REGENERATING COLOMBIAN COFFEE ECOSYSTEMS

Document Prepared By: PUR Projet

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1 PROJECT DETAILS

1.1 Summary Description of the Project

"Regenerating Colombian Coffee Ecosystems" is a grouped afforestation and reforestation project initiated by PUR Projet in 2014 in the Colombian Northern Andean Montane Forests, where watersheds and coffee lands are severely eroded and biologically degraded.

Colombia is the world's third largest coffee producer and 95% of Colombian coffee-growing families operate on small plots of land, averaging five acres each[1], and mainly depend on their crop for income generation, and many of them farming in production landscapes of high biodiversity value.

The Tropical Andes are one of the main coffee growing areas in Colombia and a major biodiversity hotspot[2], hosting 25% of the country's flora and being the richest ecoregion for birds in the country (974 bird species)[3]. The World Wildlife Fund (WWF) has classified the Northern Andes as one of the 200 global conservation priorities for biodiversity[4].

However, over the course of the last century, Colombia's Andean watersheds and the shade coffee landscape have been threatened by uncontrolled deforestation (started 20 years ago) due to rapid expansion of agriculture and through cattle grazing mostly in the highest parcels of the valley (historically covered with primary forests). The coffee farmers are mainly affected by degrading coffee farming conditions: regular pests and diseases affecting their coffee fields and yields; loss of biodiversity, reduced pollination, reduced natural pest control, reduced water resources (quantity and quality). The coffee farms are also highly vulnerable to external disturbances (natural and market): farmers are up to 100 % dependent on coffee revenues with high market price volatility; increasing prices of chemical inputs (fertilizers and chemicals). This vulnerability is strengthened by climate change and always more frequent extreme climatic events (prolonged droughts, heavy rains, storms, landslides, etc.), affecting coffee farms with limited resilience to extreme events in the absence of appropriate agricultural systems and natural protection. Moreover, the coffee fields are usually set-up on steep slopes and face important problems of erosion and landslides. Average slope may be greater than 45%. Farms face first strong erosion episodes that lixiviate nutrients, impoverish soils in organic matter, and loose substantial part of the soils. Remaining soil is thin and poor and is even more subject to landslides.

In this context, PUR Projet initiated an afforestation and reforestation project in Colombia in 2014, in collaboration with small-scale coffee farmers. PUR Projet is an international organization specialized in the development of ecosystems restoration and conservation projects, within agricultural supply chains like coffee and cocoa. PUR Projet also assists companies in insetting their supply chains and managing their socio-environmental commitments.

The project's strategy is to address all the above-mentioned stakes by planting a combination of diversified native trees in agroforestry and land restoration models inside and around small-holders' coffee plantations located in the Colombian tropical Andean region of the Northern Andean Montane Forests.

The project consists in tree planting rolled-out over annual planting waves. The duration of project activities (monitoring, maintenance, pruning, thinning, harvesting) is forecasted to be 40 years.

The sequestration of the carbon in the planted timber trees will allow the generation of GHG emission removals. The average annuals Emission Removals is 7'107 tCO2e and the Total Estimated Emission Removals 284 262 tCO2e.

[1] https://www.federaciondecafeteros.org/static/files/sostenibilidad-2012-eng.pdf
[2] Myers, N. 1988. Threatened biotas: Hostpots in tropical forest. The environmentalist 8(3):1-20.
[3] Renjifo et al 2002. Libro Rojo de aves de Colombia. Serie Libros rojos de especies amenazadas de Colombia. Instituto Humboldt- Ministerio de Ambiente.
[4] http://wwf.panda.org/about_our_earth/ecoregions/northandean_montane_forests.cfm

1.2 Sectoral Scope and Project Type

- Sectoral scope: AFOLU
- AFOLU project category: ARR
- Grouped Project: The Project is a grouped project.
- Activities:
    - Grassland to forested land
    - Cropland to forested land

1.3 Project Proponent

Organization name	PUR Development Pte. Ltd. hereinafter referred to as "PUR Projet"
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The Project Proponent PUR Projet is the project developer, which started the project on the field, set-up the plantations and the monitoring processes, and built-up the local management team. PUR Projet is in charge of the overall forestry component's design and management, the proceedings definition, the reporting, the certification, and the coordination of all activities related to trees plantation (technical assistance given to farmers on this topic, workshops, trainings, capability development, planting, monitoring). PUR Projet's team is financed for this work with the project's funds. PUR Projet wants to build a large-scale model project with coffee farmers, that would stand as a success model to be duplicated, thus promoting the roll-out of agroforestry practices across the world.

1.4 Other Entities Involved in the Project

1.4.1 Initial Project Entities (hereinafter referred to as Project Entities)

Organization name	Colombian Coffee Growers Federation (FNC - Federacion Nacional de Cafeteros)
Role in the project	The FNC implements the project through its regional committees. PUR Projet builds upon FNC's knowledge on tree species, leverages FNC's tree nurseries when relevant, and may leverage as well some manpower and equipment from the FNC when appropriate and if it makes sense in terms of cost/quality ratio. PUR Projet also uses some information from the internal control system of FNC.
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The FNC is the Federation formed in 1927 by Colombian Coffee farmers to create an institution that would represent them both nationally and internationally, defend their rights and seek ways to improve their quality of life. It is organized in regional committees.

Since the beginning, the FNC has been the main coffee association in Colombia, with presence in every rural region where coffee is grown. The work of the Federation revolves around the coffee growers and their families, ensuring Colombian Coffee is grown in a sustainable manner, strengthening common interests within coffee-growing communities while positioning Colombian Coffee as the best coffee in the world. The FNC has become probably the largest rural NGO in the world and represents more than 563 000 families of coffee growers. It is a non-profit organization and is not affiliated to any political party.

The FNC has 2,655 employees; including 1,500 field technicians whose main role is to bring know-how and innovations to Colombian coffee growers and to support the implementation of quality practices.

1.4.2 Seedlings suppliers:

The project works with different seedlings suppliers. PUR Projet and FNC also encourage cooperatives and local producer's associations to develop they own communal seedlings nurseries. This is an additional activity for cooperatives and local producer's associations to ensure complementary financial resources.

CORSAVIDA

CORSAVIDA is a reforestation Colombian company based in Popayan, with branch offices in Ibague and Pasto. This provider of seedlings and technical assistance follows controlled management techniques to produce and improve seedling production. It also conducts trainings for FNC's team of agronomists and contributes to farmers training. This Colombian tree nursery company is experienced in forestry / agroforestry and has been involved in reforestation projects for the last 13 years. The Company owns an equally extensive knowledge on the local forest characteristics, tree species, combination with agricultural systems and local markets for timber.

ASPROGALERAS

ASPROGALERAS is a community tree nursery located at the foot of the volcano Galeras in Nariño region. The group is composed of 18 coffee producers. Since 2015, ASPROGALERAS is strongly involved in the design and operation of all projects conducted in Nariño region. Thanks to the participation in a restoration project funded by the GEF/PNUD in Nariño region, this association of farmers acquired an extensive experience in terms of ecosystems conservation, tree nurseries, agroforestry systems, planting techniques and ecological services. The nursery provides the FNC for the project's plantations occurring in the communities along Rio Guaitara and around the volcano Galeras. They produced trees and also did trainings for farmers involved in the project (tree species identification, bird identification…).

1.4.3 Organization and structure: teams, roles & responsibilities, capabilities of the team

The local coordination is conducted by PUR Projet's local coordinator and the FNC Central Office.

The project is based on the collaboration between PUR Projet and the FNC. PUR Projet oversees project coordination, monitoring & evaluation, definition of processes, development of training modules, consolidation of project data, quality control, etc. while the FNC is responsible for local project implementation through his regional committees. The FNC has hired dedicated technicians to operate the project and implement monitoring activities (Figure 1: Overall project's structure).

PUR Projet monitors on a continuous basis project progresses and achievements through visits and internal audits (documents, plantations, knowledge, benefits, actual GHG removals by sinks, etc.).

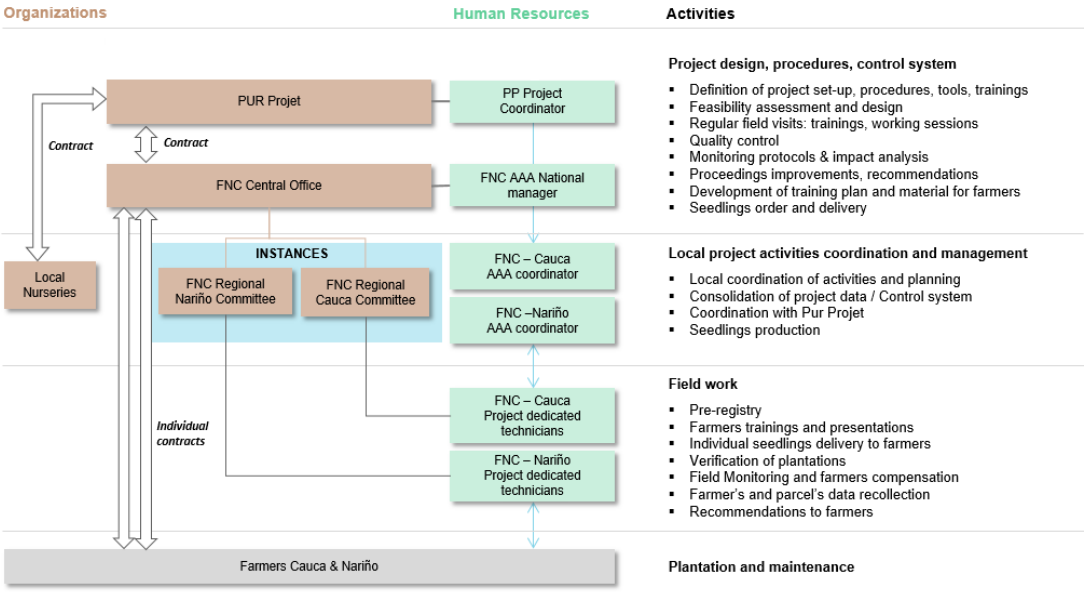


Figure 1: Overall project's structure

PUR Projet's local project coordinator oversees the coordination of planting and monitoring activities, and the control of the data collected for each area. The FNC regional coordinator leads with the local coordinator a team of fourteen technicians (see Figure 2: Organizational structure of the local team). The local project coordinator monitors the data collected by the technicians, in terms of quality and consistency.

The fourteen technicians from FNC are trained by the PUR Projet local project coordinator and are responsible for the farmers' trainings, plantation designs, and seedlings distribution. They are also conducting the registration and monitoring activities in the field.

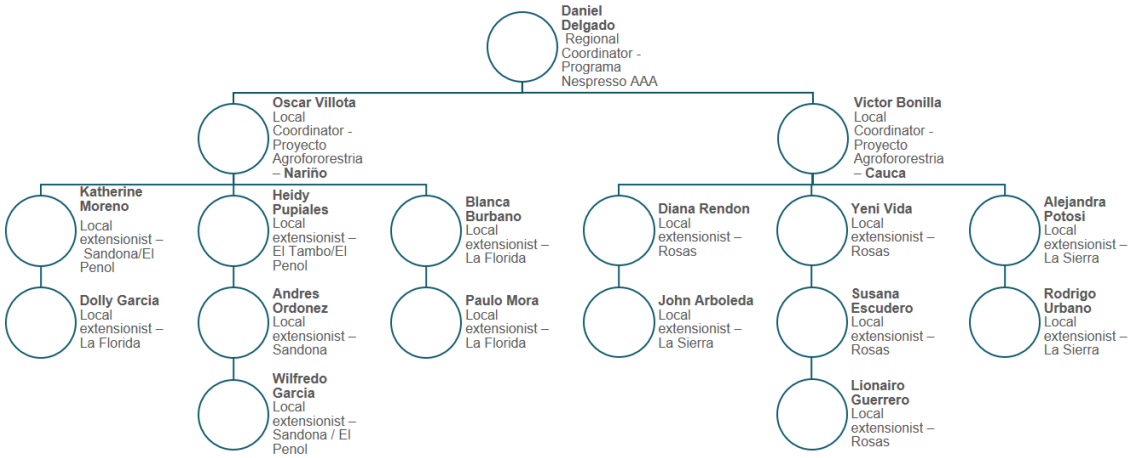


Figure 2: Organizational structure of the local team

1.5 Project Start Date

The start date for the proposed A/R project activity-crediting period is April 20th, 2014, date on which the activities for the first plantation wave started, as evidenced by the first contract signed between PUR Projet and CORSAVIDA.

1.6 Project Crediting Period

The crediting period is from April 20th,2014 to April 19th, 2054. The length of the crediting period is 40 years.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
2014	0
2015	518
2016	4 031
2017	16 623
2018	29 238
2019	41 938
2020	55 300

2021	68 953
2022	82 606
2023	96 334
2024	110 084
2025	123 820
2026	136 698
2027	147 322
2028	157 709
2029	167 866
2030	177 787
2031	187 391
2032	196 277
2033	204 238
2034	211 493
2035	218 404
2036	225 022
2037	231 316
2038	237 106
2039	242 407
2040	247 132
2041	251 294
2042	255 044
2043	258 443
2044	261 348
2045	264 045
2046	266 637
2047	269 129
2048	271 528
2049	273 839
2050	276 074
2051	278 227
2052	280 305
2053	282 315
2054	284 262
Total estimated ERs	284 262
Total number of crediting years	40
Average annual ERs	7’107

The Long-Term Average Emission Removals is **247 988 tCO2e**, calculated according to the AFOLU Requirements section 4.5.5 and AFOLU Guidance: Example for Calculating the Long-Term Average Carbon Stock for ARR Projects with Harvesting.

The period over which the long-term average is calculated is the project longevity: **80 years.**

1.8 Description of the Project Activity

1.8.1 Project's purpose and principles

The Project aims at integrating an ecosystems management component through the implementation of agroforestry and land rehabilitation practices at landscape level. The reforestation component will help small-scale farmers regenerate coffee's ecosystems at watershed and landscape level. Indeed, coffee is as much impacted by the quality of ecosystems services at a watershed/landscape level as by the trees directly intercropped in the farm. Besides, many farmers own degraded or sub optimally used pieces of land, some for cattle ranching, that could be replanted with large benefits on the whole ecosystems.

The project therefore incorporates 4 different planting models that will be combined based on farmers needs to maximize ecosystems regeneration at a landscape level (see Figure 3: Colombian coffee ecosystem regeneration at landscape level)

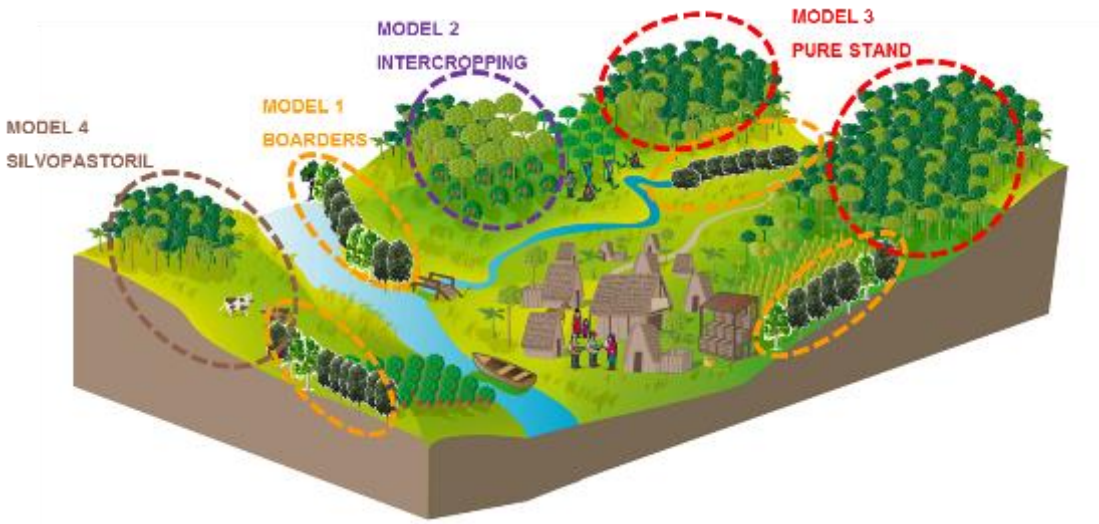


Figure 3: Colombian coffee ecosystem regeneration at landscape level

The trees planted will provide specific services (nitrogen fixing, pollinators' habitat, deep-rooted for erosion control, high value timber, fruits, medicinal, habitat for endangered species, etc.) in order to restore ecosystems at watershed and landscape level and maintain appropriate conditions for coffee farming over the long-term, while diversifying and increasing farmers' revenues with alternative co-products (timber, fruits, fuelwood).

The producer organization involved in the initial project instances is the Colombian Coffee Growers Federation (FNC). The FNC is a democratic and federated organization that represents the interests of more than 563,000 coffee-growing families. Because of its number of affiliated coffee growers, it is one of the largest agriculture organization in the world. Its activities are directed towards improving the well-being of coffee growers' families, by providing assistance in sustainable and competitive practices within the coffee industry, as well as promoting social investments.

The producers receive information about the effects of climate change, deforestation and its consequences (soil erosion, water availability decrease, natural disasters, landscapes degradation, biodiversity decrease and so on…) and about how to mitigate it by planting trees. They also receive information and trainings about agroforestry techniques, planting techniques and maintenance.

Farmers join the project on a voluntary basis and participate actively in its design and operations: farmers reforest their own land and take care of the planted trees, they participate through their organizations in the promotion of good practices, the development of co-products value chain, the securing of land tenure, and the national and international recognition of their contribution. Reforested areas are the own farmers' land, and encompass parcels smaller than 20 hectares, with an average size close to 1 hectare per farmer. Land-use before reforestation can be perennial crops (coffee, sisal, fruit trees plantation, etc.), annual crops (corn, yucca, etc.), abandoned land or land in rotations with annual crops ("rastrojo"), pastures. The reforested areas are located outside of any conservation area, have not been deforested over the past 10 years and do not fall under the definition of forests.

Each farmer willing to participate chooses a plantation model (based on the specificities of his land) and some recommended species he is interested in. After receiving the seedlings, each farmer is committed to plant and take care of the trees until they reach the harvesting date establish in the forestry management plan. Afterwards, he is free to harvest the timber in accordance with the timber management plan defined by the project. To ensure sustainability, each farmer receives an incentive for each tree planted and maintained and is trained throughout the years by the technician team hired by each Project Entity.

The project will benefit to the farmers

- Directly through the distribution of tree seedlings, trainings and technical assistance on agroforestry and tree management, an incentive per tree planted, technical assistance to their organizations in project coordination, traceability, internal control systems, technical assistance in the development of value chains for trees products.
- Indirectly through the improvement of the coffee farming conditions, the adaptation to climate change, the valuation of patrimony, the sales of trees co-products, the increased visibility of the farmers' organizations, the security and visibility over their revenues.

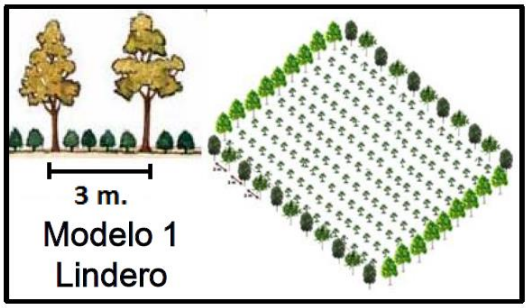
The general supervision of PUR Projet, combined with the local guidance and coordination of the Colombian Coffee Growers Federation (FNC) ensures a coherent and standardized approach to the project's reforestation activities and local economic developments, across all possible producer organizations: cooperatives, producers associations, indigenous communities, districts municipalities. The global coherence is ensured through the implementation of standardized proceedings defined by PUR Projet, and the endorsement of a common philosophy: local populations' empowerment, ecosystems regeneration, and development of long-term diversified sources of incomes.

There is no active Jurisdictional REDD+ Program in the Cauca and Nariño Regions.

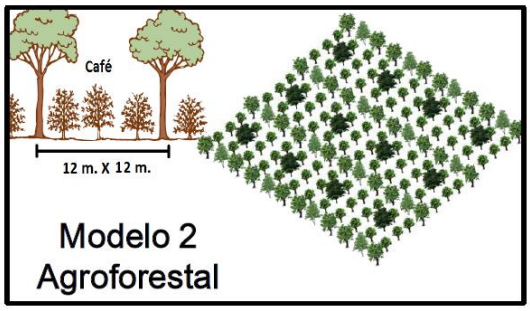
1.8.2 Plantation models

5 plantation models are proposed to the participating farmers

- **Model 1 "Lines**": Trees in lines, around the parcels (annual or perennial crops), along paths, water streams, and roads, every 3 meters. The density can be adjusted according to parcels' specificities as high slope.

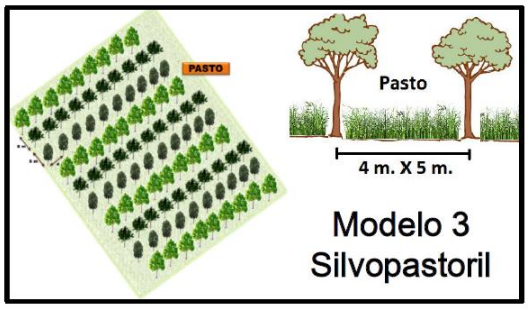


- **Model 2A "Intercropping Coffee"**: Intercropping and/or perimeter in existing coffee fields. Theoretical density varies between 70 and 250 trees/ha. The density can be adjusted according to parcels' specificities. This model is implemented in existing coffee plantations (*Coffea arabica*) at full solar exposure in the baseline case.

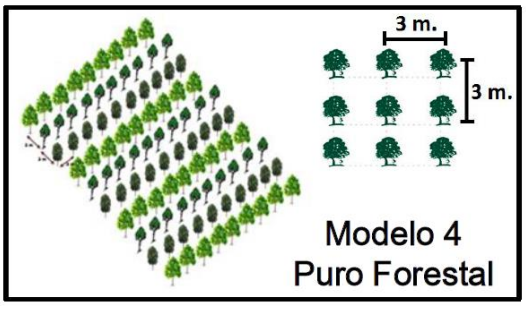


- **Model 2B "Agroforestry Coffee Installation"**: Full installation of a new coffee farm. Shade trees and coffee trees are planted simultaneously. Theoretical shade trees density varies between 70 and 250 trees/ha and coffee density varies between 5,000 and 10,000 trees/ha. The density can be adjusted according to parcels' specificities. Additional short-term crops and ground cover can be planted together with the coffee trees and the shade trees.

- **Model 3 "Silvopasture":** Tree plantations in grazing areas, 300 trees/ha. This model is implemented in areas with current pastures coverage, used for livestock or as unproductive lands.



- **Model 4 "Mixed Stand**": Dense planting on unprocessed or degraded lands (1111 trees/ha). The density varies according to parcels' specificities such as the slope for instance. In steep parcels the plantation will be established in triangular-shaped layout. This model is mainly dedicated to the protection of the water sources and streams but will also promote timber production. This model promotes the diversification of species. The species will be strategically combined in order to take advantage of their natural behaviour pattern and support each other's ecosystem functions.



1.8.3 Species and varieties selected

Tree species were selected based on farmers' knowledge, adaptability to coffee crops, timber value, adaptability to the area (e.g. altitude, rainfall) (see Table 1: Tree species). The project remains open to consider other species to include in future instances.

The choice of species is based on site evaluations and according to farmers' needs. Tree selection depends on proven suitability for the specific site conditions and purposes of trees in the agroforestry or forestry systems (timber production, shade, soil improvement, etc). Principally native species will be used.

Agroforestry systems

Systems combining tree plantation with perennial crops and/or fruit trees

- **Crops**: coffee *(Coffea Arabica*)
- **Trees**: Trees species chosen for shade, conservation, fruits and timber production purposes

Plantations for sustainable timber production

Only native tree species will be planted, except for the *Fraxinus chinensis, Pinus Oocarpa* and the *Pinus Patula* which will be planted only on a small scale (less than 7,5 % of total trees planted in total). These species were planted in the first planting waves but rapidly abandoned to prioritize native species.

For the proposed project activity, 56 tree species were chosen:

Table 1: Tree species

	Scientific name	Origin	Principal use	Altidunal range	Age of maturity	Height
Cedro Rosado	Cedrela odorata	Native	Timber	Temperate	15-20 yrs	20-30m
Cedro Negro	Juglans neotropica	Native	Timber	Temperate/Cold	15-20 yrs	20-30m
Guayacan Amarillo	Tabebuia chrysantha	Native	Timber	Temperate/Cold	15-20 yrs	35m
Guayacan de Manizales	Lafoensia acuminate	Native	Timber	Temperate/Warm	15-20 yrs	15-20m
Guayacan Rosado	Tabebuia rosea	Native	Timber	Temperate/Warm	10-15 yrs	20-25m
Nogal cafetero	Cordia alliodora	Native	Timber	Temperate/Cold	15-20 yrs	20-25m
Pino Colombiano	Podocarpus oleifolius	Native	Timber	Cold	25-30 yrs	40 m
Pino Ocarpa	Pinus oocarpa	Exotic	Timber	Cold	20-25 yrs	15-25 m
Pino Patulla	Pinus Patula	Exotic	Timber	Cold	25-30 yrs	40 m
Quillotocto	Tecoma stans	Native	Timber	Cold	15-20 yrs	25m
Cordoncillo	Piper Bogotense	Native	Conservation	Temperate/Cold	15-20 yrs	15m
Urapan	Fraxinus chinensis	Exotic	Timber	Temperate/Warm	15-20 yrs	25m
Cedro de Altura	Cedrela montana	Native	Timber	Cold	15-20 yrs	30-40m
Monte Frio	Alchornea bogotensis	Native	Timber	Cold	15-20 yrs	25m
Gualanday	Jacaranda caucana	Native	Shade	Temperate	10-15 yrs	15-20m
Jigua	Nectandra acutifolia	Native	Shade	Cold	20 yrs	15-20m
Carbonero Gigante	Albizzia carbonaria	Native	Shade	Temperate	15-20 yrs	20-25m
Cachimbo	Erythrina poeppigiana	Native	Shade	Warm	10-15 yrs	10-20m
Chachafruto	Erythrina poeppigiana	Native	Shade	Temperate/Cold	15-20 yrs	10m
Vainillo	Cañafistulo macho	Native	Shade	Warm	10-15 yrs	15-20m
Leucaena diversifolia	Leucaena diversifolia	Native	Shade	Warm	10-15 yrs	15-20m
Leucaena leucocephala	Leucaena leucocephala	Native	Shade	Warm	10-15 yrs	15-20m
Guamo machete	Inga edulis	Native	Shade	Temperate	10-15 yrs	8-10m

Guamo churimo	Inga marginata	Native	Shade	Temperate	10-15 yrs	8-10m
Laurel de Cera	Morella parvifolia	Native	Conservation	Temperate	15-20 yrs	15-20m
Arbol Loco	Montanoa ovatifolia	Native	Conservation	Warm	10-15 yrs	5-10m
Cucharo	Swartzia macrophylla	Native	Conservation	Warm	15-20 yrs	15-20m
Balso Blanco	Heliocarpus popayanensis	Native	Conservation	Warm	10-15 yrs	15-20m
Arrayan	Myrcianthes leucoxyla	Native	Conservation	Cold	15-20 yrs	15-20m
Arrayan clima frio	Myrcianthes leucoxyla.	Native	Conservation	Cold	20 yrs	15-20m
Arrayan negro	Myrcianthes rhopaloides	Native	Timber	Temperate/Cold		20-25m
Moquillo						
Pendo						
Ortigo	Urera caracasana	Native	Conservation	Warm	10-15 yrs	10-15m
Nacedero	Trichantera gigantean	Native	Conservation	Temperate/Warm	15-20 yrs	10-15m
Guada	Guadua angustifolia	Native	Conservation	Temperate	5-10 yrs	15-20m
Saman	Samanea saman	Native	Timber	Temperate/Warm	25-30 yrs	30-35m
Roble	Quercus humboldtii	Native	Conservation	Cold	20-25 yrs	20-25m
Aliso	Alnus acuminate	Native	Conservation	Temperate/Cold	25-30 yrs	15-20m
Sauce Humboltii	Salix humboldtiana	Native	Conservation	Temperate/Cold	20-25 yrs	15-20m
Higueron Uvito	Saurauia brachybotrys	Native	Conservation	Temperate/Cold	20-25 yrs	15-20m
Impamo	Chrysochlamys dependens	Native	Conservation	Temperate/Cold	20 yrs	10-15m
Limon	Citrus latifolia		Fruit	Warm	4-5 yrs	3-5m
Limon Parajito	Citrus aurantiifolia		Fruit	Warm	4-5 yrs	3-5m
Limon Tahiti	Citrus latifolia Tanaka		Fruit	Warm	4-5 yrs	3-5m
Zapote	Quararibea cordata		Fruit	Temperate/Warm	15-20 yrs	20-30m
Guanabano	Annona muricata L		Fruit	Warm	20 yrs	10-15m
Guayaba Feijoba	Acca sellowiana		Fruit	Temperate	10-15 yrs	10-15m
Guayaba Pera	psidium guajava		Fruit	Temperate	10-15 yrs	10-15m
Guayaba Peruana	Psidium cattleianum		Fruit	Temperate	10-15 yrs	10-15m
Naranja	Citrus × tangelo		Fruit	Warm	4-5 yrs	3-5m
Mandarina	Citrus × tangerine		Fruit	Warm	4-5 yrs	3-5m
Mango	Mangifera indica 'Tommy Atkins'		Fruit	Temperate	4-5 yrs	8-10m
Aguacate	Persea Americana		Fruit	Temperate	5-6 yrs	15-20m
Durazno	Prunus persica		Fruit	Cold	5-6 yrs	5-10m
Brevo	Ficus carica		Fruit	Cold	5-6 yrs	3-5m

For the future instances, this list of tree species could evolve depending on the soil and climate conditions of these future instances and on the demand of coffee farmers.

1.8.4 Technology employed in the activity

Farmers involvement and empowerment

The project undertakes a participative approach to motivate farmers to change their actual land use practices.

- Farmers within Project Entities have participated in the design and implementation of the project;
- During the consolidation phase of the project, cooperatives and the Project Entities play an active role in setting the policies and strategies of the project.

Voluntary and participative approach

As a community, farmers first receive various group trainings on climate change, deforestation and its consequences (erosion, soils losses, biodiversity loss, loss of water quality and quantity…), description of the proposed activity, agroforestry techniques and benefits.

Voluntary farmers then register to enter the project and chose the parcels to plant and the plantation model they want. Farmers receive the seedlings from the project entity, and are in charge of planting, growing, and maintaining the trees.

They are followed and trained on a regular basis by a team of agronomists and/or technicians of their Project Entity, itself trained by PUR Projet. PUR Projet or the Project Entities are in charge of purchasing the seedlings. The transport (if needed) is in charge of the tree nursery and the delivery to the farmers is planned by the Project Entity.

Farmers own the trees planted and all associated products (timber, fuelwood, medicinal products, etc.). All timber products issued from this project will be monitored, managed and distributed via the Project Entities, under the project's timber management plan, in order to ensure sustainable practices and maximum revenues for the farmers.

Education and technical assistance

A training curriculum has been developed to increase farmers' awareness on climate change, deforestation and its consequences; carbon sequestration in tree biomass; agroforestry systems and ecosystem benefits, planting and maintenance techniques; timber management and market.

PUR Projet develops training material and didactical games according to the methodology of the Farmers Field Schools (ECAS). This methodology promotes the active participation of farmers during the training to share their knowledge and good practices with each other.

The concept of "learning by doing" is very important in the ECAS+ methodology and is relevant to ensure the efficiency of the trainings and develop good practices in agroforestry in the long-term vision of tree survival.

Economic incentives

As defined and collectively approved by farmers' organizations, an economic incentive system for tree plantation is implemented: each farmer will receive after monitoring 1100 COP ($US 0.36) per tree planted and alive and does not pay for the seedling.

Legal Arrangements

A contract is signed between PUR Projet and each famer organizations, in which the famer organization commits to implement the reforestation activities and deliver the monitoring outputs according to PUR Projet proceedings. PUR Projet commits to train and assist the famer organizations and to transfer the funds for plantations and monitoring. The contract mentions the transfer of the rights over environmental services (among which carbon credits) related to the plantation of trees.

A contract is signed between each beneficiary and his related project's Entity defining commitments of the Entity and of the farmer. The contract specifies that the Entity will provide seedlings, trainings, technical assistance and financial incentive to the farmer, while the farmer commits to plant, look after the trees and respect the sustainable timber management plan.

The parcels will be registered with the CAR (Corporaciones Autonomas Regionales), which is the regional authority in charge of the control of forest activities, to control illegal harvesting. This will enable timber activities on planted areas[5].

Farm visits

The technical team will visit every planted parcel at least once a year, to provide technical assistance to the farmer on maintenance techniques and agroforestry techniques (pruning, shade management, etc.).

The technician will also monitor the compliance with the plantation contract during the various stages of project implementation. In case of non-compliance, the technical team will refer to the Project coordinator at Entity level, and if necessary to PUR Projet. Over the long run, the entity will decide whether or not the non-complying farmers should be removed from the program based on the evolution of farmer's behaviour.

Nursery techniques

The seedlings are bought from various suppliers, commercial suppliers (CORSAVIDA) well known for their experience with the production and logistic of tree seedlings, and community tree nurseries developed following the project's proceedings for tree seedlings production.

The seedlings are transported by truck to the farmers' communities. Transportation of the plant material from the nursery to the communities is made carefully in wooden boxes in order to avoid damages and deterioration in the quality of the material. Seedlings are transported up to the accessible site nearest to the parcel to be planted, in varying capacity two-axle vehicles. Ideally, the plant material should remain as little time as possible at the unloading site, which should have available water, shade and protection to avoid possible damages caused by people and/or animals.

CORSAVIDA also provides technical assistance and trainings to the Entities teams on seedlings production.

Site preparation

Sites are prepared to enhance the early growth and development of the planted seedlings.

- The planting lines are prepared oriented perpendicular to the slope, following the contour lines, in order to protect the soil and reduce possible erosion processes, caused by surface runoff.
- Weeding: a 50cm-diameter-circle is weeded around the planting point. The operation is done by hand, using a machete.
- Hole preparation: a 30cm x 30cm x 30cm hole is dug, by hand, using a shovel. GHG emissions are not significant due to the low soil disturbance caused by this form of site preparation (less than 5% of total surface)

Planting

The farmers are in charge of planting.

- The planting will be done at the most suitable moment in terms of weather conditions.
- The trees will be planted according to the plantation model, following the recommendations of a technician of the Entity's technical team

[5] Ordenación Forestal. El decreto 1791 de 1996

- The planting is done by hand, in the rainy season, in the early morning or at the end of the day, when the sun is not too high.
- Within one month after the plantation, the technical team will control the parcel.

Plantation management

All plantations are managed by the farmers according to technical recommendations provided by the project's technical team during farm visits and group trainings.

Weed control

Weed control is crucial to reach the good development of the trees. Weeds are controlled manually with machete, from the plantation date, during the three first years of growth.

During the first year after planting, there will be four manual weed control clean-ups (month 0, month 3, month 6 and month 12). During the second year, an average of three clean-ups will be carried out and the same shall occur during the third year. For the following years, clean-ups will be performed depending on the needs of each lot.

Pest Controls

The monitoring of the phytosanitary conditions of the plantations is permanent, in order to detect promptly any plague attack or systemic illness and immediately undertake the relevant measures. Evaluation procedures and protocols have been designed to identify the possible appearance of diseases, as described in the monitoring plan.

Our experience with the former plantations shows that there is one main pest to control: *Hipsiphila Grandella*; a leptidopter whose larva attacks the apex of the specie *Cedrelata Odorata*, altering the rectilinear growth of the trunk. To prevent the expansion, PUR Projet recommends to realize periodic observations to detect the pest in time. To prevent the spreading of the pest, the vulnerable species are planted randomly in the parcels, in limited number. Once the tree is attacked, the farmer will have to look for the pest and kill it manually (removing the damaged part of the plant). The pest controls are done in an organic way.

The planting models are also designed to prevent the spread of diseases thanks to tree species diversification in each plot.

Rate of success and Replanting

In case of high mortality at first monitoring, the technical team encourages the producers to replace the dead seedlings with tree species that have identical characteristics to the one initially planted, using proper planting techniques, including the cleaning and hole making. Whenever possible this replacement shall be made with native species.

Thinning and Pruning

In order to maximize the proportion of large stems and the quality of the wood, pruning and thinning is implemented.

- **Pruning:** to obtain a high-quality timber and to control the shade level in the coffee parcels, pruning is done in the vegetative rest period of the trees or at the end of the rainy season. The activity of pruning is done the first years with a pruning scissors and will be done afterwards with telescopic scissors or manual saws. Pruning is done manually, according to the characteristics of the species.

- **Thinning**: will be carried out in accordance with the sustainable management plan established by each Entity. The thinning aims at improving the growth of the best trees and could be implemented from the 8th year after the planting, according to the characteristics of the species. Thinning will be done manually, with an axe or a chain saw, according to the project's timber management plan and the recommendations of the technical team.

Measurements

Estimation of average diameters and heights per species will be conducted by the technicians at each monitoring visit, based on the measurement of a sample of trees in the planted parcel. These estimations will help the project's team estimate the growth of the trees, the biomass increase, and the volumes of timber standing.

Complete biomass inventories will be completed regularly (every 3 to 5 years) in permanent plots, after stratification of the project area, with a sampling approach, across a number of plots per strata sufficient to reach desired level of accuracy.

Timber valuation & Harvesting

A part of the trees planted will be harvested, processed and sold via the Project's Entity, following the project's sustainable timber management plan. Project's Entities and Project Proponent jointly define the harvesting methodology. The objective is to obtain FSC certification by 2020.

In accordance with the sustainable timber management plan, a maximal harvesting rate of 5% per year (smaller than natural mean increment of biomass) will be set at project level, to guarantee the permanence of carbon stocks as well as forest cover. All harvested trees will be replaced, when not regrowing by themselves. The Entity's technical team will be in charge of selecting the trees to be cut down. A dedicated team will realize the cut and manage the logistic up to a central sawmill.

The sustainable management plan ensures the maintenance of carbon stocks close to a fixed asymptotic level throughout the project longevity of 40 years.

1.8.5 Transfer of technology/know-how

Capacity building and transfer of technology and know-how are primordial for the implementation and the success of the project.

Farmers' organizations empowerment

The grouped project focuses on solid and well-organized entities that will be further trained and empowered by PUR Projet on agroforestry, project's proceedings, traceability, monitoring, data management, certifications, forestry. This progressive training and empowerment process, rolled out over several years, is critical for the complete assimilation and appropriation of the agroforestry and forestry activities by the Entities and the farmers.

Each project Entity has its own project technical team, trained by PUR Projet and/or the Entity, in charge of project implementation. The size of the dedicated team depends on the Entity and the size of the plantations managed by each Entity.

Community empowerment

Smaller communities and farmers' associations that will participate in the project without acting as project's entities will not have a dedicated technical team. However, the project will roll-out a system of "community managers" which aims at identifying, training and empowering one of the community

member (chosen by the community) to be a local facilitator and relay of the Entity's technical team. This system ensures a close linkage with the communities and a facilitated communication and transfer of the project's information and recommendations. It's also a powerful way to empower the community members and communities as a whole (democratic election of the "community manager", information meetings, etc.).

The farmers

Farmers under the Entities are the most important stakeholders for the success of the project implementation. The project therefore includes a training curriculum with group training modules done by the Entities technical teams, as well as individual technical assistance during individual farm visits.

- Group trainings ("Escuelas de campo") are both theoretical and practical trainings on a specific topic. Depending on the topic, it's a two to five hours training, where the farmers in groups share their knowledge on the topics, the technician/engineer teaches using various supporting material (presentations, drawings, posters, videos, games, etc.), and where, for relevant topics, the farmers get to observe and practice in the field. Group trainings are usually done by cooperative committee, or by community (for small communities)

- Individual visits: In addition to group trainings, all parcels are individually visited at least 3 times in the first year and a half (before planting to assess parcel eligibility, define planting scheme, choose species; after planting twice in the first year to monitor the planted parcel and tree survival); and then at least once a year by one of the Entity's technicians to check the state of the parcels and provide recommendations to the farmer.

A large-scale vision and strategy

The grouped project targets the whole area of the Colombian tropical Andean region of the Northern Andean Montane Forests from North to South of Colombia, as this region presents a consistency in terms of ecosystems, agricultural profile (small-scale agriculture – frequently coffee, orange, corn), economic and social drivers (migration of populations due to the conflicts between the Colombian government and the guerrillas, settlements and subsistence farming). Most of the areas in the Northern Andean Montane Forests also face the same challenge of illicit coca farming and the difficult transition to other crops.

The project is fully integrated into a long-term vision of 40 years which matches the pace of trees growth and ecosystems regeneration: farmers' organizations will follow-up on the tree plantations, monitor the impacts and ecosystem services, and develop value chains for trees' co-products (fruits, timber, fuelwood). Technical assistance will be provided for these activities and funded by additional PUR Projet's investments in the long run.

The project started in the framework of the Nespresso sustainability strategy Nespresso has the objective to offset its carbon footprint every year through an integrated project that has multiple positive impacts on the company's supply chain (coffee quality, better resilience, farmer loyalty,).Nespresso's vision to support from the beginning a large-scale and long-term program, which offsets its carbon emissions while providing other high value socio-environmental impacts over the long-term, reduces the risk of project's financial viability. In addition, Colombia is a significant coffee exporter and a reforestation/agroforestry project with coffee farmers should be an attractive program for more financers over the long-term.

The project aims to expand over time, with new project instances, and a target to help farmers replant a total of 5 million trees on more than 10,000 hectares over 10 years.

1.9 Project Location

1.9.1 Grouped-project Location: Northern Andean Montane Forests

All project instances will be located in the Republic of Colombia, in a Global ecoregion defined as "Northern Andean Montane Forests" by The World Wild Fund for Nature (Figure 4: Northern Andean Montane Forests Ecoregion and location of initial project instances). The complex topography, climate, geology, and biogeographic history of this Global ecoregion have helped create many distinct habitats and biological communities.

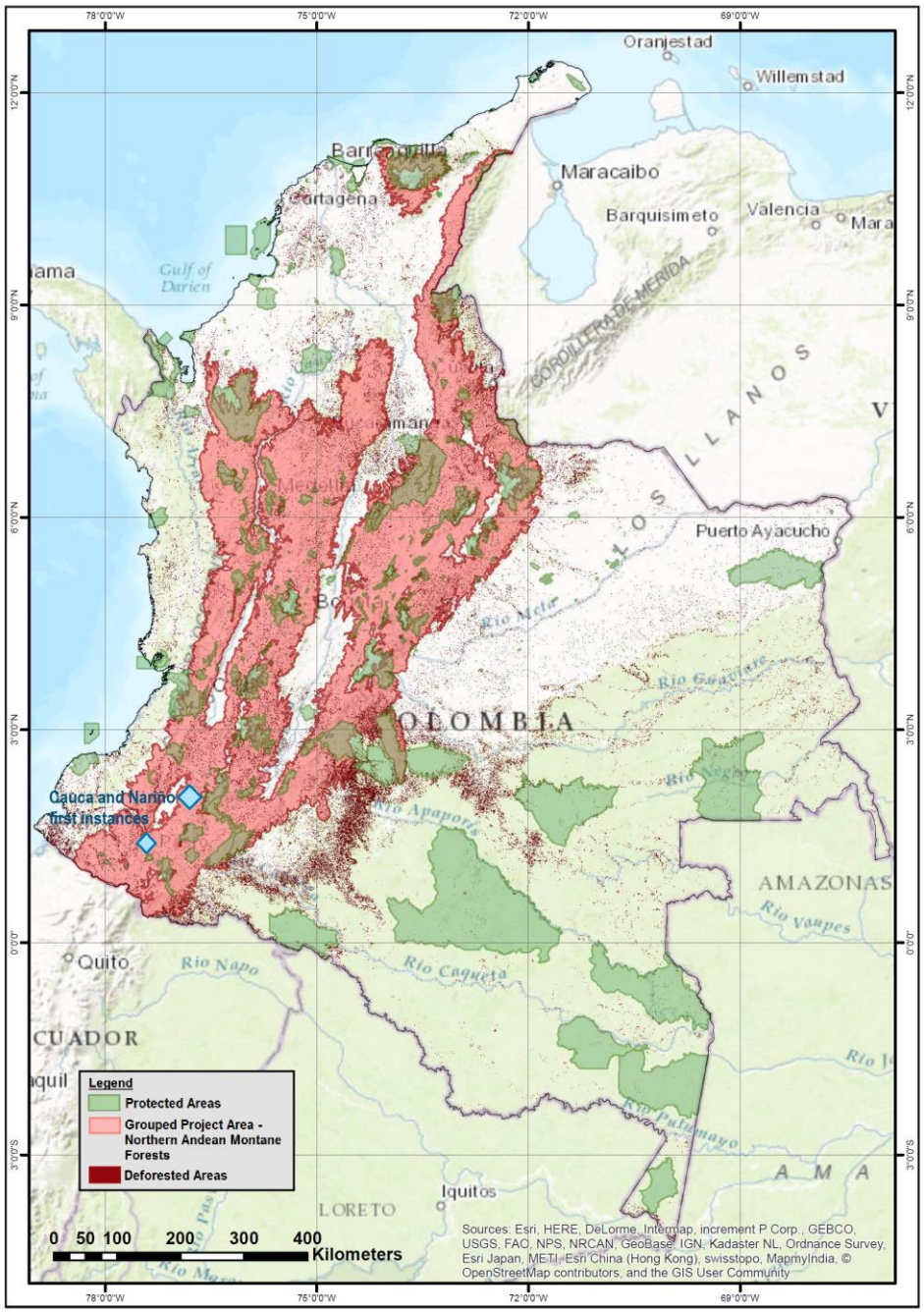


Figure 4: Northern Andean Montane Forests Ecoregion and location of initial project instances (blue diamonds)

In fact, the eastern and western slopes of some of the major valleys in this ecoregion have substantially different plants and animals, and many species are restricted to single mountaintops or ranges. These are likely to be the richest tropical montane forests on Earth, with very high levels of regional and local endemism.

In the Northwestern Andean montane forests, flowering species are extremely diverse, and up to 300 species can be found in a single 2.5-acre (one hectare) tract. Rainfall here is high, creating one of the wettest regions on Earth.

To precise the geographic area where the new instances will be implemented, the project proponent provided the KML file of a geodetic polygon (Grouped Project Area – Regenerating Colombian Coffee Ecosystems.kml) with the following coordinates:

	Decimal Degree		Degree Minute Seconds GCS_WGS_1984	
	Longitude	Latitude	Longitude	Latitude
A	-77,555	7,677	77°33'17,8"W	7°40'36,087"N
B	-79,22	1,486	79°13'11,117"W	1°29'10,016"N
C	-76,107	-0,577	76°6'23,761"W	0°34'36,67"S
D	-70,644	5,362	70°38'38,677"W	5°21'42,713"N
E	-73,237	12,492	73°14'12,261"W	12°29'33,827"N

The region is representative of a typical socio-economic and environmental context. The Northern Andean Montane Forests have the following characteristics.

1.9.2 Initial project Instances

The first project instance is constituted by the reunion of all parcels planted in the Cauca and Nariño region from 2014 to 2016. The FNC developed the reforestation activities of this first project instance.

Table 2: Locations of the Initial Project Instances

Instances	Farmer Organizations	Region	Provinces
1. Reunion of all planted parcels in Cauca region from 2014 to 2016	FNC	Cauca	La Sierra; Rosas; La Vega
2. Reunion of all planted parcels in Nariño in 2015 and 2016	FNC	Nariño	El Peñol; El Tambo; La Florida; Sandona

Project's achievements

As of May 1st, 2017, the grouped project "Regenerating Colombian Coffee Ecosystems" is active with 1 initial project instance and contributed to the plantation of 730'000 trees by 2'707 farmers on 2'321 hectares of land, as reforestation on degraded land or intercropped with coffee on small-scale farms.

		2014	2015	2016	TOTAL
CAUCA	Number of trees planted	82,835	141,572	170'000	394'407
	Total planted area (ha)	59	199	266	524
NARINO	Number of trees planted	-	134,656	200'000	334'656
	Total planted area (ha)	-	296	1501	1'797
TOTAL	Number of trees planted	82,835	276'228	370'000	729'063
	Total planted area (ha)	59	495	1'767	2'321

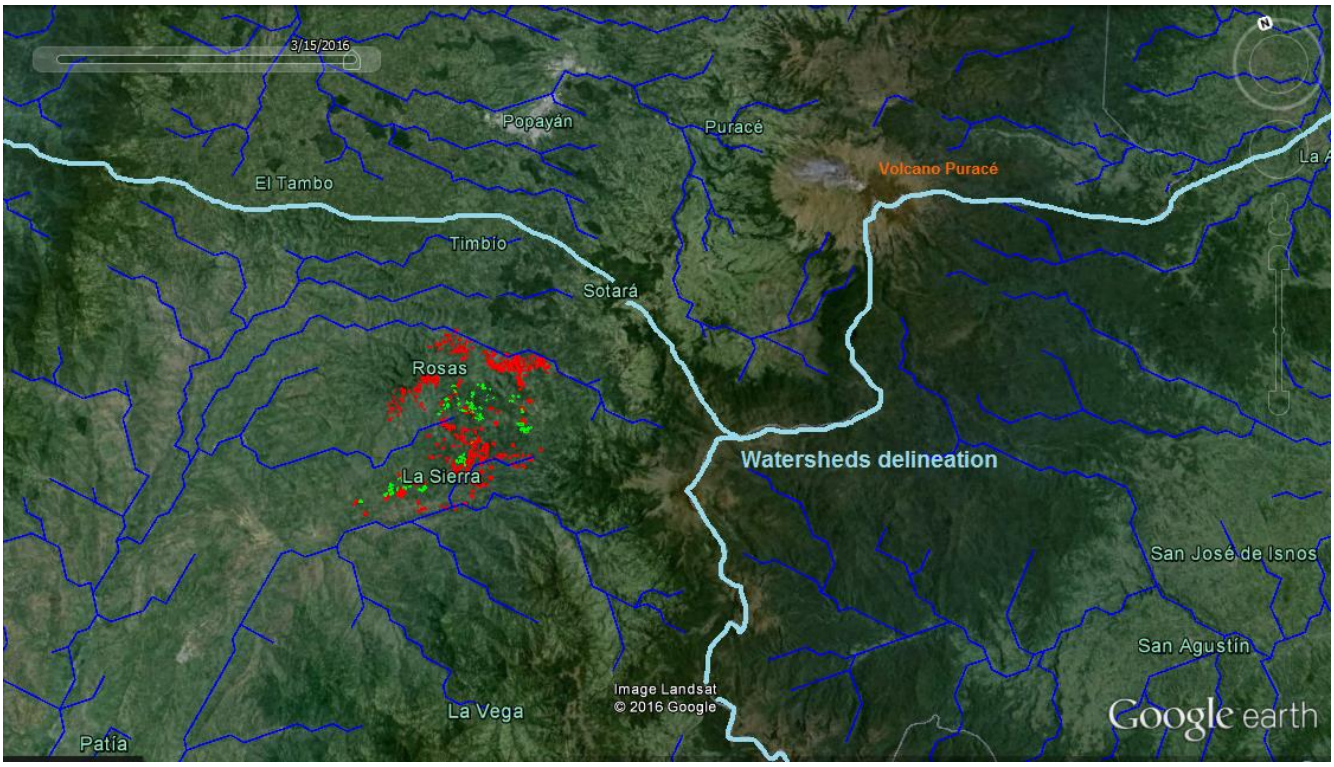


Figure 5: General Google Earth view of plantations in Cauca (2014: green; 2015: red) with the water streams (in blue) highlighting the proximity with the watersheds delineation of the three most important rivers of Colombia (Cauca, Patia and Magdalena)

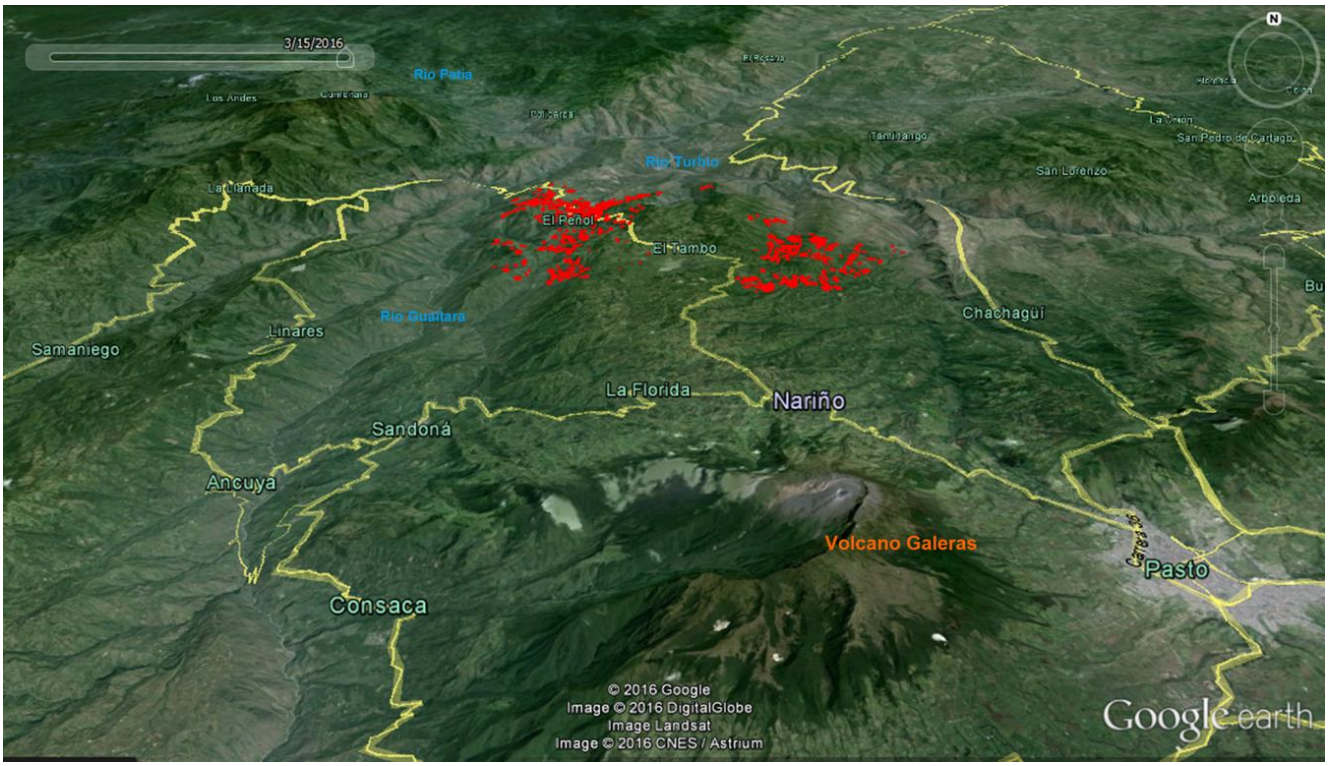


Figure 6: As in Cauca, tree plantations in Nariño are also located on the Patia River watershed

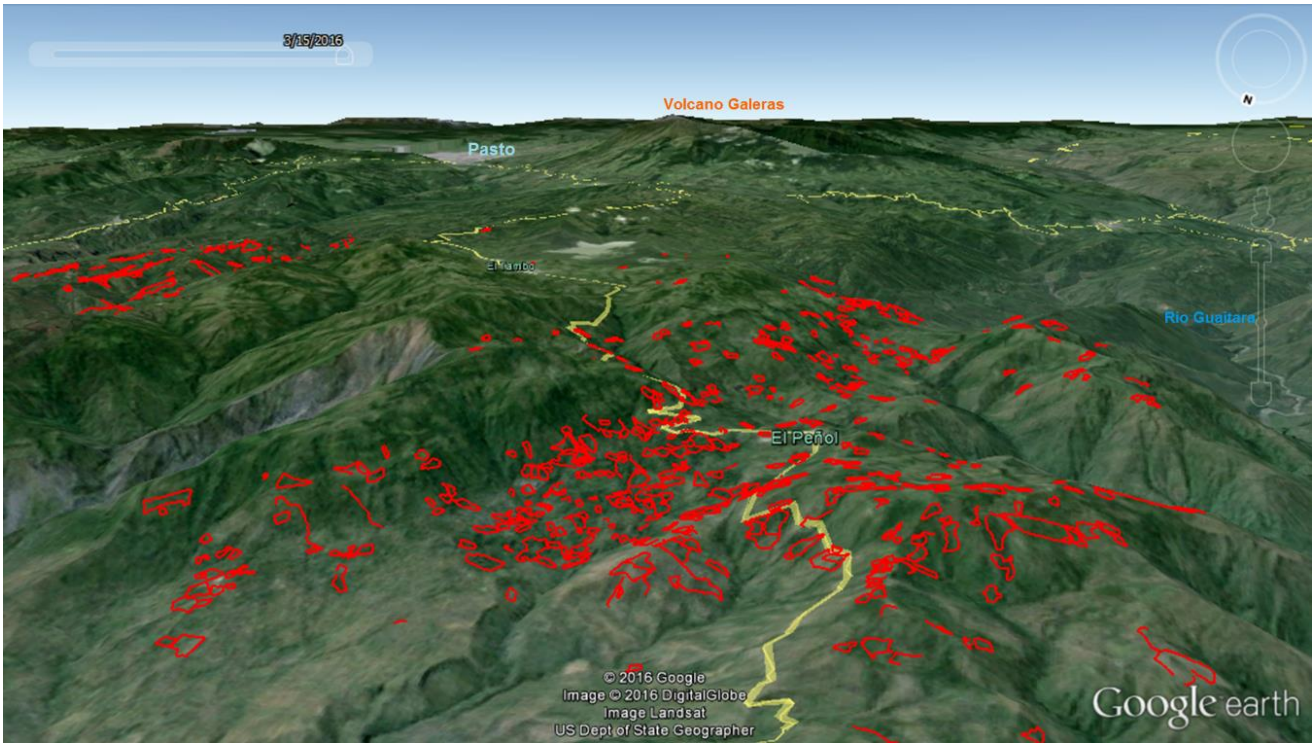


Figure 7: Details of the plantation area in El Penol municipality showing implementation of agroforestry and land rehabilitation practices at landscape level

1.10 Conditions Prior to Project Initiation

The complete list of parcels reforested in the project is available in the plantation database including the land-use before tree planting.

1.10.1 Land use before planting

There are 4 types of pre-project land-uses in the parcels reforested in the scope of the project:

Degraded land ("rastrojo")

Figure 8: "Rastrojo" of the farmer ARQUIMEDES MALES MORALES (village: LA EMPINADA).

"Rastrojos" correspond to degraded areas of land that have been over-exploited or heavily degraded by bad land-uses (coca plantations with heavy uses of chemicals for example). At local level a distinction can be made between two different forms of degraded areas:

- The moderately degraded areas present a medium height of vegetation (mostly bushes, vines) (crown cover around 15-20%, around 3 to 5 meters high), with decreasing yields and soil fertility.
- The severely degraded areas present a low height of vegetation (weeds, bushes) (crown cover about 5%, 1 to 3m high). The indicator is the presence of invasive vegetation or "pasto". These unproductive areas are abandoned by the farmers.

Coffee and Sisal plantations (perennial crops)

Figure 9: Coffee plantation of the farmer JHON EDINSON ARBOLEDA (village: FRONTINO ALTO)

Coffee fields are either in installation or already producing. When in production, coffee trees/shrubs are maintained at height of 1.5 to 2 meters.

Figure 10: Sisal plantations in Nariño, Colombia

Sisal plantations are also either in installation or already producing. When in production, sisal trees/shrubs are maintained at height of 2/3 meters.

Annual crops

Figure 11: Granadilla parcel of the farmer EUSTACIO DIAZ CIFUENTES (village: EL RETIRO) and sugar cane plantation in Nariño region

The annual crops are typically sugar cane, corn, potatoes or yucca (sometimes other vegetables).

Because of past intensive use, soils fertility is low. After harvest, the land will typically remain as fallow for several years. Farmers prefer therefore to convert it to agroforestry or pure forestry land within the scope of the project.

Pasture

Figure 12: Pasture of the farmer EMIGDIO ANACONA (village: LAS DELICIAS)

The pastures are generally unproductive with very limited number of livestock unit per hectare. This is due to non-selected and non-seeded pasture. Farmer generally chose steep land where coffee cannot develop. After several years, the soils structure is compacted and degraded which further lowers the productivity. Farmers prefer to switch for silvopasture model to enhance forage productivity.

Parcels reforested are either degraded areas or productive coffee fields that have been deforested and used for agriculture for 15 to 40 years.

As part of the initial field visit, before registering the parcel for the project, the technician of the technical team assesses the historical land-use of the parcel and ensures that the parcel was not deforested for the purpose of replanting trees.

No deforestation activity is therefore triggered by the project with the objective of reclaiming the GHG removals of the reforested biomass. The project is only claiming GHG removals due to reforestation and sequestration of carbon in the trees biomass. The project has therefore not generated GHG emission for the purpose of their subsequent removal.

1.10.2 Environmental conditions of the project area

The first instances are located in a region also called the High Andean Colombian Massif (Macizo Colombiano) that covers an area of 3,268,237 hectares in the south of the country and lies at the confluence of the Andean, Amazon and the Pacific bio-geographical regions. This location, and its climate, topography and geology have given rise to extraordinarily rich environmental assets both in terms of biodiversity and in water and climate regulation.

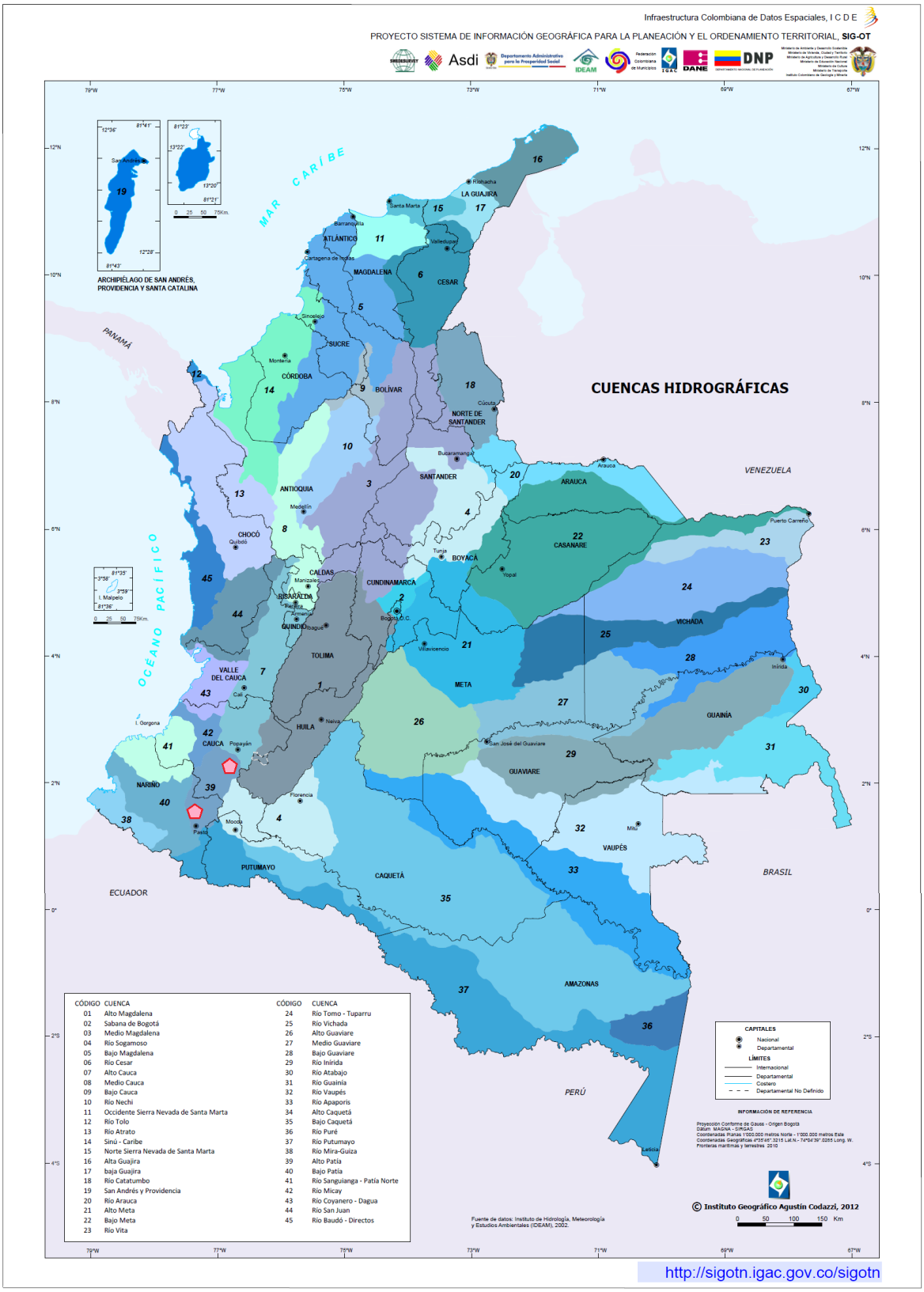
Water

At the national level the Massif has been given high priority not only for its strategic position at the confluence of three major bio-geographical regions providing widely diverse biological resources, but also as the major catchment area of the county's four main rivers Cauca, Patia, Caquetá and Magdalena rivers that supply 70% of Colombians with water.

Despite the importance of the Colombian Massif for the water supply at national level, the major issue in Cauca and Nariño regions is freshwater supply diminution through the years during dry period. Locals still remember that they used to have enough water to irrigate small auto-subsistence garden, drinking water and wash coffee all year long. Irregular seasonal patterns are designated as

responsible for recent freshwater shortages during dry season. Other reason given by locals was that the highest parcels of the valley (historically covered with primary forests) were cut clean for pastures (started 20 years ago). These areas greatly contributed to protect spring waters, and the clearings brought the loss of this supportive ecosystem service.

Water contamination is also an ongoing problem that results from the discharge of sewage and organic residues from coffee bean processing into rivers, creeks, and water springs. The growing demand for food has resulted in the increased use of agro-chemicals and pesticides in crops that further contributes to the contamination of rivers and creeks.



CÓDIGO	CUENCA	CÓDIGO	CUENCA
01	Alto Magdalena	24	Río Tomo - Tuparru
02	Sabana de Bogotá	25	Río Vichada
03	Medio Magdalena	26	Alto Guaviare
04	Río Sogamoso	27	Medio Guaviare
05	Bajo Magdalena	28	Bajo Guaviare
06	Río Cesar	29	Río Inírida
07	Alto Cauca	30	Río Atabajo
08	Medio Cauca	31	Río Guainía
09	Bajo Cauca	32	Río Vaupés
10	Río Nechi	33	Río Apaporis
11	Occidente Sierra Nevada de Santa Marta	34	Alto Caquetá
12	Río Tolo	35	Bajo Caquetá
13	Río Atrato	36	Río Puré
14	Sinú - Caribe	37	Río Putumayo
15	Norte Sierra Nevada de Santa Marta	38	Río Mira-Guiza
16	Alta Guajira	39	Alto Patia
17	baja Guajira	40	Bajo Patia
18	Río Catatumbo	41	Río Sanguianga - Patía Norte
19	San Andrés y Providencia	42	Río Micay
20	Río Arauca	43	Río Coyanero - Dagua
21	Alto Meta	44	Río San Juan
22	Bajo Meta	45	Río Baudó - Directos
23	Río Vita		

Figure 13: Colombian watersheds at national level; tree plantations areas (red diamonds) located in the Alto Patia (39)

The project is designed to maximize the impact regarding fresh water availability and quality at the scale of hydrographic basin. The producers identified the importance of protecting water streams with riverine forests and protecting the steepest parcels. Highest water runoff rates can be reduced by the implementation of adapted reforestation models (planting following contour lines in model 2) and using adapted forest species and mulching techniques.

Soils

In the forests surrounding the project sites, due to the high-water content of the soil, the reduced solar radiation and the low rates of decomposition and mineralization, the soil acidity tends to be high with more humus and peat often forming the upper soil layer. The soils are also characterized by high concentration of organic matter and were originally considered to be among the most fertile in Colombia, though intense farming and especially coca leaf production have significantly degraded the soils in some areas.

Erosion from rainwater runoff is the main cause of soil degradation in the Colombian Andes, affecting degraded lands as a result of human activities. It is related to practices such as deforestation, over-pasturing, frequent burnings, inappropriate farming methods and the absence of cover vegetation. Currently 70% of the agricultural sector relies on introduced species grown in monocultures with heavy reliance on chemicals, using methods unsuitable for the fragile mountain soils and resulting in land degradation, soil erosion, and productivity failures. Livestock rearing with high densities of cattle on steep slopes is also causing overgrazing, leading to soil compaction, soil drying, and loss of organic matter.

Soil erosion patterns are accentuated in these high tropical mountainous areas of Colombia, due to the steep topography and the very intense and prolonged rain events. According to data from plots in the Colombian coffee-growing area, rain events generate runoffs responsible of soil loss due to erosion[6]. In these areas, the maximum erosion values coincide with the two coffee harvest periods. Coffee plantation management practices, including fertilization and harvesting, have been identified as critical factors for soil erosion.

The project design is focus on studying effects of afforestation models on erosions rates of the soils in the valley. The project also provides trees species like Leucaena spp. that can be used in cropping systems to control erosion on steep slopes and to enhance yields of inter-row crops by mulching the Leucaena foliage into the soil.[7]

Climate

Tropical and Subtropical Moist Broadleaf Forests are characterized by low variability in annual temperature and high levels of rainfall (>2000mm/yr).

The proposed A/R CDM project activity takes place in the Tropical Rainforest (IPCC, 2006 – Chapter 4: Forest Land; GPG LULUCF 2006, IPCC).

The year is divided in two seasons: the summer or dry season (from June to September) and the winter or rainy season (from October to May). To be more precise:

- The first instance located in Cauca is characterized by
    - Average month temperature between 18 and 20°C, quite regular in the year, minimum temperature of 14-15°C, maximum temperature of 25-26°C.
    - Annual precipitation is more than 1500 mm.

[6] Hoyos et al. 2005
[7] http://www.fao.org/ag/agp/agpc/doc/publicat/gutt-shel/x5556e06.htm

- The second instance located in Nariño is characterized by
  - Average month temperature between 18 and 20°C, quite regular in the year, minimum temperature of 14-15°C, maximum temperature of 25-26°C.
  - Annual precipitation is more than 2200 mm

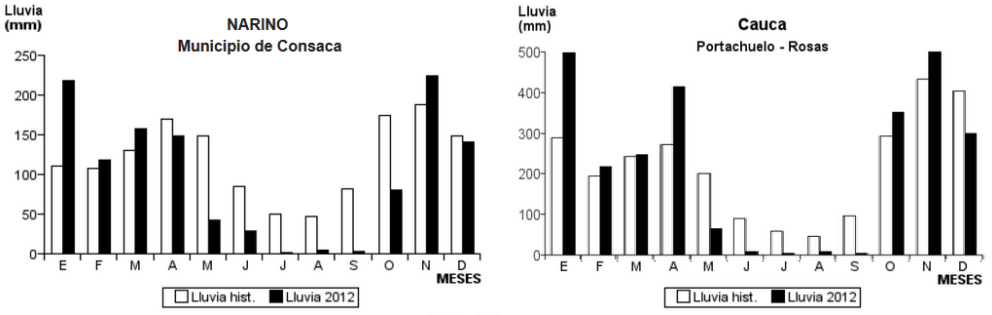


Figure 14: Climate Diagram in Nariño and Cauca regions (source: anuario meteolorigo cafetero 2012)

Most of producers in Cauca experienced unusual weather patterns, especially in terms of rainfall and sun radiation. These keys factors greatly influenced coffee production. In particular, they facilitated the development of coffee pests and fungus. Producers are well coordinated with FNC technician to develop an integrated strategy to counter effect greater attacks by pests.

The shade is closely managed by producers to comply with locally developed agroforestry models. It is widely recognized locally that shade in coffee plantations requires to be managed with care. During the project design, local forest species were designated by locals as potentially interesting for replacing old shade trees.

Biodiversity

In the Colombian Massif, from 1,500 to 2,300 m a.s.l. the cool and humid montane forest is characterised by high biomass levels, trees of up to 25 metres and an abundance of epiphyte orchids, bromeliads, tree ferns (*Cyathea spp*), mosses, lycopods and bamboos (*Chusquea spp*). The Massif is characterised by extensive stands of montane forest. Andean montane forests are particularly rich in species diversity and have high levels of endemism resulting from the different conditions between and within each Cordillera that have led to evolutionary divergence amongst many taxa[8]. This endemism is exceptionally in the Colombian Massif[9] and which have been designated as highest priority for conservation.

Over 10% of Colombian flora species, and 60% of all Andean fauna species are found in the Colombian Massif. It is particularly rich in bird life with 586 registered species, including 15% of all hummingbirds (*Trochillidae*) registered in the Americas, numerous tanagers such as the blue and black, golden crowned, masked mountain, hooded mountain, and buff breasted tanagers. Colombia's Red Book for birds identifies 19 species for the Andes facing an extremely high risk of extinction (critically endangered), including the yellow-eared parrot (*Ognorhynchus icterotis*), the Fuertes's parrot (*Hapalopsittaca fuertesis),* and the white-chested swift (*Cypseloides lemosi*).

Mammalian life is also highly diverse with a total of 73 registered species that include the endemic small Andean deer as well as many species with very restricted distribution, such as the Andean dwarf squirrel and Andean rabbit, 28% of all endangered mammals in Colombia (25 species including the spectacled bear (*Tremarctos ornatus*) and Andean tapir (*Tapirus pinchaque*)) are also found here. Despite incomplete inventories, other taxa are also known to be well represented and in many cases, include

[8] The Andean range and the Amazon Basin, for example, have similar numbers of bird species (788 and 791 respectively) but the Andes has twice as many endemic bird species (Stolz et al) 1996.
[9] The North-western Andean, the Cauca Valley, the Magdalena Valley, the Eastern Cordillera Real and the Cordillera Oriental Montane Forest Ecoregions

endemic species. For example, the Massif contains 43% of the country's amphibian species, including 28% of the endemic amphibian species of the Central Cordillera, the endemic tree lizard *Anolis huilae*, the endemic fish *Astroblephus* grixalvi, and the endemic spider Heterophrynus nicefori (Table 3: Indicative list of Colombian Massif species)[10].

Table 3: Indicative list of Colombian Massif species

Fauna[11]			
Scientific Name	**Common English Name**	**Scientific Name**	**Common English Name**
73 mammal sp. including:		528 Birds species including[12]:	
Vampyrum spectrum	Yellow shouldered fruit bat	*Tinamus osgoodi*	Black tinamou
Strurnia erythromos	White –lined fruit bat	*Anas flavirostris andium*	Speckled Teal
Lagothrix lagotricha lugens	Common woolly monkey	*Merganetta armata colombiana*	Torrent duck
Alouatta seniculus	Red howler monkey	*Vultur gryphus*	Condor
Cebus apella	Brown capuchin monkey	*Oroaetus isidori*	Black and chestnut eagle
Aotus lemurinus	Night monkey	*Phacobaenus carunculatus*	Carnuculated caracara
Ateles paniscus	Black spider monkey	*Penelope montagnii*	Andean Guan
Didelphis albiventirs	White-eared opossum	*Rubicula peruviana*	Andean Cock of the rock
Eira Barbara	Tayra	*Cistothorus platensis aequatoralis*	Sedge wren
Potus flavus	Racoon	*Leptopsittaca branickit*	Golden plumed parakeet
Mustela frenata	Long-tailed weasel	*Amazona mercenaria*	Scaley-naped parrot
Mustela felipei	Andean weasel	*Buteo polyosoma*	Red backed hawk
Nasuella olivacea	Cusumbo	*Grallaria rufocinerea romeroi*	Bicoloured antpitta
Dasyprocta fuliginosa	Black agouti	*Grallaria rufula*	Rufous antpitta
Dinomys branickii	Pacarana	*Gralleria quitensis*	Tawny antpitta
Agouti taczanowskii	Andean paca	*Grallaria alleni andaquiensis*	Brown banded antpitta
Sciurus granatensis	Red tailed squirrel	*Troglodytes solistitialis*	Mountain wren
Microsciurus pucherani	Andean dwarf squirrel	*Turdus serranus*	Glossy black thrush
Choloepus hoffmani	Hoffman two toed sloth	*T. fuscater*	Great thrush
Felis concolor soederstromi	Puma	*Tangara nigroviridis*	Paramo pipit
Felis pardalis	Ocelet	*Tangara vassorii*	Beryl spangled tanager
Felis wiedii	Margay	*Iridosornis rufivertex*	Blue and black tanager
Felis tigrina pardinoides	Oncillo	*Dubusia taeniata*	Golden crowned tanager
Felis concolor	Puma (C de G)	*Buthraupis montana*	Buff breasted mountain tan.
Tremarctus ornatus	Spectacled bear	*B. wetmorei*	Hooded mountain tanager
Sylvilagus brasiliensis andinus	Andean rabbit	*Urothraupis stolzmanni*	Masked mountain tanager
Thomasomys cinereiventris	Raton silvestre		Black backed bush tanager
Mazama rufina	Deer		
Pudu mephistophiles	Small Andean deer	Hummingbirds from the genera	Amazilia, Coeligena
Tapirus pinchaque	Andean Tapir	Aglaeactis, Haplophaedia	Anthocephala Pterophanes
Amphibians such as *Osornophryne bufoniformis, Hylopsis buckleyi, Atelopus ebenoides Gastrotheca andaquiensis, G. andaquienes, Eleutherodactylus boulengeri*			50 butterfly spp. including *Morpho sulkowskii*
Flora			
Scientific Name	**Common English Name**	**Scientific Name**	**Common English Name**
Andean Montane Tree species include: *Alchornea spp* (manzanito); *Verbesina arborea* (cubo); *Vallea stipularis* (nasua); *Hieronyma spp* (candelos); *Ficus spp* (higueron) *Myrica pubescens* (laurel de cera); *Inga spp* (Guamos); *Piper sp* (hojecueche); *Podocarpus oleifolius* (Pino colombiano); *Posoqueria sp* (azuceno); *Cinchona pubescens* (quina); *Meliosma sp* (calabacillo); *Hyeronima colombiana* (moliton); *Guarea sp* (macos); *Schefflera spp; Clusia spp* Sub andean forest of the eastern cordillera such as *Quercus humboldtii; Trigonobalanus excels*		Mixed Andean forest species (transition): *Julgans neotropica* (nogal); *Nectandra cinnamomoides; Ficus greifiana Myrcia fallaz* Palms include: *Ceroxlyon sp; Geonoma spp; Aiphanes sp* At least 200 orchid species Grasses including *Calamagrostis sp.* Bamboo areas: *Swallenochola aff. tessellata* Asteraceae family: *Baccharis genistelloides* Ericaceae family: *Vaccinium floribundum* Melastomataceae family: *Miconia salifolia*	

Historically cultivated for coffee and cattle breeding, the valley's overall biodiversity has been impacted. Vegetal biodiversity within parcels is low, though almost all coffee plantation use several tree species (between 2 and 5), mainly banana trees and local Inga species. The local communities have been very interested in increasing the number of tree species within, close to, and around coffee parcels using

[10] Alberico et al 2000. Mamiferos (Synapsida:Theria) de Colombia. Biota Colombiana,1 (1):43-75.
[11] It also houses many species from lower altitudes that are increasing threatened by habitat fragmentation in lowland forest and that have found refuge in the larger and more continuous habitat blocks of the Massif.
[12] Including 23 of the 52 migratory birds in South America. PROAVES. 2013. Field Guide to the Birds of Colombia

endemic forest species. Project design integrates plantation models with local endemic species that have been cut down historically for timber and other uses, like *Quercus humboldtii* and *Podocarpus oleifolius*[13].

This represent an opportunity for communities to develop an activity of conservation and commercialization of seeds and seedlings of great added-value. Restoring a more diversified and native tree cover will help recreate more complete ecosystem (special focus on migratory birds). In Nariño, part of the planting area is close to the National Parks "Galeras Flora and Fauna Sanctuary" which are an icon of the Nariño department, and the support of wild habitat connectivity would have a significant added value. In 2017, the project will start, in collaboration with the producer association ASPROGALERAS, a bird monitoring study with the Colombian NGO PROAVES.

Forest cover and deforestation

Forest composition is dominated by evergreen, semi-evergreen, and deciduous tree species. Some of the rainforests that grow at the altitude of the projects sites (1500 – 2500m above sea level) on the flanks of the Andes are also known as cloud forests because they are often enveloped in mist that results from the condensation of warm air against chillier mountain currents. This biome contains among the highest levels of species diversity in any terrestrial major habitat type. Generally, the biodiversity is highest in the forest canopy.

In comparison with lower tropical moist forests, montane forests show a reduced tree stature combined with increased stem density and generally the lower diversity of woody plants. Trees in these regions are generally shorter and more heavily stemmed than in lower-altitude forests in Colombia, often with gnarled trunks and branches, forming dense, compact crowns. The high moisture promotes the development of a high biomass and biodiversity of epiphyte, particularly bryophytes, lichens, ferns, bromeliads and orchids.

The Colombian forests surrounding the project's sites are in the middle of two of the 34 biodiversity hotspots defined in 2000 by "Conservation international": The tropical Andes and the "Tumbes – Choco – Magdalena" strip. The important range of altitudes in the area results in high biodiversity intensity, and those forests include a significant number of endemic species.

Deforestation rate in Colombia is estimated to an annual 120 000 ha per year. Over the course of the last century, Colombia's Andean watersheds and the shaded coffee landscape have been threatened by uncontrolled deforestation (started 20 years ago) due to rapid expansion of agriculture and cattle grazing mostly in the highest parts of the valley (historically covered with primary forests). Remaining forest patches are spread throughout valley with low continuity. Forests on the top of mountains were cut down. The level of habitat fragmentation is very high in the landscape because of the Coffee farms and pasture patchwork (estimated 80% of initial forest cover was cut clean).

Nowadays, and as result of few remaining forested areas, the Colombian Massif faces considerably lower levels of deforestation and habitat degradation than national averages. Between 2013 and 2014, in the department of Cauca, 1,708 ha were deforested and 4178 ha in the department of Nariño[14] (i.e. less than 5% of the total area deforested in Colombia between 2013 and 2014 in Colombia).

[13] https://senaintro.blackboard.com/bbcswebdav/users/1130585219/LibroRojoMaderables.pdf
[14] IDEAM, 2015

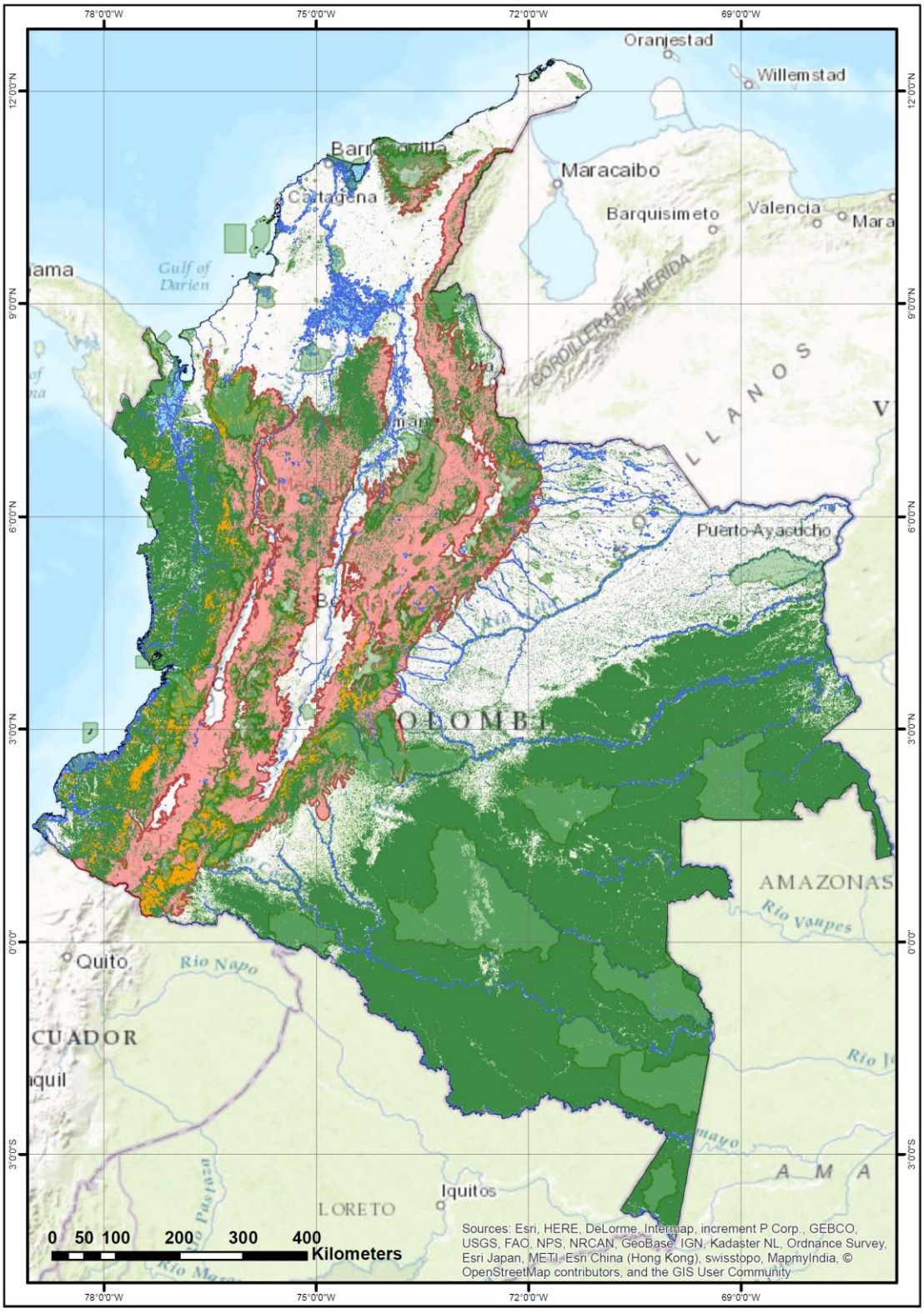


Figure 15: Location of Colombia showing the wetlands (in blue), the extent remnant forest ecosystems (in green) and the grouped project area (in red).

Socio-economic context

In Cauca and Nariño, the local economy is based on agriculture, and especially on coffee, sugar cane, fique, potato, barley and wheat. Fish (trout) or shrimp farming and timber exploitation are two other increasingly important economic sectors in the area. The two projects sites are located in coffee areas.

The farmers involved in the project are all small-scale farmers (owning less than 20ha), with low level of income and high dependence to coffee production levels and market prices.

As of 2011, HDI index of Cauca and Nariño departments are significantly lower than the national average, ranking 22 and 24 out of the 29 Colombian departments. Their HDI index is respectively of 0.782 (similar to Iran) and 0.773 (similar is to China), against 0.840 for Colombia as a whole.

Since the beginning of the Colombian conflict in the mid 1960's, Cauca and Nariño have been among the departments that were the most impacted by the violent events, Cauca being recurrently referred as one of the epicentres of the guerrilla. Also, Nariño is among the first Colombian departments in terms of coca leaf cultivation and both areas have been significantly affected by drug traffic.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The proposed project activities are all within the existing national and regional legal framework of the Government of Colombia.

Project activities are implemented in the framework constituted by the domestic legal regulations related to the forest sector, set out in Law 99 of 1993, the National Renewable Natural Resources and Environmental Protection Code (Decree 2811 of 1974)[15], and the General Forest Act (Law 1021 of 2006)[16].

These laws govern the development of timber yielding and non-timber yielding forest resources, under the principle of sustainability, giving priority to the protection of the biodiversity, the preservation of the associated environmental services, and the benefits to the community in the concerned areas.

The grouped project is also in line with the strategy[17] defined by the government to reduce the country's vulnerability and contribute to a sustainable economic growth, as its main objective, beyond climate change mitigation through carbon sequestration, is the development of multipurpose forest systems (e.g. agroforestry systems and tree planting for restauration with ecotourism activities). The project also is completely in lines with the Coffee NAMA strategies defined by the Colombian government.

The project will not encroach uninvited on private property, community property, or any other government property. On the contrary, the project will support the farmer organizations in the process of requesting the delivery of legal land titles for their members.

The project also complies with work / labour regulatory framework. In almost all cases, the project proponent will not directly hire employees, but will instead transfer funds to the Entities for them to hire employees for the implementation of specific activities, always in the mindset of empowering the organizations, entrusted with the management of the reforestation activities. The entities will use the funds to purchase services and equipment (through legal contracts), hire technical staff, and pay the incentives to the participating farmers in accordance with the internal rules of the community associations. The Project Entities (FNC, cooperatives) are also private organizations subject to financial and legal audits by the Colombian Ministry of Finance and Ministry of Labour.

The Cauca and Nariño Departmental Committees of Coffee Growers are present for more than 85 years in the territories and are very well integrated at every level of governments (municipal, departmental, national). This recognition has been very helpful in the socialization phase of the project and in the

[15] http://redjusticiaambientalcolombia.files.wordpress.com/2014/04/decreto-ley-2811-de-1974.pdf
[16] The complete texts of these laws are available at: http://www.minambiente.gov.co
[17] Consejo Nacional de Política Económica y social (CONPES). 2011. Conpes 3700 – Estrategia Institucional para la articulación de políticas y acciones en materia de cambio climático en Colombia.

relationships with governmental and public institutions. Several documents have been signed between PUR Projet or FNC and these authorities, in the framework of the Colombian law.

Additionally, the Corporaciones Autonomas Regionales and National Parks of Colombia also endorsed the project, through an evaluation survey, specifying that the project:

- is operated in accordance with Colombian national and regional legal framework
- does not threaten the existence of high value species
- has a positive impact on the environment and ensures its sustainability

1.12 Ownership and Other Programs

1.12.1 Project Ownership

Most of the farmers have a formal document recognizing their rights on the land: a legal land title (or "constancia de posesion"), a notarial land purchase contract, or a community certificate. Additionally, all the coffee producers involved in the first instances of the project are affiliated to the FNC. As explained in the legal status of the FNC[18], the coffee producers are considered affiliated once the "cedula cafetera" (coffee farmer's ID) is issued by the respective Departmental Committee of Coffee Growers. To obtain this "cedula cafetera", the coffee producers have to present to the FNC a formal document recognizing their rights on the land: a legal land title (or "constancia de posesion"), a notarial land purchase contract, or a community certificate. Can also be federated, the people who for more than five years have exploited directly a coffee plantation by lease contract recognized by public deed, or peoples holding the usufruct following the resignation of the owner. As a proof of clearly recognized usufructuary right, all farmers have been selling their coffee for many years as members of an Entity, with recognized rights on the production of their land, and no disputes have ever been recorded.

Land use rights are very clear. Farmers have owned and farmed their land for many years. They have been members of the FNC for several years, selling their coffee with undisputed rights on their land and products. New migrants do not dispute the land with existing farmers, as these ones already have recognized land-use rights, and also because there is a large availability of free land in the project area and around. Additionally, all project parcels are visited individually at least once a year by the project technical team. In 3 years, they have never recorded any incident of conflict or dispute on the parcels reforested.

Despite this complex national context, the Colombian coffee sector is rather preserved from those issues and there are no known conflicts regarding land tenure and land use rights for farmers among all selected Entities.

[18] https://www.federaciondecafeteros.org/static/files/Estatutos%20FNC.pdf

Figure 16: Poster of the Colombian government project « Formalizacion Propiedad Rural » displayed in the coffee farm of Don Quenide (village: Ufugu; Rosas)

In rural areas, land may be obtained through the country's land reform program. As of mid-2010, the National Planning Department and the Ministry of Agriculture and Rural Development are coordinating the comprehensive reformation of land policy, which will include the formalization of property rights and the restitution and protection of IDPs' lands, among other items[19][20][21].

The National Land Agency (ANT) has the authority to administer, deliver, and formalize state lands, and promote land management property throughout the national territory. The ANT replaced the Colombian Rural Development Institute (INCODER), a subsidiary of the Ministry of Agriculture and Rural Development, which was in charge of land titling and adjudication prior to 2016.

The National Land Agency, which was legally established on December 7th, 2015 facilitate and streamline massive formalization of rural property providing: the legal authorization for funding for massive formalization; the implementation of a multipurpose cadastre as the informational base for formalization; and the simplification of procedures to resolve and correct discrepancies between the actual physical size and boundaries of land parcels and the legally registered description. Law 1753 (2015) established subsidies for farmers to acquire land, with a preference for female-headed households. The subsidy covers up to 100% of the land cost.

The Municipality of Rosas (Cauca), which is part of the project area, have been declared by the Colombian government priority area for the implementation of the program for the Formalization of rural property[22].

The project ownership is guaranteed by a chain of agreement contracts between the projects actors:

- The farmers of the project are the owner of their farms. Any farmer willing to join the project signs a contract with the FNC; granting the FNC the right to enter the farmer's property to operate the project, and the property on all environmental products generated by the project, including GHG credits.
- The FNC signs a contract with PUR Projet that grants PUR Projet the right to manage and operate the project, and the property on all environmental products generated by the project, including GHG credits.

[19] Ministerio de Agricultura y Desarrollo Rural: Resolución 452 de 2010
[20] Ministerio de Agricultura y Desarrollo Rural: Resolución 347 de 2013
[21] Ministerio de Agricultura y Desarrollo Rural: Resolución 147 de 2015
[22] Ministerio de Agricultura y Desarrollo Rural: Resolución 327 de 2013

1.12.2 Emissions Trading Programs and Other Binding Limits

The VCUs generated by the GHG emission reductions of the project will be sold exclusively on the voluntary market.

The Project Proponent itself does not have any binding limits on GHG emissions and does not look for any compliance with an emissions trading program.

To date there is no emissions trading program in Colombia. The creation of the national registry of projects of GHG emissions reductions still at the stage of a draft decree. PUR Projet consulted the Colombian authorities and the representative in the “Ministerio de Medio Ambiente” (Sebastian Carranza; scarranza@minambiente.gov.co) confirmed that the project is not registered under a national registry. The project is not considered as part of the NDCs.

1.12.3 Other Forms of Environmental Credit

There is no other form of environmental credits included in the project framework or currently ongoing in the project area.

The project has not participated in any other program of environmental crediting for GHG emission removals.

The project does not intend to generate any other kind of environmental credit other than through the VCS Program. The Project Proponent aims to finance the project through the sales of VCUs issued under the VCS program. Any other form of environmental credit for GHG removals would not be valued extra and would therefore not be foreseen by the Project Proponent.

1.12.4 Participation under Other GHG Programs

The project has not been registered under any other GHG programs and is not seeking registration under any other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

The project has not participated in any other GHG programs and has therefore not been rejected by any of them.

1.13 Additional Information Relevant to the Project

1.13.1 Eligibility Criteria for grouped projects

The project is developed as a grouped project, with the following criteria for the inclusion of future projects instances.

Eligibility criteria

To ensure that new instances will meet the applicability conditions of the methodology (detail in the section 2.2), all the parcels must comply with the following criteria to be included in the project instances:

- located in the ecoregion Northern Andean Montane Forest area
- owned by small holders (less than 20 hectares)
- not deforested in the last 10 years
- not be cleared of native ecosystems within the 10-year period prior to the project start date, as set out in section 3.1.6. of the VCS AFOLU requirements
- not falling under "forest" category as defined by Colombian DNA
- owner has clear land-use rights with no land tenure conflicts
- outside of any conservation area (National Parks, concessions for conservation, etc.) and any large economic concessions (forestry, oil, mining, etc.)
- where the reforestation will take place under one of the 5 models of the project and according to the project's proceedings described in the PDD

The first eligibility condition defined by the project proponent is that the project should be located in the ecoregion Northern Andean Montane Forest. As indicated in section 1.9 of the PD this ecoregion is characterized by the presence of forest land or productive land (cropland and grasslands). According to guidance provided by 2006 IPCC Guidelines for National Greenhouse Gas Inventories, and Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003), wetlands are defined by land that is covered or saturated by water for all or part of the year and that does not fall into the forest land, cropland, grassland or settlements categories, which is the case of the lands in the project area.

The eligibility criteria are explained to any farmer willing to join the project during the initial socialization training. Then, for all new parcels to be included in the project, the project's technicians verify that the eligibility criteria are met during an onsite individual visit, the "Pre-Registry". This ensures that the new instances will all meet the applicability conditions of the methodology.

According to the AR-AMS-0007 Methodology Section 5.2, the baseline scenario is considered to be the continuation of the pre-project land-use. To guarantee that news instances are subject to the baseline scenario determined in the project description (section 1.10.1 of the PDD), PUR Projet defined as one eligibility criteria the necessity to be a small-scale farmer, owner of a multipurpose farmland located in the Northern Andean Montane Forest area and affiliated to one of the entities accepted to be part of the project. As the entities participating in the project are mainly coffee cooperatives, the main land use identified is croplands, predominantly coffee plantations and degraded land. The technical team at each relevant cooperative collects the information on the land type and land uses necessary to asses if they can integrate the project through an initial questionnaire. Therefore, the future plots (instances) will be necessary lands from members of the same organizations, located in the same area of influence and having the same profile as the initial instances.

Proceedings

The future project entities will apply PUR Projet's proceedings for the project, which include (not exhaustive) participative approach involving beneficiaries, application of defined planting models, training curriculum and technical assistance, monitoring and traceability proceedings, contracts signed with each beneficiary, and contract signed between PUR Projet and the Entity.

The plantation contracts signed or that will be signed with the project entities describes these proceedings, technology and measures (detailed in the section 1.8.4 of the PDD) to be followed to implement the project and ensure that all new instances will use the same tools specified in the project description to implement the project.

Entities

Should be either:

- A community-based organization with on-going participatory processes (general assembly, elections at least) such as cooperatives, farmers' associations, community association, native communities.
- District Municipality, operating the project through a dedicated team of professionals, under the supervision and control of PUR Projet, and following the project's proceedings communicated by PUR Projet

The project process includes a training of all technicians, of the new project entities, on those technologies and measures specified in the project description to ensure that they will be applied in the same manner.

Quality Control

Final quality control of monitoring data and deliverables done by PUR Projet to make sure the proceedings, technologies and measures are applied in the same manner. This quality control includes (not exhaustive):

- initial FNC technician training,
- continuous follow up and training with the FNC,
- and regular field visit

Instances location and possible futures instances

"Northern Andean Montane Forests" as defined by the WWF as a Global Ecoregion (accepted by the UICN), with the characteristics presented in section 1.9.1. A corresponding kml file of the Grouped Project Area is provided in appendix. All future instances will fall into this polygon.

The inclusion of possible futures instances is a dynamic process. The FNC will play a significant role in identifying new project instances (regional committees) to be included in the project. PUR Projet will also be able to identify more cooperatives and farmers' associations that are likely to be primary targets for expanding the project. They would be contractually bounded with PUR Projet to implement the project and would incorporate their own technical team to roll-out the project with the populations of their district. (some of the foreseen Instances could be located in the Huila region).

Beneficiaries

Project internal rules frames the socio-economic background of the project participants (owned by small holders - less than 20 hectares) and the requirements on the parcel characteristics (not deforested in the last 10 years; not be cleared of native ecosystems within the 10-year period prior to the project start date, as set out in section 3.1.6. of the VCS AFOLU requirements; not falling under "forest" category as defined by Colombian DNA) thus guaranty additionality.

Small-scale farmers' owner of a multi-purpose farmland within the Northern Andean Montane Forests and affiliated to one of the Project Entities are subject to the same baseline scenario determined in the project description. The baseline scenario is calculated at parcel level and the same methodology is applied for every new instance.

1.13.2 Leakage Management

As mentioned in the AR-AMS0007 methodology (version 3.1), the project will consider the leakage due to the displacement of agricultural activities the year following the plantation.

The assessment of leakage risk and leakage management measures and monitoring are described in section 3.3.

1.13.3 Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

1.13.4 Sustainable Development

Colombia's plan for development 2014 - 2018 ("Plan Nacional de Desarrollo") includes a chapter entitled "green growth", in which the reported three main objectives are the following:

1. Achieve a sustainable and low carbon growth
2. Protect and ensure the sustainable use of the natural capital, and improve the quality of environmental governance
3. Achieve a resilient growth and reduce the vulnerability towards natural disasters and climate change

The project is strongly aligned with those three objectives. It is widely recognised that, for coffee production, agroforestry brings significant benefits in terms of sustainability. In particular, through the carbon stored in the trees, agroforestry promotes a "low carbon" growth for the coffee sector, which is significant in Colombia's economy. Furthermore, the project is designed at landscape level, and parcels are reforested around the coffee production area, on degraded land, with a mindset of ecosystem regeneration. This leverages the protection of the natural capital in the coffee regions, and regenerates key ecosystem services for the protection against natural disasters: stabilisation of the soils to prevent landscapes, enhanced water penetration to prevent floods, natural barriers against pest invasion, etc.

Besides the national plan for development, Colombia defined with the UNPD (United nation plan for development) 17 objectives for sustainable development, listed in the image above.

The project is strongly aligned with 4 of them:

N°1: End of poverty: the projects secures and increase the revenues within vulnerable communities through income diversification.

N°12: Responsible production and consumption: the project promotes the sustainable production of coffee, one of Colombia's flagship exportation product.

N°13: Action for the climate: The project acts for climate change mitigation through carbon storage in the trees.

N°15: Life of terrestrial ecosystems: the project aims at protecting the ecosystem and the biodiversity at landscape level.

The project also participates in 4 other objectives:

N°2: No more hunger: through the community empowerment and income diversification in socially vulnerable areas.

N°6: Clean water: the reforestation at landscape level helps protecting the water resource.

N°8: Decent work and economic growth: beyond the income increase and the ecosystem services, agroforestry can help improving the working conditions by providing a better and healthier working environment.

N°14: Aquatic life: the project also helps protecting aquatic biodiversity through the regeneration of the ecosystems and filtration services provided by the vegetation.

1.13.5 Further Information

Socio-Economic impacts

Revenue diversification and increase

Regional economy is based largely on livestock rearing and agriculture. In the High Andean Colombian Massif (Macizo Colombiano), agricultural land cultivated is approximately 80% dedicated to permanent crops including coffee (principally below 1,8, 00m - 42%), sugar cane, banana and sisal. The remaining 20% is dedicated to annual and transitory crops including maize, potatoes, beans, peas, and cassava.

All farmers are highly dependent on coffee production and sales. In Cauca, the major part of farmers' land is planted with coffee (close to 80%). In Nariño, the coffee farms are very small (1,5 ha on average). Generally speaking, farmer's main issue is linked to their dependence on coffee sales, and thus to the yields and coffee market price. Their subsistence is directly affected by the high coffee price volatility.

With the low current coffee price, estimations based on average coffee production, input and labour costs show that coffee sales do not fully cover costs, and coffee production is actually not - or very little - profitable for the farmers. The slightest decrease in coffee prices or in yields (plagues) immediately affects the overall subsistence of farmers.

Additionally, their income is also very sensitive to potential coffee plagues and diseases (such as rust and coffee ice). A plague affecting one year a part of their coffee field will dramatically impact their only source of revenue.

Given the current conditions, farmers now realize their need for income diversification, and see the project as a way to diversify their income through fruits, fuelwood, or timber sales.

First assessments show a great interest for self-consumption fruits (and possibly to sell on local markets), fuelwood (high consumption of fuelwood in highest areas), and timber (majority of species with an already strong developed market). Farmers can leverage their organizations (through the producers' organizations of Local FNC) to access the markets for these co-products.

Examples of prices and typical production volumes[23]:

[23] Assessment of the potential and feasibility of a reforestation program with coffee farmers in COLOMBIA, PUR Projet, 2014

- Oranges and others: 12820 COP / 100 oranges (paid in farm) to 25640 COP/100 oranges on market, 200 oranges /tree
- Timber (precious): 100€ /m3 (standing) to 300€/m3 (sawed): ~1 m3/tree in plantations
- Timber (semi-precious): 35€/m3 to 100€/m3 (sawed); ~1m3/tree in plantations
- Fuelwood: 0.5 to 1€/m3; up to 250m3/ha if planted with fuelwood species.

In addition, incorporating more trees in coffee farms should help enriching, stabilizing, and activating the soils, and thus reduce the amount of fertilizers needed. It is estimated that a reduction of 10 to 20% in fertilizers use can be reached in this specific case (considering some shade trees are already present in baseline scenario). Added to these effects, silvopastoral systems enhance meat and milk productivity.

Considering the additional revenues from fruits and timber, and input reductions, gross estimations show that a farmer with 1.5 ha coffee could multiply its net income by 2 by planting 250 trees inside and around its farm.

The baseline estimations are very dependent on coffee price (volatile) and production levels (high variability from one farmer to another). PUR Projet will look forward to implementing audit and research to evaluate how project impacted farmer's revenues.

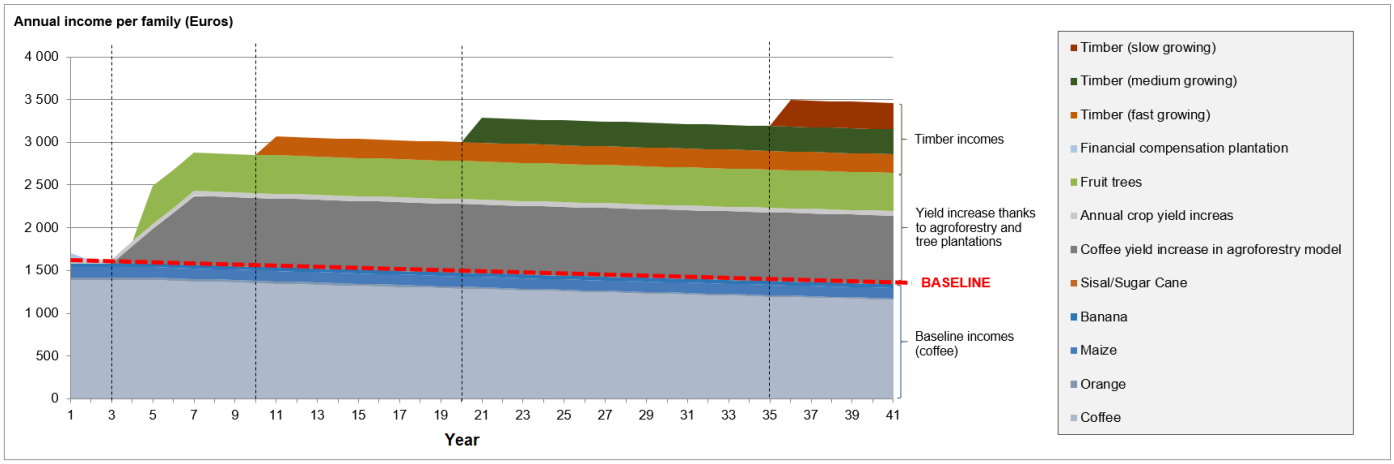


Figure 17: Revenue Increase model for the Agroforestry project; source: PUR Projet

Job creation

The project will attract resources to invigorate the local economy, stimulating the creation of stable and well remunerated employment. The technical team contracted by the Entities is mainly composed of young agricultural or forestry engineers, natives from the region, who mostly have parents who produce coffee. The project therefore also addresses the problem of generational succession faced by the whole coffee sector. The project also creates contracting labour for the establishment and the maintenance of the forest unit.

The project will have a positive impact on jobs and economic revenues for the local communities in activities such as land preparation, gathering, layout and hole making, seedling propagation, planting and maintenance, forest protection and utilization. In the medium term, value added industries to transform the timber into numerous products should generate more employment.

Social cohesion and empowerment

The whole project's strategy is to empower the farmers' organizations to manage integrally the reforestation components and the related consolidation activities over time (in particular timber and other co-products value chains, plantations registration and possible certifications, etc.). It is critical to ensure that the practices and plantations will be sustainable and maintained on the long-term. This strategy requires the following:

- Trainings on proceedings and management for the reforestation component: Farmers organizations will be trained on traceability requirements, implementation of internal control system, traceability tools, monitoring protocols, and potential certification processes.
- Organizations' empowerment: The project will also encourage farmers to gather together and create non-commercial partnerships to better manage their ecosystems. For now, farmers tend to work more as individuals but they have clear interests in joining forces, at least to get access to training, materials and incentives to shift toward agroecological practices like via this program. This progressive process will be encouraged by the project's level of requirements on traceability, internal control system and quality, that will empower farmers on management and potential certification processes.

The project started in priority with farmers organized in associations or small cooperatives (e.g. ASPROGALERAS association in Nariño), in order to build up expertise and develop proceedings with the more organized and solid farmers' organizations.

As the project expands to areas where no formal farmers' organizations are present, the project will leverage municipal committees (which represents population at municipality level and efficiently relay farmers' concerns, information to farmers, etc.) and will progressively assist the farmers in creating formal farmers' organizations (associations in the first place).

Producers organization

In Cauca and Nariño region, as everywhere in Colombia, farmers are organized in Municipal Committees of Coffee Growers. In Colombia, there are 366 Municipal Committees of Coffee Growers, responsible for the organization and representation of local coffee growers. The members are elected by coffee growers from their respective municipalities during the Coffee Elections. The Municipal Committees meet frequently to identify the needs and strengths of their communities, and to present potential projects to the Departmental Committees with the purpose of finding resources for their implementation.

These Municipal Committees are well acquainted with Departmental Committees. The members of the Departmental Committees are also elected during the Coffee Elections by direct vote of the federated coffee growers. They represent the coffee growers in their regions of origin and transmit their difficulties, priorities, and needs to the Federation´s administration. The Federation's representatives from each department convene weekly or whenever needed. They organize and orient coffee growers, and communicate the decisions taken at the national and regional level.

Each Departmental Committee is in charge of carrying out the various plans and programs and coordinating the efforts of the Extension Service in their regions.

This solid organization is definitely an opportunity for the implementation of a solid reforestation project. FNC technicians are known amongst farmers, and the project's technical team is absolutely integrated to FNC local team. At the same time, implementing a community reforestation project complimentary to coffee production is likely to strengthen these organizations, gathering the farmers around other activities and projects than coffee, giving them exposure to other organizations and markets.

A reforestation project could even eventually lead to make the different associations closer, potentially evolving towards a higher-level organization gathering the original associations or associations' members. PUR Projet and FNC are looking forward to strengthening links that pre-exist with organizations.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Methodology applied:
AR-AMS0007: A/R Small-scale Methodology - Afforestation and reforestation project activities implemented on lands other than wetlands – version 03.1.

Methodology Tools applied in the document:
CDM – AR TOOL 14 – Version 04.2: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities

A/R Methodological tool 08 “Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity (Version 04.0.0)

Others Tools applied in the document:
Calculation of the number of sample plots for measurements within A/R CDM project activities

2.2 Applicability of Methodology

The project activity meets the applicability conditions of the AR-AMS0007 methodology used by the project.

2.2.1 Activity Eligibility

As communicated by the Colombian DNA, the Colombian Government defines forests as land with:

- A minimum area of 1 hectare
- A minimum tree crown cover of 30 %
- A minimum tree height of 5 meters.

As described in 1.10, the plantations are done on parcels of one of the following land-use: degraded land (rastrojo), coffee parcels, pastures, annual crops. These land-uses fall into the grassland or cropland categories and none of them fall in the forest definition (less than 30% over 5 meters or susceptible to grow over 5 meters –coffee trees pruned, “rastrojo” regularly cleared in rotation schemes or too degraded to grow beyond grasses and bushes).

During their first visit to the parcel to be planted, the project technicians collect information on the historical land-use for this specific parcel, and assess the existing tree cover, to ensure the parcel to be planted meets the eligibility criteria. This data is saved in the planting registry.

The proposed planting models include planting forest trees at densities from 250 to 1111 trees/ha, and therefore lead to the restoration of a crown cover above 5 meters and with higher coverage than 30%.

The proposed activity is hence a reforestation activity, according to the Colombian definition of a forest, and increase carbon sequestration by establishing vegetative cover through the planting of woody species.

The land subject to the project activity does not fall in wetland category;

The proposed project activities are only implemented on croplands, pastures, or fallows and degraded lands.

Project activities are implemented on lands where < 10% of the total surface project area is disturbed as result of soil preparation for planting;

Land preparation only consists of digging a 30 cm x 30 cm x 30 cm hole for each tree. Maximum soil disturbance is reached with highest planting density in model 4 – mixed stand (1111 trees /ha). The total area disturbed therefore amounts to 100 m2 per hectare, i.e. 1% of the surface. On top of this, this plantation model is only implemented on 5% of total project area, the other models leading to even fewer disturbances.

Furthermore, the existing trees will not be removed for soil preparation before planting.

Therefore, less than 10% of the total surface project is disturbed as result of soil preparation for planting.

2.2.2 Applicability of Tools used

CDM – AR TOOL 14 – Version 04.2: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities: this tool is used for estimation for ex-ante estimation of carbon and change in carbon stock in living biomass of trees and shrubs in project, as defined in the scopes of the tools: the tool has no applicability conditions

Calculation of the number of sample plots for measurements within A/R CDM project activities: this tool has no applicability conditions.

A/R Methodological tool 08 "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity (Version 04.0.0): This tool is used for burning of biomass and forest fires, and will be used, in case of occurrence of fire within the project boundary, following the applicability conditions.

2.3 Project Boundary

Carbon pools	Included?	Justification/Explanation
Above ground biomass	Yes	According to AR-AMS0007/version 03.1, Section 5.: **"**Carbon pools to be considered by these methodologies are above- and below-ground tree and woody perennials biomass and below-ground biomass of grasslands (i.e. living biomass)**"**
Below ground biomass	Yes	
Dead wood	No	
Litter	No	
Soil organic carbon	No	

Emission sources	Gas	Included?	Justification/Explanation
Burning of woody biomass	CO_2	No	As indicated by AR-AMS007
	CH_4	Yes	According the methodological tool "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity" which identifies three possible sources of non-CO2 GHG emissions: 1. site preparation, 2. to clear the land of harvest residue prior to replanting and 3. from forest fires Given the pre-planting land-uses and planting models, there is no possible burning of woody biomass for site preparation:
	N_2O	Yes	

Emission sources	Gas	Included?	Justification/Explanation
			- For the following pre-planting land-uses: grassland/rastrojo, annual crops, pastures, there is no woody biomass on the planting site - For perennial parcels, trees are planted in intercropped models and do not require sisal or coffee trees removal Additionally, the project does not allow for burning to clear any land.

2.4 Baseline Scenario

2.4.1 Baseline stratification

Baseline stratification is done as follow:

- Selected areas are first stratified according to land-use types.
- Each stratum is then further divided in two according to the planting model. Planting model 4 (Mixed Stand) and planting model 2B (Agroforestry Coffee Installation) are distinguished from the others as it will eventually lead to the disappearing of pre-project biomass, replaced by the trees planted.

The resulting stratification of the baseline area is thus the following:

Table 4: Baseline stratification

Stratum	Initial Land-use	Reforestation model
SB1a	Degraded fallow (Rastrojo)	Model 1 or 3
SB1b	Degraded fallow (Rastrojo)	Model 2B or 4
SB2a	Pastures / Grassland	Model 1 or 3
SB2b	Pastures / Grassland	Model 2B or 4
SB3a	Annual crops	Model 1
SB3b	Annual crops	Model 2B or 4
SB4a	Perennial crops (coffee, sisal)	Model 1 or 2A
SB4b	Perennial crops (coffee, sisal)	Model 4

- SB1a & SB1b: Abandoned degraded area, locally called “rastrojo”

According to the A/R Methodological tool “Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R Project activities” and CIFOR, 2006, this stratum corresponds to former agricultural highly degraded land with low height of vegetation (1 to 5 m, crown cover up to 20%). Such lands are cyclically used as annual crops and fallows.

- SB2a & SB2b: Pasture

In the area, livestock is the activity that spread most significantly above 1,800 m a.s.l. Cattle herd size vary between very small (1 to 9) to medium (20 to 49) in number of cattle per production site. This activity is considered as first responsible for deforestation, including in the region. The practice in the region is extensive and we model pasture as permanent grassland without overgrazing pressure.

- SB3a and SB3b: Annual crops

The annual crops are typically corn or other annual crops. Because of past intensive use, soils fertility is low. After harvest, the land will typically remain as fallow for several years.

- SB4a and SB4b: Perennial plantations

The concerned sisal and coffee fields are in installation (that is to say less than two years old) or already in production. The coffee trees height is from 1 to 3m high and the crown cover up to 100%.

2.4.2 Baseline scenario

In line with the AR-AMS-0007 Methodology Section 5.2, baseline scenario is considered to be the continuation of the pre-project land-use: that is to say degraded land, pasture, annual crops, and permanent crops (coffee).

During the 20th century, high prices supported the continued expansion of coffee plantations in Colombia, and led to a bonanza reflected in the rapid development of infrastructure and the highest standard of living in the country. The rush to produce coffee in the fertile Andes mountains led to the rapid deforestation throughout the region, in a band between 1000 and 2000 meters of altitude. Colombia's success in exporting high quality coffee allowed the institutionalization of the coffee market with the foundation of the National Federation of Coffee Growers (FNC), and the National Coffee Fund, created in 1940, which further supported the expansion of coffee growing areas.

Prices peaked in the 1970s and lower prices led to a restructuring of coffee production in which the number of large producers fell significantly and farms were subdivided over and over, creating a very large number of small scale farmers, all using the monoculture model in full solar exposure. As prices fell farmers also eliminated coffee stands and replaced them with extensive cattle ranching. In some areas previously dedicated to coffee, cattle grazing has become the main productive activity.

Rastrojo, pasture and annual crops

- The degraded areas are supposed to remain abandoned, as they are unproductive soils. Natural regeneration will not occur due to strong deterioration of the soils (chemicals due to coca production), or when the soils could regenerate, area would be reused for annual crops cultivation in the future.
- Traditional cultivation pattern and historic land use is to periodically slash and burn these areas (typically 2-3 years of corn cultivation, then 5-10 years left as fallow for regeneration), thus preventing any growth of carbon stocks on these parcels above the average carbon stock of grasslands.

No significant changes in the carbon stocks, and the belowground biomass of grasslands, are therefore expected to occur in the absence of the project activity.

Perennial crops

The coffee tree plantations are supposed to remain coffee tree plantations, as it's a perennial crop and coffee bushes are pruned regularly and maintained at a given height. No significant positive changes in the carbon stocks within the project boundary would occur considering that reforestation is facing the barriers outlined.

As a result, in the absence of the reforestation project, no changes in carbon stocks in the living biomass of woody perennials and the below-ground biomass are expected to occur.

2.5 Additionality

The demonstration and assessment of additionality is done hereafter using the Appendix 1 of the AR-AMS0007 - A/R Small-scale Methodology: "Afforestation and reforestation project activities implemented on lands other than wetlands".

2.5.1 Investment barrier

Barriers for reforestation

Lack of local or regional investments for the installation and maintenance of forest plantations (commercial and protective) and especially due to the absence of adequate roads for access and to transport planting or harvested material. There is no tradition within companies for long term investments, especially when repayment periods are long. In 2014, the forest plantations in Colombia occupied 477,575 hectares, equivalent to about only 6% of the country's total potential area for forestry plantation[24]. In 2014, silviculture and extraction of wood represents 0.4% of the national Gross Domestic Product (GDP), only 3.2% of the GDP subsectors that include animal husbandry, silviculture, hunting and fishing, manifesting that commercial forestry is a scarce activity relative to others in the sector[25]. The very low level of economic activity in the commercial forestry sector is attributed to several factors which include low rates of return, the high number of intermediaries, the long production cycle, the long periods between cash flow disbursements, the high concentration of costs in the first years of production and the long wait for economic returns, the difficulties in obtaining credit for this type of activity, and the inflexibility in the use of land while in trees[26].

Banks perceive the investment risk for this type of projects as very high, due to market limitations, the lack of cash flow and the very long wait for return on investment. Furthermore, because of internal social conflict, Colombia is perceived as a country with high risks for international investment, making access to international capital for long-term investments such as reforestation projects virtually impossible[27].

Although there are some important efforts, like the Forest Investment Fund Colombia (Forestry Incentive Certificate - CIF); the policies and procedures related to effectively obtaining this incentive are confusing for local communities and constantly changing, and the delivery of the incentive is highly uncertain given that it is becomes unavailable when the national government accounts go into deficit. The amount of resources allocated from the Colombian Government to CIF are insufficient; besides allocation of resource and the delivery of funds to beneficiaries are very slow[28]. Small farmers do not have individually the financial capacity to invest beforehand in the purchase of seedlings, transport, labour, financing of forest management plan, nor the knowledge or experience to complete the formal process to apply for the government incentive.

There is a high risk of shortage of cash flow during different stages of the project since Colombian government and/or the timber companies, as potential investors, not only lack funds for the investment phase but lack a continued cash flow capacity, and there is simply no tradition to anticipate future expenses. This makes it unlikely that the needed investments during the whole period will be covered and thus that the management of the plantation will be successful.

Examples show that even in those cases where the establishment phase was financed by ODA projects, the management of plantations failed in later years due to financing and capacity deficits, leading to loss of plantations.

[24] UPRA, 2014
[25] DANE, 2015
[26] Acosta, C. 2004. Estudio de tendencias y perspectivas del Sector Forestal en América Latina. Corporación Nacional De Investigación Y Fomento Forestal (CONIF) Organización De Las Naciones Unidas Para La Agricultura Y La Alimentación. Roma.
[27] Herrera, G. 2015. Colombia: Potencial de Reforestación Comercial. Banco Mundial, DNP, MinAgri
[28] Acosta 2006. Diagnóstico del Sector Forestal Colombiano.

The proposed project will cover the financing needs during the entire project period, guaranteeing the appropriate implementation and long-term management of the plantations. The project budget covers all projects operations as well as provisions for the long-term activities.

Barriers for new coffee fields installation

About coffee fields extension and renovation, since its creation, FNC has encouraged farmers to renovate their coffee parcels with disease-resistant varieties and this strategic orientation grew stronger from 1998. Indeed, coffee need to be renovated at a certain frequency (from 7 to 15 years for coffee) before undergoing severe decrease in productivity. Renovation processes also enable to introduce new varieties that can be more resistant to some diseases generating important damages (e.g.: roya or ojo de gallo for coffee).

FNC's Coffee Renovation Programs (Competitividad and Permanencia, Sostenibilidad y Futuro) enabled from 1998 until 2015 to grant credits to smallholder coffee producers (less than 7 hectares) to renovate 716'000 hectares[29, 30]. Since 2011, it is estimated that an average of 15,000 credits per year have been granted to FNC members for coffee renovation. The target is to renovate 98% of total coffee areas by 2020.

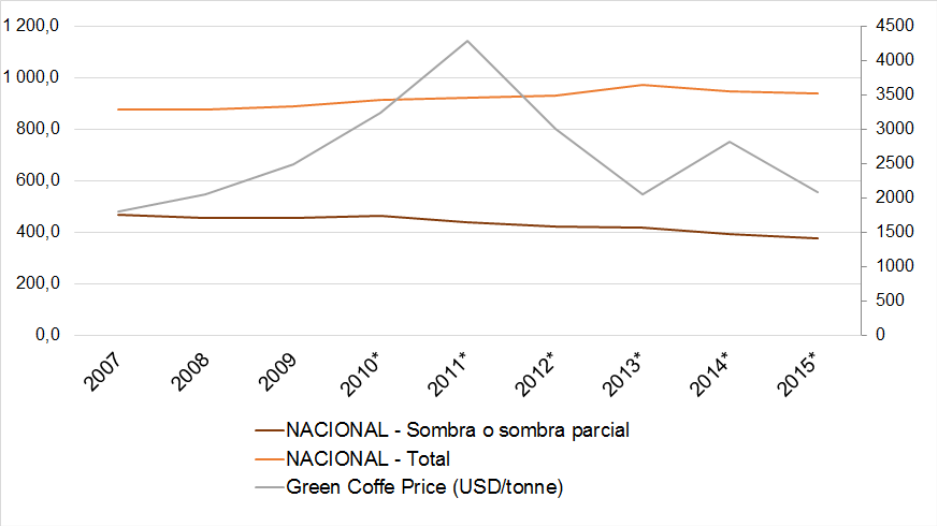


Figure 18: Area cultivated in coffee according to solar exposure (thousands of hectares) and green coffee price; source: FNC

However, even if the extension of the coffee fields in new area is part of the national strategy defined by the FNC, the FNC does not support this strategy through large scale program that provide technical and financial assistance like for the coffee renovation.

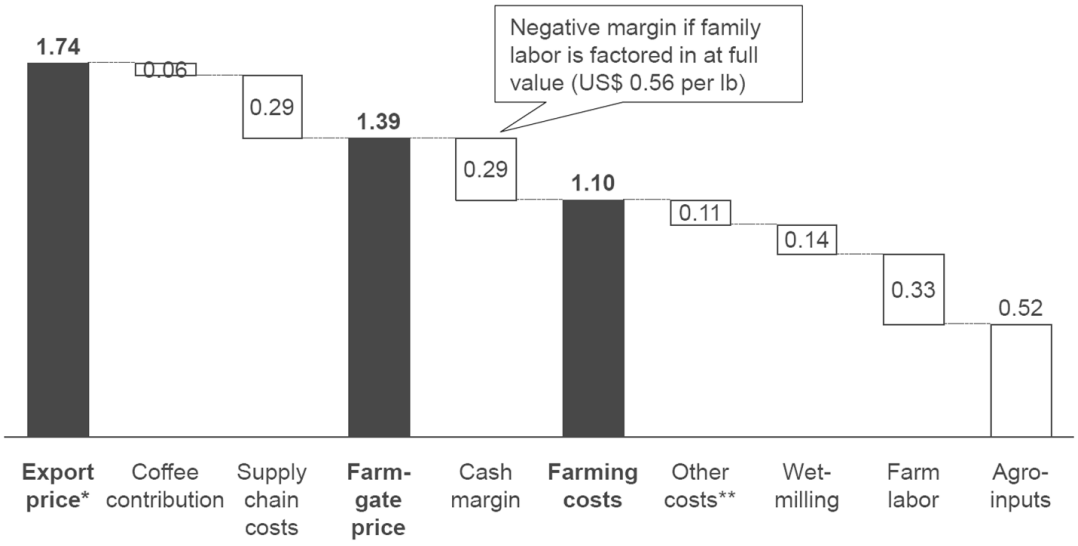
Historical information on the rates of change in land use from shade-grown to other coffee production systems show that the distribution of coffee growing systems in 2007 was 46% sun-grown (i.e., coffee plants are grown in full sun), 54% modernized and traditional shade-grown, (i.e., coffee plants have varying degrees of shade cover, low density of plants/hectare and the use of a high number of coffee varieties) and that by 2015, these numbers had changed to 60% sun-grown and 40% modernized and traditional shade-grown[31]. The underlying causes to the transformation of shade-coffee farms into unsustainable production schemes such as livestock production and more profitable sun-grown coffee are found in:

- Farmers' margins from coffee have been eroding. The costs associated with key production inputs including labour and fertilizer have increased rapidly over the past decade. Rising costs have made Colombia less competitive than other Arabica origins. In 2013, for the first time the

[29] https://www.federaciondecafeteros.org/static/files/Informe_Comportamiento_de_la_Industria_2015.pdf
[30] https://www.federaciondecafeteros.org/static/files/informe_sostenibilidad_esp.pdf
[31] https://www.federaciondecafeteros.org/particulares/es/quienes_somos/119_estadisticas_historicas/

Colombian government provided direct cash subsidies to farmers and paid more than US$ 600 million to bolster farmers' incomes. As a result, farmers are increasingly weighing the opportunity cost of coffee farming, both in terms of land and labour (time)[32]. The project promotes and train on cultivation practices that enable diversification and increase of income during farmer trainings (cf training manual), thus contributing to overcome the issue of eroding margins.

In comparison to other Arabica producers, Colombian coffee farmers face high production costs, based on high input costs, in particular fertilizers. Cash costs of production are estimated to amount to US$ 1.10 per lb on average (Figure 19: Cash cost of production for average Colombian farm (US$ per lb green)), although there is considerable variability among different farmer archetypes. Rising farming costs and currency appreciation have increased production costs, eroding farmers' margins (Figure 20: Colombia prices and production costs* (US cents per lb green)). Going forward, farmers will increasingly weigh the opportunity costs of coffee farming, both in terms of land and time (Figure 21: Farmers will increasingly weigh the opportunity cost of coffee farming, both in terms of land and time (labour)) [33].



Note: Cost of production does not include costs for installation of wet milling equipment, tree renovation or financing
*Normalized to 2012/13 average commodity prices – Arabica ICE "C" of $1.50 but adjusted for market differentials)
** Includes farm tools, equipment, internal transport, etc.
Source: Stakeholder interviews, TechnoServe analysis

Figure 19: Cash cost of production for average Colombian farm (US$ per lb green)

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[32] Colombia, A business case for sustainable coffee production, Sustainable Coffee Program, 2014
[33] Colombia, A business case for sustainable coffee production, Sustainable Coffee Program, 2014

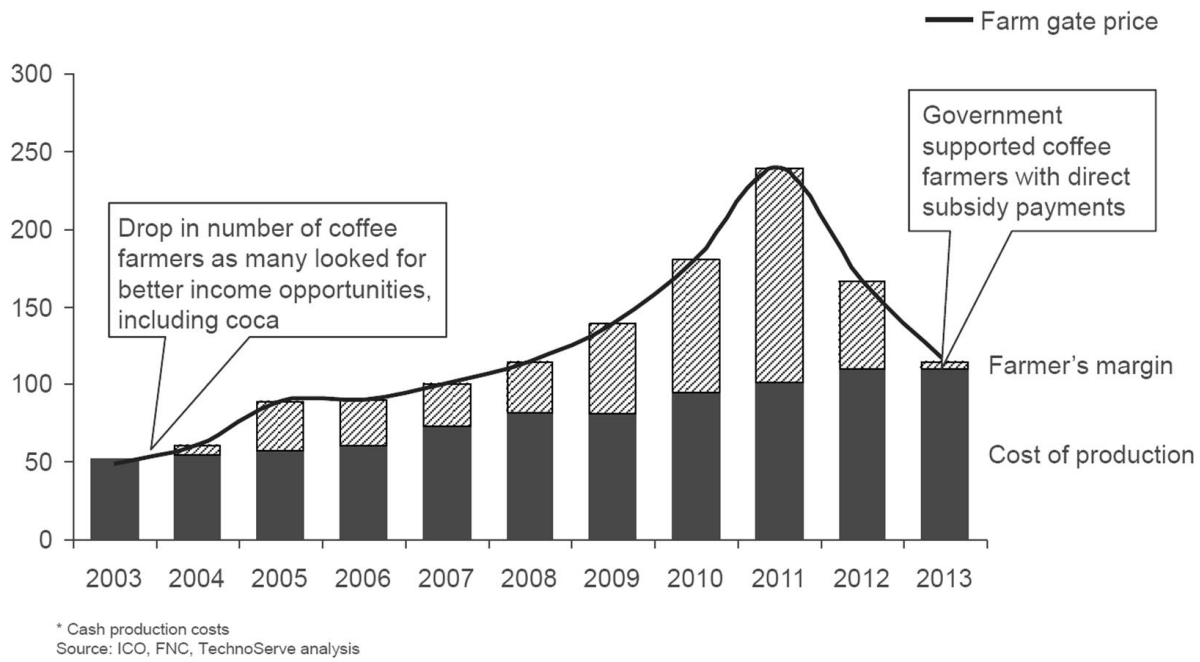

Figure 20: Colombia prices and production costs (US cents per lb green)*

Figure 21: Farmers will increasingly weigh the opportunity cost of coffee farming, both in terms of land and time (labour)

- limited investment capacity of the small-scale producers compared to the level of financial investment required to install new coffee fields; the investment required to plant and maintained (during three years) one hectare of coffee is around 1400 USD knowing that the average annual salary for 2600 USD[34]. The project finances the installation of new parcels, including the vegetal material, a contribution for organic fertilizers and a financial incentive to compensate for the labour, to overcome the lack of investment capacity.

- limited knowledge about the revenue potential of evolving biodiversity-friendly coffee certification systems and their technical production standards; and insufficient information about consumer demand for biodiversity-friendly certified coffee labels such as Fair Trade, Rainforest Alliance and UTZ in international markets. The project process includes farmers trainings on agroforestry and agroecology benefits and generates knowledge exchange about consumer demand for high environmental value coffee, labels and certifications.

2.5.2 Barrier relating to local tradition

Evidence of the existence of the barrier

There is no tradition in Colombia to invest in plantation forestry even if the investment itself is profitable[35]. There was almost no reforestation activity in Cauca and Nariño regions before the start of the project in 2014.

Interviews with stakeholders (among them CORSAVIDA and CAR) and land use surveys show that similar lands in the vicinity are not being converted on a significant scale to either commercial plantations, agroforestry or silvopastures.

Assessment of common practices, public strategies and initiatives show that some reforestation activities do already take place in Colombia and in the coffee producing regions. But there have only been 3 programs of reforestation in the Cauca and Nariño regions before 2014. Either they have had a very limited scale (small scale project), or there was a budget shortage from the organizations that developed it.

FNC has run a large-scale reforestation program starting in 2003 funded by KFW, with 10,000 beneficiaries in 59 municipalities, focused on Santander, Antioquia, Risaralda, Cundinamarca, Huila, Tolima, Caldas and Cauca departments. Since the end of this initiative in 2016, there has been no more funding, training, monitoring or seedling provided by the KFW to the producers, and the project has now terminated its activities in the Cauca region.

FNC also implements few small reforestation programs such as the Intelligent Water Management (IWM) Program in order to protect water sources and availability in coffee areas but it's a very small-scale project (75'000 trees; 100ha) and only dedicated to the water sources protection.

The Regional Government of the Cauca and Nariño also developed projects to help small-scale farmers planting trees. These programs were giving mainly seeds to farmers and sometimes seedlings but in very limited quantities and of poor quality (according to farmers' interviews and comments). Seeds had a poor germination rate, and no training was given, nor any monitoring or follow-up of the planting on site. According to local farmers who participated, the impact was very limited due to the lack of training and the poor genetic material given (both seeds and seedlings were deficient). After discussing with the administrators of the regional government environmental bodies, they declared not to have any plan to renew this operation but were willing to give political support to the reforestation project.

Currently, there is no public afforestation project in the area. Proceedings are always uncertain with regards to timings, duration, and sustainability of funding (dependent on public budget, annually voted

[34] Global Strategy to Improve Agricultural and Rural Statistics, Technical Report

[35] https://vuf.minagricultura.gov.co/Documents/5.%20Estadisticas%20Sector%20Forestal/Potencial%20de%20Reforestacio%CC%81n%20Comercial%20en%20Colombia.pdf

and allocated). Present project will greatly benefit of National recognition for the area in which it will be implemented.

The historical deforestation data in the Andean region also show that it is very likely that the process of extension of the agricultural frontier will continue[36].

Farmers have a projection towards the extension of the agricultural frontier and not towards reforestation, although they recognize the environmental problems caused by deforestation and the benefits which could be obtained from forestry. They do not have access to information, planting material[37] and training where they are located and forestry activities are not part of the culture yet. There are as well market access and regulatory issues for small-scale farmers to enter the forestry market, like the registration of the plantation with local authorities, which is a strong barrier, especially for farmers having limited land title deeds or no title deeds[38].

The project contributes to overcome this barrier by promoting and financing a large scale, long term reforestation project with coffee farmer, with high quality standards for the vegetal material, sustained monitoring of the planting parcels, technical assistance for the project participants and training of farmers and local teams.

Knowledge barriers

It is common practice for coffee production in Colombia to plant only few species of shade trees. Farmers do not have (or have lost) the knowledge of other potential species with higher benefits and positive interactions with the coffee crops, as they usually do not know which forest tree species could be combined well with coffee. They do not have the experience of other combined systems, and do not have a good knowledge of what are the valuable native species. Most farmers have little knowledge on agroforestry systems, planting techniques, and maintenance techniques for timber or fruit trees. This lack of knowledge discourages them from planting these trees[39].

The project contributes to overcome this barrier by providing trainings on agroforestry benefits for coffee production, to both farmers and FNC technicians, as well as on planting techniques and tree maintenance, as formalized in the training manual.

2.6 Methodology Deviations

There are no methodology deviations.

[36] http://www.ideam.gov.co/documents/11769/44688974/
[37] Investigacion en Semillas Forestales.pdf
[38] 2005.salazar.cadenamadera.colombia.centrodoc_1140.pdf
[39] Agroforesteria y sistemas agroforestales con café, Farfan, CENICAFE, 2014

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Each reforested parcel is stratified in 8 strata described in section 2.4.1, for which steady-state biomass/carbon stocks are calculated (Table 5: Parameters used for the calculation of carbon stocks in baseline carbon pools).

The baseline emissions are therefore calculated for each parcel according to its strata. We calculated the evolution of carbon sequestration in the baseline scenario ΔCbsl(t), t CO2e

$$\Delta Cbsl\ (t) = Cbsl\ (t) - Cbsl\ (t\text{-}1)$$

Cbsl (t) is the cumulated carbon sequestration in the baseline scenario the year t (tCO2e)
Cbsl (t-1) is the cumulated carbon sequestration in the baseline scenario the year t-1 (tCO2e)

$$Cbsl\ (t) = \sum Cbsl\ (t,i,j)$$

Cbsl (t,i,j) is the carbon sequestration of the parcels j in the baseline scenario the year t (tCO2e)

$$Cbsl\ (t,i,j) = 44/12 * B(ss)\ (i) * S\ (t,i,j)$$

S (t,i,j) is the area of the parcel j in the baseline scenario in the baseline strata i the year t (ha)

Table 5: Parameters used for the calculation of carbon stocks in baseline carbon pools

Stratum	Initial Land-use	Reforestation model	M(ss) above	R	M(ss) below	B (ss)	B (ss)	Baseline removed	Source
			tdm/ ha	tdm/tdm	tdm/ha	tdm/ha	tC/ha		
SB1a	Degraded fallow (Rastrojo)	Model 1, 2A or 3	19,2	-	-	19,2	9,0	No	IPCC 2006 Chapter 6 Grassland; IPCC 2003 GPG LULUCF Table 3A.1.5, Table 3A.1.8
SB1b	Degraded fallow (Rastrojo)	Model 2B or 4	19,2	-	-	19,2	9,0	Yes	
SB2a	Pastures / Grassland	Model 1, 2A or 3	6,2	1,58	9,8	16	7,5	No	IPCC 2006 Chapter 6 Grassland; IPCC 2003; M(ss) above: Table 6.1 R: Table 6.4
SB2b	Pastures / Grassland	Model 2B or 4	6,2	1,58	9,8	16	7,5	Yes	
SB3a	Annual crops	Model 1, 2A or 3	-	-	-	10	4,7	No	IPCC 2006 Chapter 6 Grassland; IPCC 2003; B(ss): Chapter 6.3.1.2
SB3b	Annual crops	Model 2B or 4	-	-	-	10	4,7	Yes	
SB4a	Perennial crops (coffee)	Model 1, 2A or 3	-	-	-	22	10,3	No	Henk Rikxoort, Götz Schroth, Peter Läderach, Beatriz Rodriguez S nchez. Carbon footprints and carbon stocks reveal climate-friendly coffee production. Agronomy for Sustainable Development, Springer Verlag/EDP Sciences/INRA, 2014, 34 (4), pp.887-897
SB4b	Perennial crops (coffee)	Model 4	-	-	-	22	10,3	Yes	

Where

- **M(ss)above** is the biomass per hectare aboveground (tdm.ha-1)
- **M(ss)below** is the biomass per hectare belowground (tdm.ha-1)
- **M(ss)above and M(ss)below** is the non-woody biomass for SB2a/SB2b and SB3a/SB3b.
- **BA(ss)** is the total aboveground carbon stock (tC.ha-1)
- **BB(ss)** is the total belowground carbon stock (tC.ha-1)
- **B(ss)** is the total (aboveground and belowground) biomass (T.C.ha-1)

For the baselines calculations, whenever possible and relevant, the parameters recommended by the IPCC have been used. For biomass stocks in coffee, we used a scientific study that suited better our context than the general IPCC general value for perennial crops.

3.2 Project Emissions

3.2.1 Calculation of project GHG removals

We calculated the annual net removals by sinks ΔCactual (t) (t CO2/yr)

ΔCactual (t) (t CO2/yr) = Cactual (t) - Cactual (t-1)

Cactual (t) is the GHG removals by sinks the year t (tCO2)
Cactual (t-1) is the GHG removals by sinks the year t-1 (tCO2)

Cactual (t) = Cbslp (t) + C (t)

Cbslp (t) is the GHG removals in the baseline sinks in the year t (tCO2)

C (t) is the stock of carbon in the standing trees planted in the project area the year t (tCO2e)

Stratification of the project for calculation of project GHG removals

For the ex-ante calculation of the project biomass, the project area is stratified according to the planting model and year of planting:

Plantation models:

- Model 1 “Lines”: Trees in lines, around the parcels, water streams and roads, every 3 meters.
- Model 2A “Intercropping Coffee”: Trees planted intercropped in coffee fields, 70-250 trees/ha
- Model 2B “Agroforestry Coffee Installation”: Trees intercropped in coffee fields, 70-250 trees/ha + coffee trees installation, 5,000-10,000 trees/ha
- Model 3 “Silvopasture”: Trees planted in grazing areas, 300 trees/ha
- Model 4 “Mixed Stand”: Dense plantation on unproductive or degraded lands, 1111 trees/hectare

Plantation year:

First plantations started in November 2014, at the date of the first validation, the project does not count with any area planted under the model 2B. As a result, 15 strata were defined for ex-ante calculation of project GHG removals

Table 6: Project area stratification for project scenario

Strata	Plantation Model	Year of Plantation
S1	Model 1	2014
S2	Model 1	2015

S3	Model 1	2016
S4	Model 2A	2014
S5	Model 2A	2015
S6	Model 2A	2016
S7	Model 2B	2014
S8	Model 2B	2015
S9	Model 2B	2016
S10	Model 3	2014
S11	Model 3	2015
S12	Model 3	2016
S13	Model 4	2014
S14	Model 4	2015
S15	Model 4	2016

Carbon stock calculation

Ex-ante estimation of GHG removals Cbslp (t) in the baseline carbon pools (tCO2):

For the GHG removals in baseline sinks (grassland, annual crops, coffee trees), according to the Table 5: Parameters used for the calculation of carbon stocks in baseline carbon pools, we consider that:

- for strata SB1a, SB2a, SB3a and the strata SB4a: the baseline carbon pools are unaffected by the tree planting. The trees are planted around the parcel or in an intercropped model, etc.

For the strata SB1b, SB2b, SB3b and the strata SB4b the biomass will disappear:

- for strata SB1b, SB2b: we consider that bushes of baseline pools will disappear (over 4 years) as the trees (planted at high density) grow on the parcel
- for strata SB3b: we consider that the grasses of baseline pools will disappear (over 1 years) as the trees (planted at high density) grow on the parcel
- for strata SB4b: the abandoned coffee trees will degrade slowly over 8 years as the planted trees grow

Ex-ante estimation of GHG removals C (t) in planted trees (tCO2):

Estimation by modeling of tree growth (in accordance with CDM- AR Tool 14- Version 04.2: Estimation of carbon stocks and change in carbon stocks of trees and shrubs [...])

$$C(t) = \sum C(t,j)$$

C(t) standing is the stock of carbon in the standing trees planted in the project area the year t (tCO2e); see section below (Tree growth estimation)

For each parcel, we calculate the carbon remove from the trees growth planted in the project area:

$$C(t;j) = C(t;i;j) * Sj$$

C (t;j) standing is the stock of carbon in the standing trees planted in the project area the year t in the parcel j (tCO2e); see section below (Tree growth estimation)

Sj is the total planted area of the parcel j (ha)

$$C(t,i;j) = 44/12 * CF * (1 + R) * MIN [(C(t-1;i;j) * (1 – H * Tj)) + (MAI \times SRj); Maximum\ tdm\ per\ ha]$$

C (t-1;i;j) is the stock of carbon per hectare of the parcel j of the project strata i in the standing trees the year t (tCO2e/ha)
We consider that the year of the plantation and the year following the plantation C (0;i;j) is nil.

MAI is the Mean Annual Increment of above ground biomass per hectare (in tdm/(ha*yr))

H is the harvesting rate / year equal to 3% according to the timber management plan related to the FSC certification.

Tj is the share of timber trees in the parcels j (information from the planting database)

$$SRj = MIN (1; Density\ \#\ trees/ha\ (j) / 700)$$

SRj is the ratio of the maximum mean increment value of the parcel j
Density # trees/ha (j) is the number of trees per hectare in the parcel j (information from the planting database)

We consider that the maximum mean increment value (10 tdm/ha/year) is reached for a planted density above 700 trees / ha. For lower densities, the MAI is adjusted linearly. Therefore, in the carbon calculations, the parcels with lower densities do not reach the maximum theoretical density of 150 tdm/ha within the project duration. In this way, the projections of the GHG removals reflect the planting density and tree mortality.

The following parameters were used to model and estimate the growth of planted trees within project area:

Table 7: Parameters used for the calculation of carbon stocks in Ex-ante estimation of GHG removals in planted trees

Mean annual increment	tdm / (ha*yr)	10	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 AFOLU, Chapter 4 Forest Land, Table 4.10, ABOVEGROUND NET BIOMASS GROWTH IN TROPICAL AND SUBTROPICAL FOREST PLANTATIONS, Tropical rainforest, Americas other broadleaf. Initial value: 20 tdm/year. Degraded to 10 to remain conservative and based on our experience on previous projects
Maximum tdm per ha	tdm/ha	150	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 AFOLU, Chapter 4 Forest Land, Table 4.8, ABOVEGROUND BIOMASS IN FOREST PLANTATIONS, Tropical rainforests, Americas other broadleaf
R (root to shoot ratio)	tdm / tdm	0,37	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 AFOLU, Chapter 4 Forest Land, Table 4.4. ratio of below-ground to above-ground biomass, Tropical rainforest
CF	tC / tdm	0,47	Carbon Fraction - AR TOOL 14
CC	Age	10	Age of the first commercial cut
H	%	3	Harvesting rate / year according to the forest management plan related with the FSC certification

Mean annual increment, maximum tdm per hectare and root to shoot ratio have been chosen after a review of existing literature. They correspond to conservative values among the ones that were relevant with the project context.

Note about the calculation method:

The long-term biomass stock, or maximum possible biomass per hectare, is determined by the available resources in the environment, and thus by pedoclimatic conditions (soil, precipitation, temperature, sunshine). After a bibliography review, the value of 150tons of dry matter per hectare for above ground biomass (2006 IPCC value for Andean forests) was retained to be the most adapted to our project's context, as it was the context that fitted the most the project location, and it was below the average of the other value, thus guaranteeing conservativeness. The Mean Annual increment considered was of 10 tdm/year/ha, as justified in table 7.

For the calculation of GHG removals, the mean annual increment of each parcel was adjusted based on its density. A study about tree diversity (5) conducted in seven locations in the amazon basin found one instance over 700 trees/ha (842), 1 between 600 trees/ha and 700 trees/ha (650), and 5 below 600 (minimum 493). Based on those results and given that forests in the project location - tropical montane areas – have a lower overall tree density than the Amazon basin, 700 trees / ha was chosen as a conservative value for the reference number of trees per hectare, at which the mean actual increase of biomass reaches the chosen reference level of 10 tdm/year/ha. For densities over 700, the same mean actual increment has been considered. For lower densities, the mean annual increment has been adjusted linearly to the tree density.

Therefore, in the GHG removals calculations, though the same long-term biomass stock per hectare have been applied for all plots (consequences of similar pedoclimatic conditions), the parcels with lower densities (due to initial low planting density and / or mortality) never reach the maximum theoretical level of 150 tdm/ha within the project duration.

The mean annual increment was applied on a linear basis starting year 2 (consistent with observations in the field, no biomass gain in year 1), until reaching the Maximum quantity of biomass per hectare for the given climatic conditions.

Ex-post estimation of GHG removals in planted trees

Sampling plots selection

The protocol for biomass inventory was designed according to CDM A/R methodological tools: "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" and "Calculation of the number of sample plots for measurements within A/R CDM project activities".

Size of permanent plots

- For model 2A/2B/3/4 (area planting): 500m2 circular plots
- For model 1 (perimeter/line planting): 100 meters' line following planted line

Plots selection

- Planted parcels registered in the database are filtered by strata (planting year and model). For each stratum, a first arbitrary number of parcels will be randomly selected (using a random number generator). This first number of parcels per stratum is chosen arbitrary based on the size of the stratum (less in smaller strata) and expected biomass quantity (less in more recent waves).

- After the first inventory wave, the results will be plugged in the calculation workbook to compute the variance and uncertainty and deduct the theoretical number of plots to measure. This will lead

to the random selection of additional parcels for each stratum. This process may be repeated several times until reaching the appropriate level of uncertainty below 10%

Plot demarcation

- The center point of the plot (model 2A, 2B, 3 or 4) or the end of the sample line (model 1) are recorded with GPS and marked in the field with a wood stick.
- In model 2A, 2B, 3 or 4, the boundary of the sample plot is marked measuring radiuses of the sampling circle with a measuring tape (implementing slope correction factors when appropriate). In model 1, the two extremities of the sampling line are marked using a measuring tape.
- All trees falling inside the plot boundaries were marked with aluminium plates nailed or attached to the trees.

Inventory team trainings

- FNC technical team members will be trained several times by PUR Projet from 2018, when biomass inventories will be done for the VCS verification of the Agroforestry project.
- In each session, PUR Projet will ensure that all the technical will apply the procedures in the same way to ensure the consistency of the data collection, will verify the team's skills and will go through the issues specifics to biomass inventory in reforested parcels.

3.2.2 Estimation of project emissions

According to AR-AMS0007/version 03.1, Section 5.5:

GHG emissions resulting from removal of herbaceous vegetation, combustion of fossil fuel, fertilizer application, use of wood, decomposition of litter and fine roots of N-fixing trees, construction of access roads within the project boundary, and transportation attributable to the project activity shall be considered insignificant and therefore accounted as zero.

$$GHG(E,t) = 0$$

GHG(E,t) is the emission of non-CO2 GHGs resulting from burning of biomass and forest fires within the project boundary in year t (t CO2-e)

3.3 Leakage

According to AR-AMS0007/version 03.1, Section 5.6, leakage due to the displacement of agricultural activities shall be assessed.

The project area was stratified based on the initial land-use and planting model

Stratum	Initial Land-use	Reforestation model
SB1a	Degraded fallow (Rastrojo)	Model 1 or 3
SB1b	Degraded fallow (Rastrojo)	Model 2B or 4
SB2a	Pastures / Grassland	Model 1 or 3
SB2b	Pastures / Grassland	Model 2B or 4
SB3a	Annual crops	Model 1
SB3b	Annual crops	Model 2B or 4
SB4a	Perennial crops (coffee, sisal)	Model 1 or 2A
SB4b	Perennial crops (coffee, sisal)	Model 4

Strata SB1a, SB1b, SB2a, SB2b, SB3a and SB4a:

There is no risk of displacement of pre-project activities

- SB1a and SB1b: **Degraded Fallow**

  Plots are not farmed, there is therefore no agricultural activity to displace. On the contrary, trees will contribute to regenerate the soils and provide additional arable land (hence lower relative pressure upon available land)

- SB2a and SB2b: **Pastures** (total of 182 hectares, i.e. <8% of total project area)
  - In SB2a, trees are planted around the grazing area or in silvopastures model, which precisely intends to mix trees with pastures, therefore not displacing any grazing activity.
  - In SB2b, trees and/or coffee trees are planted to replace pastures. This happens when farmers have grazing areas in excess of their need for the number of cattle heads (ratios of up to 5 ha per head of cattle). In that case, the planting will not trigger pasture displacement as the existing cattle will be moved to other existing grazing areas.

- SB3a: Annual crops

  Trees are planted around the farmers' plot, therefore not displacing any farming activity. On the contrary, the trees will precisely benefit the existing crops, acting as wind-barriers and/or limitation of erosion

- SB4a: Coffee

  Trees are planted around the farmers' plot, therefore not displacing any farming activity. ON the contrary, the trees will precisely benefit the coffee, acting as wind-barriers and/or limitation of erosion, as well as shade for the coffee.

In all these cases, the better land-use practices implemented will, on one hand regenerate arable land and help secure and increase existing crop production yields, and on the other hand give back value to unproductive degraded land. Sustainable crop and timber production will generate income in the short, mid, and long term, thus lowering the risk of farmers to move to other places.

Strata SB3b, SB4b:

- SB4b: Perennial crops

In strata SB4b, farmers usually decide to plant timber trees in model 4 "Mixed Stand" because they do not want to cultivate their permanent crops anymore.

Most often it is because they have too much area of coffee and cannot maintain and harvest all of it; in that case, there is no risk of displacement of coffee plantations.

In other cases, it is because the coffee is not adapted to the area or in bad shape, and not productive enough for the farmer to keep cultivating it. In that case, there could be a risk of displacement of pre-project activity, which could be considered as leakage only if the farmer deforests another area to replant coffee (but as explained in 2.5.2, he would face investment barriers and most likely he would move the coffee to a degrade land)

Displacement of coffee to a forested area is therefore very unlikely. Still, there will be monitoring for leakage, as required in AR-AMS0007 Version 03.1.

- Strata SB3b: Annual crops

In strata SB3, farmers usually cultivate annual crops by default in unproductive area in a periodic system. Land deforested before 2000 was used in a slash and burn system, where rice first, then maize was

grown, before it was left as a fallow because of the soil degradation. In a first fallow, it takes normally 4 years after the land can be used for agriculture again. After a second cultivation period, it takes at least 7 year before it can be used again for cropping, and after that it takes at least 10-12 years before land can be recovered. On top of that, production yields keep going down. Being conservative, a cycle of more than 10 – 12 years of fallow followed by one year of annual crops can be considered, on those areas deforested before 2000.

Annual crops cultivation is for them more a way of using as much as possible low productive land that was degraded by the cultivation of coca in the past. The crops cultivated are most often not necessary for the farmer's subsistence.

Therefore, it is not very likely that there would be displacement of this activity due to the project, and if there was, it would mostly be to other degraded areas / "rastrojo".

Displacement of agriculture activities can thus be considered insignificant and leakage considered as nil.

As a result, **the overall leakage for the project is considered as nil.** Still, there will be monitoring of leakage, as required in AR-AMS0007 Version 03.1, according to the process described in the table hereafter

Data variable	Source of data	Data unit	Measured calculated or estimated	Recording frequency	Proportion of data to be monitored	Archiving (electronic / paper)	Comment
Displacement of agricultural activities	Survey	ha	Estimated	- Once after project is established - Before the first verification	20%	electronic / paper	Field survey

3.4 Net GHG Emission Reductions and Removals

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2014	0	0	0	0
2015	2 822	2 304	0	518
2016	27 352	23 320	0	4 031
2017	112 881	96 258	0	16 623
2018	125 496	96 258	0	29 238
2019	138 196	96 258	0	41 938
2020	151 558	96 258	0	55 300
2021	165 211	96 258	0	68 953
2022	178 864	96 258	0	82 606
2023	192 592	96 258	0	96 334
2024	206 342	96 258	0	110 084
2025	220 078	96 258	0	123 820
2026	232 956	96 258	0	136 698

2027	243 580	96 258	0	147 322
2028	253 967	96 258	0	157 709
2029	264 124	96 258	0	167 866
2030	274 045	96 258	0	177 787
2031	283 649	96 258	0	187 391
2032	292 535	96 258	0	196 277
2033	300 496	96 258	0	204 238
2034	307 752	96 258	0	211 493
2035	314 662	96 258	0	218 404
2036	321 280	96 258	0	225 022
2037	327 574	96 258	0	231 316
2038	333 364	96 258	0	237 106
2039	338 665	96 258	0	242 407
2040	343 391	96 258	0	247 132
2041	347 553	96 258	0	251 294
2042	351 302	96 258	0	255 044
2043	354 701	96 258	0	258 443
2044	357 607	96 258	0	261 348
2045	360 303	96 258	0	264 045
2046	362 895	96 258	0	266 637
2047	365 387	96 258	0	269 129
2048	367 786	96 258	0	271 528
2049	370 097	96 258	0	273 839
2050	372 333	96 258	0	276 074
2051	374 485	96 258	0	278 227
2052	376 563	96 258	0	280 305
2053	378 573	96 258	0	282 315
2054	380 520	96 258	0	284 262
Total	380 520	96 258	0	284 262

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	**Carbon Fraction of dry matter**
Data unit	tC/tdm
Description	Total carbon in weight per ton of tree fresh matter.
Source of data	AR-AMS 00007
Value applied:	0,47
Justification of choice of data or description of measurement methods and procedures applied	Reference value
Purpose of the data	Determination of baseline scenario and project removals.
Comments	

Data / Parameter	**CO2 fraction**
Data unit	T(CO2)/tC
Description	Total CO2 in weight per ton of C in trees.
Source of data	AR-AMS 00007
Value applied:	44/12
Justification of choice of data or description of measurement methods and procedures applied	Reference value
Purpose of the data	Determination of baseline scenario and project removals.
Comments	

Data / Parameter	**Root to shoot ratio**
Data unit	Ton dry matter / Ton dry matter
Description	Ratio between belowground and aboveground Ratio
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 AFOLU, Chapter 4 Forest Land, Table 4.4. ratio of below-ground to above-ground biomass, Tropical rainforest IPCC 2006 Chapter 6 Grassland; IPCC 2003; Table 6.4
Value applied:	For trees: 0,37 For grasslands: 1.58

Justification of choice of data or description of measurement methods and procedures applied	Reference value
Purpose of the data	Determination of baseline scenario and project removals.
Comments	

4.2 Data and Parameters Monitored

Data Unit / Parameter:	**Area planted per strata**
Data unit:	Hectares
Description:	Area planted under each model, in each plantation wave
Source of data:	Field Measurement (GPS)
Description of measurement methods and procedures applied:	Area planted is measured by project team's technicians, at first parcel monitoring, 3 months after plantation. For model 1, the distance planted is measured, and area is recalculated using a given width.
Frequency of monitoring/recording	Once
Value applied:	See GHG calculation model
Monitoring equipment	GPS, Field Form and Registry
QA/QC procedures to be applied	Data is cross-checked in the field by PUR Projet during each visit and by other Entities' technical teams.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Any comment:	- Stored electronically - 100% of project area to be recorded

Data Unit / Parameter:	**Plantation density per strata**
Data unit	Number of trees per hectare
Description	Stocking level of the area planted
Source of data	Field Measurement
Description of measurement methods and procedures to be applied	Field Measurement (Counting of trees planted and alive)
Frequency of monitoring/recording	At the monitoring 1 & 2
Value applied:	See GHG calculation model

Monitoring equipment	Field Form and Registry
QA/QC procedures to be applied	Data is cross-checked in the field by Pur Projet during each visit and by other Entities' technical teams.
Purpose of data	Determination of project removals
Calculation method	N/A
Comments	- Stored electronically - 100% of project area to be recorded

Data Unit / Parameter:	**Area of biomass inventory plots**
Data unit:	Hectares
Description:	Total surface inventoried
Source of data:	Field Measurement (GPS)
Description of measurement methods and procedures to be applied:	Counting of all parcels inventoried for biomass inventory.
Frequency of monitoring/recording:	For each biomass inventory (<5 years)
Value monitored:	Number of plots
Monitoring equipment:	GPS, Field Form and Registry
QA/QC procedures to be applied:	Data is cross-checked in the field by PUR Projet during each visit and by other Entities' technical teams.
Purpose of the data	Ex-post calculation of project removals
Calculation method:	N/A
Any comment:	- Recorded once after inventory - Stored electronically - 100% of inventory area to be recorded

Data Unit / Parameter:	**Diameter at breast height**
Data unit:	cm
Description:	Diameter of trees planted at 1,30m height
Source of data:	Field measurements in sample plots
Description of measurement methods and procedures to be applied:	Diameter is measured at 1,30m height by technicians from the project team, for all trees planted in designated sample plots
Frequency of monitoring/recording:	At each inventory (<5 years)
Value applied:	N/A (diameter not used for ex-ante estimate)
Monitoring equipment:	Caliper or diameter tape

QA/QC procedures to be applied:	Cross-checked verification on sample basis
Purpose of the data	Ex-post calculation of the project removals
Calculation method:	N/A
Any comment:	

Data Unit / Parameter:	**Tree height (total and commercial)**
Data unit:	meters
Description:	Height of the trees planted
Source of data:	Field measurements in sample plots
Description of measurement methods and procedures to be applied:	Tree height is measured by technicians from the project team, for all trees in designated sample plots.
Frequency of monitoring/recording:	Yearly
Value applied:	N/A (diameter not used for ex-ante estimate)
Monitoring equipment:	Clinometer
QA/QC procedures to be applied:	Cross-checked verification on sample basis
Purpose of the data	Ex-post calculation of the project removals
Calculation method:	N/A
Any comment:	

Data Unit / Parameter:	**Carbon stock**
Data unit:	T CO2
Description:	Stock of carbon in the biomass of the planted trees
Source of data:	Calculation based on diameter and height measurement in the sampling plots
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	After each biomass inventory
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Purpose of the data	Determination of the project removals
Calculation method:	Allometric equations are used to calculate above ground biomass in sampling plots. Root to shoot ratio is used to compute below ground biomass. The total is extrapolated to total project area

	based on area ratio per strata between sampling plots and total project area
Any comment:	

Data Unit / Parameter:	**Project area affected by fire**
Data unit:	Hectares
Description:	Surface affected by fire
Source of data:	Observations at each parcel monitoring
Description of measurement methods and procedures to be applied:	During parcel visits, the technicians assess whether the parcel was affected by fire and if yes, the affected surface is estimated.
Frequency of monitoring/recording:	At every parcel monitoring
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Purpose of the data	
Calculation method:	Technicians estimate with the farmer the % of the parcel affected by the fire and apply this percentage to the registered area of the planted parcel.
Any comment:	

4.3 Monitoring Plan

4.3.1 Monitoring plan

Table 8: General monitoring plan

Topic	Elements to be monitored	Procedure of monitoring	Responsibility and field participants	Frequency over the project lifetime	Output
Plantations	Pre-identification of parcel to be planted	Individual visit of technician prior to plantation	- Project Entities' project team (technicians dedicated per area) - Quality control (field and data) : PUR Projet	Once before planting	Pre-registration form / Farmer's order
	Number of planted trees	Individual visit of technician after planting		Once after planting	Parcel registration form / Planting registry
	Area and features of planted parcel	Individual visit of technician after planting		Once after planting	Parcel registration form / Planting registry
	Mortality (survival rate and mortality causes)	2 monitorings with full counting of surviving trees (3 months and one year after planting) ; biannual visits to parcels to check on drastic mortality events		2 complete counting within 1.5 years after planting: biannual visits afterwards	Monitorings 1 and 2 forms / Planting registry
Plantation management	Pruning	- Field visits to every parcels	- Project Entities' project team	Biannual visits	Biannual Monitoring forms
	Thinning				
	Harvesting (trees to be harvested, trees replanted)		- Project Entities' forestry team		Forestry Sustainable Management Plan
Emissions reductions	Area of each strata (ha)	- GPS mapping of all planted areas - Consolidation in planting registry	- Entities' project team	At first monitoring of each planting wave	Planting registry
	Carbon stock per ha, for each strata (tCO2/ha)	Field measurements (biomass inventory plots)	- Execution : Entities' project team and farmers - Quality control (field) : Other Entities' project team - Quality control (data) / Interpretation : PUR Projet	- Measurement of diameter and height averages in planted parcels: regularly - Full biomass inventory protocol : every 2-5 years	Biomass inventory forms and Excel file
Leakage	Displacement of pre-project crops	- Survey on a sample basis	- Entities' project team	- After the end of plantations : Every 2/3 years for 6 years (after that, the deforestation of forest is not assumed to be due to the project)	Survey forms / Planting registry
Non-permanence risks factors	Fires	- Information reporting through Project Entities' regular canals - Field visits to every parcels - Scientific monitoring data collected at regional level	- Entities' project team for annual visits - PUR Projet - Participating communities and farmers	Ongoing monitoring / watch	Planting registry
	Droughts				Planting registry
Environmental and socio-economic impact	Soil enrichment	- Scientific inventories and thematic studies - Survey in communities - Public socio-economic studies - Public environmental studies	- Protocols : PUR Projet (PUR Lab) - Implementation : Entities' project teams - Participating communities - Scientific partners (University, scientific institutes) - Government, NGO and other involved organisations in Colombia	Depending on the funds available & needs: - On selected topics: continuous monitoring through annual field visits - On selected topics : scientific protocols with pre-defined periodicity of measurements - Socio economic surveys in communities all along the project	Specific outputs according to topic (survey forms and tables, inventory forms and results, etc)
	Soil fixation				
	Water quantity				
	Water quality				
	Biodiversity and pollination				
	Community incomes				
	Food security				
	Food sovereignty				
	Grassroot empowerment and ownership feeling				
	Communities adaptation to climate change				
	Happiness				

Ex post estimation of the baseline net greenhouse gas removals by sinks

As permitted by decision 6/CMP.1, appendix B, paragraph 6, the baseline will not be monitored. The baseline net GHG removals by sinks will be assumed to be those estimated in section 3.1.

Ex post estimation of the actual net greenhouse gas removals by sinks

The project participant will determine any changes in carbon stocks, by measuring and monitoring the project area and the trees that have been planted, and conducting carbon sampling within stratified sample plots. The Project Entities' technical teams will be in charge of supervising the monitoring activities.

Step 1: Monitoring of planting progress and tree survival

- All the plantations will be monitored regularly by the team of technicians from Project Entities, in order to monitor the number and species of surviving trees, to assess the good development of the trees, the quality of plantation, weed control, and presence of pests and diseases.
- Two to three months after planting, quality and stock will be checked by Initial Project Entities technicians, in order to determine mortality, and number and species of surviving trees. Farmers will receive a first payment based on the living trees.
- Mapping of the planted areas will be conducted with a GPS.
- Another parcel visit will be conducted 10-12 months later to check again mortality and maintenance. Farmers will receive a second payment based on surviving trees.
- Then technicians from Initial Project Entities will conduct periodical site visits. In the three first years, all sites will be evaluated at least every year on survival rates, growth and development of the plants, quality of the plantation, weed control, pests and diseases.
- Frequencies of visits will then decrease gradually to reach a frequency of at least one site evaluation every 2 years.

All data recorded during the site visits (GPS mapping, number and species of living trees) will be stored in a database.

Step 2: Stratification

Stratification for ex-post estimation of GHG removals will be based on the stratification for the ex-ante estimation of the actual net GHG removals by sinks, as described in 3.2.1.A. Stratification is based on plantation model and year of plantation.

However, the need for further and/or different ex-post stratification shall be evaluated at each monitoring event and changes in stratification shall be reported to the DOE for verification.

Step 3: Establishment of permanent sampling plots

Step 4: Field data measurement

Step 5: Carbon stock calculation

See section 3.2.1 for description of the biomass inventories protocol and carbon stocks calculation methodology.

Ex post estimation of leakage

As described, in 3.3. there will be monitoring for leakage, as provided in AR-AMS0007 (Version 3.1).

- Very few farmers participating to the project raise cattle, therefore leakage from displacement of cattle will be monitored directly for all participants who have planted a model 4 in grazing.
- Leakage coming from displacement of coffee activities will be monitored for farmers who have planted a model 4 in their coffee fields.

On sample basis, surveys will be conducted and completed with farmers in their farm, at third monitoring of plantation.

4.3.2 Organizational structure for monitoring

The grouped project is based on the relationship between PUR Projet, the Project proponent and coordinator, fundraiser and carbon offset trader of the project, and the Project Entities, in charge of the implementation of the project. The entities have developed internal dedicated teams to operate the project and implement monitoring activities.

PUR Projet will check each year through an internal audit the state of the project (documents, plantations, knowledge, benefits, actual GHG removals by sinks…) and pay the Entity to implement the monitoring activities.

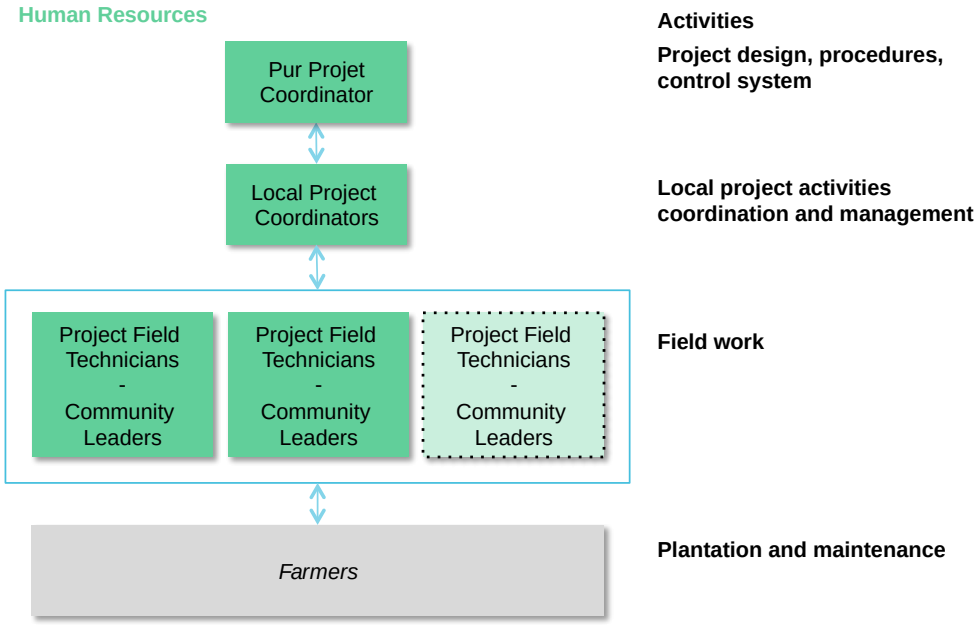

Figure 22 : Generic project implementation structure

A Local **Project Coordinator** is in charge of the Reforestation and Carbon sequestration in each Entity. The Local Project Coordinator's responsibilities include overall daily **planning**, **coordination** of plantation and **monitoring** activities, and checking each area's results. According to the size of the Entity, one or several Engineers can be responsible for the technicians' and farmers' trainings, plantation designs, seedlings distribution; he/she will check the monitoring results presented by the technicians for quantity, quality and coherence. **Field Technicians** trained by the Project Coordinator and/or the Forest Engineer(s), and/or other external partners of the project (CORSAVIDA, CAR, FSC Colombia), will conduct the registration and monitoring activities in the field.

4.3.3 Quality control and quality assurance procedures

A quality control and quality assurance (QA/QC) plan describes all procedures and includes instructions related to:

a) Collecting reliable field measurements;

b) Verifying methods used to collect field data;

c) Verifying data entry and analysis techniques;

d) Data maintenance and archiving

Data collection

Monitoring will be done by trained project technicians hired for the project, who understand the importance of accurate data collecting.

This technical team will receive trainings about field measurements, both theoretical and practical, before every new wave of measurement, and at least twice a year. During this participative workshop, each technician will measure the same sample in order to ensure harmonised monitoring practices, share good practices for the reporting of key indicators and the entering of data in the database. These frequents trainings ensure that all technicians have standardised monitoring and reporting practices.

Moreover, the engineer responsible for monitoring will evaluate each of the member in the monitoring team to identify errors in field's techniques, verify measurements processes and correct any identified problems before they carry out the measurements.

Verification of data collection

Data collected will be controlled by The Local Project Coordinator first, and then by PUR Projet to identify both systematic and isolated errors. Identification of systematic errors will help improving the trainings and/or the monitoring methods to avoid future monitoring errors.

Data analysis

Field data (pre-registry; monitoring) are collected on field forms and will progressively be done through an online application. Systematic consistency checks and analysis are performed to detect incoherencies and systematic errors. Furthermore, field data is cross-checked with reported data and, where necessary, systematic consistency tests are included throughout the spreadsheets to ensure data reliability. Continuous communication between the staff involved in the data collection and the staff responsible of the analysis ensures the quick resolution of any apparent anomalies before the final analysis is conducted.

Moreover, consistency checks with the previous years' data are systematically performed.

Storing and maintenance information

The information will be stored and made available upon request to all authorized stakeholders.

Because of the long-term nature forestry activities, data archiving (maintenance and storage) is a key component of a project. Copies of all data analysis and models, the final estimate of carbon sequestration, GIS products and all measurements and monitoring reports will be securely stored, electronically (PUR Projet server) and physically (paper), with the relevant backups and safeguards.

Given the time frame of the project, and the evolution rate of data storage technologies, electronic copies of data and reports will be periodically updated or converted in order to be kept in an up-to-date format.

4.3.4 Adaptive management plan

All the procedures described in the documents are already the results of recurrent corrections and adaptations of precedent procedures.

More generally, the project has an adaptive approach, in which the project proponent and the local management team regularly document the feedbacks from the previous experiences and continuously work on identifying improvements for the project procedures.

After field visits to the project of the Project proponent, and yearly after the plantation waves, a progress report including feedbacks and suggested improvements is drafted, discussed, and approved by the

Project Proponent and the Management team. Examples of such reports, proceedings, or meeting minutes can be found appended to the PD. These reports lead to the continuous adaptation of project procedures to constantly improve quality of the project.

5 SAFEGUARDS

5.1 No Net Harm

N/A

5.2 Environmental Impact

Project's benefits

In tropical regions, the extent of agricultural land is rapidly increasing at the expense of natural forest with associated losses of biodiversity and ecosystem services. Agroforestry has long been proposed as a more sustainable agricultural system, conserving biodiversity and ecosystem services, while providing significant local livelihood and thus decreasing the need for agricultural expansion. In this context, coffee agroforestry is often regarded as more compatible with conservation of ecosystem integrity than full-sun coffee plantations.

The project will generate multiple benefits that will be shared between the coffee farmers, and the society as a whole. They will consolidate over time at different time horizons. That's why the project is integrated in a longer-term program vision, where the benefits most relevant to the project and the farmers will be monitored over 40 years.

Environmental benefits

- Water: Preservation of water resources, Increase of water stocking capacity[40], Regulation of rainfalls and water cycles[41], Infiltration and limitation of water runoff, filtration of runoff water and depollution[42]
- Soils: Soil enrichment in organic matter[43], in nutrients[44], microbial activity enhancement, soil decompiling, Soil fixation[45] (Erosion avoided, reduction of landslides frequency and indirect damages)
- Biodiversity: Beneficial insects (natural plague control[46,47], pollination[48], etc.), preservation of habitats for high value species, cycle of organic matter, seeds dispersal, allelopathic interactions[49]
- Climate: Carbon sequestration in trees, Microclimate regulation (humidity, shade, temperature, windbreak), Better adaptation to climate change

Social and economic benefits

- Income increase and diversification: coffee yield increase (as a result of better ecosystem, water and soil conditions), fruit, timber, fuelwood sales; risk management, less dependence on main crop only, increased food sovereignty
- Cost management : reduction of inputs needed (due to more stable and naturally richer soils[43,44,45]), reduced need for control of plagues and diseases[46,47]

[40] Agroforestry, water and soil fertility management to - Roose et al., 1997
[41] Water inputs across a tropical montane - Ponette et al., 2009
[42] A review of rapid transport of pesticides from sloping farmland - Tang et al., 2012
[43] Protective shade, tree diversity and soil properties in coffee agroforestry systems - de Souza et al., 2012
[44] Environmental services of coffee agroforestry - Vaast et al., 2004
[45] For services rendered? Modeling hydrology and livelihoods in Andean payments for environmental services schemes Quintero et al., 2009
[46] Shade over coffee: its effects on berry borer, leaf rust and spontaneous herbs in Chiapas, Mexico, L. Soto-Pinto et al., 2002
[47] The ecology and economics of insect pest management - Stamps et al., 2009
[48] Linking deforestation scenarios to pollination services - Priess et al., 2007
[49] Productivity and profitability of multistrata - Lyngbæk et al., 2001

- Adaptation to climate change: Better resilience of crops, Limited impacts of extreme climatic events
- Patrimony: Long-term and high value assets (trees), consolidation of land tenure and user rights certification, increased land value, facilitated access to credits, transmission of patrimony
- Cohesion, empowerment: better transparency and decision process, favoured communities' interactions, education and training, skills development in project and financial management, higher sense of responsibility, emancipation and leadership

PUR Projet also developed a scientific approach and tool to assess the potential value creation of specific projects in terms of soil conservation, water purification & regulation, climate change mitigation, economic diversification, supply chain control, and expresses it in a standard unit of measure: US dollars. Many studies are aimed at identifying and estimating the value of environmental and socio-economic services. PUR Projet compiled hundreds of them and came up with a complete and non-redundant list of 46 services, divided in 3 categories:

- Environmental regulation & maintenance (5 groups, 8 indicators and 21 services)
- Livelihoods of local communities (2 groups, 5 indicators and 15 services)
- Business sustainability (1 group, 4 indicators and 10 services)

The results of the application of this tool to the "Regenerating Colombian Coffee Ecosystems" project is presented in Figure 23: Potential value creation through Colombia agroforestry project. The main highlight is that a tree planted can generate up to 14,3$ of social-economic and ecosystem services every year over the medium to long-term.

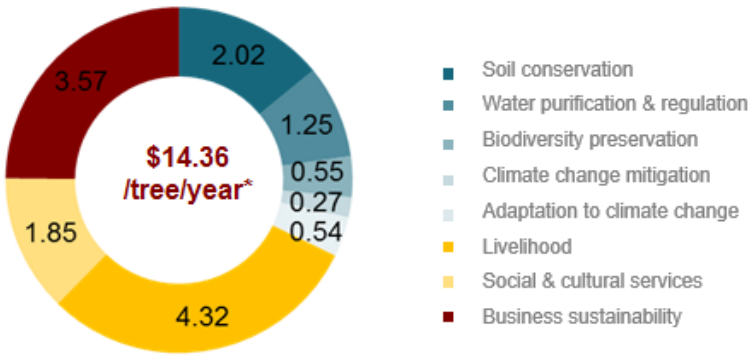

Figure 23: Potential value creation through Colombia agroforestry project

The project was designed to have positive environmental impacts:

Impact on soils: maintenance of soil fertility and erosion prevention

Many conditions contribute to soil fertility, such as:

- an adequate concentration of soil organic carbon and nutrients

- the presence of a range of microorganisms that support plant growth

- the absence of toxic substances

Conventional crops cultivation practices often lead to soil depletion and represent a serious threat to agricultural production and yields.

Soil losses are a major concern for agriculture, as soil creation is very long and that 25 to 40 billion tons of the first soil layer are lost every year. Soil erosion entails important damages both on-site and off-site and can represent a total annual cost of US$ 400 billion (Eswaran et al., 2001).

Impact on water cycle and water resources

In agriculture, the trend towards greater intensification and higher productivity during the past fifty years was followed by a significant increase in the use of both inorganic nitrogen and phosphorous fertilizers. This led to excessive amounts of nitrates and phosphates in waters, with very serious impacts: eutrophication, health danger, destruction of fisheries, etc.

Water regulation provides essential services for the development of cultures such as: fog and water retention, salinity management, resilience to extreme flood and drought events, etc. Mass deforestation tends to disrupt the hydrological cycle: it leads to a much drier soils and climate and threatens crop sustainability. Tropical rainforests produce about 30% of our planets' fresh water, and they are quickly being destroyed by intensive agricultural and manufacturing sector.

Impact on biodiversity

Functional biodiversity refers to part of the total biodiversity providing (agro)ecosystem services, such as pollination and biological control.

- Pollinators are essential for sustainable yields, as 75% of the world's major crops are dependent on or benefit from them (Carvalheiro et al., 2012).

- Some insects are natural predators for pests and vector-borne diseases and provide natural pest management services. Agricultural pest control by bats is valued at US$ 22.9 billion per year in the US (Boyles et al., 2011).

Climate change mitigation

As an A/R project, the project is designed to increase sequestration capacity of CO2, therefore playing a positive role in regulation of climate change. Protection and restoration of natural carbon sinks (forests, oceans, etc.) and reduction of GHG emissions strongly contribute to mitigate climate change effects.

- 300 billion tons of carbon are currently stored in trees, which represents 40 times the annual GHG emissions from fossil fuels.

- Conventional agriculture practices currently produce 13% of the human-based global GHG emissions (UNEP). Since 1990, climate change has caused average losses of $60 billion/year.

Adaptation to climate change

Agriculture is estimated to be the direct driver for around 80% of deforestation worldwide. However, trees provide essential services to adapt to climate change: thermoregulation, shade, protection against wind and adaptation to extreme events. Better local climate regulation can contribute to decrease the remediation costs of climate change, estimated to US$ 20 trillion/year by 2100 (WPF).

5.3 Local Stakeholder Consultation

N/A

5.4 Public Comments

The project no received public comments.