differentiated impacts, including and benefits, costs and risks, for each of the Community Groups and must include an evaluation by the affected Community Groups.

Community impacts will be evaluated every verification period through the indicators described in Table 15. This evaluation aims to answer three key questions<sup>66</sup>:

- What changes have there been in the community since the start of the project?
- Which of these changes are attributable to the project?
- What difference have these changes made to people's lives?

Quantitative indicators will be compiled using the records were kept of the implementations activities in each nucleus (Data record). Qualitative indicators will be compiled through survey of stakeholders.

Table 15. Indicators used for assessing the social impact of the project

Livelihood Asset	Expected impact	Indicator	Method	Frecuency
Human Capital	Increased <b>life expectancy</b>	Number of lectures on Occupational Health	Data record	Each verification period
		Number of persons attending these lectures	Data record	Each verification period
	Increase in perception/ recognition of the <b>value of forest resources</b>	Level of awareness, perception/ recognition of the value of forest resources	Survey	Each verification period
	Improvement in <b>skills and knowledge</b> in forest management	Number of lectures on Industrial Safety	Data record	Each verification period
		Number of persons attending these lectures	Data record	Each verification period
Social Capital	Relations of <b>trust and mutual support</b>	Amount invested (COP) in educational and health institutions, provision of lighting and power plants for the community.	Data record	Each verification period
		Level of awareness, perception/ recognition of decent and fair conditions work conditions	Survey	Each verification period

<sup>66</sup> Overview of the PIA approach. Richards, M. 2011. Social and Biodiversity Impact Assessment (SBIA) Manual for REDD+ Projects: Part 2 – Social Impact Assessment Toolbox. Climate, Community & Biodiversity Alliance and Forest Trends with Rainforest Alliance and Fauna & Flora International. Washington, DC.



Livelihood Asset	Expected impact	Indicator	Method	Frequency
<b>Physical Capital</b>	<b>New or improved transportation infrastructure</b>	Amount invested (COP) in roads or transportation infrastructure	Data record	Each verification period
		Number of kilometers of roads or transportation infrastructure in maintenance, upgrade or renovation	Data record	Each verification period
		Number of kilometers of roads or transportation infrastructure built	Data record	Each verification period
	<b>Improved access to markets</b> (due to new or improved roads/infrastructure)	Number of persons under improved accessibility to local markets	Survey	Each verification period
	<b>Ecotourism facilities</b> developed or improved	Number of tourists (for ecotourism facilities) who visit the project area	Data record	Each verification period
		Number of ecotourism initiatives implemented	Data record	Each verification period
<b>Financial Capital</b>	<b>Employment</b> (direct and indirect)	Number of people employed	Data record (contracts)	Each verification period
	Increase in <b>cash income from carbon payments</b> to individuals	Number of activities implemented due to the sale of carbon credits	Data record	Each verification period
	New income from <b>ecotourism</b>	Number of ecotourism initiatives implemented	Data record	Each verification period
	Increase in income or new <b>income from the sale of timber</b>	Gain achieved (COP) from the sale of timber	Data record	Each verification period
<b>Natural Capital</b>	<b>Tools and technology</b>	Number of training workshops regarding to forest management and silvicultural practices.	Data record	Each verification period

Livelihood Asset	Expected impact	Indicator	Method	Frequency
		Number of persons attending these workshops	Data record	Each verification period
		Level of perception/ recognition of increase in job opportunities due to skills obtained in the project	Survey	Each verification period
	Increased in the <b>availability of timber</b>	Número de personas que consideran mayor oferta forestal en la zona del proyecto	Survey	Each verification period
	Forest and non forest <b>products</b>	Number of non-timber products	Data record	Each verification period
		Yield of non-timber products activities	Data record	Each verification period
	Increased in <b>land prices</b>	Percent change in land valuation	Data record	Each verification period
	Increase or <b>stabilization of water flows and/or quality</b> for local people	Gallery forests expansión (ha)	GIS	Each verification period
	Increase in <b>wildlife populations</b> due to increased forest cover or protection	Please refer to biodiversity monitoring		
	<b>Damage to crops or plants</b> due to increased in wildlife inhabiting new nearby forest cover	Number of incidents of wildlife	Data record	Each verification period
		Area affected by wildlife (ha)	Data record	Each verification period
Increased in <b>soil conservation</b> and soil fertility/ productivity	Please refer to biodiversity monitoring			

Livelihood Asset	Expected impact	Indicator	Method	Frequency
	Increased in <b>erosion</b> due to logging and/or road building	Number of harvested trees	Data record	Each verification period
		Number of harvested hectares (ha)	Data record	Each verification period
		Number of trees replanted (after harvest)	Data record	Each verification period
		Number of hectares (ha) replanted (after harvest)	Data record	Each verification period
		Affected area (ha) due to logging and/or road building-excluding the roads	GIS	Each verification period
	Increased in <b>availability of fuel-wood</b>	Production of biochar	Data record	Each verification period

The main steps proposed in the assessment are:

- Gather and train the team. Once the technician team is involved in the project, training workshops will be held for discussing, in order to ensure that all team members fully understand the purposes, contents, procedures and specific methods of the field survey.
- Define the questions to be answered. The key research issues and questions should be identified, based on a clear understanding of the project logic and objectives. It is suggested using a simple questioning process or semi-structured interview with project participants.
- Define the stakeholders involved in the surveys, and the corresponding questions according to each stakeholders sub-groups (project owners, farm workers and their families – in the case they live in the project zone-, neighbors farm –including the administrator of the farm-local government, environmental government – CORPORINOQUIA- NGOs, local leaders, grass roots or community-based organizations such as AGAF, etc.).
- Collect the information according to the indicators described in Table 15.
- Systematize the results obtained and assess the project’s social contribution differentiating between the benefits and costs and risks (negative impacts). If it was needed, develop a mitigation plan for identified negative impacts.
- Feedback and verify the results with the stakeholders sub-groups previously mentioned.

**CM4.2.** Develop and implement a monitoring plan to assess the effectiveness of measures taken to maintain or enhance all identified High Conservation Values related to community well-being.

The measures taken to maintain or enhance the identified HCV related to community well-being and taken for avoiding the impact: *Increased erosion due to logging and/or road building*, are:

- Segmentation of large lots into separate blocks by ridges permanently constructed according to the slope, reducing erosional processes caused by rainwater.
- Establishment of live barriers or dams in strategic locations.
- Improve the physical, chemical and microbiological soil conditions, through the management of soil compaction by using a deep vibratory chisel for plowing prior to planting. Proper management using drainages to reduce the velocity of the runoff.
- Improve the physical and microbiological soil conditions, through the implementation of environmentally friendly and natural practices, such as applying natural fertilizers and mycorrhizae.
- Allow the surface of the exposed soil to keep its natural cover in order to reduce the incidence of direct sunlight, reducing the evaporation of water. This allows the thermal amplitude variability to be lower, favoring the plantations and the activity of soil microorganisms.
- Use more appropriate technologies to continually and progressively reduce significant environmental impacts of forest operations.
- Train the staff and provide adequate means, to work with a responsible attitude towards the protection of the environment. In addition, promote environmental awareness among staff and the community itself.
- Follow the harvesting plan of each species, responding to the needs of forest products. The harvesting plan involves immediate replanting to maintain the soil cover and the sequestration of carbon. Roots, branches and other parts that are not useful during the harvest will be converted into chips or rolled pieces and then reintegrated to the soil to maintain the contents of organic material.

Effectiveness of these measures will be assessed on basis of the replanting plan compliance and quantified through the geographic information system using the next indicators:

- Number of hectares (ha) replanted (after harvest)
- Number of hectares (ha) replanted (after harvest)
- Affected area (ha) due to logging and/or road building- excluding the roads

**CM4.3.** Disseminate the monitoring plan, and any results of monitoring undertaken in accordance with the monitoring plan, ensuring that they are made publicly available on the internet and summaries are communicated to the Communities and Other Stakeholders through appropriate means.

The results of monitoring undertaken will be made publicly available on the internet and through the web site of the project proponent (Fundación Natura) and the ones of the project owners.

Additionally, all documents and information about the results of the monitoring and verification of this project will be published in the platforms of the VCS and CCB standards as usual.

## BIODIVERSITY SECTION

### B1. Biodiversity Without–project Scenario

**B1.1.** Describe biodiversity within the Project Zone at the start of the project and threats to that biodiversity, using appropriate methodologies.

The natural ecosystem in which the municipality of Puerto Carreño is located, has been dramatically intervened without any restrictions by the action of man, threatening the ecological balance. In an effort to ensure their survival (self-consumption), both, settlers and Indigenous peoples, have been using small plots "conucos" resulting from logging, an action that predisposes soil loss due to its highly eco systemic fragility

There is no doubt that the treatment that has been given to the natural vegetation and land use for agricultural purposes has generated fundamental changes in the physiognomy of different plant associations, affecting the fauna component (Municipio de Puerto Carreño 2012). The most representative ecosystems in the project area are (see detailed description in G1.3):

- Flooded Forest
- Gallery Forest
- Savannas
- Dwarf trees
- Morichales and Saladillales



Figure 18. Natural vegetation. *Mauritia flexuosa* (Palma de Moriche).

In addition to this local problem, during the past three decades, the Colombian Orinoco has undergone a rapid change in their natural covers due to an increase in land use for the purpose of establishing agro-industrial systems, exploitation of hydrocarbons, among others. This growth reduces the quantity and quality of the natural habitat, which results in fragmentation and changes in

the landscape composition (changes in geometry and amount of habitat edge) and then a decreases of biodiversity (Pacheco et al, 2014).

Endangered species

The freshwater dolphin (*Inia geoffrensis*), the West Indian manatee (*Trichechus manatus manatus*) and the giant otter (*Pteronura brasiliensis*), are threatened aquatic mammals. In mammals, the pressures on their habitat represent the greatest threat to species like the leopard (*Leopardus pardalis*) and the *Cebus apella*. The “llanero” caiman (*Caiman intermedius*) is emblematic of the area and one of the most studied crocodiles in the basin; it is of commercial importance, endemic and in critical need of conservation. The morrocoy and charapa turtles (*Geochelone denticulata* and *Podocnemis expansa*), are also in danger of extinction; locals consume the eggs or meat of these specie and they are hunted very young to be exported as aquarium pets<sup>67</sup>.



**Figure 19.** Some endangered species of the Orinoco region.

Appendix I presents the list of species reported as endangered in the region, according to the UICN red list of threatened species, version 2012. Endangered species usually habit in natural savannahs, gallery forest and water ecosystems of the main rivers: Meta and Orinoco. Such covers are present within the project zone, and therefore such species use the project zone during some portion of their lives.

In the without project scenario, is likely that the use of soil would be the continuity of livestock under conventional conditions of low productivity. The pasturelands for cattle simply cannot support the diversity of a forest plantation: cows pollute water sources and compact soil, which decreases fertility. In the baseline scenario, the extensive cattle-ranching is constantly competing with the forest covers and with the natural savannahs, and therefore, is displacing the fauna and flora present mostly inside the gallery forest.

<sup>67</sup> Governance of Vichada 2008, CORPORINOQUIA, 2004.



**B1.2.** Evaluate whether the Project Zone includes any of the following High Conservation Values (HCVs) related to biodiversity and describe the qualifying attributes for any identified HCVs.

High conservation values (HCV) will be protected by the Project owners and developers. In general there are two HCV identified as:

- Gallery forests, wetlands and morichales. These ecosystems have been recognized by the owners of the instances and no plantings or human interventions will take place on such areas. Those places are constantly monitored by the environmental authorities and by the communities as they found these areas very important, for the conservation of water resources and the establishment of fauna.
- Threatened and endemic species (see B1.1 and Appendix I).

**B1.3.** Describe how the without-project land use scenario would affect biodiversity conditions in the Project Zone.

As described in section G.2.1, in the without project scenario, is likely that the use of soil would be the continuity of livestock under conventional conditions of low productivity. Besides, the dominant food and main source of dietary energy for livestock are natural pastures with high level of lignification, therefore widespread slash-and-burn techniques and prescribed burns are used to encourage the regrowth of these pastures<sup>6869</sup>.

The pasture lands for cattle simply cannot support the diversity of a forest plantation: cows pollute water sources and compact soil, which decreases fertility. In the baseline scenario, the extensive cattle-ranching is constantly competing with the forest covers and with the natural savannahs, and therefore, is displacing the fauna and flora present mostly inside the gallery forest<sup>70</sup>.

The project activities will help the natural regeneration in the areas of influence of riparian forests. In addition, the balance between mature forest and stubble depends on the management of sites and of each particular case to assess these effects of plantations on biodiversity.

Forest plantations have their own levels of structural connectivity and behavioral determined by its ability to provide means for the development of ecological processes; these conductivity levels depend on the silvicultural processes and on the species to be used.

## B2. Net Positive Biodiversity Impacts

**B2.1.** Use appropriate methodologies to estimate changes in biodiversity, including assessment of predicted and actual, positive and negative, direct and indirect impacts, resulting from project

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<sup>68</sup> Parques Nacionales Naturales de Colombia. 2005. Línea Base para la Planeación del Manejo Parque Nacional Natural El Tuparro. Disponible en:

<http://www.parquesnacionales.gov.co/PNN/portel/libreria/pdf/LneaBasePNNTuparro.pdf>

<sup>69</sup> Diagnóstico E.O.T. Puerto Carreño, 2010

<sup>70</sup> La Orinoquia de Colombia. Disponible en: <http://www.imeditores.com/banocc/orinoquia/cap7.htm>

activities under the with-project scenario in the Project Zone and over the project lifetime. This estimate must be based on clearly defined and defensible assumptions.

The project is developed as a system of well-managed commercial plantations, which seeks to minimize the impact of plantations on natural ecosystems and promote the maintenance of the different ecosystem services in the high plains, using criteria of environmental sustainability. The intervention areas and the zoning process, is based on the precautionary principle, therefore, it intends to leave some potential planting area as natural ecosystem, including savannahs. This promotes the permanence of habitat for wildlife and a part of the structure and functionality of the landscape of the high plains, which can be crucial to maintain the provision of ecosystem services (Pacheco et al 2014).

According to the previously exposed, besides the productive systems, the project is also considered an activity of landscape restoration<sup>71</sup> that incorporates objectives of conservation of biodiversity and generates the following impacts:

Table 16. Expected impacts on biodiversity

Impact	Effect	Actual/ Predict	Direct/ Indirect
Increase of forest cover	Positive	Actual	Direct
Connectivity of strategic ecosystems	Positive	Predicted	Direct
Recovery of ecological niches.	Positive	Predicted	Indirect
Conservation of water sources	Positive	Predicted	Direct
Landscape restoration	Positive	Predicted	Indirect
Recovery of fauna habitats	Positive	Predicted	Indirect
Increase of native plant covers.	Positive	Predicted	Direct
Increase of biodiversity: fauna and flora	Positive	Predicted	Indirect
Carbon sequestration	Positive	Actual	Direct
Control of erosion	Positive	Predicted	Direct
Loss of biodiversity due to the disturbance of natural ecosystems	Negative	Predicted	Direct
Disturbance of the natural balance of nutrients in the soil, changes of pH, salinization, and pollution of water bodies due to the excessive or inappropriate use of agrochemicals	Negative	Predicted	Direct
Disturbance of Wildlife due to the excessive or inappropriate use of herbicides	Negative	Predicted	Direct

<sup>71</sup> OIMT and UICN (2009) recognize well-managed commercial plantations as a restored forest landscapes, as well as the benefits of those. IUCN, 2010. Gestión Forestal Sostenible, biodiversidad y medios de vida. Disponible en: <https://www.cbd.int/development/doc/cbd-guide-des-bonnes-pratiques-forests-web-es.pdf>

**B2.2.** Demonstrate that the project's net impacts on biodiversity in the Project Zone are positive, compared with the biodiversity conditions under the without-project land use scenario (described in B1).

As described in section G.2.1, in the without project scenario, is likely that the use of soil would be the continuity of livestock under conventional conditions of low productivity. Besides, the dominant food and main source of dietary energy for livestock are natural pastures with high level of lignification, therefore widespread slash-and-burn techniques and prescribed burns are used to encourage the regrowth of these pastures<sup>72,73</sup>.

The pasturelands for cattle simply cannot support the diversity of a forest plantation: cows pollute water sources and compact soil, which decreases fertility. In the baseline scenario, the extensive cattle-ranching is constantly competing with the forest covers and with the natural savannahs, and therefore, is displacing the fauna and flora present mostly inside the gallery forest<sup>74</sup>.

In the project scenario, the intervention of the planted areas has been done by using criteria of environmental sustainability, which includes prevention and mitigation of possible adverse impacts (Table 16 and section B2.3).

As part of the sustainable management of the properties, the project intends to leave some potential planting area as natural ecosystem, including savannahs. This promotes the permanence of habitat for wildlife and a part of the structure and functionality of the landscape of the high plains, which can be crucial to maintain the provision of ecosystem services (Pacheco et al 2014).

These features decrease the ecosystem fragility, increase the quantity and quality of the natural habitat, reduce the impact of fragmentation and change in landscape composition and its consequences on biodiversity.

**B2.3.** Describe measures needed and taken to mitigate negative impacts on biodiversity and any measures needed and taken for maintenance or enhancement of the High Conservation Value attributes (identified in B1.2) consistent with the precautionary principle.

The measures needed and taken to avoid negative impacts on biodiversity are described in detail in the documents related to the sustainable forest management plan (PMFS) of each nucleus.

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<sup>72</sup> Parques Nacionales Naturales de Colombia. 2005. Línea Base para la Planeación del Manejo Parque Nacional Natural El Tuparro. Disponible en:

<http://www.parquesnacionales.gov.co/PNN/portel/libreria/pdf/LneaBasePNNTuparro.pdf>

<sup>73</sup> Municipal Center for Documentation and Information. Zoning scheme. Available at:

[http://cdim.esap.edu.co/BancoMedios/Documentos%20PDF/diagnostico\\_pto\\_carre%C3%B1o\\_\(59\\_pag\\_126\\_kb\).pdf](http://cdim.esap.edu.co/BancoMedios/Documentos%20PDF/diagnostico_pto_carre%C3%B1o_(59_pag_126_kb).pdf)

<sup>74</sup> La Orinoquia de Colombia. Disponible en: <http://www.imeditores.com/banocc/orinoquia/cap7.htm>

***Impacts on soil, fauna, flora and water bodies due to the excessive or inappropriate use of agrochemicals***

- Set the optimum composition and concentrations of nutrients required and the type of materials used for its production.
- Train the staff in charge of handling the product
- Administer the product during the appropriate seasons to maximize their efficiency and avoid the imbalance of nutrients in the soil.
- During the process of fertilization and composting, is produced a degree of non-reusable waste (plastics and others. The person in charge should clearly identify this type of material, to proceed with the proper method of storage and disposal.
- Washing and maintenance of machinery, tools and containers used for the handling of products, is forbidden in areas close to natural drainage or water sources.
- Improvement of the physical and microbiological soil conditions by implementing a natural silviculture strategy that includes applying natural fertilizers and mycorrhizae (Farm La Pedregoza).
- Application of the principle of organic farming and weed control through the use of bio-degradable herbicides, plant protection with less impact and biological control for pests (Farm El Toro).

***Control of erosion***

- Segmentation of large lots into separate blocks by ridges permanently constructed according to the slope, reducing erosional processes caused by rainwater.
- Establishment of live barriers or dams in strategic locations.
- Improve the physical, chemical and microbiological soil conditions, through the management of soil compaction by using a deep vibratory chisel for plowing prior to planting. Proper management using drainages to reduce the velocity of the runoff.
- Allow the surface of the exposed soil to keep its natural cover in order to reduce the incidence of direct sunlight, reducing the evaporation of water. This allows the thermal amplitude variability to be lower, favoring the plantations and the activity of soil microorganisms.

***Loss of biodiversity due to the disturbance of natural ecosystems (savannahs)***

- Leave some potential planting area as natural ecosystem, including savannahs. This promotes the permanence of habitat for wildlife and a part of the structure and functionality of the landscape of the high plains, which can be crucial to maintain the provision of ecosystem services
- Keep a band of 100 meters as buffer zones and transition area between the plantations and the forest, in order to allow successional forest dynamics is developed, in addition to minimizing the human intervention on it.

**B2.4.** Demonstrate that no High Conservation Values (identified in B1.2) are negatively affected by the project.

The forest cover generated by the plantations, increase the connectivity of natural ecosystems, which favors the protection of gallery forests, wetlands and morichales. Additionally, the recovery of ecological niches for endemic, vulnerable or threatened species is favored. Therefore, the HCV are not expected to be negatively affected by the project.

**B2.5.** Identify all species used by the project and show that no known invasive species are introduced into any area affected by the project and that the population of any invasive species does not increase as a result of the project.

The most used species for the project are the *Acacia mangium*, *E. tereticornis* and native species. These species occupy more than 80% of the area intervened by the project. To a lesser extent, other species have been used, such as *E. pellita*, *A. occidentale*, *H. brasiliensis* and *P. caribaea*. The main characteristics and growth conditions of these species are described below.

- *Acacia mangium*

The most used specie for reforestation projects is the *Acacia mangium*<sup>75</sup>. It is an indigenous species from the northwestern part of Australia, Papua New Guinea and eastern Indonesia, including the Moluccas islands. In Central America it is known as Mangium or Acacia. It has been introduced in countries like Sri Lanka, Popular China, Thailand, Malaysia, Nepal, the Philippines, among others. In Central America was introduced in 1979, for research purposes only and to a higher level only from 1984, in Panama, Costa Rica and Honduras. It is a fast growing species, which grows well in wet and very humid tropical forest; especially in the lower areas of flat topography.

This tree reaches 25-30 m in height and up to 90 cm in diameter. It grows well from the sea level to 720 meters above, with temperatures between 12 °C and 34 °C and rainfall between 1,500 and 4,500 mm / year. It grows fast, prefers fertile soils that present good drainage, grows well in acidic soils, tolerates low pH greater than 4. It has an apical dominance when grows in open areas.

It is a heliofita specie that regenerates prolifically on abandoned land, or after heavy disturbances such as fires. It prefers deep alluvial soils, but also grows on soils depleted by the prolonged use in agricultural production. The wood is beautiful and with fine features, thus this specie has several uses; heavy constructions, wood crafts and furniture. Its cultivation has been encouraged in Colombia and Venezuela as a source of forage for livestock.

Although in Brazil this species has an invasive behavior (in the states of Amapa and Roraima in the Amazon and in the Atlantic Forest and coastal vegetation zones of Bahía, Espiritu Santo and Rio de

<sup>75</sup> Pabón, C & Restrepo, C. 2009. Reforestación: Mecanismo rentable y precursor de Desarrollo para Vichada. EIA. Disponible en: <http://repository.eia.edu.co/bitstream/11190/1593/1/ADMO0566.pdf>

Janeiro<sup>76</sup>), in Colombia it has not been considered an invasive species, as it has been widely promoted for restoration processes and recovery of degraded areas (Castellanos et al. 2010, 2011, Mateus 2013, Vargas 2013).

Due to the conditions of the department of Vichada, the acacia does not present any problems for growing in this region as the climatic characteristics, height and precipitation are outstanding for this species.

- *Eucalyptus tereticornis*

*E. tereticornis* has the widest latitudinal distribution of any species in the genus. Native of Australia and Papua New Guinea. It occurs over a wide range of climatic conditions, and principally in open-forest formation with a number of other eucalypts and on river flats or hill slopes with alluvial or sandy to gravelly soils. *E. tereticornis* has been most successful in summer rainfall conditions with a moderate to fairly severe dry season. It is considerably drought resistant but is susceptible to frost. The species tolerates occasional waterlogging. In many countries, among the Eucalyptus species, *E. tereticornis* is considered relatively fire resistant.

Is a tree up to 45 m tall or taller; trunk erect, 1-1.8 m in diameter; crown large, open or fairly dense, variable; bark smooth, whitish, peeling in irregular thin sheets or large flakes, becoming mottled with white, grey or bluish patches, often some rough, dark grey bark at base; twigs reddish or yellowish-green.

It easily adapts to poor soils, represented by an early growth and absence of pests and diseases. It grows on slightly sloping topography. Altitude: 0-800 m, average temperature of 19-29 °C, annual rainfall 900-3,000 mm, resists strong winds, prefers sandy, deep, well-drained, fertile, moist, with pH of 5-6 but also well developed in acid soils. It grows well in sandy and clay soils.

In general, *E. tereticornis* has proved fairly free of pests and diseases. In many areas termites attack young plants if insecticide is not used while planting. In India, the most serious disease has been the canker caused by the fungus *Corticium salmonicolo*<sup>77</sup>.

- *Eucalyptus pellita*

In its natural habitat; Australia and Papua New Guinea; is found in open forest formation with a large number of other Eucalyptus species, in tall sclerophyll forest and at the margins of rainforests. The tree grows mainly on gentle to moderately sloping topography, although it is found, to a limited extent, on steep, well-drained slopes of large ridges and even alongside small streams in the drier and hotter parts of its occurrence. On bare rock above beaches, it may be reduced to a bushy shrub. It grows quickly in humid and subhumid, tropical lowland regions and requires uniform to summer rainfall. The species is frost resistant.

<sup>76</sup> GISP 2005. Programa Mundial sobre Especies Invasoras. 2005. Disponible en: <http://www.issg.org/pdf/publications/GISP/Resources/SAmericaInvaded-ES.pdf>

<sup>77</sup> World Agroforestry. Eucalyptus tereticornis. Disponible en: [http://www.worldagroforestry.org/treedb/AFTPDFS/Eucalyptus\\_tereticornis.PDF](http://www.worldagroforestry.org/treedb/AFTPDFS/Eucalyptus_tereticornis.PDF)



Is a medium-size to large tree, up to 40 m in height and 1 m in diameter at breast height. At its best, it has a straight trunk to about a half of the tree height and a large, heavily branched crown. The bark is rough and persistent to the small branches, shortly fibrous, shallowly to coarsely fissured, thick and brown to reddish-brown<sup>78</sup>.

It easily adapts to poor soils, represented by early growth and the absence of pests and diseases. It grows in slightly inclined topography altitude: 0 to 800 meters, average temperature of 19-29 °C, annual rainfall of 900 to 3,000 mm. Resists strong winds, prefers sandy, deep, well-drained, fertile, moist, with pH of 5-6 but also well developed in acid soils. It grows well in sandy and clay soils.

As for pests and diseases, the *Coreolopsis fulvocinerea* has been reported in Ayapel, Colombia, attacking the wounds left by pruning. There are no reports inside the project area, about the existence of conditions that could compromise the project, and that are frequently mentioned in the literature as diseases that cause significant economic losses.

Among the main uses and wood products are the sawmilling industry, timber for structures (easy for immunization), fence posts and electrical transmission. It is used as firewood, coal, pulp, paper, plywood and for the production of fiber and particle boards.

- *Anacardium occidentale*

This specie is a medium-sized tree, spreading, and evergreen, much branched; grows to a height of 12 m. When grown on lateritic, gravelly, coastal sandy areas, it rarely exceeds 6 m and develops a spreading habit and globose shape with crown diameter to 12 m. Grown inland on loams, it reaches 15 m and is much branched, with a smaller (4- 6 m) crown diameter. The root system of a mature *A. occidentale*, when grown from the seed, consists of a very prominent taproot and a well developed and extensive network of lateral and sinker roots.

*A. occidentale* requires high temperatures; frost is deleterious. Distribution of rainfall is more important than the amount of it. The tree fruits well if rains are not abundant during flowering and if nuts mature in a dry period; the latter ensures good keeping quality. The tree can adapt to very dry conditions as long as its extensive root system has access to soil moisture. In drier areas (800-1,000 mm of rainfall), a deep and well-drained soil without impervious layers is essential.

The ideal weather conditions during the specie's growing are: altitude: 0-1,000 m, mean annual temperature: 17-38 deg. C, mean annual rainfall: 500 - 3,500 mm, soil type: prefers deep, fertile, sandy soils but will grow well on most soils except pure clays or soils that are otherwise impermeable, poorly drained or subject to periodic flooding<sup>79</sup>.

- *Hevea brasiliensis*

Commonly known as the rubber tree, *Hevea brasiliensis* is a native tree species of Brazil, Bolivia, Peru, Colombia, Guyana, and Suriname. The rubber tree is found in tropical America from Mexico to Sao Paulo, in Africa from Mozambique to Madagascar, in southern India, Sri Lanka, and throughout

<sup>78</sup> World Agroforestry. *Eucalyptus pellita*. Disponible en:  
[http://www.worldagroforestry.org/treedb/AFTPDFS/Eucalyptus\\_pellita.PDF](http://www.worldagroforestry.org/treedb/AFTPDFS/Eucalyptus_pellita.PDF)

<sup>79</sup> World Agroforestry. *Anacardium occidentale*. Disponible en:  
[http://www.worldagroforestry.org/treedb/AFTPDFS/Anacardium\\_occidentale.PDF](http://www.worldagroforestry.org/treedb/AFTPDFS/Anacardium_occidentale.PDF)

Southeast Asia, the Philippines, Indonesia, and New Guinea. Commercial rubber plantations are found between 24 degrees north latitude in China to 25 degrees south latitude in the state of Sao Paulo, Brazil.

Is a rapid-growing species that can reach 40 m in height and 35 cm in diameter. Its trunk is cylindrical with a narrow base, a gray-green bark, and irregular branches. Its leaves are compound, trifoliate, and alternate. They have a dark green upper face, a light green lower face, and marked venation. The form and composition of the leaves varies between individuals.

*Hevea brasiliensis* is cultivated from sea level to 1,200 m in a range of temperatures between 20°C and 30°C, with 25°C being its optimal temperature. If temperatures are below 20 °C or above 35°C, growth and production is noticeably affected. Precipitation should range from 1,800 mm to 2,500 mm and be well distributed throughout the year and without dry seasons, pronounced, or prolonged heavy precipitation. Otherwise, tree growth and latex production can be delayed. Relative humidity should fluctuate between 70% and 90%. An average humidity of 50% can alter production by affecting levels of defoliation.

Trees should annually receive between 1,500 and 2,500 hours of sunshine. Less than an average of 1,200 hours per year can notably affect the content of dry rubber in the latex. Rubber trees should not be planted in areas with high winds given that stems break easily and adult plantations can suffer great losses. The slope of the ground should not be greater than 25%. It is ideal to have flat or slightly undulating soil that has a depth of 1–1.5 m, a sandy loam and clay loam texture, good capacity for retaining humidity, good drainage, and acidity (with a pH between 4.1 and 6.0).

In Colombia, all commercial plantations have been established with one or two clones introduced from Thailand, Indonesia, Malaysia and Brazil. In the Department of Caquetá (Colombian Amazon), the promotion and development of crops of rubber (*H. brasiliensis*) during the past 25 years, has favored the establishment of thousands of hectares in other regions<sup>80</sup>.

- *Pinus caribaea*

It is located on the Atlantic side (Central America) from the sea level on the coastal plains up to 850 m in the hinterland. It has been planted even out of its range at altitudes up to 1,500 meters. It fits to a variety of environments, including poor and degraded soils in sandy to clay and acid soils (pH 4-6.5).

*Pinus caribaea* is a fine tree to 20-30 m tall, often 35 m, with a diameter of 50-80 cm and occasionally up to 1 m; trunk generally straight and well formed; lower branches large, horizontal and drooping; upper branches often ascending to form an open, rounded to pyramidal crown; young trees with a dense, pyramidal crown.

This species grows best in frost-free areas up to about 700 m in more fertile sites with good subsoil drainage and annual rainfall of 2,000 -3,000 mm. Generally at elevations of 600-800 m it is associated

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<sup>80</sup> Sterling, A & Hernando, C. 2011. New clones of natural rubber for the Colombian Amazon: emphasis in the resistance to the southamerican evil of leaves (*Microcyclus ulei*). Disponible en: [http://sinchi.org.co/images/pdf/dfpublicaciones/2011/Nuevos\\_clones\\_cauchoweb.pdf](http://sinchi.org.co/images/pdf/dfpublicaciones/2011/Nuevos_clones_cauchoweb.pdf)

with *P. oocarpa* var. *hondurensis* and *P. oocarpa* var. *ochoterenai*. *P. caribaea* is rated as moderately fire resistant. It tolerates salt winds and hence may be planted near the coast.

Young plantations usually start bearing female cones when they are 3-4 years old but these do not produce fertile seed owing to the inadequate supply of pollen at this age, unless older plantations adjoin the site. Male and female flowers are borne on the same plant. The female cones are the equivalent of long shoots whereas the male cones are the equivalent of needle bundles (short shoots). There is a variation in the proportion of male to female cones, with some trees producing almost entirely male cones and others almost entirely female cones.

In many places where *P. caribaea* grows, the mat of needles on the ground is considered valuable for the protection of the soil surface from erosion. In Sri Lanka a massive reforestation programme was undertaken with plantations of *P. caribaea* to convert heavily eroded lands on which nothing else could be grown. It is the only species so far successfully used to clothe barren eroded and denuded lands with a tree cover<sup>81</sup>.

With the exception of the caribbean pine (species that represents less than 3% of the project area), none of the species used has been reported as invasive, according to databases and available sources (GISIN<sup>82</sup>, GISP 2005<sup>83</sup>, Baptiste et al. 2010<sup>84</sup>).

Although Baptiste et al. 2010, reports the *P. caribaea* as of high risk of invasion, this specie has been widely recommended for the establishment of plantations in Vichada (CONIF 1998<sup>85</sup>, Trujillo 2011<sup>86</sup>). In addition, several studies (Fernando et al. 2012<sup>87</sup>, Cortes-Perez et al. 2005<sup>88</sup>) have reported successful cases of the specie in Casanare and Vichada for both ecosystem restoration and commercial forest plantations. These researches serve to prove that the caribbean pine plantations favor the development of a diverse underwood of native species, which varies according to the gradient of the silvicultural management and the age of the plantation. Fernando et al. 2012, state that no evidence was recorded about the regeneration of *P. caribaea* in the ecosystems surrounding the plantations (ie natural forest and savanna), which so far has shown a low potential for invasion and dominance, compared to the succession in unattended sites.

Finally, the evidences prove that the presence and diversity of vegetation in plantations is a sign that wildlife is not absent within the planted area, where the main dispersal agents are wind, followed by

<sup>81</sup> World Agroforestry. *Pinus caribaea*. Disponible en:

[http://www.worldagroforestry.org/treedb/AFTPDFS/Pinus\\_caribaea.PDF](http://www.worldagroforestry.org/treedb/AFTPDFS/Pinus_caribaea.PDF)

<sup>82</sup> GISIN: Global Information Species Information Network

[http://www.gisin.org/DH.php?WC=/WS/GISIN/GISINDirectory/home\\_new.html&WebSiteID=4](http://www.gisin.org/DH.php?WC=/WS/GISIN/GISINDirectory/home_new.html&WebSiteID=4)

<sup>83</sup> GISP: Global Invasive Species Programme, GISP 2005.

<http://www.issg.org/pdf/publications/gisp/resources/samericainvaded-es.pdf>

<sup>84</sup> Baptiste M.P., Castaño N., Cárdenas D., Gutiérrez F. P., Gil D.L. y Lasso C.A. (eds). 2010. Análisis de riesgo y propuesta de categorización de especies introducidas para Colombia. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. Bogotá, D. C., Colombia. 200 p.

<sup>85</sup> CONIF 1998. Guía para plantaciones forestales comerciales ORINOQUIA.

<sup>86</sup> Trujillo 2011. Pino Caribe: El Multipropósito Fuerte de su Género. Revista M&M.

<sup>87</sup> Fernández et al 2012. Biodiversidad Vegetal Asociada a Plantaciones Forestales de *Pinus caribaea* Morelet y *Eucalyptus pellita* F. Muell Establecidas en Villanueva, Casanare, Colombia

<sup>88</sup> Cortés-Pérez, F., H. Dueñas y H. Cardozo. 2005. Cambios en la vegetación de sabana ocasionados por la plantación de *Pinus caribaea* en Vichada-Colombia. Revista de la Academia Colombiana de Ciencias 29(110): 69-84.

fruit-eating birds and omnivorous animals. This indicates that the resources provided by the plantations are being used for structural connectivity and shelter (Fernando et al. 2012).

**B2.6.** Describe possible adverse effects of non-native species used by the project on the region's environment, including impacts on native species and disease introduction or facilitation. Justify any use of non-native species over native species.

Since commercial plantations are part of the project activities, the use of exotic or introduced species generates higher profitability for the project as they need short shifts or rotations, allowing revenues during the first years of the establishment (thinning). In addition, these species have been widely recommended for reforestation projects in the Orinoco (CONIF 1998, Correa et al 2005) and according to current reports, the main tree species planted in Vichada are: *Acacia mangium*; *Eucalyptus pellita* and *Pinus caribaea*<sup>89</sup>.

The possible adverse effects due to the use of introduced species are:

- Land preparation:
  - Disturbance of special areas and loss of biodiversity, disruption of water streams and quality of water due to the washing of sediments and nutrients; these depend on the soil type and degree of mechanized work related to the type of crop.
  - Loss of soil fertility. It is produced by the permanent planting of a single crop and by the erosion. The most obvious symptom is loss of topsoil and organic matter. Inside the first few centimeters of soil, inhabit organisms that contribute to plant nutrition and nutrient absorption.

Further possible impacts related to fertilization and pest, disease and weed control, are described in the section B2.8 (below).

The measures taken by the farms to offset any negative impact of the plantations are described in the sustainable forest management plan (PMFS - section Environmental Management Plan) and in the Integrated management plan of pests and diseases.

A study in the Colombian Orinoquia, concluded that the damages of young plantations of *Acacia mangium* are caused mostly by generalist's native insect widely distributed in the tropics<sup>90</sup>.

On the other hand, the ICA (Instituto Colombiano Agropecuario) performs health checks to forest plantations in the department of Vichada, being part of the forest nucleus of the Orinoco. The main objective of the plant health program of the forest technical office about epidemiology and phytosanitary surveillance (Programa Fitosanitario Forestal de la Dirección Técnica de Epidemiología y Vigilancia Fitosanitaria) in the country, is to prevent, control and mitigate endemic and exotic pests and diseases that may occur in tree crops and agroforestry systems for commercial purposes.

<sup>89</sup> Agricultural Colombian Institute. 2014. ICA performs sanitary control to forest plantations. Available at: [http://www.ica.gov.co/Noticias/Agricola/2013-\(1\)/El-ICA-hace-control-sanitario-a-las-plantaciones-f.aspx](http://www.ica.gov.co/Noticias/Agricola/2013-(1)/El-ICA-hace-control-sanitario-a-las-plantaciones-f.aspx)

<sup>90</sup> Lores, Angélica & Pinzón-Florián, O. 2011. Insectos fitófagos en plantaciones comerciales de *Acacia mangium* Willd. En la costa Atlántica y la Orinoquia Colombiana. Disponible en: [http://www.scielo.org.co/scielo.php?pid=S0120-07392011000200004&script=sci\\_arttext](http://www.scielo.org.co/scielo.php?pid=S0120-07392011000200004&script=sci_arttext)

There are no evidences of pest and disease problems that might affect the permanence of planted areas.

**B2.7. Guarantee that no GMOs are used to generate GHG emissions reductions or removals.**

All seeds used in each nucleus come from certified companies.

Table 17. Origin of seeds used in the project

<b>Nuclei</b>	<b>Certified Company</b>	<b>Place of origin</b>
Canapro	Inversiones Siringueira	Ibagué, Tolima
El Diamante	Certified companies for marketing of seeds; seed trees	Tierra Alta, Córdoba
El Toro	Company El Semillero	Forest Firts (Orinoquía)
La Pedregoza	Company El Semillero, Refocosta, Conmoringa, Impulsemillas, Kanguroy S.A., Proforca	Bogotá, Orinoquía
Horizonte Verde	Vivero y Reforestadora La Salada, Company El Semillero, Company Refocosta S.A.	Bogotá, Orinoquía

In the case of rubber (*Hevea brasiliensis*) at the property of Canapro, seeds and / or plant material tolerant to pests and diseases will be used, for example, rubber clones IAN 710, IAN 873 and FX 3864 are tolerant to the fungus that transmits the disease known as south-American leaf blight (SALB) (*Mycrocyclus Ulei*)<sup>91</sup>.

**B2.8. Describe the possible adverse effects of, and justify the use of, fertilizers, chemical pesticides, biological control agents and other inputs used for the project.**

Low fertility is one of the most common aspects in all soils of the project zone (Cortés, 1978), therefore, for the establishment of forest species, it is necessary to undertake activities that promote the accumulation of nutrients and that guarantee the suitable development of plants.

For the particular case of La Pedregoza, since 2012, the project owners are using an organic fertilizer as a natural forestry practice, that includes the use of composts, manure broths, and cut grass. The fertilization method is performed by preparing natural and organic materials only. One of these is the composting, the other is an exclusive treatment of la Pedregoza, that includes manure balls of zebu. An organic fertilization means that fertilizers, can not cause any damage to the environment, minimize transportation costs and cause less risk to the health of humans, animals and wildlife. Additionally, it means there is a better retention of nutrients, with better maintenance of underground microfauna and better retention of soil moisture during the summer.

<sup>91</sup> The south-American leaf blight the main fungal disease of rubber trees in South America. Disponible en: <http://www.ica.gov.co/getattachment/b615d264-72e4-4964-b734-7a8b7ec4578a/El-mal-suramericano-de-las-hojas,-enfermedad-limit.aspx>

Additionally, in the short term, La Pedregosa is planning the use of biochar (charcoal loaded with composting) as an amendment into the soil to improve the retention and cation exchange capacity of the soil. The owner of this farm aim is to make biochar by using pyrolysis furnaces, which prevents the escape of greenhouse gases and that produces ash as sub-product, which is a very potent fertilizer with many trace elements from natural sources and immediately bioavailable for the trees.

The possible adverse effects for the use of fertilizers, chemical pesticides, biological control agents and other inputs used for the project, are:

- Fertilization

When using fertilizers, is important to establish the optimum composition, nutrient concentrations and the type of materials used in its production, as certain components can alter the biochemical characteristics of soil and water, accelerate the process of eutrophication in aquatic systems and negatively affect the crop production.

Sometimes, the excessive use of chemical fertilizers and / or applications at unsuitable times (for both crops and environmental components) may adversely affect the environment, altering the balance of nutrients in the soil, changing the pH, salinity, and pollution of water bodies caused by discharges of chemical waste.

In the process of fertilization, a certain degree of non-reusable waste (plastic containers and agrochemicals etc.) is produced. Project participants should clearly identify this type of material, to proceed with the proper method of storage and disposal.

- Weed control, Pest and diseases

The excessive use of herbicides to eradicate weeds, pollutes natural systems directly influencing the quality of the soil resources, water and air and indirectly in the flora and fauna; and it incorporates evil substances that accumulate in organisms.

Improper control of pests and handling of chemicals, pollutes soils and areas where they are applied, including water bodies and alters the biological activity of many native species.

The Improper control of crop diseases can affect interactions between insects - entomopathogenic fungi (beneficial Populations) - plant and create resistance in populations of pests and weeds (evil Populations).

**B2.9. Describe the process for identifying, classifying and managing all waste products resulting from project activities.**

- For handling chemical products, recommendations of the technical data should be followed, including the security and safety standards and other procedures determined by the company, for the work of handling, mixing and application of agro-inputs.
- Those responsible for handling pesticides, should wear protective equipment, in order to avoid poisoning and health damages.

- The chemicals are identified and stored, preserving their original labels. The respective safety data sheets will be available in the field.
- The packages and containers of chemicals will be disposed as hazardous waste and will be delivered to the office of health of Puerto Carreño for their final disposal, therefore they won't be reused.
- Location of chemical inputs in the corresponding cellar, following the necessary instructions for handling and storage.
- Handling chemicals following the recommendations of the technical data sheets and sheets of security and the safety rules and other procedures determined by the company, for the work of handling, mixing and application.
- The packages and chemical containers should not be reused for any purpose.
- The personnel or machinery operators will be trained in the proper handling and disposal of fuels and lubricants.
- Washing and maintenance of machinery, tools and containers is forbidden in areas close to natural drainages or water sources.

### **B3. Offsite Biodiversity Impacts**

**B3.1.** Identify potential negative impacts on biodiversity that the project activities are likely to cause outside the Project Zone.

No potential negative offsite biodiversity impacts have been identified

**B3.2.** Describe the measures needed and taken to mitigate these negative impacts on biodiversity outside the Project Zone.

No potential negative offsite biodiversity impacts have been identified

**B3.3.** Evaluate unmitigated negative impacts on biodiversity outside the Project Zone and compare them with the project's biodiversity benefits within the Project Zone. Justify and demonstrate that the net effect of the project on biodiversity is positive.

No potential negative offsite biodiversity impacts have been identified

### **B4. Biodiversity Impact Monitoring**

**B4.1.** Develop and implement a monitoring plan that identifies biodiversity variables to be monitored, the areas to be monitored, the sampling methods, and the frequency of monitoring and reporting.



Monitoring variables must be directly linked to the project's biodiversity objectives and to predicted activities, outcomes and impacts identified in the project's causal model related to biodiversity (described in G1.8).

The monitoring plan contains the following elements:

### **1. Review and Frequency**

The monitoring of each management plan will take place at least once a year and will be the manager, the person responsible to designate the person responsible for this work.

### **2. Modifications and approval**

Amendments shall be done by a person designated by the manager, and then be approved by him.

### **3. Following plan**

The indicators established to monitor the programs during the project's implementation are presented as follows:

#### **Monitoring plan for biodiversity:**

Countries that have signed the convention of biological diversity (Convención de Diversidad Biológica CDB), must implement policies to protect biodiversity at different levels<sup>92</sup>, including ecosystems that contain rich and vulnerable biodiversity and threatened or endemic natural species as well as threatened communities that involve domesticated or non-native species but which social and economic importance is very high.

Colombia has signed this agreement, for this reason, the Impacts assessment on biodiversity is so important and in some cases mandatory. Even though that none endemic specie were found as highly threatened in the study area, some endangered species have a direct or indirect dependence from the forest covers of the area. Thus monitoring activities must follow up very close the changes in populations and any variations of the associated biodiversity.

According to the approach for the impacts assessment generated by the International Association for Impact Assessment (IAIA), every project must try to achieve the goal of zero net loss of biodiversity. This objective can be achieved when the project seeks for alternative solutions to minimize biodiversity losses, and also when using mitigation to restore biodiversity resources, among others. With this approach any monitoring plan should start from taking an ecosystem approach, for this reason any assessment on biodiversity should be make in an integrated way and taking into account long term perspectives.

Additionally and according to the IAIA the approach to be implemented for this project shall include the following aspects:

- Sustainable use of biodiversity resources.

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<sup>92</sup> IAIA Biodiversity in impact assesment. Special publication series No 3.

- Ensure equitable sharing by making sure that traditional rights and uses of biodiversity are properly recognized and respected.
- Apply the precautionary principle, which means that any action shall be delayed when the area has not sufficient information related to its biodiversity or natural resources in general.

The monitoring of biodiversity implies the assessment and quantification of positive or negative changes in the patterns, characteristics, populations, communities, niches and other ecological features that could be affected due to the implementation of the project.

Within the monitoring plan must be include a description of aerial, underground and terrestrial biodiversity directly affected by the project, through characterization and analysis of the structure and composition of vegetation and associated fauna, including analysis of frequency, richness and abundance of the identified species. This analysis should include sections related to the connectivity of the ecosystems in the area, the current state of conservation of soils and their sensitivity to agrochemicals or organic products, among others.

In terms of vegetation, it is planned to evaluate the remaining areas of natural forest and its proximity to the area to be operated. Native species should be identified and quantified within the forest inventory including saplings and shrubs. An assessment of the level of degradation of the study area should be carry out and a special effort should be done in order to identify the possible actions or activities to be implemented to offset or reduce these levels of degradation.

In terms of wildlife, an inventory all individuals present in the area of influence of the project should be done, with the aim of identifying patterns and relationships between species, such as seed dispersal mechanisms and fauna related to that purpose; identification and description of native species, or species of special character due to their ecological behavior (endemic species), economic (high commercial value) and social (particularly important for certain communities).

The monitoring plan should include the following items:

- Identification and description of niches.
- Description of the main eco region present in the study area.
- Aquatic, aerial and terrestrial habitat types present in the area and associated communities.
- Description of the landscape elements of special importance.

*Final products of the monitoring:* By the end of each monitoring conducted within the study area, some of the results listed below should be presented, depending on the type of information collected and the purposes of collecting:

- Vegetation map.
- Results of interviews carried out with local communities, with the aim of identifying wildlife species of special value.
- Description of taxa.
- History of previous research in the area of study (review of secondary information in general), including analysis of threats to biodiversity and management. Relationship between the threats described and communities present in the area.
- If any elements with high conservation values are found, they must be located by maps or satellite images. In the case of endemic species, photographic evidence must be provided.
- Description of impacts on biodiversity in the scenario without and with project.

- Description of measures to maintain biodiversity.
- Select biodiversity indicators (pressure, state and response indicators are mostly used) in order to facilitate monitoring activities.
- Describe the state of the species found including its social, economic and ecological values.

**B4.2.** Develop and implement a monitoring plan to assess the effectiveness of measures taken to maintain or enhance all identified High Conservation Values related to globally, regionally or nationally significant Biodiversity (identified in B1.2) present in the Project Zone.

The effectiveness of measures used to maintain or enhance HCVs will be assessed through the monitoring plan described above.

**B4.3.** Disseminate the monitoring plan and the results of monitoring, ensuring that they are made publicly available on the internet and summaries are communicated to the Communities and Other Stakeholders through appropriate means.

The results of monitoring undertaken will be made publicly available on the internet and through the web site of the project proponent (Fundación Natura) and the ones of the project owners.

Additionally, all documents and information about the results of the monitoring and verification of this project will be published in the platforms of the VCS and CCB standards as usual.

## APPENDIX I: THREATENED SPECIES

According to the IUCN red list of threatened species, version 2012, the following species are catalogued as DD (Data deficient), LC (Least concern)<sup>93</sup>, NT (Near threatened), VU (Vulnerable), EN (Endangered), or CR (Critically endangered) (Catalogue of life)<sup>94</sup> depending of their current status of threat.

**Table 18. Endangered fauna species in the Orinoco region**

<i>Scientific name</i>	<i>Common name</i>	<i>Category</i>
<b><i>Fish</i></b>		
<i>Osteoglossum ferreirai</i>	Araucana Azul, Arawana	LC
<i>Colossoma macropomum</i>	Cachama Negra, Cherna, Gamitana	LF
<i>Brachyplatystoma juruense</i>	Apuy, Manta Negra, Camisa Rayada	VU
<i>Brachyplatystoma filamentosum</i>	Valentón, Plumita, Lechero, Pirahiba	EN
<i>Brachyplatystoma flavicans</i>	Dorado, Plateado	EN
<i>Brachyplatystoma vaillantii</i>	Blancopobre, Pirabutón, Capaz	EN
<i>Paulicea luetkeni</i>	Saliboro, Bagre Sapo, Peje Negro	EN
<i>Pseudoplatystoma tigrinum</i>	Pintadillo Tigre, Bagre, Capararí	EN
<b><i>Mammals</i></b>		
<i>Aotus brumbacki</i>		VU
<i>Aotus vociferans</i>		LC
<i>Ateles belzebuth</i>		EN
<i>Callicebus torquatus</i>		LC
<i>Cebus apella</i>		LC
<i>Saimiri sciureus</i>		LC
<i>Cacajao melanocephalus</i>		LC

<sup>93</sup> When a taxon has been evaluated against the criteria and does not qualify for Critically Endangered, endangered or vulnerable or any other category

<sup>94</sup> The species catalogued as LF, are those who have not been yet reported by the IUCN but appear on the Catalogue of life (indexing the world's known species)

Scientific name	Common name	Category
<i>Lagothrix lagothricha</i>	Choyo	VU
<i>Alouatta seniculus</i>	Araguato	LC
<i>Cebus apella</i>	Maicero	LC
<i>Cerdocyon thous</i>	Zorra	LC
<i>Eira Barbara</i>	Ulamá	LC
<i>Inia geoffrensis</i>	Delfín Rosado	DD
<i>Leopardus pardalis</i>	Leopardo	LC
<i>Leopardus wiedii</i>	Tigrillo peludo	NT
<i>Lontra longicaudis</i>	Nutria neotropical	DD
<i>Myrmecophaga tridactyla</i>	Oso hormiguero, oso palmero	VU
<i>Odocoileus virinianus</i>	Venado sabanero	LF
<i>Panthera onca</i>	Tigre	NT
<i>Pecari Tajacu</i>	Zaino	LC
<i>Prionomys maximus</i>	Armadillo gigante	VU
<i>Pteronura brasiliensis</i>	Perro de agua	EN
<i>Puma concolor</i>	Puma	LC
<i>Saimiri sciureus</i>	Mico	LC
<i>Tapirus terrestres</i>	Danta común	VU
<i>Tayassu pecari</i>	Cajucho	NT
<b>Reptiles</b>		
<i>Ameiva ameiva</i>	Lobato cardenillo	LF
<i>Amphisbaena alba</i>	Tatacoa	LC
<i>Boa constrictor</i>	Boa	LF
<i>Bothrops asper</i>	Mapaná	LF
<i>Caiman crocodilus crocodilus</i>	Cachirre	LF
<i>Chelonoidis carbonaria</i>	Morrocoy	LF

<b>Scientific name</b>	<b>Common name</b>	<b>Category</b>
<i>Chelonoidis denticulata</i>	Tortuga morrocoy	VU
<i>Chironius carinatus</i>	Voladora	LF
<i>Cnemidophorus lemniscatus</i>	Lobo	LF
<i>Crocodylus intermedius</i>	Caimán del Orinoco, llanero	CR
<i>Crotalus durissus</i>	Cascabel	LC
<i>Eunectes murinus</i>	Guio	LF
<i>Gonatodes albogularis</i>	Toteca	LF
<i>Iguana iguana</i>	Iguana	LF
<i>Leptodeira annulata</i>	Falsa Mapaná	LF
<i>Mabuya mabouya</i>		LF
<i>Mastigodryas pleei</i>	Guardacaminos	LF
<i>Paleosuchus palpebrosus</i>	Babilla	LC
<i>Podocnemis expansa</i>	Galápaga	LR
<i>Podocnemis unifilis V</i>	Galápaga	VU
<i>Tupinambis teguixin</i>	Lobo pollero	LC
<b>Birds</b>		
<i>Amazona amazónica</i>	Lora	LC
<i>Amazona ochrocephala</i>	Lora Cabeciamarilla	LC
<i>Ammodramus humeralis</i>	Correcaminos Sabanero	LC
<i>Anas cyanoptera</i>	Pava negra	LC
<i>Anthracothorax nigricollis</i>	Colibri	LC
<i>Ara macao</i>	Guacamaya Macao	LC
<i>Ara militaris</i>	Guacamaya verde	VU
<i>Ara severus</i>	Guacamaya Cariseca	LC
<i>Aratinga pertinax</i>	Perico Carisucio	LC
<i>Ardea alba</i>	Garza Blanca	LF

<b>Scientific name</b>	<b>Common name</b>	<b>Category</b>
<i>Arremonops conirostris</i>	Pinzón conirrostro	LC
<i>Arundinicola leucocephala</i>	Monjita pantanera	LC
<i>Athene cunicularia</i>	Murruco , Guarracuco	LC
<i>Basileuterus cinereicollis</i>	Arañero pechigris	NT
<i>Botaurus pinnatus</i>	Avetoro	LC
<i>Brachygalba goeringi</i>		LC
<i>Burhinus bistriatus</i>	Guerere – Gurre	LC
<i>Buteo albicaudatus</i>	Gavilan	LC
<i>Buteo magnirostris</i>	Gavilán azul	LC
<i>Buteogallus meridionalis</i>	Aguila mona	LC
<i>Butorides striata</i>	Chicuaco	LC
<i>Cacicus cela</i>	Arrendajo	LC
<i>Cacicus uropygialis</i>	Arrendajo escarlata	LC
<i>Caprimulgus cayennensis</i>	Guardacaminos	LC
<i>Caracara cheriway</i>	Carraco	LC
<i>Cathartes aura</i>	Guala	LC
<i>Cathartes burrovianus</i>	Laura	LC
<i>Chlorostilbon poortmanni</i>	Esmeralda rabicorta	LC
<i>Circus buffoni</i>	Aguilucho Negro	LC
<i>Coereba flaveola</i>	Mielero Común	LC
<i>Colaptes punctigula</i>	Carpintero	LC
<i>Colinus cristatus</i>	Perdiz	LC
<i>Columbina squamata</i>	Torcaza	LF
<i>Columbina talpacoti</i>	Tierrera	LC
<i>Coragyps atratus</i>	Samuro	LC
<i>Crax daubentoni</i>	Pavón moquiamarillo	NT



Scientific name	Common name	Category
<i>Crotophaga ani</i>	Jirijuelo	LC
<i>Cyanocorax violaceus</i>	Pollo de monte	LC
<i>Dacnis cayana</i>	Dacnis azul	LC
<i>Dendrocygna viduata</i>	Careto	LC
<i>Dryocopus lineatus</i>	Carpintero real	LC
<i>Egretta caerulea</i>	Garza Azul	LC
<i>Elaenia flavogaster</i>	Elaenia copetona	LC
<i>Falco deiroleucus</i>	Halcón Colorado	NT
<i>Falco femoralis</i>	Halcon	LC
<i>Falco sparverius</i>	Halcon, Cernícalo	LC
<i>Forpus conspicillatus</i>	Periquito	LC
<i>Gymnomystax mexicanus</i>	Toche	LC
<i>Harpia harpyja</i>	Águila moñuda	NT
<i>Herpetotheres cachinnans</i>	Guacabó	LC
<i>Hypnelus ruficollis</i>		LC
<i>Jabiru mycteria</i>	Gaban	LC
<i>Manacus manacus</i>	Pica piedra	LC
<i>Megaceryle torquata</i>	Matraquero, Martin pescador	LC
<i>Milvago chimachima</i>	Chiriguare	LC
<i>Mimus gilvus</i>	Parablata	LC
<i>Mitu tomentosum</i>	Paujil	NT
<i>Momotus subrufescens</i>	Barranquero	LF
<i>Morphnus guianensis</i>	Águila arpía	NT
<i>Myiozetetes cayanensis</i>	Siriri	LC
<i>Neochen jubata</i>	Pato carretero	NT
<i>Nycticorax nycticorax</i>	Chicuaco	LC

Scientific name	Common name	Category
<i>Nyctidromus albicollis</i>	Bujio	LC
<i>Orthopsittaca manilata</i>	Catarnica	LC
<i>Oryzoborus angolensis</i>	Arrocero	LC
<i>Patagioenas cayennensis</i>	Torcaza	LC
<i>Pauxi pauxi</i>	Paujil Copete de Piedra	EN
<i>Penelope jacquacu</i>	Pava	LC
<i>Piaya cayana</i>	Pisca, pascuita	LC
<i>Pilherodius pileatus</i>	Garza	LC
<i>Pipra erythrocephala</i>		LC
<i>Pitangus lictor</i>	Caballicero	LC
<i>Pitangus sulphuratus</i>	Cristofue	LC
<i>Polystictus pectoralis</i>	Tachurí barbado	NT
<i>Progne chalybea</i>	Golondrina	LC
<i>Pyrocephalus rubinus</i>	Pechirrojo	LC
<i>Quiscalus lugubris</i>	Mirla	LC
<i>Ramphastos tucanus</i>	Piapoco, Tucán	LC
<i>Ramphocelus carbo</i>	Come queso	LC
<i>Sarcoramphus papa</i>	Raisamuro	LC
<i>Sicalis flaveola</i>	Canario	LC
<i>Sporophila minuta</i>	Espiguero	LC
<i>Sturnella magna</i>	Chirlobirlo	LC
<i>Sturnella militaris</i>	Soldadito	LC
<i>Syrigma sibilatrix</i>	Campanilla, Chunguita	LC
<i>Tachycineta albiventer</i>	Golondrina	LC
<i>Tangara cayana</i>	Tangara triguera	LC
<i>Theristicus caudatus</i>	Tautaco	LC

<b>Scientific name</b>	<b>Common name</b>	<b>Category</b>
<i>Thraupis episcopus</i>	Azulejo	LC
<i>Thraupis palmarum</i>	Azulejo	LC
<i>Tigrisoma lineatum</i>	Vaco Colorado	LC
<i>Todirostrum cinereum</i>	Espatulilla	LC
<i>Trogon viridis</i>	Trogon	LC
<i>Tyrannus melancholicus</i>	Caballicero	LC
<i>Tyrannus savana (Ma)</i>	Tijereta	LC
<i>Tyrannus tyrannus</i>	Siriri	LC
<i>Vanellus chilensis</i>	Alcaraván	LC
<i>Veniliornis passerinus</i>	Carpintero	LC
<i>Xiphorhynchus obsoletus</i>	Trepa troncos	LC
<i>Zenaida auriculata</i>	Paloma	LC
<b>Amphibians</b>		
<i>Rhinella granulosa</i>	Sapito verrugoso	LC
<i>Rhinella marina</i>	Sapo	LC
<i>Hypsiboas boans</i>	Rana	LC
<i>Hypsiboas crepitans</i>	Rana	LC
<i>Hypsiboas punctatus</i>	Rana	LC
<i>Pseudis paradoxa</i>	Rana	LC
<i>Trachycephalus venulosus</i>	Rana	LC
<i>Leptodactylus fuscus</i>	Saltóna	LC

Source: Mojica et al. (2002)<sup>95</sup>, Renjifo et al. (2002)<sup>96</sup>, Corporinoquía (2004)<sup>97</sup>, Romero et al (2009<sup>98</sup>), Rodríguez et al (2006).

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<sup>95</sup> Mojica, J. I., C. Castellanos, J. S. Usma y R. Álvarez (eds.). 2002. Libro rojo de peces dulceacuícolas de Colombia. Serie Libros Rojos de Especies Amenazadas de Colombia. Instituto de Ciencias Naturales - Universidad Nacional de Colombia y Ministerio del Medio Ambiente. Bogotá, Colombia.

<sup>96</sup> Rengifo, L. M., A. M. Franco-Maya, J. D. Amaya-Espinel, G. H. Kattan y B. López-Lanús (eds.). 2002. Libro rojo de aves de Colombia. Serie Libros Rojos de Especies Amenazadas de Colombia. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt y Ministerio del Medio Ambiente. Bogotá, Colombia.

<sup>97</sup> Corporación Autónoma Regional de la Orinoquía (CORPORINOQUIA). 2004. Plan de Acción 2004-2006. Yopal, Colombia.

<sup>98</sup> Romero M.H., Maldonado-Ocampo J.A., Bogotá- Gregory J.D., Usma J.S., Umaña-Villaveces A.M., Murillo J.I., Restrepo-Calle S., Álvarez M., Palacios-Lozano M.T., Valbuena M.S., Mejía S.L. Aldana-Domínguez J. y Payán E. 2009. Informe sobre el estado de la biodiversidad en Colombia 2007- 2008: piedemonte orinoquense, sabanas y bosques asociados al norte del río Guaviare. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. Bogotá D.C., Colombia. 151 p.