# Esquema de Retribución por Servicios Ambientales

# (ERSA)

## para la Conservación de los Bosques y Gestión de Fuentes Hídricas en la jurisdicción de CORPOCHIVOR

Esquema de Retribución por Servicios Ambientales (ERSA) para la Conservación de los Bosques y Gestión de Fuentes Hídricas en la jurisdicción de CORPOCHIVOR

# Proyecto REDD+ Agrupado Jurisdicción de Corpochivor-Estándar VCS

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Esta publicación ha sido generada en el marco del Contrato para la Administración de Proyectos No.237–15, suscrito entre Corpochivor y South Pole Carbon Asset Management SAS, gracias a la cofinanciación del Fondo de Compensación Ambiental -FCA- del Ministerio de Ambiente y Desarrollo Sostenible en desarrollo del proyecto “Desarrollo de Estrategias de Gobernanza Forestal para la Gestión y Monitoreo de las Coberturas Boscosas de la Jurisdicción de CORPOCHIVOR”.

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Medellín, 14 de diciembre de 2017

**Revisión Técnica Corpochivor**

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**Cítese como:**

2017, Corporación Autónoma Regional de Chivor, Corpochivor; South Pole Carbon Asset Management SAS en consorcio con Centro de Investigación en Ecosistemas y Cambio Global -Carbono & Bosques; Esquema de Retribución por Servicios Ambientales (ERSA) para la gestión de los bosques y la conservación de las fuentes hídricas en la Jurisdicción de CORPOCHIVOR.



Garagoa-Boyacá
Colombia
2017

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# 1 Project Details

## 1.1. Summary Description of the Project

This project was developed under the rules required for Agriculture, forestry and Other Land Use (AFOLU) projects. The specific project category is Reducing Emissions from Deforestation and Degradation (REDD) with "Avoided Unplanned Deforestation & Degradation" (AUDD).

The project area is located in a region with agricultural vocation. This region has integrated traditional knowledge systems with vertical green economy. All of this related to a mountain topography with different heights that allowed developing a diversified food system, avoiding the development of enterprise market. The rural development has depended on the resilience of the communities given soil characteristics and climate, currently very degraded through the application of agrochemicals and agricultural monoculture model. This situation affects the sustainability of environmental supply and forces them to seek new productive areas, especially in areas highly fragile ecosystem [1].

The patterns of deforestation in the reference region and their associated agents and drivers are the expansion of agricultural activities, forest fires caused by slash and burn methods of land clearing and mining. In this sense, the main change that occurred in the jurisdiction of CORPOCHIVOR is the transition from forest cover to pasture and heterogeneous farmlands. In total, approximately 39% of deforested forests became pasture for cattle use; and 56% of the deforested area went to heterogenous farmlands. The project will implement measures in order to reduce the rate of deforestation, including the involvement and participation of deforestation agents in activities that enhance natural resource conservation.

According to the assessments, between the years 2010-2014 there was a slight decrease in the deforestation rate in the region. Despite this decrease, previous analyses and information gathered through surveys indicate that the agents and drivers of deforestation continue to be present in this area, and, therefore, the risk of deforestation has not disappeared. In addition, the peace agreement signed recently (2016) will influence the natural resources management and impact in the forest areas and ecosystem services, as it is expected an increase

[1] PGAR CORPOCHIVOR 2007 – 2019.

in the deforestation rate due to the return of the displaced people and even the colonization of new areas.

The flora and fauna of the reference region comprises a diverse set of ecosystems that includes the last remnants of the Colombian Andean forest and other major natural systems such as wetlands and *páramos*. Similarly, within the project area endemic, rare and migratory species have been reported. Diversity within the project area is high, however, each taxon is represented by a small number of individuals which reflects a low abundance[2].

The implementation of this REDD+ project seeks to protect threatened forests while at the same time conserving and improving the quality of the benefits that forests provide to the community. The continued provision of forest ecosystem services is directly and indirectly contingent on the exploitation of forested lands.

The project has a potential reduction of 49,857 tCO2e of GHG emissions in 30 years, with an average annual reduction of 1,662 tCO2e (for this first instance), through the implementation of activities to reduce deforestation and degradation in more than 937.19 ha of natural forests.

## 1.2. Sectoral Scope and Project Type

The project corresponds to VCS Sectoral Scope 14: Agriculture, forestry and Other Land Use (AFOLU) in the category of REDD Avoided Unplanned Deforestation and Degradation (AUDD). The project will use a programmatic approach (grouped project). The first instance includes thirteen (13) municipalities: Campohermoso, San Luis de Gaceno, Santa María, Chivor, Chinavita, Garagoa, Ciénega, Ramiriquí, Tibaná, Úmbita and Viracachá.

## 1.3. Project Proponent

| | |
|---|---|
| Organization name | Local Environmental Authority of Chivor (CORPOCHIVOR– Corporación Autónoma Regional de Chivor). |
| Contact person | Nestor Valero Fonseca |

[2] South Pole Group, 2016. Analysis of Ecosystem Services in the jurisdiction of CORPOCHIVOR using the InVEST program.

| | |
|---|---|
| Title | forestry Project Coordinator |
| Address | Carrera 5 No. 10 - 125<br>Garagoa - Boyacá (Colombia) |
| Telephone | Cel Phone: (+57) 312 4843658<br>PBX: (+57-8) 750 0771 Ext. 308 |
| Email | nestor.valero@corpochivor.gov.co |

## 1.4. Other Entities Involved in the Project

| | |
|---|---|
| Organization name | South Pole Carbon Asset Management Ltd. (South Pole) |
| Role | Project developer |
| Contact person | Victor David Giraldo |
| Title | Head of Implementation, forest and Land Use Projects |
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| Telephone | +57 4 352 4428 |
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## 1.5. Project Start Date

The first activity implemented by the project was *Education, training and strengthening citizen participation*. Through these activities the project is seeking that the community in the project area gain sense of property and management over their own territory and add value to their natural resources.

The workshop conducted on April 11, 2014 was attended by local leaders including the presidents of communitarian organizations in the project area (municipality of La Capilla). Supporting documentation for the start date can be found in the folder “Project start date”.

## 1.6. Project Crediting Period

The project crediting period is 30 years and 0 months. The start date of the crediting period is April 11, 2014 and the end date is April 11, 2044.

## 1.7. Project Scale and Estimated GHG Emission Reductions or Removals

| Project Scale | |
|---|---|
| Project | X |
| Large project | |

| Year | Estimated GHG emission reductions or removals (tCO2e) |
|---|---|
| 1 | 1,468 |
| 2 | 1,407 |
| 3 | 1,287 |
| 4 | 1,286 |
| 5 | 1,454 |
| 6 | 1,413 |
| 7 | 1,541 |
| 8 | 1,723 |
| 9 | 1,459 |
| 10 | 1,655 |
| 11 | 1,557 |
| 12 | 1,866 |
| 13 | 2,038 |
| 14 | 1,905 |

| Year | Estimated GHG emission reductions or removals (tCO2e) |
|---|---|
| 15 | 2,046 |
| 16 | 1,829 |
| 17 | 1,628 |
| 18 | 1,944 |
| 19 | 1,883 |
| 20 | 1,564 |
| 21 | 1,564 |
| 22 | 1,891 |
| 23 | 1,847 |
| 24 | 1,555 |
| 25 | 1,619 |
| 26 | 1,858 |
| 27 | 1,656 |
| 28 | 1,642 |
| 29 | 1,620 |
| 30 | 1,652 |
| **Total estimated ERs** | 49,857 |
| **Total number of crediting years** | 30 |
| **Average annual ERs** | 1,662 |

## 1.8. Description of the Project Activity

The activities proposed to avoid deforestation are presented in Table 1.

For the implementation of these activities the land owners will be linked to the project by conservation agreements signed between each of them and the

Project proponent. Their participation in the project is completely voluntary, through free, prior and informed consent.

The main responsibility of the land owners and the impacted community is to support the overall project monitoring. Given that this group of stakeholders has a permanent presence on the ground, with constant contact with the other stakeholders that can affect the forest. In this regard, it is critical for the project to maximize their participation in social spaces, workshops and training, to understand the operation of the communication channel and use it in an appropriate and timely manner. This will allow them to transmit the observations, suggestions and contributions from their vision, according to social and environmental problems.

On the other hand, as education, training, capacity and citizen participation move forward, it is expected that the community can actively participate in the monitoring of the project.

Additionally, other public or private actors will be engaged in the process by the allocation of and the creation of capacities or by supporting the trainings and local empowerment for the sustainability of the mitigation actions.

The project is not located within a jurisdiction covered by a jurisdictional REDD+ program.

**Table 1. Description of project activities.**

| Activity | Objective | Products | How climate, social and biodiversity expected benefits will be achieved? |
|---|---|---|---|
| Education, training and strengthening citizen participation | Strengthening environmental education and training, creating attitudes and behaviors that raise awareness among citizen participation in the conservation and protection of the environment and natural resources. | • Enjoyable and theoretical/practical workshops on issues related to the correct use of fertilizers, herbicides, potential pesticides, water management and biodiversity conservation, among others.<br>• Awareness-raising events on environment and culture.<br>• Assistance and support in the development and implementation of projects with emphasis on recognition of the land tenure. | The current economic growth and social development has negatively influenced the rampant use of natural resources.<br><br>Rural communities that depend directly on logging, either for expansion of their productive activities or for family support (extraction of firewood, medicines and food) have particularly limited access to quality education and environmental education which leads to a lack of awareness of the importance of its territory and natural resources.<br><br>The REDD + project is seeking that the people gain sense of property and management over their own territory and add value to their natural resources. Education activities will be aimed at empowering children, youth and community about the importance of conservation of biodiversity and forests for the enjoyment of future generations. Workshops and training will also be aimed at families of small, medium and large producers, whose activity depends on the direct land use within the territories prioritized criteria. |

| Activity | Objective | Products | How climate, social and biodiversity expected benefits will be achieved? |
|---|---|---|---|
| Conservation, restoration and sustainable management of strategic ecosystems and biodiversity | Develop activities which foster conservation, restoration, administration and sustainable management of strategic ecosystems and biodiversity existing in the selected municipalities for REDD + project through participatory processes and awareness. | • Reforestation for conservancy-productive purposes.<br>• Restoration of water sources and forest areas.<br>• Management of incentives for conservation.<br>• Protection of water sources and forest resources and isolation areas.<br>• Prioritize and declare regional strategic areas.<br>• Adopt management plans of protected areas declared by law.<br>• Handling disruptions measures between wildlife - domestic animals. | The planned reforestation activities will include native species as a priority. They will contribute to the recovery of ecosystems and improving biological corridors, to ensure the survival of endangered, endemic and migratory species. The support will consist of input distribution and execution of training and monitoring of the species planted, in order to ensure their permanence in each of the properties involved in the project. |

| Activity | Objective | Products | How climate, social and biodiversity expected benefits will be achieved? |
|---|---|---|---|
| Crops improvements | Improve crops and marketing (production chains), through the identification of crops that are within the preferences of the participants, in order to characterize their productivity and recognize the inputs, tools and yields. Improving crop seeds involves obtaining high yields, improve soil quality, reduce the amount of inputs used, promote the use of organic fertilizers, crop diversification and training of farmers, among others. | • Advice and environmental support.<br>• Establishment of agroforestry systems demonstration plots.<br>• Comparative productivity analysis of between the new implemented systems versus conventional systems. | It is expected the reduction of the agricultural frontier into forest areas. The activities aimed to maintain the size of the production area and improving the productivity. This activity seeks to promote a production that minimizes waste and increase quality of products, so that in this way can be included into a value chain that delivers economic benefits to the producer |

| Activity | Objective | Products | How climate, social and biodiversity expected benefits will be achieved? |
|---|---|---|---|
| | Promote proper land management by implementing agroforestry systems in the thirteen municipalities that are part of the project area for the first instance. | | |
| Home vegetable gardens | Promote food security with the implementation and use of complementary food systems. | • Advice and support on nutritional value and food preparation.<br>• Implementation of family vegetable gardens with focus on food sovereignty. | The project seeks to implement agroecological family gardens, with family basic agricultural products consumption, including tubers, vegetables, herbs and fruit, to meet basic household food needs. Also, it is intended that people reduce their dependence on regional markets for staple foods with the aim of being able to secure a healthy and balanced diet in their homes. At the same time, they can save money while conserving and managing sustainably forests. |
| Silvopastoral systems | Promote proper management of land dedicated to livestock through the | • Promote proper management of land dedicated to livestock through the | Extensive livestock farming has become the main cause of deforestation within the municipalities that are part of the REDD + project. This is because this type of farming processes involve expansion into forest areas, |

| Activity | Objective | Products | How climate, social and biodiversity expected benefits will be achieved? |
|---|---|---|---|
| | implementation of low impact systems. | implementation of low impact systems.<br>• Establishment of silvopastoral systems. | which are usually located in the highlands of the Andes mountains and even in areas of sub paramo ecosystem.<br><br>The development of livestock in areas suitable for forestry implies that cattle pastures count with low quality in their protein content. This situation results in decreased supply of pasture and the displacement of livestock to unproductive areas, usually called "stubble" or wooded areas.<br><br>Improved pastures in association with the establishment of forest species, as part of a silvopastoral system, involves obtaining a greater supply of high quality pasture in a smaller area. Higher productivity per unit area results in a better fed cattle. The selling price in the market could be significantly larger and capable of generating additional income to the producer. These systems allow the conservation of forest territories and hence carbon content, while the farmer operates in a sustainable manner. |
| Ecotourism | Create an alternative sustainable development through | • Implementation and / or improvement of | Ecotourism can be an economic alternative for those owners who own forests and natural landscapes therefore scenic appeal should be preserved as they |

| Activity | Objective | Products | How climate, social and biodiversity expected benefits will be achieved? |
|---|---|---|---|
| | the strengthening of ecotourism activities. | ecological trails in municipalities.<br>• Training of the service providers on trail functionality | can become tourist attractions. Owners who wish to develop this activity should consider their scope must be conservation and sustainable management of natural resources within their farms. Thus, the entrance to the public will be allowed to promote the enjoyment of the natural sites. This entry should involve basic restrictions for conservation sites (forestry use, hunting and agricultural development of high-impact activities)<br><br>As part of the REDD + project, owners who want to run this activity will receive incentives, advice and training related to sustainable tourism. They will also take into account the legal implications and use restrictions associated with the development of ecotourism. |
| Cookstoves | Reduce degradation of the forests within the jurisdiction through the establishment of improved cookstoves. | Establishment of improved cookstoves taking into account the selection criteria described by CORPOCHIVOR. | The establishment of improved cookstoves will contribute to reduce the number of people with lung diseases, eye disorders and other cardio-respiratory diseases derived from the use of firewood to cook. This represents an improvement in housing as well, by reducing pollution in the kitchen because of the smoke and micro-particles. |

| Activity | Objective | Products | How climate, social and biodiversity expected benefits will be achieved? |
|---|---|---|---|
| | | | Finally, it is expected to improve climate impacts through reduced consumption of firewood, and therefore the pressure on the remaining forests will be reduced. This will contribute to reducing $CO_2$ emissions to the atmosphere. |

In addition to the activities described, Corpochivor has identified the following measures to encourage and facilitate owners participating in the project:

- *Advice concerning the procedure to clean up the land tenure*: In the department of Boyacá 70% of rural properties have some character of informality or adverse possession and that causes those who acquire these areas not having access to state services (financial, public and institutional). Therefore, the project supports owners interested in participating in obtaining legal title to their land. This activity would also have a great effect on the community in terms of entrenchment and governance over its territory and its capital strength on production and development.

- *Counseling about the reduction on taxes in forested areas:* These procedures take into account that the owner is not making productive activities in these areas but they are protecting it. This could generate a great positive impact, as farmers are generally encouraged to deforest if low productivity of the land does not allow them to realize profit expectations. However, this measure is subject to approval by the City Council and the municipal administration of each municipality.

## 1.9. Project Location

### 1.9.1. Reference Region

The "Corporaciones Autónomas Regionales y de Desarrollo Sostenible" (CAR, Autonomous Regional and Sustainable Development Corporations) are self-governing public entities integrated with local authorities which form geopolitical, biogeographic, or hydrogeographic governance units. They are charged with administrating the environment and renewable and non-renewable natural resources, as well as promoting the sustainable development of the areas under their jurisdiction (Artículo 23 ley 99 de 1993 / Article 23 of Law 99 of 1993).

Regional environmental planning allows for concerted and coordinated management, administration, and use of natural renewable resources. Such organization facilitates short, medium, and long-term approaches to alternative, sustainable development compatible with the biophysical, economic, social, and cultural character of each territory.

The Ministerio de Ambiente y Desarrollo Sostenible (MADS, Ministry of the Environment and Sustainable Development), based on its duties and powers as established by law (Lay 99 de 1993 / Law 99 of 1993), directs and coordinates the planning and implementation activities of the entities that compose the Sistema Nacional Ambiental (SINA, National Environmental System), which includes the CARs.

The Reference Region is the area under the authority and scope of the Corporación Autónoma Regional de Chivor (CORPOCHIVOR, Local Environmental Authority of Chivor). The Reference Region limits are presented in **Figure 1**. This area contains the following twenty-five municipalities that compose the district: Almeida, Boyacá, Campohermoso, Chinavita, Chivor, Ciénega, Garagoa, Guayatá, Guateque, Jenesano, La Capilla, Macanal, Nuevo Colón, Pachavita, Ramiriquí, Santa María, San Luis de Gaceno, Somondoco, Sutatenza, Tibaná, Tenza, Turmequé, Umbita, Virachá, and Ventaquemada.


**Figure 1. Reference Region location.**



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### 1.9.2. Project Area – First instance

The first instance of the grouped project has been defined. In the coming years, new instances will be defined with their exact locations incorporated into the description of this study area.

In agreement with the methodology VM0015, for the first project instance (I), the Project Area corresponds to the total area of publicly and privately held forests under legal land tenure status (Figure 2). The total Project Area for the first instance contains 937.19 hectares.

The database of the actual land owners engaged in the project and the polygons with their geographic coordinates are available in the folder Project Boundary file: BD Beneficiarios_Finales. Also, the kml file is included in the supporting documentation.

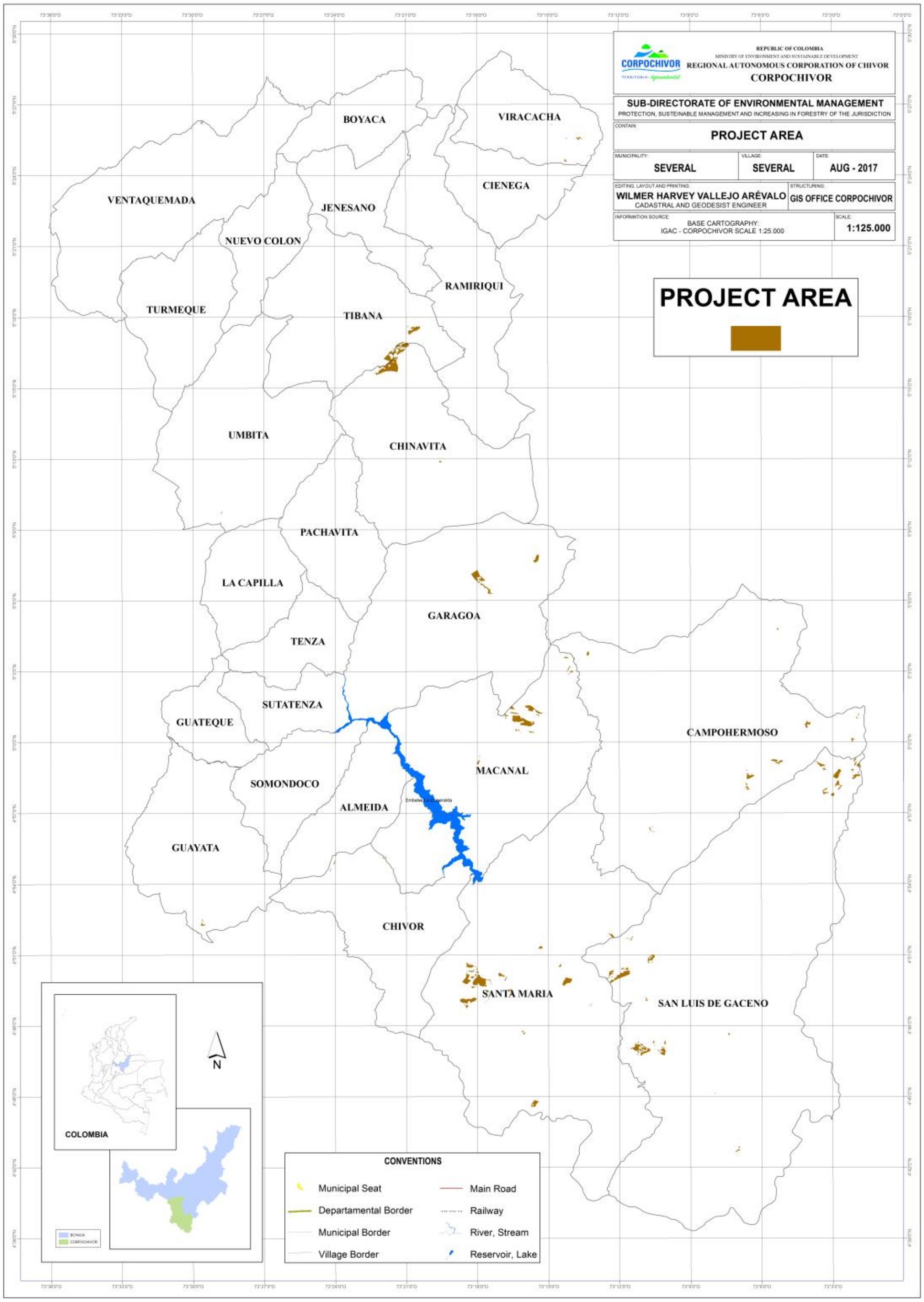



**Figure 2. First instance project area.**

## 1.10. Conditions Prior to Project Initiation

### 1.10.1. Project physical parameters

Table 2 is the general description of the physical characteristics of the project area. The description of the physical characteristics of the 25 municipalities is detailed in the PGOF, Chapter III Characterization General CORPOCHIVOR[3]. Table 3 and Table 4 are the general description of the climate characteristics of the first Instance.

**Table 2. General description of the physical characteristics of expansion of the project area (jurisdiction of Corpochivor)[4].**

| Physical parameters | Description |
|---|---|
| Hydrography | The region is bounded by the watersheds of rivers Garagoa, Súnuba, Guavio, Lengupa and Upía. The Garagoa and Súnuba rivers join to form the La Esmeralda Dam, which is part of Chivor hydroelectric system. These same waters are important tributaries of Upía River, which flows into the Meta river that finally brings its waters into the Basin of the Colombian Orinoco. In total the project area has 22 sub-basins, 265 micro-basins and 5 macro-basins (See Figure 3). |
| Topography | The topography of the area comprises rolling and steep, with heights ranging from 300 m reliefs, in the municipality of San Luis de Gaceno, to 3,500 meters above sea level in the municipalities of Viracachá and Ventaquemada. |

[3] *Supporting document PGOF*: MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, ENVIRONMENTAL & COMPENSATION FUND REGIONAL AUTONOMOUS CORPORATION CHIVOR-CORPOCHIVOR. 2013. General forest Management Plan -PGOF- Chapter III: Characterization General Jurisdiction of CORPOCHIVOR.

[4] This table was created using information from the following sources:

- Regional Autonomous Corporation of Chivor, CORPOCHIVOR. 2010. Atlas Geographic and Environmental CORPOCHIVOR.
- MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, ENVIRONMENTAL & COMPENSATION FUND REGIONAL AUTONOMOUS CORPORATION CHIVOR-CORPOCHIVOR. 2013. General forest Management Plan -PGOF- Chapter III: Characterization General Jurisdiction of CORPOCHIVOR.

| Physical parameters | Description |
|---|---|
| Temperature | Ranging from -8°C and 25°C. |
| Life zones | Within the jurisdiction of the project there are 11 life zones according to Holdridge: tropical humid forest, very humid tropical forest, montane rain forest, montane wet forest, montane dry forest low, low montane rain forest, lower montane wet forest humid montane, montane wet forest and montane rain forest (Figure 4) |
| Geomorphology | Two physiographic zones are presented: a zone of undulating topography, located in areas where outcrops of little consistency and whose heights range between 600 and 2,600 m.a.s.l area and some large cliffs with heights up to 3,600 m.a.s.l. formed by resistant rocks. |
| Soils | Map of soil associations in the municipalities of the jurisdiction of CORPOCHIVOR is presented in **Figure 5**.<br>• Association Typic Hapludands - Andic Dystrudepts – Typic Dystrudepts. MKV symbol (of Andisols and Inceptisols orders). They are located in relief beams, hills and glacis, moderately to strongly broken and moderately steep topography, slopes between 12 and 75%; source rock type gneiss, schist, limestone and, in many sectors, by layers of volcanic ash. In some areas accumulation of rock fragments on the surface occurs, as removal processes occurring in mass as landslides, solifluction and creep.<br>• Complex Lithic Udorthents – Typic Dystrudepts – Rocky outcrops. Symbol MLE (of Entisoles and Inceptisols orders). They are located in some municipalities in the province of Márquez, at altitudes ranging between 2000 and 2500 m.a.s.l. with reliefs in homoclinales ridges and outcrops, composed of interbedded sandstones and limestones and shales and in small areas, no presence of volcanic ash. The topography is moderately to strongly steep, slopes above 50%. Mass movements are manifested as landslides, rock falls and creep. |

| Physical parameters | Description |
|---|---|
| | • Complex Lithic Ustorthents – Humic Dystrustepts – Rocky outcrops. Symbol MME (of Entisoles and Inceptisols orders). The areas of these soils are found in the province of Marquez, especially in the municipalities of Turmequé, and Nuevo Colón, at an altitude of 2000-3000 meters. These areas correspond to homoclinales steeps ridge mainly to steep ridges and outcrops homoclinales moderate to strongly steep with slopes greater than 50%; has its origin from sedimentary rocks, siltstones, sandstones and shales, with inclusions of metamorphic rocks and volcanic ash layers. Landslides and rock sectors.<br>• Association Oxic Dystrudepts - Lithic Udorthents – Lithic Dystrudepts. Symbol MPE (Entisoles and Inceptisols orders). This unit is in reliefs of ridges and homoclinales crestones, located in the province of Neira and East, especially in the municipalities of Guateque, Tenza, Garagoa, Almeida, Guayatá, Chapel, Santa Maria and Sutatenza at altitudes between 1000 and 2000 meters. The soils have developed from sedimentary rocks (shales, shales and sandstones) and metamorphic (phyllites); are located in relief's homoclinales steep ridges and outcroppings homoclinales, moderately to strongly steep, with slopes greater than 50%. They are affected by movements (landslides), by the presence of rock fragments on the surface of the soil in the valleys, creeping up and solifluction widespread in many sectors. The forest cover occupies much of the study area, and the lowest proportion is occupied by pasture land.<br>• Complex Andic Dystrudepts – Humic Dystrudepts – Typic Placudands. Symbol AHE. The soils of this association are in the Center province, municipality of Ventaquemada between 3000 and 3200 m.a.s.l. The soils have been originated from clastic sedimentary rocks silty clay and sandstone, coated in large sectors with volcanic ash. The type of relief is homoclinales crestones, with slopes greater than |

| Physical parameters | Description |
|---|---|
| | 50%. lower slopes with no accumulation of rock fragments on the surface.<br>• Association Melanudands – Humic Dystrudepts – Typic Hapludands. AHV symbol (of Andisols and Inceptisols orders). The soils of this association are located in the Center province, municipality of Ventaquemada at a higher altitude 3000 m. The soils have been originated from surface deposits of volcanic ash and sedimentary rocks in relief types of hills and glacis. They have strongly undulating topography to slightly steep, with slopes 12-25% and 25-50%, being affected by mass movements, especially solifluction.<br>• Association Typic Udifluvents - Fluvaquentic Endoaquepts – Typic Udipsamments. VUK symbol (of Entisoles and Inceptisols orders). The Association is presented in the provinces of Neira and Lengupa, especially in the municipalities of San Luis de Gaceno and Campohermoso at an altitude of 400 meters. They are located in an alluvial terrace aggradational (recent terrace), originating from surface hydrogen clastic deposits, mixed, transported by the river Upía. The topography is slightly flat, with slopes 1-3%; some sectors are affected by rock fragments on the surface and within the profile. |
| Suitability of the soils | In the jurisdiction of CORPOCHIVOR, there is a wide variety of soils; the most fertile are located in the municipalities of Ventaquemada, Turmequé, New Columbus, Cienega, Úmbita, Ramiriquí and Jenesano, ie, those that are located in areas of flat and slightly sloping topography; medium fertility soils are located in the municipalities of Boyacá, Viracachá, Tibana, Chinavita, Garagoa, Pachavita, La Capilla Tenza, Sutatenza, Somondoco, Almeida, Guayatá, Guateque, Macanal, Chivor and Campohermoso; and low agricultural capacity is located in the municipalities of Santa Maria and San Luis de Gaceno. |


**Figure 3. Hydrography in the area of expansion of grouped project**

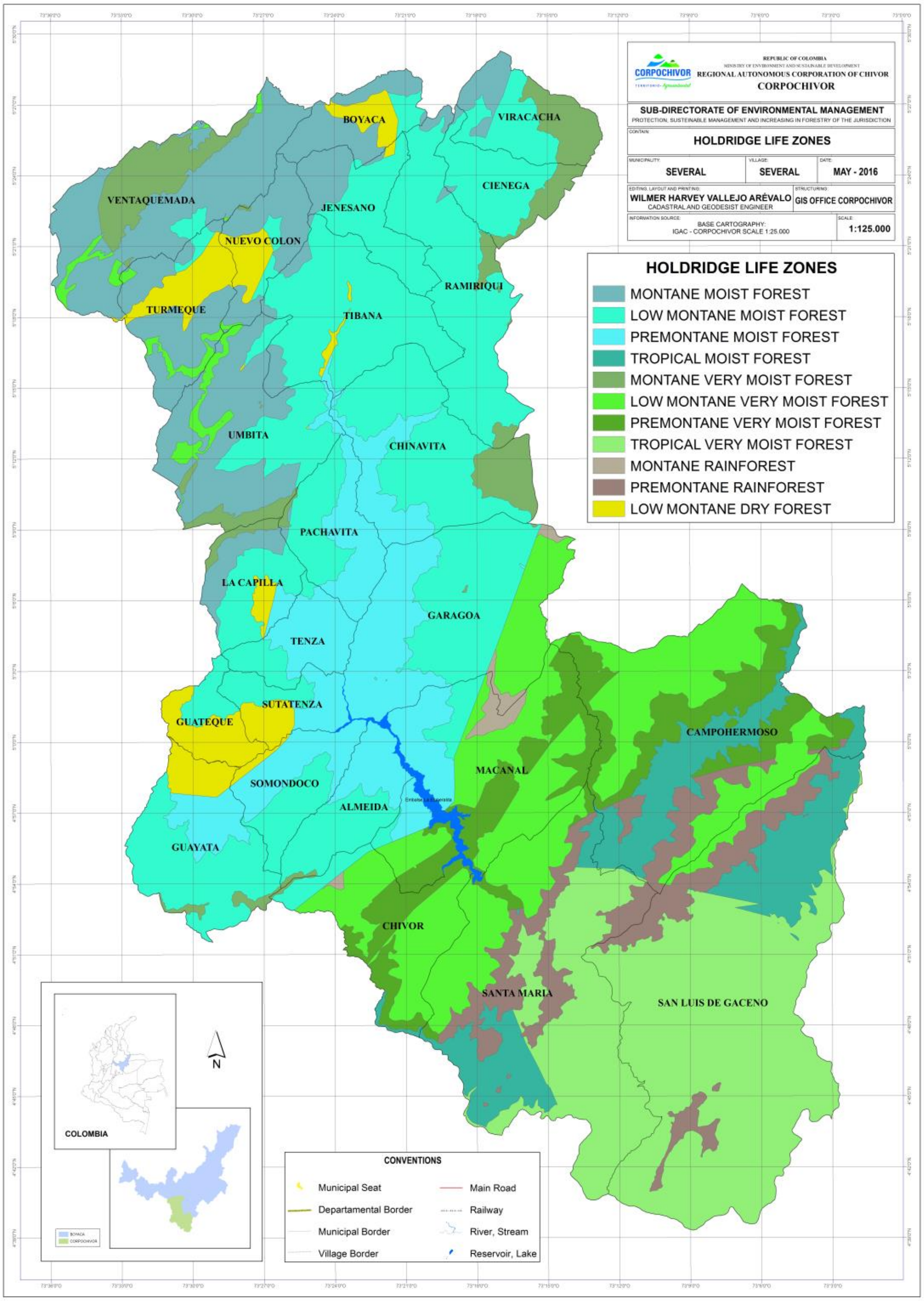



**Figure 4. Life zones in the area of expansion of grouped project**

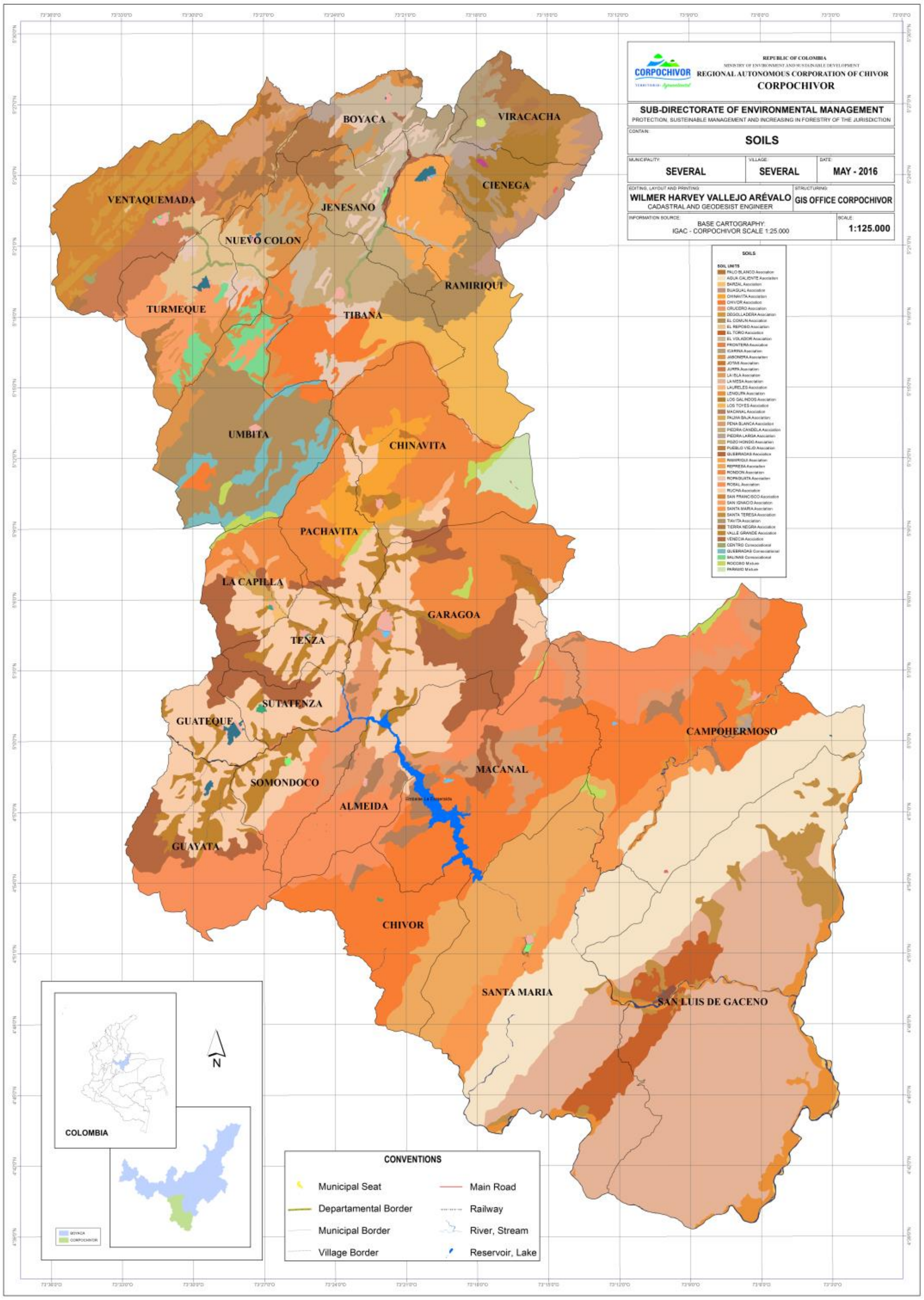



**Figure 5. Map of soil associations in the municipalities of the jurisdiction of CORPOCHIVOR.**

**Table 3. Climate of the municipalities of the first instance.**

| Municipality | Climate |
|---|---|
| **Campohermoso** | The annual average precipitation is 3,180 mm, with a variation between 2,050 and 4,040 mm depending on the altitude. The rainy period spans from March to October. The annual average temperature is 21 °C. The municipality is classified as wet premontane forest, according to Holdridge. |
| **Chinavita** | The annual precipitation is 1,600 mm and their distribution is mono-modal type. The annual average temperature is 17°C. The municipality is located between 1,900 and 2,150 meters. This municipality has very humid to semi-humid climate according to the biophysical conditions. |
| **Chivor** | The average annual precipitation is 2,900 mm. It has an average annual temperature of 18.2°C. According to Holdridge and taking into account the distribution of the height, the municipality has two types of climatic zones: very humid forest montane low and wet forest premontane. |
| **Ciénega** | The annual average precipitation is 1,509 mm. It has an average annual temperature of 16.4°C. According to Holdridge and taking into account the distribution of the height, the municipality has four bioclimatic units: lower montane rainforest, lower montane dry forest, lower montane rainforest and rain Sub-Andean paramo. |
| **Garagoa** | The annual average precipitation of this municipality is 1,664 mm. It has an average annual temperature of 17.7°C. According to Holdridge and taking into account the distribution of the height, the municipality has four bioclimatic units: humid forest montane low, low montane wet forest, wet forest and wet forest premontane montane. |
| **Macanal** | The annual average precipitation in this municipality is 2,054 mm. The annual average temperature of the municipality of Macanal is 17.3°C. Four types of climates are present: damp cold (at altitudes between 2,000 and 3,000 m.a.s.l, temperatures |

| Municipality | Climate |
|---|---|
| | between 12°C and 18°C and precipitations between 1000 and 2000 mm); very wet cold (at altitudes between 1900 and 2900 m.a.s.l, temperatures between 12°C and 18°C and precipitations between 2000 and 3000 mm); temperate humid (at altitudes between 1000 and 2000 meters above sea level, temperatures between 18°C and 24°C and precipitation between 1000 and 2000 mm) and temperate very humid (at altitudes between 1000 and 2000 meters above sea level, temperatures between 18 ° C and 24 ° C and precipitations between 2000 and 4000 mm). |
| **San Luis de Gaceno** | The annual average precipitation is 4,026 mm, and their distribution is a mono-modal type. The monthly average temperature is 23°C with a maximum temperature of 25°C. The life zones present in the municipality according to Holdridge are humid tropical forest and humid premontane forest. |
| **Santa María** | The annual average precipitation is 4,890 mm, and their distribution is a mono-modal type. The monthly average temperature ranges between 22.9°C and 26.5°C. The life zones present in the municipality according to Holdridge are humid premontane forest and rain premontane forest. |
| **Tibaná** | The spatial distribution of precipitation is a bimodal type with abundant precipitation between May and August with a maximum centered on July and a dry period at the end and the beginning of the year. The average annual precipitation in the municipality is 933 mm. Tibana has two types of climate: wet cold (present at altitudes between 2,000 and 3,000 m.a.s.l), and with humidity index of 60 and 100% and Cold dry (at altitudes between 2,000 and 3,000 m.a.s.l, with an average temperature 12°C and 18°C) and with a humidity index between 20 and 60%. |
| **Umbita** | The annual average precipitation is 1064.1 mm. It has an annual average temperature of 14.3°C. According to Holdridge and taking into account the distribution of the height, the municipality has four bioclimatic units: humid montane forest, montane rain forest Low, moist montane forest and Andean paramo. |

| Municipality | Climate |
|---|---|
| **Viracacha** | The annual average precipitation is 1981.2 mm. It has an annual average temperature of 16.1°C. According to Holdridge and taking into account the distribution of the height, the municipality has four bioclimatic units: low humid montane forest, montane wet forest and lower montane dry forest and montane wet forest. |

**Table 4. Hydrogeology and hydrography of the first instance.**

| Parameter | Description |
|---|---|
| Hydrogeology | In the project region there is a high presence infiltration of rainwater areas. These areas have significant amounts of surface water and areas of high potential for the development of projects using groundwater, especially in the municipalities of Cienega, Ramiriquí, Tibana, Úmbita and Viracachá, belonging to the province of Marquez. In this province, there are highly productive aquifers.<br><br>In contrast, in the municipalities of Garagoa, Chinavita, Macanal, Chivor, Guayata and La Capilla, aquicludes exist in a large percentage of the area, which are not suitable for the use of groundwater. Currently, most of the water used is taken from surface sources; however, in some municipalities in the province of Marquez this resource is scarce, especially during the dry season, so communities have seen the need to make use of other sources of supply such as drilling wells. |
| Hydrography | The project area of the first instance is part of a network consisting of 4 water pipes, 420 water gorges and 9 rivers. It should be noted that the Garagoa River is the largest basin of the jurisdiction, covering 60.71% of the total area. This area is organized through joint commission with the Local Environmental Authority of Chivor (CORPOCHIVOR), the Autonomous Regional Corporation of Boyacá (CORPOBOYACÁ) and the Autonomous Regional Corporation of Cundinamarca (CAR) from 1$^{st}$ September 2006.<br><br>The river Garagoa begins in the Rabanal paramo, on the border of the municipalities of Samacá and Ventaquemada; it receives waters of the Juyasia, Albarracín or Turmequé, Forest, Súnuba and Fusavita |

| Parameter | Description |
|---|---|
| | rivers. All the water of this basin is deposited in the reservoir of La Esmeralda, which is used for the generation of electricity in the Chivor hydroelectric plant. This plant provides the country with 8% of its total energy consumption. |

### 1.10.2. Current land cover

The predominant land cover is pasture comprising 43.71% of the region. Forested areas are the third largest land cover with a considerably smaller share (19.87%). Forested land is mainly located in the highlands of the municipalities of Garagoa, Ciénega, Viracachá and San Cayetano in the municipality of Guayatá, Negra in Chivor and Santa Maria, Guaneque in Macanal and Santa Maria, Calichana in Santa Maria, Buenavista in Campohermoso and San Agustin in Campohermoso and San Luis de Gaceno[5].

Santa Maria, Campohermoso and San Luis de Gaceno, have an area of 33,149 hectares of forested land, comprising 54% of the natural forests of the jurisdiction (See Figure 6)[6].

[5] MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, ENVIRONMENTAL & COMPENSATION FUND REGIONAL AUTONOMOUS CORPORATION CHIVOR-CORPOCHIVOR. 2013. General forest Management Plan -PGOF- Chapter III: Characterization General Jurisdiction of CORPOCHIVOR.

[6] MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, ENVIRONMENTAL & COMPENSATION FUND REGIONAL AUTONOMOUS CORPORATION CHIVOR-CORPOCHIVOR. 2015. Identification of "hotspots" in deforestation and implementing strategies under the REDD + scheme, in forest ecosystems of the jurisdiction of CORPOCHIVOR.

**Table 5. Land cover of the expansion of the area in Jurisdiction of CORPOCHIVOR 2014[7].**

| Land Cover IPCC | Area (ha) | Percentage | Description according to CLC categories[8]. |
|---|---|---|---|
| Grassland | 135,529.60 | 43.71% | Pastures |
| Heterogeneous farmland | 69,737.48 | 22.49% | Mosaic of pastures and crops. In the Figure 6 is presented as other lands. |
| Forest land | 61,608.84 | 19.87% | Forest |
| Cropland | 24,100.21 | 7.77% | Crops |
| No data | 15,135.6 | 4.88% | - |
| Other lands | 3,981.12 | 1.28% | Presented in Figure 6 as settlements, water bodies and rivers. |
| Total | **310,092.86** | **100%** | **-** |

[7] Corporación Autónoma Regional de Chivor - CORPOCHIVOR. 2014. Generación de mapa de uso y cobertura corine land cover IPCC. Informe Técnico Metodológico. See supporting document [Anexo_met15/Methodology_land use]
[8] National legend of the land cover of Colombia, scale 1: 100,000, according to the methodology Corine (Coordination of Information on the Environmental) Land Cover, adapted for the country. Jointly by IDEAM, IGAC, Sinchi, IAvH and UAESPNN, with the collaboration of ASOCARS, INVEMAR, Pedagogical and Technological University of Colombia and CORMACARENA.

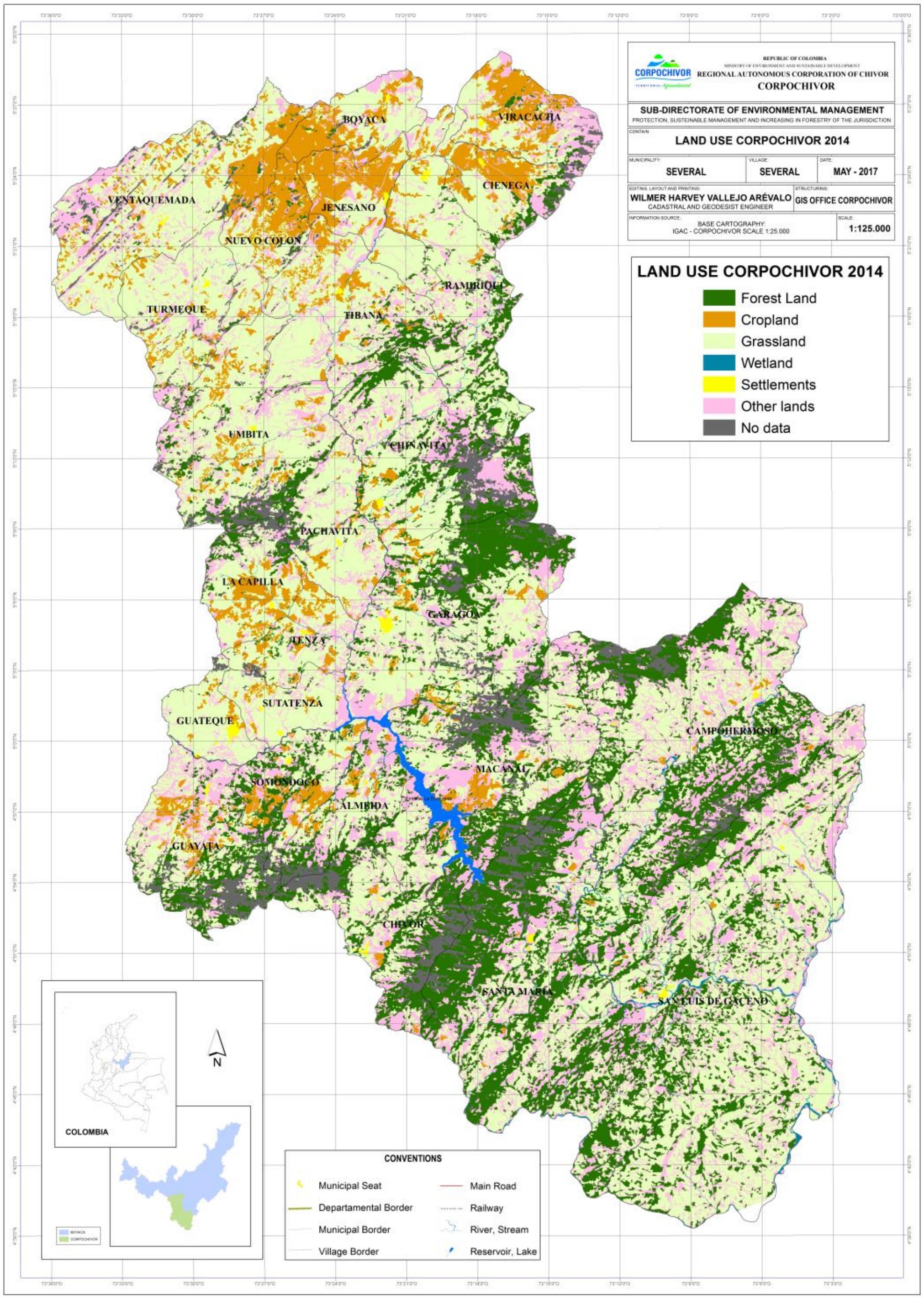



**Figure 6. Land cover of the expansion of the area of the project. Other lands, Heterogenous farmland; wetland and settlements, other lands.**

### 1.10.3. Description of biodiversity within the reference region

Andean forest ecosystem provides the enabling environment for the establishment of epiphytic species such as bromeliads, orchids and fungi. In the high Andean forests the most abundant species are the *Tuno* (Miconia sp.), followed by *Cedrillo* (Brunellia sp.), *Granizo* (Hedyosmum sp.), *Gaque* (Clusia sp.), *Encenillo* (Weinmannia sp.) and *Escobo* (Alchornea sp.). The most abundant species in the sub-Andean forest are *Tuno* (Miconia sp.), *Colorado* (Hieronyma sp.), *Cedrillo* (Guarea sp.), *Escobo* (Alchornea sp.), *Guamo* (Inga sp.), *Chizo* (Myrcia sp.), *Amarillo* (Ocotea sp.), *Amarillo oloroso* (Aniba sp.) and *Manzano* (Clethra sp.), among others.

A detailed description of the biodiversity in the project area is presented in sections B1.2 and B1.2 of the CCB-PDD.

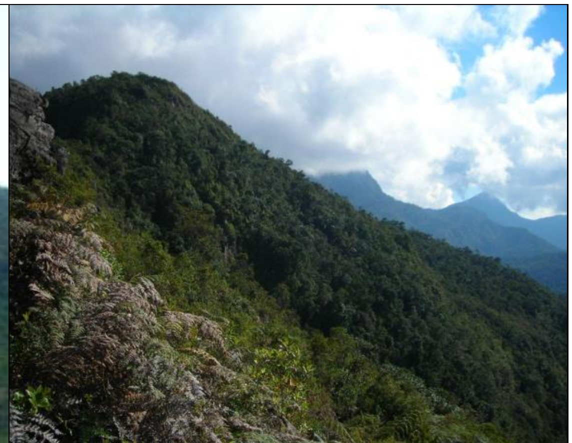
### 1.10.4. Types and condition of vegetation within the reference region

In the jurisdiction of CORPOCHIVOR there are paramo ecosystems, Andean forest (High Andean, Andean and sub-Andean) and Piedemont forest containing samples of flora and fauna of great importance.

The paramo ecosystem present within the jurisdiction of the project are mentioned below:

- Rabanal paramo located in the municipality of Ventaquemada;
- Bijagual paramo located in the municipalities of Ciénega, Ramiriquí, Tibaná and Viracachá;
- *Serranía de Mamapacha* located in the municipalities of Garagoa, Chinavita Tibaná and Ramiriquí;
- Castillejo paramo located in the municipalities of Turmequé and Úmbita;
- Cristales paramo located in the municipalities of Pachavita, Úmbita and La Capilla.

To describe the types of forest in the jurisdiction of CORPOCHIVOR, a physiognomic and physiographic classification of forests with notes on the floristic[9] composition was used. In total, there are 10 types of forest that describe in general terms the vegetation in the region expansion project.

| | |
|---|---|
|  |  |
| **Accessible forest hills.** Undisturbed forest, species heterogeneous. Trees have large variation in size and height; slopes between 25 and 50%. | **Forested hills.** Non accessible forest hills. It develops on steep slopes that are difficult to access and with cover discontinuity at the tops |
|  |  |
| **Forest on mountain ranges.** Forest with stunted and malformed trees, growing on slopes of ridges and hills | **Forest on the slope of the mountain.** Forest with trees of different diameters growing on the slopes of mountains with slopes less than 50%. In some cases a |

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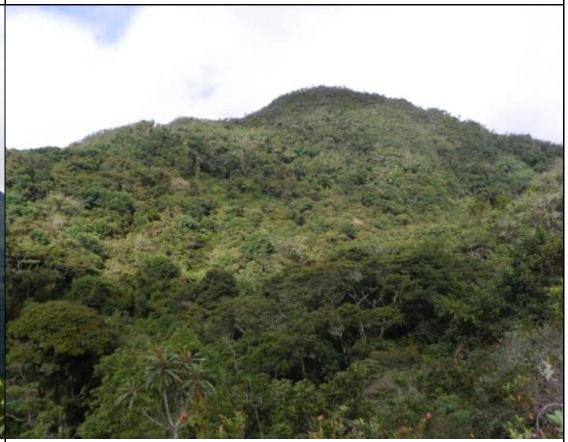
9 Classification used in the PGOF, following the methodology of Rangel, J. O., Lowy, P. D., Aguilar, M. Garzon, A. "Types of Vegetation in Colombia, a better knowledge of the phytosociological, Fitoecológica Terminology and Common Use". Editorial Guadalupe Ltda. 1997. 436 p.

| | |
|---|---|
| with steep slopes with inclination greater than 75%. | tendency to homogeneity in species according to certain climatic regimes is observed. |
|  |  |
| **Foothill forest.** Vegetation type considered as a transition forest between the forest of the Mountain range and the Savanna. | **Mountain forest.** Subtropical forest and temperate zone forest (Cloud forest). The lower altitudinal limit of subtropical climate is determined by the height of the condensation while the upper altitudinal limit of temperate forest is influenced by the tree growth critical temperature. |
|  |  |
| **Foothills forest.** Highly disturbed. Nowadays, most of the forest has been deforested and has been transformed into large areas of crops and improved pasture grass, in some sectors | **Foothill forest on a mountain chain.** Highly disturbed. Remaining forest grows on slopes of mountain ranges, with slopes greater than 50%. |

| | |
|---|---|
| pastures. It is characterized by being hydrophilic. | |
|  |  |
| **Forest on the escarpments of the mountain chain.** Forests unsuitable for logging. Grows on shallow soils, steep slopes susceptible to erosion. They are considered as typical forest for conservation. | In the foreground, **paramo graminoid vegetation**. It occurs in adjacent areas to forests on the escarpments of the mountain chain, at heights more than 3000 m. |

**Figure 7. Types of forest in the project expansion area.**

## 1.11. Compliance with Laws, Statutes and Other Regulatory Frameworks

The national and sectoral policies relevant to this project are those derived from laws pertaining to natural resources and forestry activities. These laws have direct implications on the land use and forestry activities proposed in this project. These laws are summarized in Table 6.

**Table 6. National, sectoral, and regional policies related with project activities.**

| **National Policies** | |
|---|---|
| National forest Policy<br><br>*Política Nacional de Forests* | It aims to achieve sustainable forest use, with the end of conserving this resource, further incorporating the forestry sector into the national economy, and |

| National Policies | |
|---|---|
| (CONPES Document No. 2834 of 1996) | contributing to the improved quality of life of the population.<br><br>The project aims to create awareness and opportunities for the community, to encourage them to the preservation of the natural resources while improve the production areas (productive protection areas according to the PGOF) for wood supply. |
| Law 164 of 1994<br><br>*Ley 164 de 1994*<br><br>Ratification of the UNFCCC | Decision 1/CP16: the parties adopt measures to reduce emissions that result from the deforestation and degradation of forests.<br><br>This project is in line with the regulation, because it is a measure to avoid the deforestation and degradation of forests in the region. |
| Law 99 of 1993<br><br>*Ley 99 de 1993*<br><br>Establishment of the National Environmental System (*Sistema Nacional Ambiental*)<br><br>MADS delimitation of páramos (Resolution 937 of 2011). | Declares that paramo, sub-paramo, headwaters, and aquifer recharge zones shall be given special protection.<br><br>The project uses this delimitation in order to protect the strategic ecosystems and HCV identified. The project activities are not implemented or promoted on these areas.<br><br>The hydric resources and the paramos are also the core of the project. Therefore, is a priority for the project the protection and inclusion of these areas and the community associated to these ecosystems. |
| Law 629 of 2000<br><br>*Ley 629 de 2000* | Establishes methods for the formulation of national and regional programs to improve the scientific and technical knowledge concerning emissions for incorporation into national emissions inventories; formulate programs aimed at mitigating climate change and adapting to its effects; and create environmentally rational actors with regard to climate change, among other ends. |

| National Policies | |
|---|---|
| | All the information generated in the monitoring will be available for public consultations in the standards websites. Besides, contributing to the processes at regional and national level regarding to climate change issues is a priority for the project proponent. |
| Institutional Strategy for the Articulation of Climate Change Policies and Actions in Colombia<br><br>*Estrategia institucional para la articulación de políticas y acciones en materia de cambio climático en Colombia*<br><br>(CONPES Document 3700 of 2011) | Constructing an interdepartmental coordination scheme that facilitates and foments the formation and implementation of policies, plans, programs, methodologies, incentives, and projects to address climate change, resulting in the consideration of climate as a determining factor for the design of development projects.<br><br>The project design in line with the standards for the voluntary carbon markets enables the articulation to other initiatives at regional or national level. |
| Colombia Low Carbon Development Strategy<br><br>*Estrategia Colombiana de Desarrollo Low en Carbono*<br><br>2012 | Planning program for short, medium, and long-term development, aimed at decoupling national economic growth from increasing greenhouse gas emissions (GHG). To be achieved through the design and implantation of plans, projects, and policies that simultaneously mitigate GHGs and strengthen the social and economic growth of the country while complying with global standards for efficiency, competition, and environmental performance.<br><br>The project complies with this strategy through the design of activities that simultaneously mitigate GHGs and strengthen the social and economic growth of the Corpochivor´s jurisdiction. |
| REDD+ Strategy, as provided for in the National Development | The project is a REDD+ project with the ends of reducing GHG emissions, decreasing deforestation and degradation of the forests, and to preserve and augment |

| National Policies | |
|---|---|
| Plan (*Plan Nacional de Desarrollo*) | carbon reserves through sustainable forest management. |
| National Climate Change Adaptation Plan<br><br>*Plan Nacional de Adaptación al Cambio Climático*<br><br>(PNACC, 2012) | Seeks to reduce the vulnerability of the country and its people to climate change and increase the nation's capacity to respond when faced with its threats and impacts.<br><br>The project is implementing activities associated not only to mitigation but also to adaptation measures (see PD CCB). |

| Sectoral Policies | |
|---|---|
| Strategic forest Restoration and Implementation Plan for Colombia – Green Plan<br><br>*Plan estratégico para la restauración y la implementación de Forests Colombia - Plan Verde*<br><br>1998 | Seeks to generate a basis for the inclusion of commercial forest restoration and agroforestry into environmental land management.<br><br>The promotion of commercial forest restoration and agroforestry are part of the project activities in order to reduce the pressure on the natural forests |
| **Local Policies** | |
| *Board of Directors Agreement No. 16 (27 November 2013)* | Adopts the General Forest Management Plan (*Plan General de Ordenación forestal-PGOF)* for the jurisdiction of the Autonomous Corporation of Chivor - CORPOCHIVOR *(Corporación Autónoma Regional del Chivor)*. The PGOF is the Corporation's basic tool for the administration for natural forests and lands suitable for forestry in the Jurisdiction, the creation of forest management plans and silviculture implementation, and |

| Sectoral Policies | |
|---|---|
| | the power to make decisions concerning their use and exploitation.<br><br>All the intervention strategy inside the properties of the project area will be based in the agreements and the zoning guidelines set in the PGOF. |
| *Internal Resolution No. 01084 of 2002* | Establishes the charge to create a single, national transport permit for primary forest plantation products and species/specimens of importance to biological diversity, and fixes the payment and issuance schedule for said permits.<br><br>The project aims to create awareness and opportunities for the community, to encourage them to the preservation of the natural resources while improve the production areas for wood supply. |

## 1.12. Ownership and Other Programs

### 1.12.1. Project Ownership

The property rights of the land owners for each land property are recognized through the review of the legal documentation[10]. All the properties involved in the project either have property titles or equivalent documents to certify and assure rights over the land.

On the other hand, the land owners engaged in the project have stated their intention to transfer the rights over the Certified Emissions Reductions to be generated by the project activities, to the project proponent (see folder *Cartas de Intención*). The management and commercialization of the emission reductions by the project proponent will allow these resources to contribute to the project implementation and monitoring.

[10] The Land tenure is ensured by the project proponent through review of the official database. In this database Corpochivor identifies the cadastral number of the properties, according to the coordinates obtained in field and the identification number of the land owner. See document support VERIFICACIÓN DE LA TENENCIA LEGAL DE LA TIERRA

#### 1.12.2. Emissions Trading Programs and Other Binding Limits

Carbon credits are currently the only environmental credit being generated from this project.

#### 1.12.3. Other Forms of Environmental Credit

Not applicable. The project has not sought or received any other GHG-related environmental credit or renewable energy certificates.

#### 1.12.4. Participation under Other GHG Programs

Not applicable. The project has not been registered or is seeking registration under any other GHG program.

#### 1.12.5. Projects Rejected by Other GHG Programs

Not applicable. The project has not been rejected by any other GHG program.

### 1.13. Additional Information Relevant to the Project

#### Eligibility Criteria

New project areas (new instances) that may be included should be located within the Reference Region, i.e. the project expansion area of the group project is the reference region. All project participants with legal land tenure that meet the eligibility criteria specified below may be part of the project.

The eligibility criteria for project expansion under the program approach, are:

- *Legal land tenure*

  Owner with property title or certifies of land use rights. For each new project instance, it will require that the owner present a certificate of land use and tenancy emitted by the corresponding authority.

- *Conservation agreement signed*

  The conservation agreement is signed between the owner and CORPOCHIVOR, where the owner agrees to conserve the forests and the corporation agrees to implement the project activities in each property.

- *Representative forest cover*

  GIS analysis will be performed to determine the forest areas to be potentially deforested in the baseline case.

- *Technical land eligibility criteria for forest carbon projects*

  Comply with the complete set of eligibility criteria and methodology tools described in Section 2 of the VCS PD.

- *Adoption of project activities specified in the PD*

  New instances should implement the project activities described in Section G1.8 in their areas.

- *Free, prior and informed consent approved*

  To include a new instance local consultation should be carried out.

It is expected that the expansion of the project will occur during the monitoring and verification of the previously validated instances. In addition, new instances should comply with VCS criteria:

- Meet the applicability conditions set out in the methodology and tools applied in this project. New instances must comply with 5 criteria (VM0015 methodology described in Section 4.2 of the VCS PD):
  - Unplanned deforestation (agriculture, grazing, fuel-wood, timber, charcoal) as long as fitting with most recent VCS AFOLU Guidelines;
  - Can include one or more activities;
  - Can include multiple forest types, ages, successional state, agro-forestry, natural, planted;
  - Must have forest classification minimum 10 years before start date;
  - Can include wetland forests unless they grow on peat (at least 65% organic matter, min. thickness 50 cm).
- Have the same baseline scenario determined in the project description which are agriculture and pasture cattle (Section 4.6 of the VCS PD).

Determination of baseline scenario is based on the initial project activity instances.

- New instances shall implement the same project activities described in Section 2.2.

- A Non-permanence risk buffer assessment shall be performed for each new instance.

- Demonstration of additionality is based on the initial project activity instances. Faces one of the same additionality barriers as the initial project instances (Section 4.7 of the VCS PD). The common practice analysis is necessary to be completed by the time of the validation of new instances, in order to demonstrate that the project activity stills not a common practice.

- Not be included in another GHG program.

**Inclusion of New Project Activity Instances:**

1. Occur within one of the designated geographic areas specified in the project description.

2. Comply with the complete set of eligibility criteria for the inclusion of new project activity instances.

3. Be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.

4. Be validated at the time of verification against the applicable set of eligibility criteria.

5. Have evidence of right of use, in respect to each project activity instance, held by the project proponent from the respective start date of each project activity instance.

6. Be eligible for crediting from the start date of the instance through to the end of the project crediting period.

It is expected that expansion of the project will occur during the monitoring and verification of the previously validated instances. These new instances shall comply with the established eligibility, additionality and baseline conditions. New instances have not yet been included in the project.

### Leakage Management

The leakage management plan focuses on implementing project activities in the non-forested areas. Please refer to Section 3.3.

### Commercially Sensitive Information

Apart from the financial section, no commercially sensitive information has been excluded from the public version of the project description.

### Sustainable Development

According to the expected impacts, the project will contribute to the following sustainable development priorities:

| | |
|---|---|
|   | The project contributes to reduce the poverty by providing new productive alternatives to the small holders and increasing the productivity of their current activities.<br><br>Also, improving pastures in association with the establishment of forest species as part of a silvopastoral system results in higher productivity per unit area and thus, a better fed cattle. The selling price in the market could be significantly higher and capable of generating additional income to the producer. |
|   | The project seeks to end hunger, achieve food security, improved nutrition, and promote sustainable agriculture through the implementation of agroecological family gardens, with family basic agricultural products consumption, including tubers, vegetables, herbs and fruit, able to meet basic household food needs. Also, it is intended that people reduce their dependence on regional markets for staple foods with the aim of being able to secure a healthy and balanced diet in their homes. |

| | |
|---|---|
| 3 GOOD HEALTH AND WELL-BEING | Through the establishment of the cook stoves, the number of people with lung diseases, eye disorders and other cardio-respiratory diseases are expected to be reduced. This represents an improvement in housing as well, by reducing pollution in the kitchen because of the smoke and micro-particles.<br><br>Decreased risk of disease due to poisoning by pesticides and chemical fertilizers. |
| 4 QUALITY EDUCATION | The REDD + project is seeking the people to appropriate their territory, know and defend it against any action or activity that threatens forests, water sources and the other ecosystem services. Education activities will be aimed at empowering children, youth and community about the importance of conservation of biodiversity and. Workshops and training will also be aimed at families of small, medium and large producers, whose activity depends on the direct land use within the territories prioritized criteria. |
| 6 CLEAN WATER AND SANITATION | The project contributes to ensure availability and sustainable management of water and sanitation for all, through the change in the traditional way of production to a more sustainable production, such as use of techniques of conservation tillage of soil and change to more sustainable agrochemicals use. |
| 8 DECENT WORK AND ECONOMIC GROWTH | Ecotourism can be an economic alternative for those owners who own forests and natural landscapes that for its beauty should be preserved and it can become tourist attractions. As part of the REDD + project, owners who want to run this activity will receive incentives, advice and training related to sustainable tourism. They will also consider the legal implications and use restrictions associated with the development of ecotourism. |
| 12 RESPONSIBLE CONSUMPTION AND PRODUCTION | The reduction of the expansion of agricultural activities into forest areas is expected while maintaining the size of the production area and improving the level of productivity. This activity seeks to promote a production that minimize waste and increases the quality of products, so that in this way can be included in a value chain that bring economic benefits to the producer. |

| | |
|---|---|
| 13 CLIMATE ACTION | All the project activities aim to take urgent action to combat climate change and its impacts. The project has the potential of reducing 49,857 tCO2e of GHG emissions in 30 years. Also, through the implementation of cook stoves it is expected to improve climate impacts through reduced consumption of firewood, and therefore the pressure on the remaining forests will be reduced. |
| 15 LIFE ON LAND | The main project´s goal seeks to protect, restore, promote sustainable use of terrestrial ecosystems, sustainable managed forests, fight desertification, halt land degradation and halt biodiversity loss. It will be achieved by reducing the pressure on natural forests, which allows ecosystems to preserve their high conservation values associated with the structure, composition and functionality. |
| 16 PEACE, JUSTICE AND STRONG INSTITUTIONS | The human and social capital are enhanced by the project through education, training and strengthening of citizen participation. These activities strengthen existing institutions, such as corporations, associations and cooperatives. |

## 2. Application of Methodology

### 2.1. Title and Reference of Methodology

- VCS Methodology for Avoided Unplanned Deforestation (VM0015 v1.1)
- Tool for the demonstration and assessment of additionality in VCS Agriculture, forestry and Other Land Use (AFOLU) project activities Version 3.0
- VCS AFOLU Non-permanence Risk Tool: VCS Version 3.3

### 2.2. Applicability of Methodology

The applicability conditions of the methodology VM0015 are enumerated below

1. ***Baseline activities may include planned or unplanned logging for timber, fuel-wood collection, charcoal production, agricultural and grazing activities as long as the category is unplanned deforestation according to the most recent VCS AFOLU requirements.***

This condition is fulfilled as the baseline activities include both planned and unplanned exploitation of forest resources. This scenario considers the conversion of forested areas to agriculture cover and pasture through unplanned deforestation.

According to Law 99 of 1993 *(Ley 99 de 1993)*, CORPOCHIVOR has the power to approve or deny exploitation permits within its jurisdiction. This power was granted to the CARs – as the authorities in the execution of policies, plans, programs, and projects concerning the environment and natural renewable resources – to allow for the full and timely implementation of existing legal provisions regarding the management and use of resources under the regulations, standards, and guidelines issued by the Ministry of the Environment. Refer to the folder “Logging Permits” for the record of permits approved by the Corporation.

2. ***Project activities may include one or a combination of the eligible categories defined in the description of the scope of the methodology.***

The project falls within the category “D – Avoided Deforestation with Logging in the Baseline and Project Cases” in the scope of the methodology.

Legal exploitation of forest resources is possible in the Reference Region only when executed under exploitation permits. All forest exploitation should comply with the practices and legal procedures mandated by CORPOCHIVOR.

As such, the scope of the methodology falls under case D, which has a baseline scenario defined as “old-growth with logging” and a general project activity described as “protection with controlled logging, fuel wood collection or charcoal production”

| | | | PROJECT ACTIVITY | |
|---|---|---|---|---|
| | | | Protection without logging, fuel wood collection or charcoal production | Protection with controlled logging, fuel wood collection or charcoal production |
| BASELINE | Deforestation | Old-growth without logging | A | B |
| | | Old-growth with logging | C[1] | D[1] |
| | | Degraded and still degrading | E[1] | F[1] |
| | | Secondary growing | G[1] | H[1] |
| | No-deforestation[2] | Old-growth without logging | No change | Degradation |
| | | Old-growth with logging | IFM | IFM-RIL |
| | | Degraded and still degrading | IFM | IFM |
| | | Secondary growing | No change | Degradation |

1. Accounting for carbon stock increase in the project scenario is optional and can conservatively be omitted.
2. If the baseline is not deforestation, the change in carbon stocks is not covered in this methodology.

**Figure 8. Scope of the methodology.**

3. ***The project area can include different types of forest, such as, but not limited to, old-growth forest, degraded forest, secondary forests, planted forests and agro-forestry systems meeting the definition of "forest".***

This condition is fulfilled as the Project Area includes diverse types of natural forest, which have been classified by Life Zones according to the methodology developed by Holdridge (1967)[11]. The following Life Zones are present in the Reference Region: moist montane forest; moist, lower-montane forest; moist pre-montane forest; moist tropical forest; wet montane forest; wet lower-montane forest; wet pre-montane forest; wet tropical forest; montane rainforest; pre-montane rainforest; dry lower montane forest.

4. ***At project commencement, the project area shall include only land qualifying as "forest" for a minimum of 10 years prior to the project start date.***

[11] Holdridge, L. E. S. L. I. E., & Ecology, L. Z. (1967). Tropical Science Center. Life Zone Ecology. San José, Costa Rica.

At the beginning of the project, the Project Area only included land qualifying as forest for a minimum of ten years prior to the start date based on the definition of forest for Colombia. This definition describes forest as covering a minimum surface of 1.0 hectares (ha) with a canopy cover (or equivalent population density) exceeding 30% and with trees that reach a minimum height of five meters (m) at maturity in situ.

These criteria were demonstrated for the forests of the Project Area by conducting a forest/non-forest and land cover analysis for 2005, 2010, and 2014 through a classification of Landsat imagery for the aforementioned years. These maps demonstrate the original forest cover in 2005 and the loss of forest cover that has since occurred. Refer to Section 2.4 for a more detailed explanation of the process used.

5. ***The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) as long as they do not grow on peat. Peat shall be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm. If the project area includes forested wetlands growing on peat (e.g. peat swamp forests), this methodology is not applicable*.**

Two types of ecosystems that potentially contain peatlands are found within the Reference Region: paramos[12] and wetlands[13]. However, the Project Area itself includes neither of these ecosystems.

---

[12] wetlands such as peatlands can be found in Colombian paramo and their presence is closely related with bogs and the myriad ponds and pools found between 3,000 and 3,500 MAMSL. Peatlands in these areas are typically former ponds or lacustrine basins with thick caps of saturated, organic soils.
Source: Ministerio del Medio Ambiente Colombia. 2002. Programa para el manejo sostenible y restauración de ecosistemas de alta montaña colombiana. Pag. 16. Available at: http://www.minambiente.gov.co/images/ForestsBiodiversidadyServiciodrysistemicos/pdf/paramos/5595_250510__rest_alta_montana_paramo.pdf

[13] Peatlands in the Reference Region can be found in the wetlands of the interior, which are lacustrine and permanent.
Source: Ministerio del Medio Ambiente Colombia. 2002. Política Nacional para Humedales Interiores de Colombia. Pag 18. Available at: https://redjusticiaambientalcolombia.files.wordpress.com/2012/09/polc3adtica-nacional-de-humedales-interiores-de-colombia.pdf

Applicability of the Tool for the demonstration and assessment of additionality in VCS Agriculture, forestry and Other Land Use (AFOLU) project activities Version 3.0

*a) **AFOLU activities the same or similar to the proposed project activity on the land within the proposed project boundary performed with or without being registered as the VCS AFOLU project shall not lead to violation of any applicable law even if the law is not enforced;***

As it is demonstrated in the sections 2.5 and 1.11, the project activities are in line with the local, regional and national regulations.

*b) **The use of this tool to determine additionality requires the baseline methodology to provide for a stepwise approach justifying the determination of the most plausible baseline scenario. Project proponent(s) proposing new baseline methodologies shall ensure consistency between the determination of a baseline scenario and the determination of additionality of a project activity.***

The most plausible baseline scenario was determined according to the guidelines provided by the methodology VM0015.

## 2.3. Project Boundary

- **Aboveground Biomass – Tree**. Included. Main carbon source in forest ecosystems. Significant and required.
- **Aboveground Biomass – Non-Tree**. Included. This source should be included when the final land cover includes permanent crops. It was not included as a separate category but rather was incorporated into the post-deforestation calculations of GHG sources. A perennial crop cover factor was integrated into final average accumulation factor after finding evidence that African palm and other perennial crops such as cacao were serving as post-deforestation land cover in the Project Area.
- **Below-ground Biomass**. Included. This source is optional according to the methodology. It was calculated by application of expansion factors (root-to-shoot ratios). According to the Agriculture, forestry, and Other Land Use (AFOLU) Requirements, the loss of carbon via this GHG source is assumed to occur gradually, modelled as a linear decay function beginning at the deforestation event.

- **Deadwood**. Excluded. Optional according to the methodology.
- **Harvested Wood Products**. Excluded. Domestic harvest[14].
- **Litter**. Excluded. According to VCS, this pool does not apply to REDD projects.
- **Soil Organic Carbon**. Excluded. This pool is recommended by the methodology VM0015 but is optional and inclusion falls under the discretion of the project proponent. In this case, it was conservatively excluded.

**Table 7. Project boundaries.**

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Aboveground biomass: Tree | $CO_2$ | Included | Mandatory |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Aboveground biomass: Non-Tree | $CO_2$ | Included | Optional |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Below-ground | $CO_2$ | Included | Significant carbon pool |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Deadwood | $CO_2$ | Excluded | Insignificant carbon pool |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | | $CO_2$ | Excluded | Insignificant carbon pool |

[14] See supporting document *Tree carbon harvested*.

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| | Harvested Wood Products | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Litter | $CO_2$ | Excluded | Insignificant carbon pool |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Soil Organic Carbon | $CO_2$ | Excluded | Insignificant carbon pool |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Biomass burning | $CO_2$ | Excluded | Counted as carbon stock change. |
| | | $CH_4$ | Excluded | Although non-$CO_2$ occurred in the baseline scenario, these are excluded following a conservative approach. |
| | | $N_2O$ | Excluded | Considered insignificant as per the methodology. Although non-$CO_2$ occurred in the baseline scenario, these are excluded following a conservative approach. |
| | Livestock emissions | $CO_2$ | Excluded | Not a significant source as per the methodology. |
| | | $CH_4$ | Excluded | The project aim to manage the livestock in a sustainable way. These are excluded from the project boundary following a conservative approach. Also, it is optional source according the VM0015 methodology. |
| | | $N_2O$ | Excluded | The project aims to manage the livestock in a sustainable way. These are excluded from the project |

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| | | | | boundary following a conservative approach. Also, it is optional source according the VM0015 methodology. |
| Project | Aboveground biomass: Tree | $CO_2$ | Included | Mandatory |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Aboveground biomass: Non-Tree | $CO_2$ | Included | Optional |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Below-ground | $CO_2$ | Included | Significant carbon pool |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Deadwood | $CO_2$ | Excluded | Insignificant carbon pool |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Harvested Wood Products | $CO_2$ | Excluded | Insignificant carbon pool |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Litter | $CO_2$ | Excluded | Insignificant carbon pool |
| | | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | | $CO_2$ | Excluded | Insignificant carbon pool |

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| | Soil Organic Carbon | $CH_4$ | Excluded | Not applicable according to VM0015 |
| | | $N_2O$ | Excluded | Not applicable according to VM0015 |
| | Biomass burning | $CO_2$ | Excluded | Counted as carbon stock change. |
| | | $CH_4$ | Excluded | Although non-$CO_2$ occurred in the baseline scenario, these are excluded following a conservative approach. Also, it is expected that under the project scenario, these emissions reduce. |
| | | $N_2O$ | Excluded | Considered insignificant as per the methodology. |
| | Livestock emissions | $CO_2$ | Excluded | Not a significant source as per the methodology. |
| | | $CH_4$ | Excluded | The project aims to manage the livestock in a sustainable way. These are excluded from the project boundary following a conservative approach. Also, it is optional source according the VM0015 methodology. |
| | | $N_2O$ | Excluded | The project aims to manage the livestock in a sustainable way. These are excluded from the project boundary following a conservative approach. Also, it is optional source according the VM0015 methodology. |

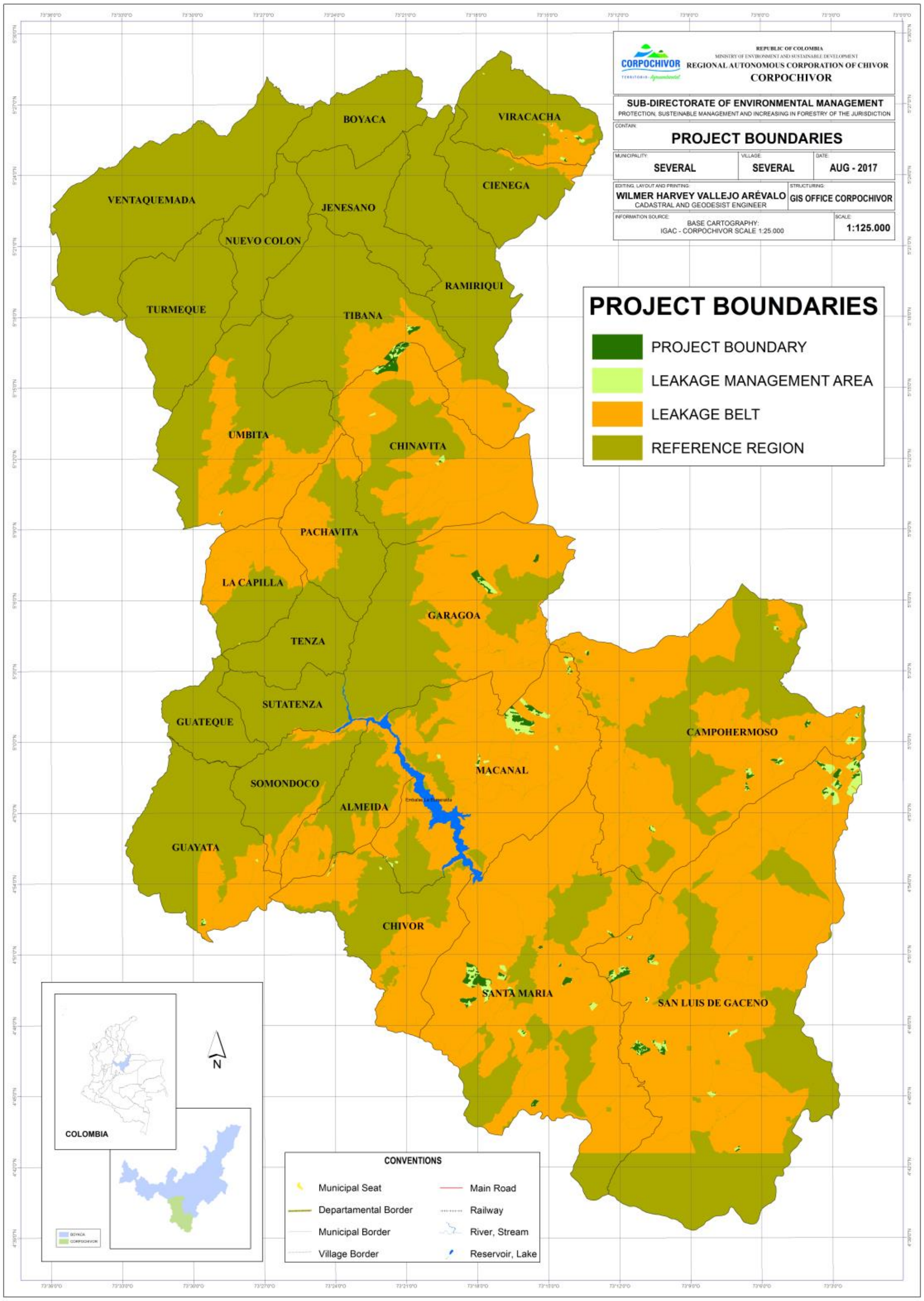



**Figure 9. Project boundary**

## 2.4. Baseline Scenario

The most likely land-use scenario in the absence of the project is the use of land for agriculture and cattle pasture. The identified agents deforest due to a lack of productive economic alternatives.

### 2.4.1. Deforestation map

Figure 10 presents the historic deforestation maps generated for each of the historic sub-periods selected for analysis (2005 – 2010, and 2010 – 2014). These maps were created using the forest cover maps from 2005, 2010, and 2014. They demonstrate the deforestation that has occurred in the Reference Region and represent the area of forest that has been lost since the year analyzed in the initial forest cover map (2005).

The maps of forest/non-forest cover for 2005, 2010, and 2014 were used as inputs to determine the historic rate of deforestation and the degree of forest cover loss. This assessment was conducted with deforestation matrices created using the program Dinámica EGO.

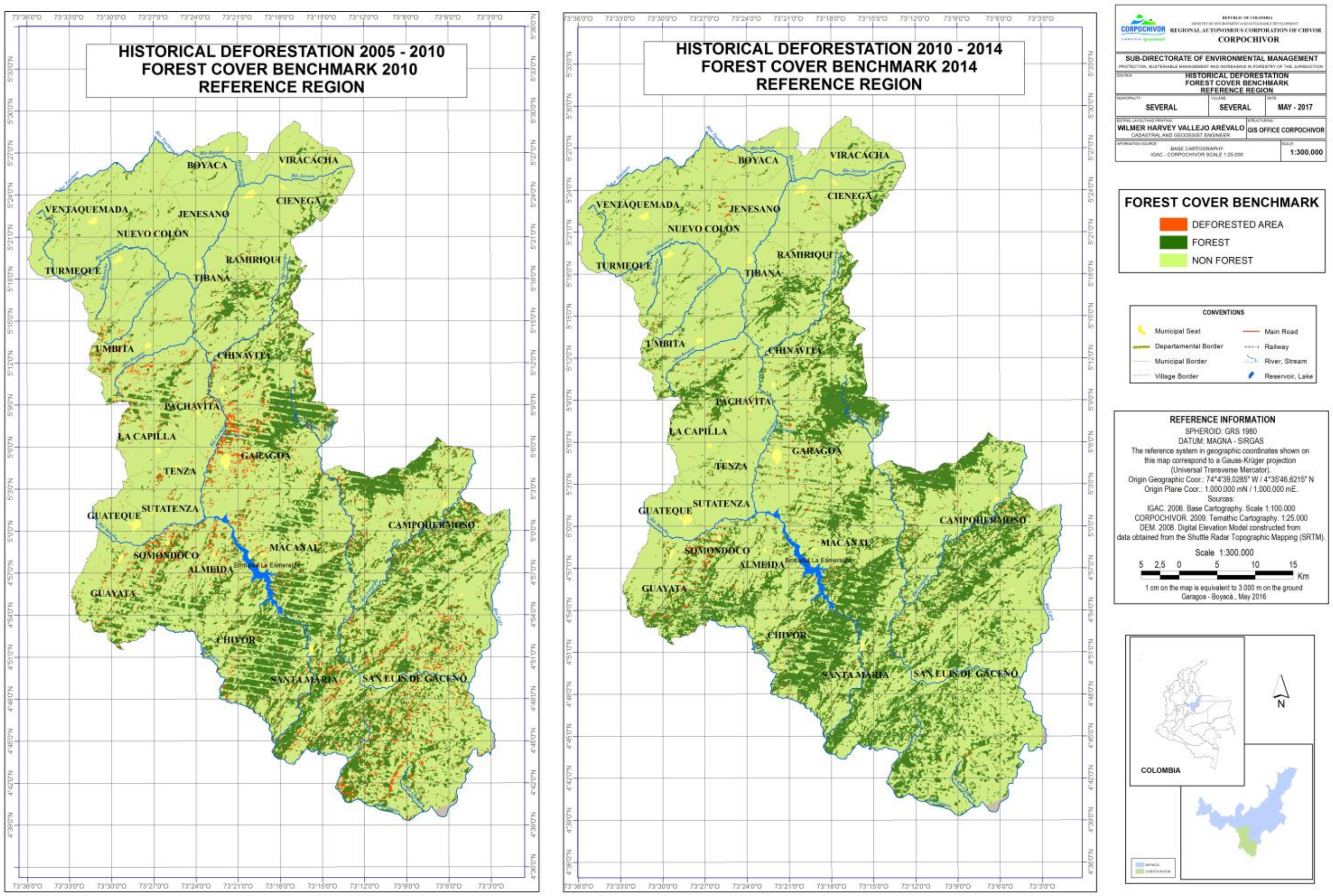



**Figure 10. Deforestation of the Reference Region, 2005 – 2014**

## 2.5. Additionality

For the Additionality analysis, the latest version of the tool is used: "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, forestry and Other Land Use (AFOLU) Project Activities - VT0001", Version 3.0, del VCS.

**Step 1. Identification of alternative land use scenarios to the proposed VCS AFOLU project activity**

**Sub-step 1a: Identification credible alternative land use scenarios to the proposed VCS AFOLUproject activity**

73% of the jurisdiction of CORPOCHIVOR bases its economy on livestock and agriculture, maintaining traditional ways of establishing crops and grazing for livestock to cut not only the parcel of land that will be used for this purpose, but a much larger area. This indicates that in the absence of the project, the most likely scenario is the loss of forest area because of the expansion of cattle ranching and agriculture. This trend is confirmed by the conclusions of the analysis of agents and drivers of deforestation and changing land covers that occurred between 2005 and 2014.

Deforestation in the reference region is closely related to socioeconomic and cultural phenomena and their location depends on geographical and economic variables; the use given to the soil in these areas is determined by the opportunity cost of land. In the case of the project area for farmers it is more profitable convert forests to carry out agricultural and livestock activities that keep them standing. Therefore, alternative activities in the absence of the project are:

**Livestock**

According to the analysis of changes in land cover, 4,861.82 hectares (27% of deforested forests) experienced a transition from forest cover to pasture in the period 2005 - 2014. This pattern of change is common at national and regional level and include people that keep livestock for productive purposes and those seeking to secure land tenure by introducing cattle[15].

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[15] González, J.J., Etter, A.A., Sarmiento, A.H., Orrego, S.A., Ramírez, C., Cabrera, E., Vargas, D., Galindo, G., García, M.C., Ordoñez, M.F. 2011. Trend analysis and spatial patterns of

Pasture areas in the jurisdiction are characterized by their dedication to extensive livestock farming with a density of less than one head of cattle per hectare[16]. This is an indicator of low productivity in the farms and low technical assistance.

In prioritized municipalities, farmers express the lack of technical assistance for the development of their productive activity[17]. That is why this activity occurs mostly extensively and in a traditional way, which means low-tech and low nutritional quality pasture.

This form of exploitation is characterized by the large amount of land that cattle need to develop. Farmers call for technical support regarding their production processes to identify alternatives that increase the productivity of their business and can get the same or better results than those achieved with extensive livestock[18].

Because of the significance of livestock in the country and in the department of Boyacá in particular, the sector has great institutional and sectoral support. This strength is reflected in the considerable number of existing federations: the Colombian Federation of farmers (FEDEGAN), The National Endowment Livestock (FNG), the Stabilization Fund for the Promotion of Export of Meat, Milk and Derivatives (FEP), the Colombian Livestock Foundation (FUNDAGAN) and locally the Federation of Farmers Boyacá (FABEGAN). These institutions and the support of the Ministry of Agriculture promote programs that constantly improve productivity[19], sustainable support systems[20] and associativity of producers. For example, the livestock sector in Boyacá in 2014 created a dairy cluster, the formation of various cattle associations and

deforestation in Colombia. Institute of Hydrology, Meteorology and Environmental Studies-IDEAM. D.C. Bogotá, Colombia. 64 p.

[16] Given the amount of pastures in the jurisdiction in 2010 and bovine year inventory for the same area.

[17] According to polls of owners in priority areas (2016), the 94.94% of farmers surveyed receive no technical assistance for the development of their productive activity.

[18] According to polls of owners in priority areas (2016).

[19] Government of Boyacá, 2015. More resources to strengthen the livestock sector in Boyacá. Available in http://www.boyaca.gov.co/prensa-publicaciones/noticias/5273-m%C3%A1s-recursos-para-fortalecer-el-sector-ganadero-de-boyac%C3%A1

[20] Fedegan, 2010. Colombian Sustainable Livestock Project. Available in http://www.fedegan.org.co/programas/ganaderia-colombiana-sostenible

achieving FEDEGAN funded projects to consolidate the department as a leader in this activity[21].

- **Agriculture:**

Agriculture is the most important activity in the jurisdiction, characterized by smallholder family farms, not technologically advanced, without specialized tools and dependent on the rainy season. Most of the population engaged in this activity is underemployed and generally work as small independent producers. Generally, family labour is employed and sometimes they hire external labour[22].

The most predominant crops in the municipalities of the reference region are temporary crops that occupied the 46% of the total area planted in 2010, followed by permanent crops with 32% and annual crops with 22% (Figure 11).

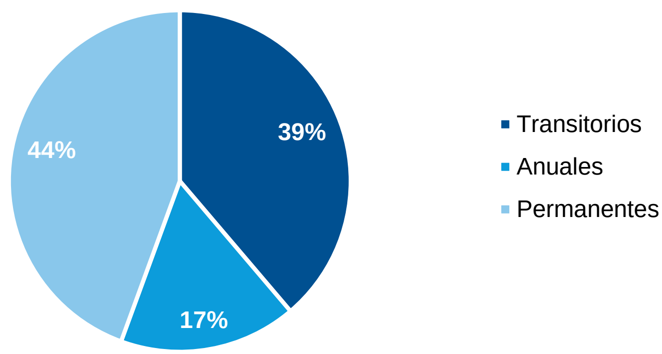


**Figure 11: Percentage by vegetative cycle of crops planted**

The prevailing practice of this land use is based on the need of populations to meet their food requirements. These are considered as subsistence activities, while for others it means to increase its production capacity by incorporating more land to farming, so it becomes a way to increase family income and complete the family diet. Besides, the availability of labour is based on

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[21] Livestock context, 2014. http://www.contextoganadero.com/sistemas-silvopastoriles/asociatividad-pilar-de-la-ganaderia-en-boyaca-en-2014. Accessed March 8, 2016.

[22] Ministry of environment and sustainable development - environmental compensation fund, regional autonomous corporation of Chivor-CORPOCHIVOR; FORMULATION GENERAL PLAN OF FOREST -PGOF. interadministrative cooperation contract No. 003-10 UDFJDC-CORPOCHIVOR

agricultural activities which generates significant revenue through the elimination of forest cover to establish crops.

Culture plays a crucial role in agriculture. In the absence of other activity young people follow the same pattern of their ancestors. A householder expands its crop areas so their offspring possess land to till, in order to acquire revenues to sustain its own family. This leads the division of land and the concentration of more people in that area. This results in an extension of the roads to transport their products and access to services.

Farmers generally are encouraged to deforest if low productivity of the land does not allow them to consummate profit expectations[23] because they cannot meet their basic needs. And if farmers wish to increase their income, the trend shows that will increase the area available to develop their economic activity.

The potato crop is the most predominant crops in the department of Boyacá, in different varieties. The potato is the most important agricultural product of cold weather in Colombia, due to: the cultivation, the production value, surface, the number of families engaged in this work and because it constitutes one of the main food of the population, with a consumption per capita of about 65 kg per year[24].

In the region, potato production is one of the activities that contaminates the soil the most. This is due to overuse of agrochemicals, which damage the soil, pollute water sources and poisons native fauna and air. Also, potato crops are cultivated in high Andean forest land and paramos, decreasing the protective forest[25].

Agricultural practices necessary for the installation of this crop started with preparing the soil, which in some regions of Colombia includes slash-and-burn agricultural practices. The first plowing breaks the structure of the topsoil, which is damaged and mixed with natural vegetation; to get the land does not lose

[23] Ministry of environment, housing and development territory-Institute of Hydrology, Meteorology and Environmental Studies-IDEAM. 2011. Analysis of trends and spatial patterns of deforestation in Colombia. Available in: http://www.ideam.gov.co/documents/13257/13817/Proyecciones.pdf/6cad956b-6b92-4320-a090-2000408a5765

[24] Colombian *paramos*, 2001. Ecological Paper Collection West Bank, Chapter 7de Colombia, 2001.

[25] URPA, Municipal Agricultural evaluations, 2010, Secretary of Agricultural Development, Government of Boyaca. Available in: http://www.boyaca.gov.co/SecFomento/2-uncategorised/26-informacion-evaluaciones-agropecuarias

fertility, after the crop is left fallow for a rotating basis and sometimes goes to grazing for a few months[26]. It is, after deforestation and planting of crops with high impact, livestock become a main activity afterwards. Thus, the loss of environmental soil quality is encouraged by the phenomena of contamination (overuse of agrochemicals and compaction by trampling by livestock.

The relationship between the planted area of this crop and the permanence of forest cover in the project area is reflected in the reduction of deforestation between 2013 and 2014. During this period, the cultivation of this product also decreased by 9% in the municipalities of Chinavita, Cienega, Garagoa, Tibaná and Viracachá.

- **Mining**

As mentioned previously, mining is the drynd productive sector of the department after agricultural activities. In the case of jurisdiction, the mining activity takes place with the exploitation of clays, coal, emeralds, phosphates, sand quarries, gravel, copper ore, iron ore and gypsum.

According to the mining census conducted by the Ministry of Mines and Energy (between 2010 and 2011), there is 14,357 Mining Planning Units (MPU) in Colombia, 18% of them were located in Boyacá. This department is the department with more MPU in the country[27]. In addition, the growth in this sector is constant and is backed by the Ministry of Mines and Energy of Boyacá, whose vision for the year 2019 is to become the first energy mining power in the country[28].

In the first instance, coal mining occurs mainly in the municipalities of Úmbita and Tibaná and several neighboring villages. Other holdings present is emerald mining in the municipalities of Chivor and Guayatá. In the case of Chivor, its economy is based largely on mining emeralds (since 1537[29]). In the other municipalities in the region aggregates extraction activities are directed to the production of top dressing for road maintenance and building materials.

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[26] Colombian *paramos*, ecological book collection Banco de Occidente, 2001, Chapter 7.
[27] Mining Census. 2012 Ministry of Mines and Energy. Mining Planning Unit
[28] SIMCO, 2015. http://www.simco.gov.co/Home/MineriaenBoyac%C3%A1/tabid/269/language/es-ES/Default.aspx. Accessed June 26, 2016.
[29] Municipality of Chivor, Land Management Scheme

According to official reports, in 2010 the coal mining in the department reached 2,675,000 Kton with an increasing trend, given the volumes reported for previous years. On the other hand, the exploitation of emeralds in the municipalities of Chivor, Macanal and Guayatá generated royalties for the department totaling 299,497,050 million Colombian pesos[30].

Within the priority areas, exploitation of coal, emeralds, sand and construction materials have been identified (Figure 13). This land use promotes deforestation directly and indirectly, either by logging or road construction for t extraction of materials, facilitating illegal timber transport.

30 SIMCO, 2015. http://www.simco.gov.co/Home/MineriaenBoyac%C3%A1/tabid/269/language/es-ES/Default.aspx. Accessed June 26, 2016.

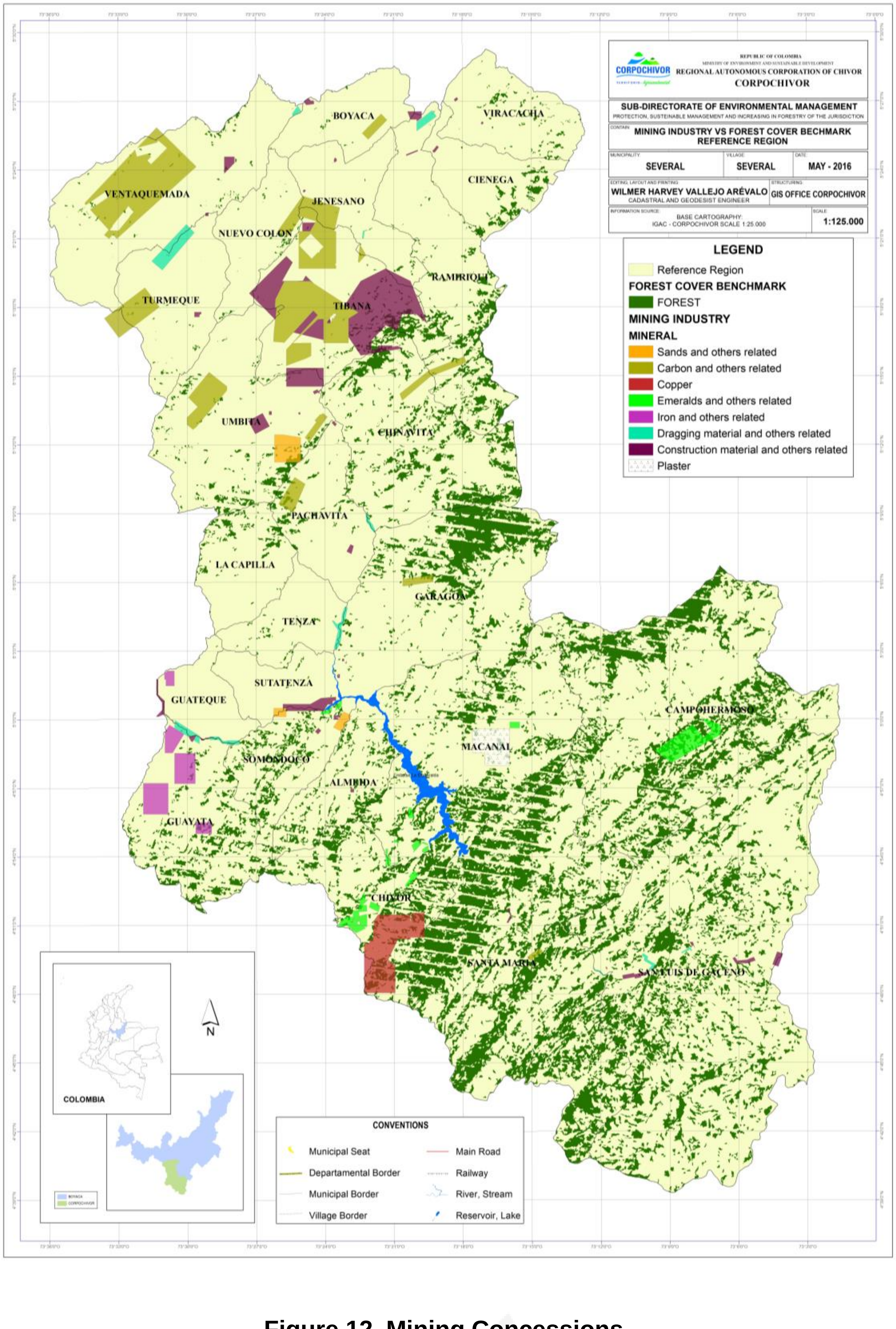


**Figure 12. Mining Concessions.**

- **Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project**

Corpochivor, depending on their mission objectives, is the entity responsible for implementing national environmental policy, with the aim of managing and conserving resources in their jurisdiction. The environmental activities that the Corporation runs currently within the project area include the following: restoration and protection of water sources, projects to mitigate and adapt to climate change and natural phenomena such as la Niña and el Niño, social inclusion projects and environmental education, monitoring and conservation of endangered species, forest management programs, actions and activities for the conservation of water resources, among others.

Therefore, considering the nature of the project proponent and the environmental characteristics of the prioritized area, it is clear that forest conservation (without being registered as a VCS project) represents a unique opportunity, from the environmental and social standpoint, for the socio-economic development of the region. However, as set forth below, this scenario faces several barriers to their short-term viability.

**Outcome of Sub-step 1a:** List of credible alternative land use scenarios that could have occurred on the land within the project boundary of the VCS AFOLU project

- Scenario 1: Traditional livestock
- Scenario 2: Agriculture
- Scenario 3. Mining
- Scenario 4. Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project*;*

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

All identified alternative scenarios are legal and consistent with the applicable laws and regulations at national, regional and local levels. They are even promoted as pillars of sustainable development of national and regional level department[31], as long as it respects the suitability of soil and zoning established by the Corporation.

In the case of the suitability of soils, it is common the use of conflicts in areas where agricultural, livestock and mining activities[32] are carried out. Despite all the administrative tools that the Corporation applies, it is not possible to restrict on private land the implementation of these activities and the consequent impacts on natural forest. Except for mining which requires the granting of a license and environmental control, given by the competent environmental authority.

On the other hand, according to the values of loss of forest cover in the last decade, even in protected areas such as paramos, one can conclude that these legal bodies have not exercised their powers of controlling and preserving of forest ecosystems[33], therefore considered systematically not enforced in the region.

**Outcome of Step 1b:** List of plausible alternative land use scenarios to the VCS AFOLU project activity that are in compliance with mandatory legislation and regulations.

All scenarios are enforced by the current national regulations.

***Sub-step 1c. Selection of the baseline scenario***

The selected baseline scenario is the activity of traditional livestock and agriculture, described in the previous section.

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[31] For example, according to the law 1372 of January 7, 2010, through which the "Free Trade Agreement between the Republic of Colombia and the United States of America" was approved, the need to expand the area dedicated to agricultural production and fattening hectares of pasture has increased.

[32] 78% of the land in the jurisdiction presents conflict in use, which is broken down as follows: mild negative conflict (44%); negative conflict moderate (11%) and severe negative conflict (24%) (PGOF 2010).

[33] Widespread in the country, the problems associated with the use of natural forests has been closely related, among other factors, with low institutional presence to ensure compliance with current regulations and inadequate implementation of management plans and management forest (Becerra 2003. Present and future of forests in Colombia. Conceptual basis for the international conference forests debate Santa Marta, Colombia).

In the absence of the project, the most likely activities are agriculture and livestock under traditional systems with management practices that generally are detrimental to natural resources. This in turn affects gradually the loss of soil fertility, increase erosion and decrease topsoil and as a result, a decrease in productivity is achieved with unprofitable products.

However, these activities continue to perform as traditional methods also involve low capital investment and implementation of known techniques. These characteristics are most important when taking into account that much of the rural population in the prioritized area corresponds to adult age groups, culturally most established to the knowledge acquired from their parents and less willingness to change their traditional systems production.

This situation hinders access to knowledge and skills that are essential for forest management, preventing the use of the essential tools and techniques to maintain fertility and soil productivity. As a result, new areas must be cleared for family support.

**Step 2: Investment analysis:** Not applicable.

**Step 3: Barrier analysis**

**Sub-step 3a: Identify barriers that would prevent the implementation of the type of proposed project activity:**

- **Investment barrier**

The main forest conservation initiatives undertaken by private owners in Colombia are those implemented through the creation of Nature Reserves of Civil Society (RNSC in Spanish). These initiatives are national schemes registered with the National Parks Unit, established voluntarily by owners who wish to retain their lands[34]. Since the benefits generated by these reserves (mostly) are environmental, they are generally implemented by owners who do not economically depend on the use of their land.

Within the current records of the Colombian Association of Civil Society Reserves (RESNATUR in Spanish), there are five reserves in Boyacá

[34] Towards the construction of a joint financial strategy of nature reserves networks of civil society and natural-fund biodiversity and protected areas in Colombia. *Patrimonio Natural*, 2007.

department, however none of these are located in the jurisdiction of Corpochivor[35].

These conservation activities require the opportunity cost related to reduce or avoid inappropriate use of natural resources, in exchange for keeping and implement conservation and ecotourism activities. That is, that only persons capable of assuming these costs can implement conservation activities. In the context of the project, most owners rely on the direct exploitation of their land and short-term economic returns; therefore, it is unlikely to bear the costs involved in the abstention or reduction of farm production[36].

Another limiting factor to invest in conservation and sustainable management of natural forests in Colombia has to do with the absence or ineffectiveness of bank credits or incentives created for this purpose. Proof of this is the Certificate of forest conservation incentive (Decree 900 of 1997), which was created so that the owners of natural forests to access a monetary incentive in exchange for keeping up to 50 hectares of forest (disturbed or undisturbed) situated above the altitude of 2,500 meters. However, this mechanism did not work due to lack of clarity in the procedures, lack of guarantees in the resources required to finance projects, and because the amount of the incentive is below the opportunity cost of the land.

Finally, another opportunity to implement conservation actions and sustainable forest management are the activities developed by Corpochivor that seek the protection of the remaining forests and therefore the conservation of wildlife and flora in the region. However, the financial resources of Corpochivor are restricted by the administrative periods and validity of Institutional Action Plan of the Corporation[37]. For this reason, the implementation of a project of 30 years without proper funding strategy (see supporting document *Non-Permanent Risk Tool*) and additional funding mechanisms such as carbon credits, is outside the administrative and operational scope of this entity.

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[35] Association of Civil Society for the conservation of Colombian reserves. 2016. http://www.resnatur.org.co/las-reservas/reservas-asociadas/. Accessed July 1, 2016.
[36] Towards the construction of a joint financial strategy of nature reserves networks of civil society and natural-fund biodiversity and protected areas in Colombia. *Patrimonio Natural*, 2007.
[37] The Institutional Action Plan of the Corporation establishes budget allocation for administrative periods, now 4 years.

On the other hand, the amount of resources of the Corporation is limited. To launch the REDD initiative, Corpochivor accessed the resources from the Environmental Compensation Fund (FCA) of the Ministry of Environment and Sustainable Development[38], to counteract the causes of deforestation that leads to increased GHG emissions. This fund is a financial instrument for redistributing resources among the CARs[39] in the country, benefiting those with fewer opportunities for income generation. The operating regulation defines as beneficiaries of the FCA the15 CARs with lowest total current budget, among these Corpochivor[40]. In the absence of these resources, Corpochivor would not have the financial capacity to propose and implement the project.

- **Barriers due to social conditions and technical capacity**

The implementation of project activities faces another barrier: the low availability of suitable and qualified people to work in rural areas of the project. A study by the Department of Youth of the Government of Boyacá notes that the population distribution by area indicates that the infrastructure of the agricultural[41] sector weakens due to the predominance of industrial and social development of the urban area and the steady loss of rural population. According to the same study, the department of Boyacá is characterized at national level as an ejector of population (nearly 30% percent of the total migration of the country). The problem is that the Department is not able to provide employment for people of working age. People leaving the department are mostly between 15 and 24 years old and emigrate from their home villages seeking new learning, knowledge and employment opportunities. This results in the loss of productive and skilled population in the department, who seeks employment in other departments or even in other countries[42].

This situation is also identified in the first instance, where landowners are persons of advanced age (average age: 55 years old and 32% of the population is between 50 and 63 years of age[43]) with low levels of schooling and illiteracy

[38] Resolution 1020 of April 19, 2015
[39] Regional Autonomous Corporation (CARs in Spanish)
[40] Environmental Compensation Fund. 2016. https://www.minambiente.gov.co/index.php/component/content/article?id=346:plantilla-areas-planeacion-y-seguimiento16
[41] El Tiempo. 2012. http://www.eltiempo.com/archivo/documento/CMS-11976263. Accessed July 1, 2016
[42] El Tiempo (press cutting), 2012. http://www.eltiempo.com/archivo/documento/CMS-11976263. Accessed April 3, 2016.
[43] Surveys owners in the prioritized area in 2016.

in some cases. This condition negatively predisposes the responsiveness of landowners concerning the proposed activities.

In addition, the success of the proposed project activities will also depend on exogenous variables such as weather and pests. These variables have changed sharply in recent years, even manifesting unpredictable behavior, so it is necessary to implement measures to adapt to these changes and re-learn about new management systems and atypical production cycles. For this process to take effect it is necessary to combine the technical-scientific knowledge for understanding the exogenous variables, with local knowledge to formulate accurate, viable and adaptive measures.

Although these shortcomings are addressed by Corpochivor in its objective of promoting sustainable environmental practices often the technical staff of the Corporation, which is concentrated in a single municipality -Garagoa-, is unable to meet the needs of the community because of the large distances between each territory and the problems of road infrastructure in rural areas.

These conditions, coupled with the need to increase their income and the low productivity of the land, lead the farmer to give continuity to the prevailing practices and constitute a barrier to the project activities and the protection of the forest resource.

These barriers can be even more restrictive than the investment barriers (described above). In the case of agriculture, for example, the farmer carries out this activity in a traditional way, without sophisticated tools, without technical advice. Agriculture is often financed through resources that reach the hands of farmers who are unaware of alternative systems that enable them to improve their productivity agricultural loans. In this regard, often this money is not invested in improving the capacity of the property to optimize processes but to continue with traditional models of production. These models seek to generate a monetary profit, which in addition to high production costs, now can discount financial obligations, which reduces net income of landowner again.

In conclusion, the human, technical and financial resources are highly correlated when looking to implement sustainable alternative systems; a failure in any part limits the deployment and productivity of alternative systems and consequently limits the protection of the forest resource.

- **Land Fragmentation**

Fragmented land ownership is a common phenomenon in Boyacá. The smallholding is an important feature of this region, because most owners have small parcels of land. According to Fedesarrollo 2013[44] in the study entitled "Policies for development of Colombian agriculture," it notes that on smallholdings, peasant economic activity depends on the full exploitation of the natural resources of their land. This means that they should work on each plot of land they possess and make it productive.

Given the above, the fragmentation of ownership becomes a constant threat to forest fragments. The presence of these fragments is an obstacle to the entire productive use of the farmland. Therefore, the peasant prefers to burn and remove them. In other words, when an owner divides his land covered by forests in small plots and then sell them to different users, each user will have a negligible productive area (in agricultural terms). Hence, they will decide to remove the amount of forest to take advantage of a larger amount of area, either for the installation of crops or livestock development.

Large portions of land generally belong to owners who do not live in the region or sublease the land, as observed directly in the field. Therefore, the land of small size is the land which is currently being exploited steadily, and it is precisely in those areas where the remaining forests are threatened by deforestation.

[44] Perfetti *et all.* 2013. Policies for Agriculture Development in Colombia.

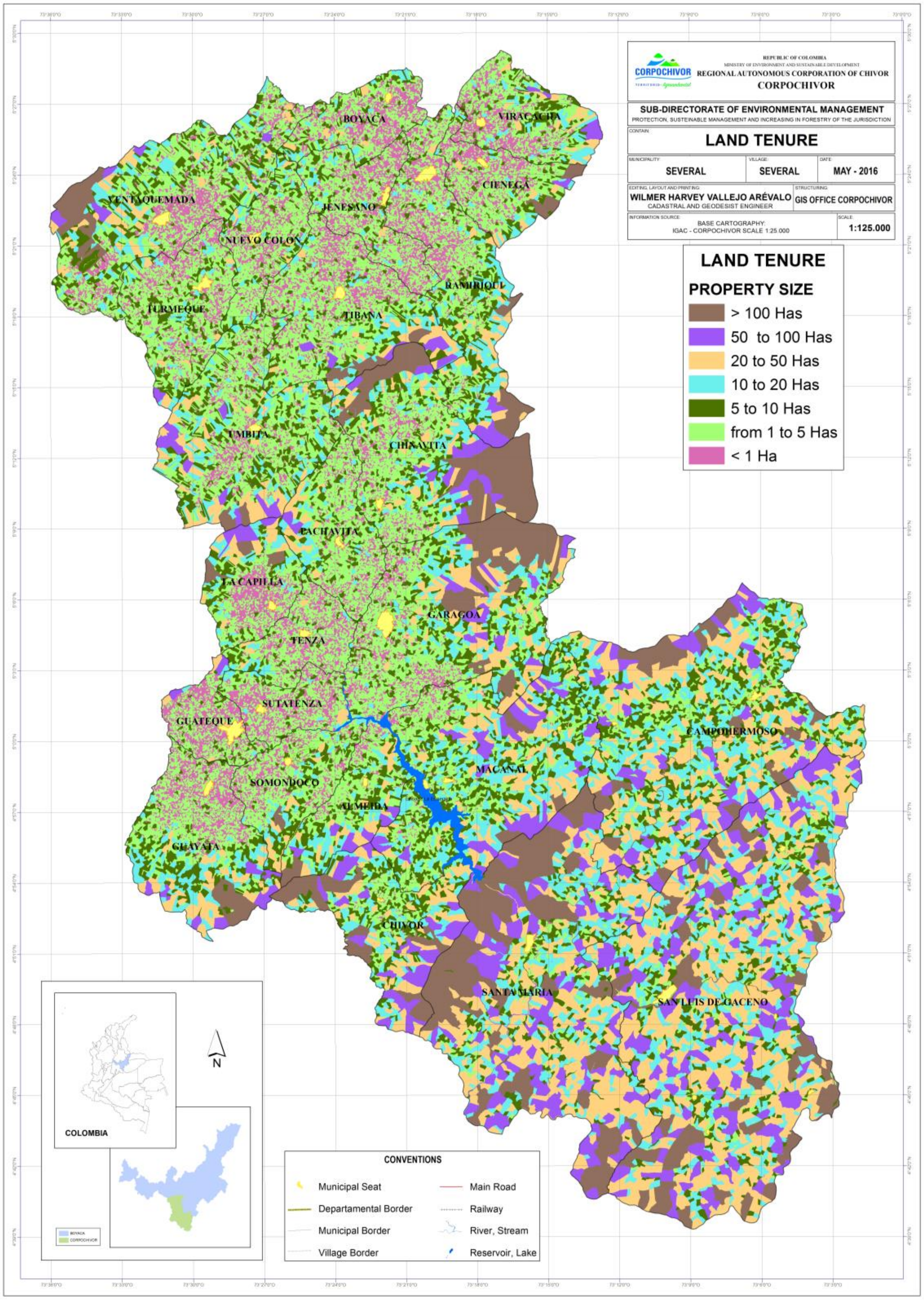


**Figure 13. Land Fragmentation.**

**Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):**

Eventually, the mining activity could face similar barriers facing the project activities, as they have a constant need of qualified staff, available land and economic resources to carry on with the execution of activities and to purchase tools, machinery and invest on skilled labor. However, this activity receives constant support from the government and local authorities, as mining has been recognized as a major economic activity for the national development according to the National Development Plan.

This is reflected in the provided tax incentives to this activity. The state encourages foreign investment, the renewal of the industry, creating better conditions for competitiveness. Despite the market obstacles caused low prices, employment is boosted and generally economic and social development are promoted by receiving tax benefits[45,46].

On the other hand, livestock and agriculture expansion does not incur in costs other than the ones that can be easily afforded by the farmer. This activity receives funding from *Finagro* and *Banco Agrario* in forms of loans with very low interest rates and flexible payment periods.

In particular, the department of Boyacá, listed as "Colombia's agricultural pantry" because much of the food consumed in the country comes from these lands, is one of the regions with more investments in form of loans granted by the *Banco Agrario* and *Finagro* to finance the agricultural sector (**Figure 14**). 9.7% of loans disbursed by these entities during the period 2000 to 2015 were for the department of Boyacá, just next to the investments in Antioquia and Cundinamarca.

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[45] Resolution 40659, Minister of Mines and Energy, 2015. This resolution defines the incentive scheme for mining and energy production, which initiates the approval of the projects that have been presented to the mayors of the municipalities with greater production of oil, coal, gas and nickel, to access resources and set them up. For more information: https://www.minminas.gov.co/web/10180/1332?idNoticia=2642448.

[46] Portfolio 2012. Press release: Mining is the sector with more tax benefits. http://www.portafolio.co/negocios/empresas/mineria-sector-beneficios-tributarios-106052

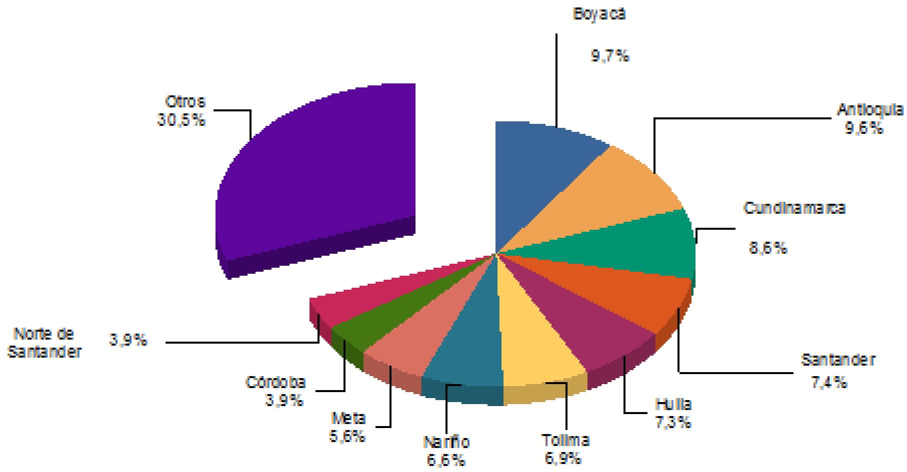


**Figure 14. Total allocation of agricultural credit by department, between 2000 and 2015. - Banco Agrario. Source: Agronet 2015[47].**

It is important to show these statistics because in Colombia the lack of a functional Agrarian Reform, that could focus on increasing productivity of the Colombian rural areas, together with the lack of coordination between environmental conservation policies and agricultural policies in the historical period of analysis have triggered the purpose of these loans to expanding the agricultural frontier. The main objective is to achieve the profit expectations of the farmers and thus to cover payments to the financial sector. Furthermore, traditional livestock and agricultural activities do not require skilled labor as the activities performed are normally known by all farmers as they have been traditionally taught in how to handle cattle and crops in large and small areas with very limited tools and machinery. Even under current conditions (low productivity) in the absence of the project, the owners could continue to perform these tasks.

In conclusion, the only activities that do not face any of the above barriers are livestock activities and traditional agriculture (Table 8).

[47] Agronet 2015 Available at: http://207.239.251.112/www/htm3b/excepcionesNuke/cargaNet/netcarga113.aspx?cod=113&submit=Ver%20Reporte&reporte=Cr%E9dito%20agropecuario%20por%20departamento%20-%20Banco%20Agrario&file=20084394053_reportBancoAgrario_totagrodepto_pub.rpt&codigo=113&excepcion=1&fechaI=2000&fechaF=2015.

**Table 8. Identified barriers and alternative scenarios.**

| SCENARIOS | BARRIERS | | |
|---|---|---|---|
| | **Social conditions and labor skills** | **Investment** | **Land fragmentation** |
| Livestock and agriculture expansion | | | |
| Mining | X | | X |
| Project activity on the land within the project boundary performed without being registered as a VCS AFOLU project | X | X | X |

**Step 4: Common practices analysis**

Other REDD initiatives are under way in Colombia, but these are located in other regions. Furthermore, the uniqueness of the project Scheme of Compensation for Ecosystem Services for forest Management and Conservation of water sources in the jurisdiction of Corpochivor is that it combines the REDD framework and the compensation scheme for environmental services related to water resources through several financing mechanisms and many types of donors and private sponsors. It enables the project owner to create managerial and financial synergies.

As Step 4 is satisfied and the proposed VCS AFOLU project activity is not the baseline scenario, the proposed VCS AFOLU project activity is considered additional.

## 2.6. Methodology Deviations

This project did not employ any deviations from the methodology.

# 3. Quantification of GHG Emission Reductions and Removals

## 3.1. Baseline Emissions

This section summarizes the specific procedures for quantifying baseline emissions starting with Part 2 of the methodology VM0015.Part 1 has been included and described in the PD in sections 2.2 and 2.5. The full details of the ex-ante baseline emissions quantification procedure are described in detail in the VCS Technical Annex.

## PART 2: METHODOLOGY STEPS FOR EX-ANTE ESTIMATION OF GHG EMISSION REDUCTIONS

### 3.1.1. STEP 1: DEFINITION OF BOUNDARIES

**Step 1.1: Spatial boundaries**

**Step 1.1.1: Reference Region**

The "Corporaciones Autónomas Regionales y de Desarrollo Sostenible" (CAR, Autonomous Regional and Sustainable Development Corporations) are self-governing public entities integrated with local authorities and which form geopolitical, biogeographic, or hydrogeographic governance units. They are charged with administrating the environment and renewable and non-renewable natural resources, as well as promoting the sustainable development of the areas under their jurisdiction (Artículo 23 ley 99 de 1993 / Article 23 of Law 99 of 1993).

Regional environmental planning allows for concerted and coordinated management, administration, and use of natural renewable resources. Such organization facilitates short, medium, and long-term approaches to alternative, sustainable development compatible with the biophysical, economic, social, and cultural character of each territory.

The Ministerio de Ambiente y Desarrollo Sostenible (MADS, Ministry of the Environment and Sustainable Development), based on its duties and powers as established by law (Lay 99 de 1993 / Law 99 of 1993), directs and coordinates the planning and implementation activities of the entities that compose the Sistema Nacional Ambiental (SINA, National Environmental System), which includes the CARs.

The Reference Region is the area under the authority and scope of the Corporación Autónoma Regional de Chivor (CORPOCHIVOR, Local Environmental Authority of Chivor). The Reference Region limits are presented in the next figure. This area contains the following twenty-five municipalities that compose the district: Almeida, Boyacá, Campohermoso, Chinavita, Chivor, Ciénega, Garagoa, Guayatá, Guateque, Jenesano, La Capilla, Macanal, Nuevo Colón, Pachavita, Ramiriquí, Santa María, San Luis de Gaceno, Somondoco, Sutatenza, Tibaná, Tenza, Turmequé, Umbita, Virachá, and Ventaquemada.

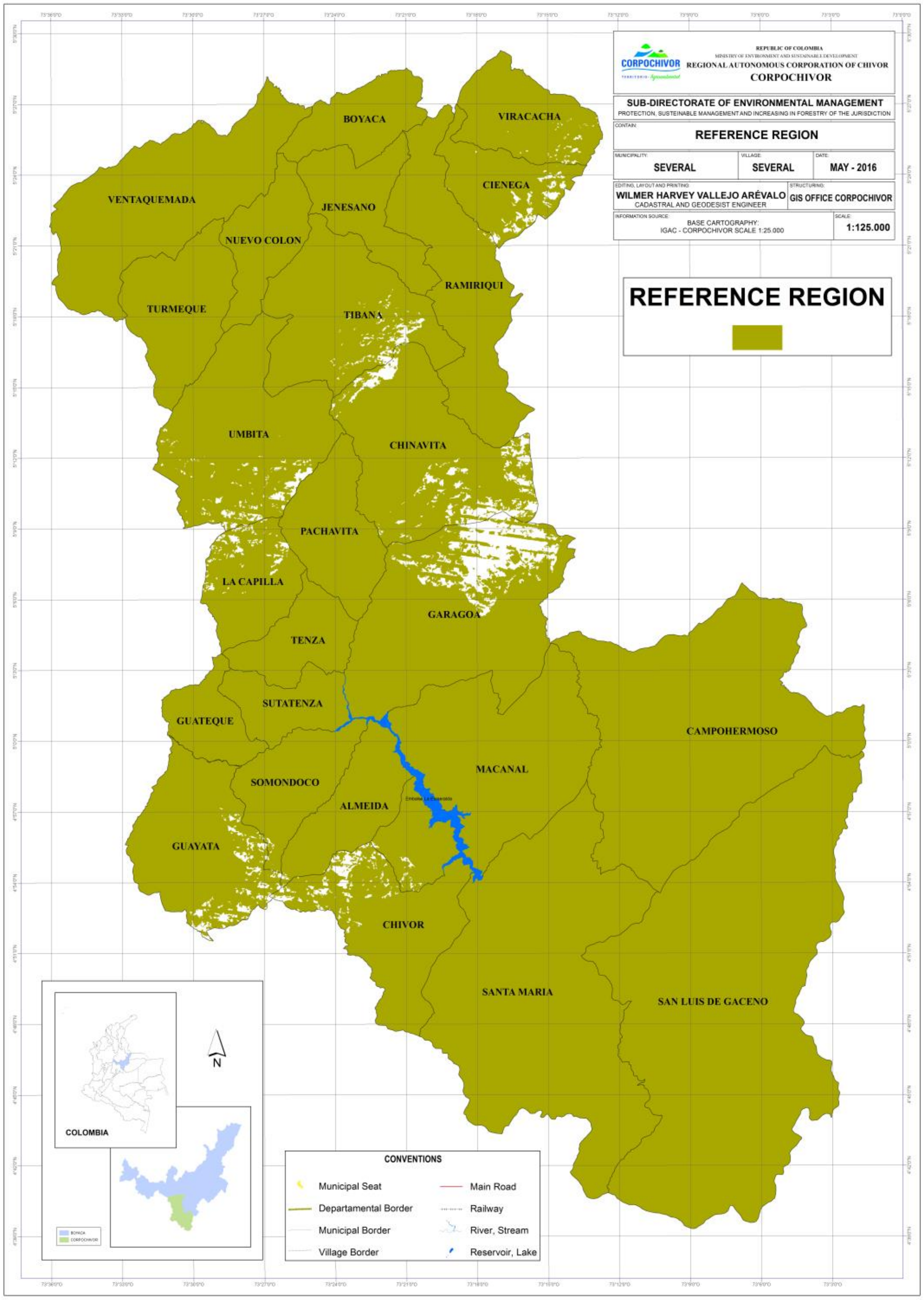


**Figure 15. Reference Region location.**

**Step 1.1.2: Project Area**

The first instance of the grouped project has been defined. In the coming years, new instances will be defined with their exact locations incorporated into the description of this study area.

In agreement with methodology VM0015, the Project Area is the area of forest within the selected region. For the first project instance (I), the Project Area corresponds to the total area of publicly and privately held forests under legal land tenure status. The total Project Area for the first instance contains 937 hectares situated in the municipalities of Campohermoso, San Luis de Gaceno, Santa María, Chivor, Guayatá, La Capilla, Chinavita, Garagoa, Ciénega, Macanal, Tibaná, Úmbita and Viracachá.

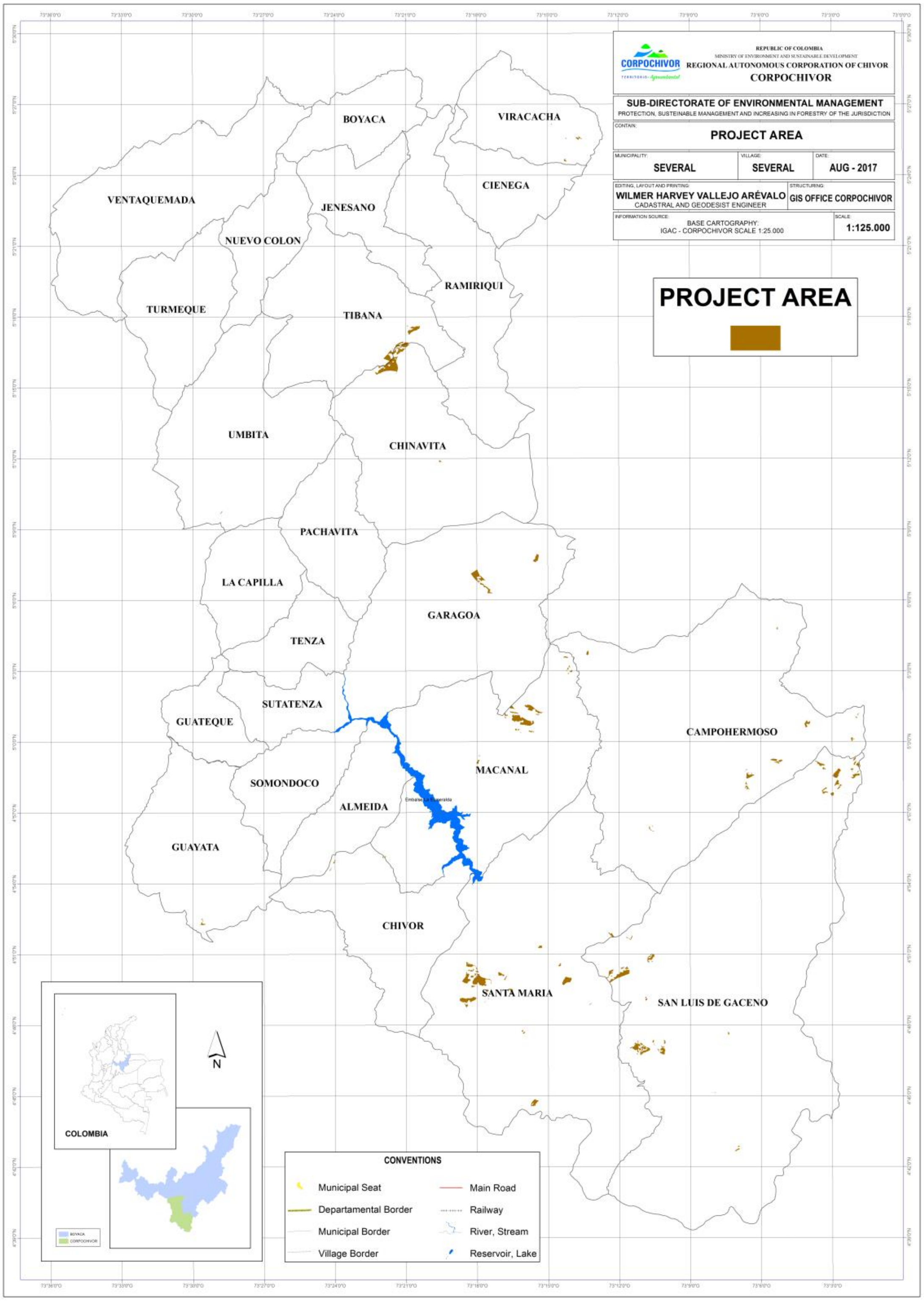


**Figure 16. First instance project area.**

**Step 1.1.3: Leakage Belt**

The leakage belt was designed using Option II of the methodology VM0015, which is based on a "Mobility Analysis". Option I (Opportunity Cost model) was disregarded because the main productive activities in the zone are rather for own consumption than for commercial purposes. It was proved by the Opportunity Cost analysis conducted for *Livestock* and *Potato cultivation*[48], which showed that the latter case is an economically risk activity because there is a high probability (34.9%) NPV of being less than zero. Similarly, this analysis showed that, despite livestock generates low benefits (COP 768,450/ha) the probability for NPV of being less than zero is lesser for this activity than for potato cultivation (only 15.6%).

**Step 1.1.4: Leakage Management Areas**

The project proponent understands that leakage management will be a very important component of effectively reducing emissions via the proposed activities. Therefore, the project will undertake leakage mitigation activities in the so-called Leakage Management Areas. These activities aim to reduce the impacts of deforestation agents if they choose to leave the Project Area to continue their current deforestation and forest degradation activities, generating $CO_2$ emissions elsewhere. This project has designated leakage management activities to coincide with activities that will be also implemented as project activities within the Project Area.

The Leakage Management Areas correspond to non-forest areas within the properties of the land owners included in the First Instance. The Project Activities will be implemented on properties where the owners have legal title over their lands, and as such, the displacement of these landowners is minimal. Figure 17 demonstrates the non-forest areas present within the properties of participating landowners.

[48] See document Informe Costo de oportunidad

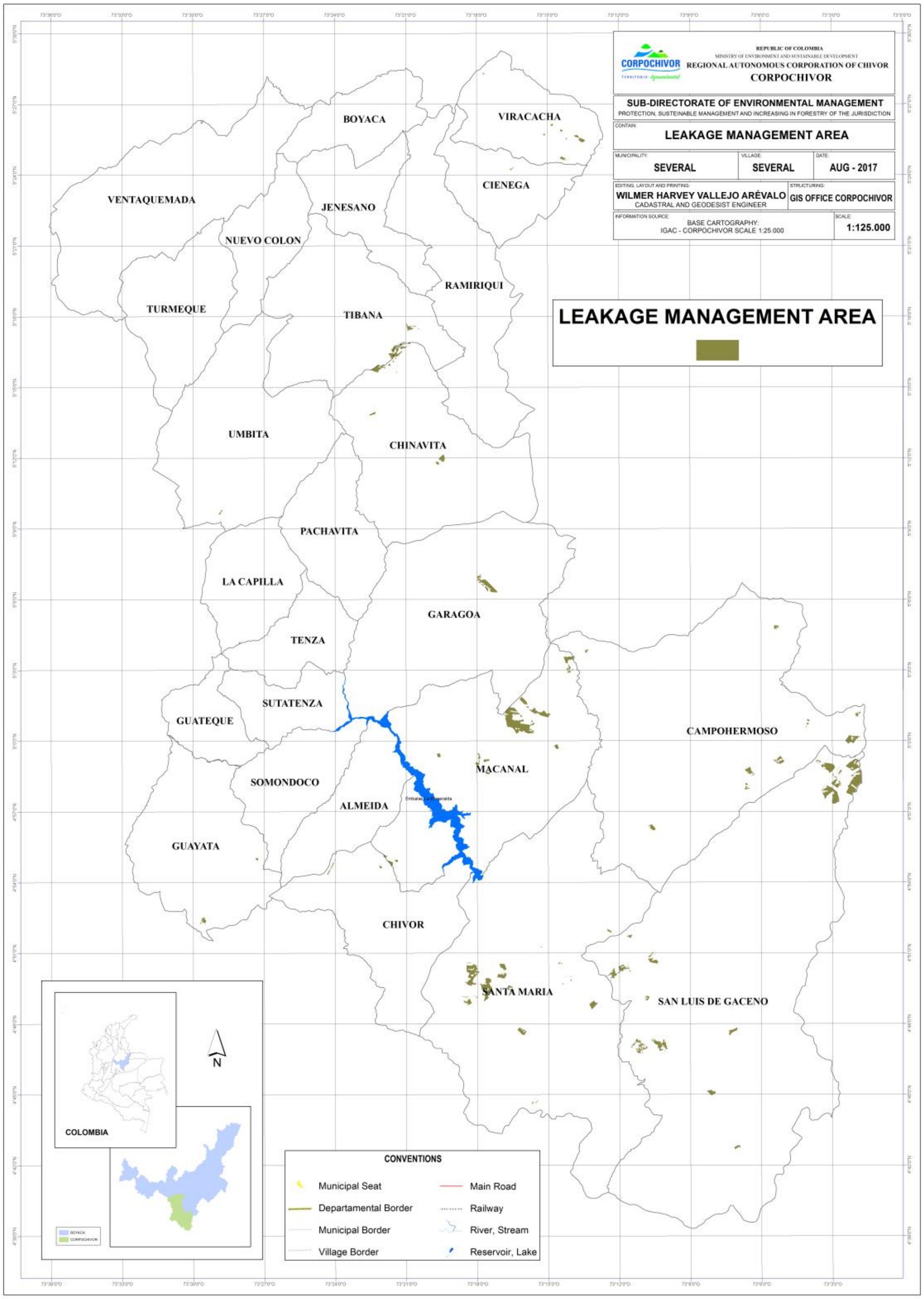


**Figure 17. Leakage Management Areas**

**Step 1.1.5: Forest**

Colombia forest definition describes forest as covering a minimum surface of 1.0 hectares (ha) with a canopy cover (or equivalent population density) exceeding 30% and with trees that reach a minimum height of five meters (m) at maturity in situ.

**Step 1.2: Temporal boundaries**

**Step 1.2.1: Starting date and end date of the historical reference period**

The starting date and end date of the historical reference period is 2000 and 2014 respectively. The project start date is April 11, 2014.

**Step 1.2.2: Starting date of the project crediting period of the AUD project activity**

The project crediting period is 30 years and 0 months. The start date of the crediting period is April 11, 2014 and the end date is April 11, 2044.

**Step 1.2.3: Starting date and end date of the first fixed baseline period**

Starting date for the first fixed baseline period is April 11, 2014.

End date for the first fixed baseline period is April 11, 2024.

**Step 1.2.4: Monitoring period**

The monitoring period / verification process will be every 3 to 5 years. It will depend on the income managed by the Corporation and the cost-benefit analysis for the optimal verification period (amount of expected carbon credits).

**Step 1.3: Carbon pools**

- **Aboveground Biomass – Tree**. Included. Main carbon source in forest ecosystems. Significant and required.
- **Aboveground Biomass – Non-Tree**. Included. This source should be included when the final land cover includes permanent crops. It was not included as a separate category but rather was incorporated into the post-deforestation calculations of GHG sources. A perennial crop cover factor was integrated into final average accumulation factor after finding evidence that African palm and other perennial crops such as cacao were serving as post-deforestation land cover in the Project Area.

- **Below-ground Biomass**. Included. This source is optional according to the methodology. It was calculated by application of expansion factors (root-to-shoot ratios). According to the Agriculture, forestry, and Other Land Use (AFOLU) Requirements, the loss of carbon via this GHG source is assumed to occur gradually, modelled as a linear decay function beginning at the deforestation event.
- **Deadwood**. Excluded. Optional according to the methodology.
- **Harvested Wood Products**. Excluded. Domestic harvest[49].
- **Litter**. Excluded. According to VCS, this pool does not apply to REDD projects.
- **Soil Organic Carbon**. Excluded. This pool is recommended by the methodology VM0015 but is optional and inclusion falls under the discretion of the project proponent. In this case, it was conservatively excluded.

For further information, please refer to Section 2.3

**Step 1.4: Sources of GHG emissions**

The two sources of GHG emissions included or excluded in this methodology within the boundary of the proposed AUD project activity are described in the table below.

| Sources | Gas | Included/ TBD/excluded | Justification |
|---|---|---|---|
| Biomass burning | $CO_2$ | Excluded | Conservative. Counted as carbon stock change. Fires occurred with more frequency during deforestation in the baseline scenario. |
| | $CH_4$ | Excluded | Conservative. Fires occurred with more frequency during deforestation in the baseline scenario. |
| | $N_2O$ | Excluded | Considered insignificant as per the methodology |
| | $CO_2$ | Excluded | Not a significant source as per the methodology. |

[49] See supporting document *Tree carbon harvested*.

| Sources | Gas | Included/ TBD/excluded | Justification |
|---|---|---|---|
| Livestock emissions | $CH_4$ | Excluded | Conservative. There are livestock population in the project area, however, these emissions will be higher in the baseline scenario than the project scenario. |
| | $N_2O$ | Excluded | Conservative. There are livestock population in the project area, however, these emissions will be higher in the baseline scenario than the project scenario. |

### 3.1.2. STEP 2: ANALYSIS OF HISTORICAL LAND-USE AND LAND-COVER CHANGE

**Step 2.1: Collection of appropriate data sources**

The forest/non-forest information agrees with the official data generated by the governmental organization IDEAM (Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia – Institute for Hydrology, Meteorology, and Environmental Studies of Colombia). The cartographic information and the methodology used to develop said data is available from the following sources:

- Forest/non-forest and deforestation layers for 2000, 2005, 2010 and 2012: http://www.siac.gov.co/Catalogo_mapas.html
- Methodology used to generate the layers: http://www.ideam.gov.co/documents/13257/13817/Memoria+T%C3%A9cnica+Deforestaci%C3%B3n+.pdf/5f2741b4-ffa1-4b58-b986-f2fbefd6d006

**Step 2.2: Definition of classes of land-use and land-cover**

The project defined eighteen (18) LU/LC classes. Classes 1 to 11 represent forest cover and are differentiated by type based on climatic patterns (Life Zones). Classes 12 to 18 are non-forest and non-native forest classes resulting from the conversion of native forest (See **Table 9** and **Figure 18**).

**Table 9. Land Use / Land Cover (LU/LC) classes.**

| Land Use/Land Cover classes | |
|---|---|
| 1. Moist montane forest | 9. montane Rainforest |
| 2. Moist lower-montane forest | 10. Pre-montane Rainforest |
| 3. Moist Pre-montane forest | 11. dry lower-montane forest |
| 4. Moist Tropical forest | 12. Pasture |
| 5. wet montane forest | 13. Other Lands |
| 6. wet lower-montane forest | 14. Heterogeneous Agricultural Lands |
| 7. wet Pre-montane forest | 15. Cropland |
| 8. wet Tropical forest | |

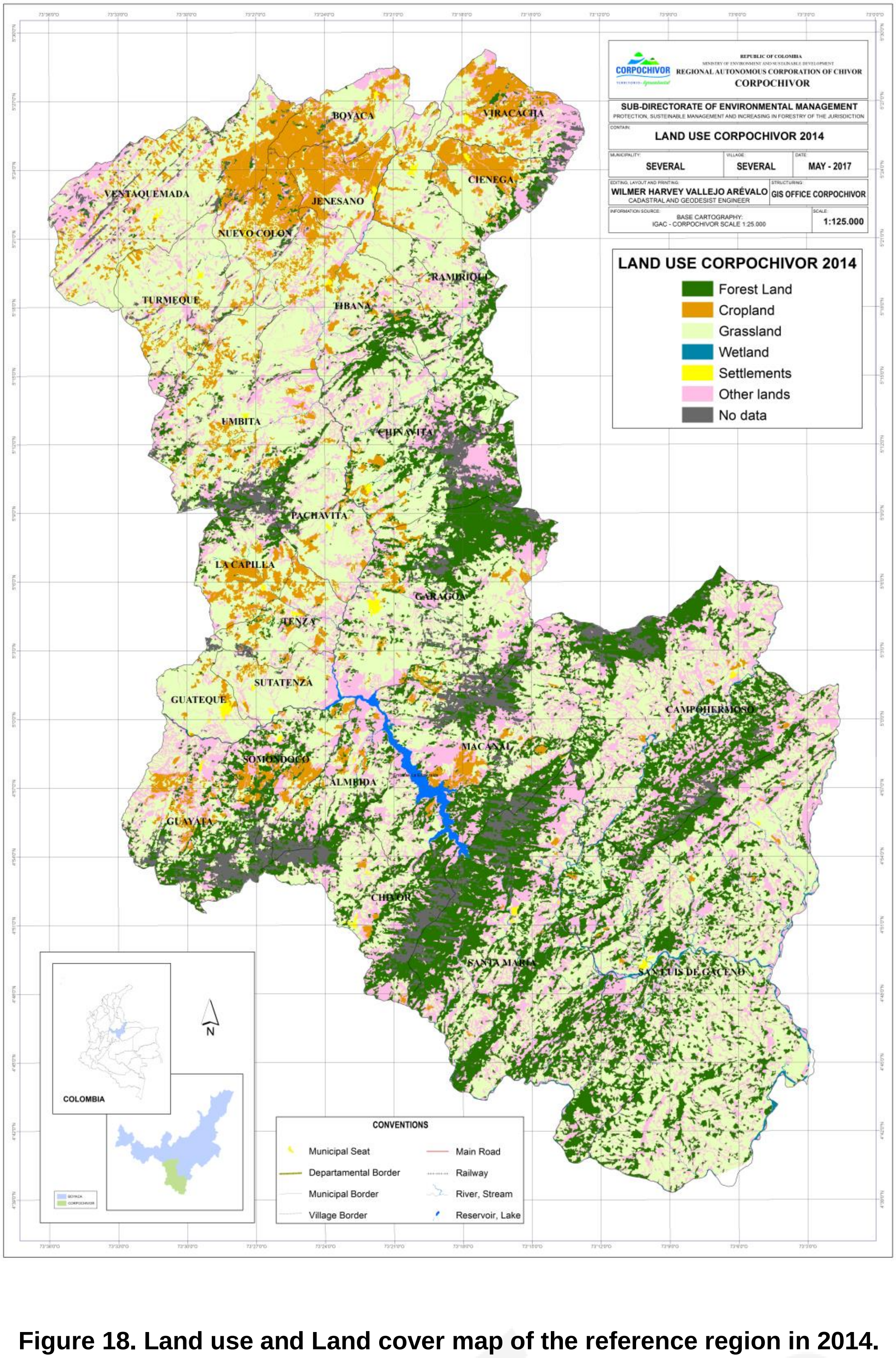


**Figure 18. Land use and Land cover map of the reference region in 2014.**

**Step 2.3: Definition of categories of land-use and land-cover change**

The map of LU/LC change (Figure 19) demonstrates the transitions that have occurred based on the forest cover map of 2005 and the LU/LC map of 2014 (Figure 18). The LU/LC change map only represents changes from the initial forest cover (2005) to non-forest cover in 2014. It was created using Method 1 of Section 5.2, Methodology VM0015, version 1.0.

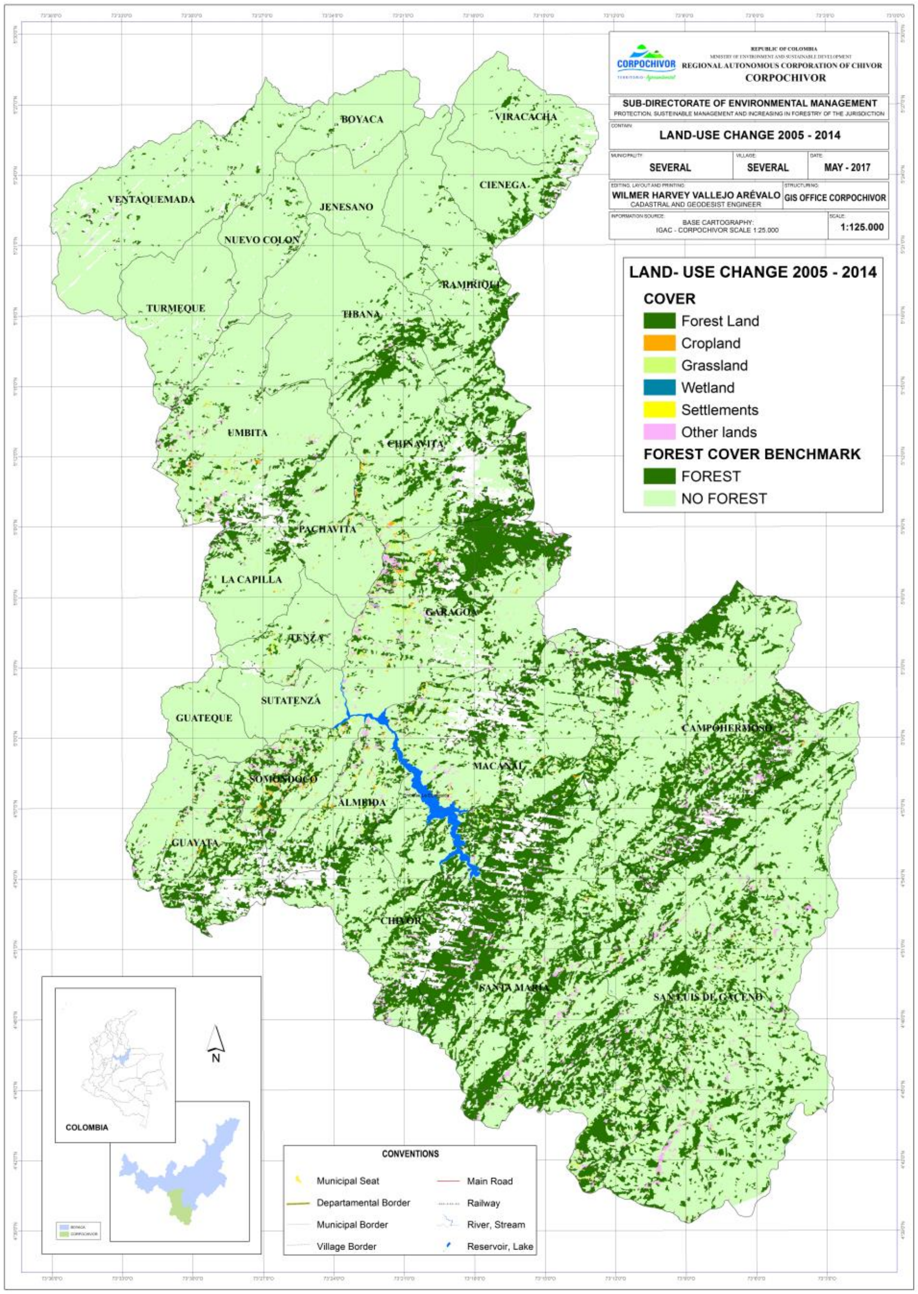


**Figure 19. Land use and Land cover change 2000-2010**

## Step 2.4: Analysis of historical land-use and lad-cover change

The forest/non-forest maps for 2000, 2005, 2010, and 2012 were used as inputs to determine the percent forest cover via deforestation matrices created with the program Dinámica EGO.

**Table 10. Area of forest and non-forest cover for the historic reference period.**

| Shapefile | Area by Land Cover (ha) | | |
|---|---|---|---|
| | Forest | Non-Forest | No Data |
| BNB_2005 | 62598,11 | 223055,83 | 27320,85 |
| BNB_2010 | 53691,18 | 231962,76 | 27320,85 |
| BNB_2014 | 55334,48 | 230319,45 | 27320,85 |

The annual deforestation rate for the 2000-2012 period (based on a multi-step matrix) demonstrates that the forest is being lost at a rate of 2.32% each year. The single-step matrix constructed for 2000 to 2012 shows a 27.9% loss of forests during this period. This analysis only considered the change in the cover in terms of two land-cover classes: forest and non-forest.

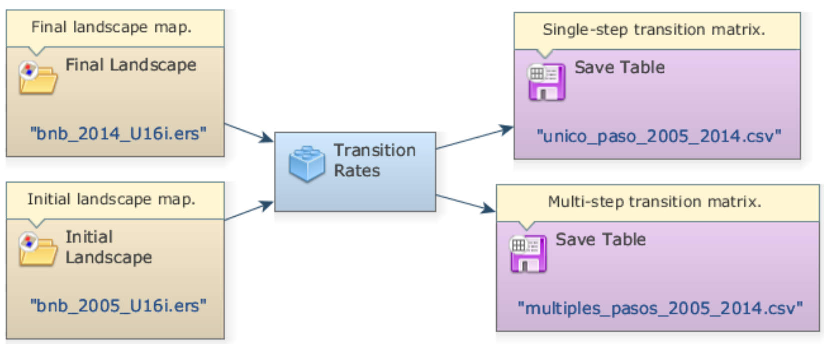


**Figure 20. Diagrama modelo de cálculo de las matrices de transición.**

The spatial model of Dinamica EGO was applied to generate projections and calibrate the model for the calculation of deforestation rate.

**Table 11. Deforestation Rate 2005 – 2010.**

| LC Class | $ARR_1$ 2005 | $ARR_1$,2010 | RBSLRR $_1$,2005-2010 |
|---|---|---|---|
| **Forest** | 62598,11 | 53691,18 | -3.06% |



CORPOCHIVOR
TERRITORIO Agroambiental

**Table 12. Deforestation Rate 2010 – 2014.**

| LC Class | $ARR_1$ ,2010 | $ARR_1$,2014 | $RBSLRR_1$ ,2010-2014 |
|---|---|---|---|
| **Forest** | 53691,18 | 55334,48 | 0.75% |

**Table 13. Deforestation Rate 2005 – 2014.**

| LC Class | $ARR_1$ ,2005 | $ARR_1$,2014 | $RBSLRR_1$ ,2005-2014 |
|---|---|---|---|
| **Forest** | 66,515.58 | 50,923.53 | 1.89% |

**Step 2.5: Map accuracy assessment**

La evaluación de la información de los mapas de cobertura de bosque (*Forest Cover Benchmark Maps)* generados por el IDEAM, se encuentran en la memoria técnica[50].

### 3.1.3. STEP 3: ANALYSIS OF AGENTS, DRIVERS AND UNDERLYING CAUSES OF DEFORESTATION AND THEIR LIKELY FUTURE DEVELOPMENT

Section 3 of the VCS Technical Annex contains a highly detailed description of the agents of deforestation according to the guidelines of VM0015.

**Step 3.1: Identification of agents of deforestation**

The main groups of deforestation agents acting within the jurisdiction of CORPOCHIVOR were identified through a literature review, surveys conducted in the field, and project consultation workshops. Two main groups were identified:

[50] Cabrera E., Vargas D. M., Galindo G. García, M.C., Ordoñez, M.F., Vergara, L.K., Pacheco, A.M., Rubiano, J.C. y Giraldo, P. 2011. Memoria técnica de la cuantificación de la deforestación histórica nacional – escalas gruesa y fina. Instituto de Hidrología, Meteorología, y Estudios Ambientales-IDEAM-. Bogotá D.C., Colombia. Disponible en: http://www.ideam.gov.co/documents/13257/13817/Memoria+T%C3%A9cnica+Deforestaci%C3%B3n+.pdf/5f2741b4-ffa1-4b58-b986-f2fbefd6d006

***Ranchers:*** Ranchers are non-organized rural farmers and private property holders whose vocation includes raising, use, and sale of livestock – mainly cattle – for meat and dairy. This agent group includes those who maintain livestock for productive ends, like those that seek to ensure land tenure by introducing cattle[51] and who cut natural forests to seed new pasture for grazing their animals. The typical chain of activities for small producers is to slash, burn, plant crops, and seed pasture. Large producers tend to use mechanized processes in achieving these ends. This category consists of agents who were grouped based on their dedication to extensive livestock (cattle) grazing and management.

***Farmers:*** This agent group includes farmers and other small- and medium-scale agricultural producers in rural areas of the jurisdiction. Two sub-groups were distinguished within this group, based on mode of production; one sub-group engages in commercial agricultural production while the other consists of subsistence farmers (small operations). Changes in land use result from the activities of this group. These actions are one of the main causes of deforestation in the Reference Region. With finite land resources, cultivation competes directly with forest cover for space in the landscape. Farmers and agricultural producers are typically incentivized to deforest when productivity of cultivated lands is low and earnings fall below desires or expectations[52].

**Step 3.2: Identification of deforestation drivers; Step 3.3: Identification of underlying causes of deforestation; Step 3.4: Analysis of chain of events leading to deforestation**

The relationships between the agents, drivers, and underlying causes of deforestation were analyzed using the compiled historical evidence to explain the sequences of events that have caused and continue to drive deforestation.

Deforestation in the Reference Region is closely related to socioeconomic and cultural phenomena. Its spatial distribution is tightly linked with economic and

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51 FEDEGAN, 2006. Plan Estratégico de la Ganadería Colombiana 2019. Available at: http://portal.fedegan.org.co/Documentos/pega_2019.pdf [Accessed May 5, 2016].
52 Ministerio de ambiente, vivienda y desarrollo territoria-Instituto de Hidrología, Meteorología y Estudios Ambientales-IDEAM. 2011. Análisis de tendencias y patrones espaciales de deforestación en Colombia. Available at: http://www.ideam.gov.co/documents/13257/13817/Proyecciones.pdf/6cad956b-6b92-4320-a090-2000408a5765

geographic variables. Land use in these areas is principally determined by the opportunity cost of the land. In the case of the Project Area, it is more profitable for the farmers to convert forests to land suitable for agriculture or livestock than to keep them standing.

As rural farmers are the individuals who predominantly make decisions regarding land use in the Reference Region, they are the main agents of deforestation. Therefore, the dominant drivers of deforestation are the activities that these actors choose to develop: agriculture and extensive grazing. While there are numerous possible sequences of events through which rural farmers convert forested land, the effect is the same (deforestation).

Most of the rural farmers in the Reference Region are persons of old age who often have low levels of education and who in some cases are illiterate. These social factors act as a barrier to accessing new knowledge and techniques for sustainable production activities.

In addition to the previously mentioned conditions, a high proportion of the rural population in the Reference Region has unsatisfied basic needs; they live in poverty. It is often the case that these inhabitants' resources come from their small properties, which are most often used for livestock or agriculture. If rural farmers need to increase their incomes to meet the basic needs of themselves and their families, the only option currently accessible is to increase the land area available for these activities. This is mainly achieved by expanding into forested lands.

For ranchers, production is of an extensive nature. Therefore, increasing livestock production implies expanding the area of pasture in order to support additional head of cattle. This is exacerbated by the fact the properties in the Reference Region have demonstrated low productivity, with an average of 0.8 head of cattle per hectare.

The character of the soils in the Reference Region, traditional ranching systems, lack of technical advising in the establishment and management of productive systems, the need to increase incomes, and the low productivity of the land are all conditions that together have encouraged rural ranchers to continue the expansion of the agricultural frontier.

The situation for rural farmers raising crops is similar – land is managed in a traditional manner without sophisticated tools, methods, or technical guidance. Agriculture is often financed through small agricultural loans. These loans are often given to rural farmers that do not know of alternative production systems that could improve their productivity. Therefore, investment does not go towards improving capacity or optimizing efficiency in production. Instead, it supports the traditional production model and the clearing of more forest as a means of generating income to both cover the financial obligations of these farmers and their excessive costs of production. Agricultural production also depends on external factors including weather, pests, and blight that can affect production and cause economic losses, pressuring the farmers to harvest valuable timber species to cover their losses.

Regarding the spatial character of deforestation, investments made to improve existing roads allows for greater accessibility to forests. This attracts migrant farmers who may choose to settle in the zone, establish extensive livestock, and fall into the same cycle as those who already inhabit the Reference Region, incentivized to expand into new territory and convert forested land in the process.

Armed groups are key agents in the forestry transformation processes. The presence of these agents leads to migration process, after which the land is abandoned, and usually, the forest is conserved or recovered[53]. Around 50% of the armed conflict was developed in forested regions, showing a strong correlation between the forest and the conflict[54]. Therefore, after a peace process, it is expected an increase in the loss of forest due to the return of the displaced people and even the colonization of new areas.

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[53] González, J., Etter, A., Sarmiento, A., Orrego, S., Ramírez, C., Cabrera, E., Ordoñez, M. (2011). Análisis de tendencias y patrones espaciales de deforestación en Colombia Análisis de tendencias y patrones espaciales de deforestación en Colombia. Retrieved from http://www.ideam.gov.co/documents/13257/13817/Proyecciones.pdf/6cad956b-6b92-4320-a090-2000408a5765

[54] González, J., Etter, A., Sarmiento, A., Orrego, S., Ramírez, C., Cabrera, E., … Ordoñez, M. (2011). Análisis de tendencias y patrones espaciales de deforestación en Colombia Análisis de tendencias y patrones espaciales de deforestación en Colombia. Retrieved from http://www.ideam.gov.co/documents/13257/13817/Proyecciones.pdf/6cad956b-6b92-4320-a090-2000408a5765

Several examples of chains of events leading to deforestation are displayed in the next figure. All the processes presented in this figure could be enhanced by the peace process due to new immigration trends.

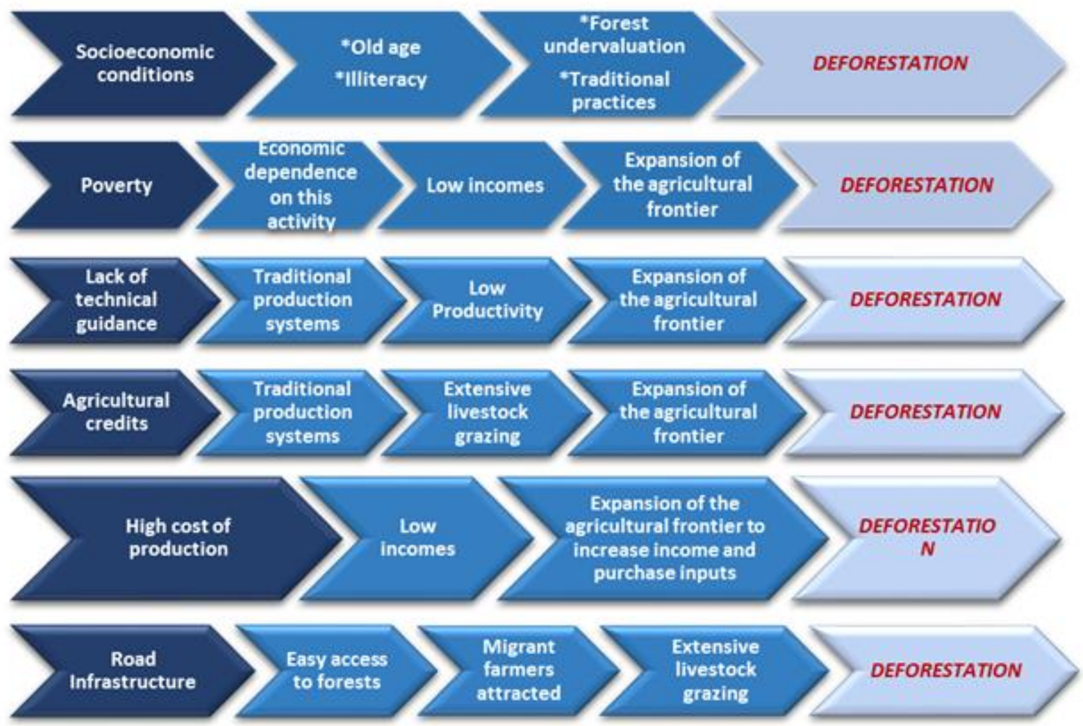


**Figure 21: Example chains of events driving deforestation.**

### 3.1.4. STEP 4: PROJECTION OF FUTURE DEFORESTATION

**Step 4.1: Projection of the quantity of future deforestation**

The Reference Region was not stratified in terms of land cover. To project the amount of future deforestation, the analysis of agents and causes of deforestation was considered alongside historical deforestation trends in the Reference Region of the project.

**Step 4.1.1: Selection of the baseline approach.** Section 4.1.1 of the methodology VM0015 dictates that if the deforestation rates in the Reference Region do not demonstrate a clear trend for different periods, there is conclusive evidence that the agents and drivers explain the observed deforestation, and there is at least one variable that can be used to model deforestation, then baseline approach “C” should be employed. The approach

C estimates the annual area of deforestation using a model that expresses future deforestation as a function of the variables mentioned in the supporting document "*Future deforestation methodology".*

The final forest area for the historical analysis period was used as a reference point for the baseline deforestation model.

Approach C – Modelling

As mentioned before, modelling began with the use of forest/non-forest layers (in shapefile format) provided to the Corporation by IDEAM. These layers have a scale factor of 1:100,000. A preliminary revision of the specific conditions in the region analyzed the variables that significantly impact deforestation. The elements determined for consideration are:

- Distance to roads
- Distance to population centers
- Distance to mining zones (Environmental licenses)
- Steepness of the gradient (land surface slope)
- Digital Elevation Model (DEM)

The results of the future deforestation analysis for the reference area, Project Area, and Leakage Belt are presented in Table 14, Table 15 and

Table **16**, respectively (methodology VM0015 Tables 9.a, 9.b, and 9.c, respectively).

**Table 14. Annual area of deforestation in the Reference Region in the baseline scenario (VM0015 Table 9.a).**

| Project year t | Stratum I in the refrence region | Total | |
|---|---|---|---|
| | 1 | annual | cumulative |
| | ABSLRRi,t | ABSLRRt (Annual area of baseline deforestation in the reference region at year t) | ABSLRR (cumulative area of baseline deforestation in the reference region at year t) |
| | ha | ha | ha |
| 1 | 1,041.46 | 1,041.46 | 1,041.46 |
| 2 | 1,002.32 | 1,002.32 | 2,043.78 |
| 3 | 983.25 | 983.25 | 3,027.03 |
| 4 | 964.53 | 964.53 | 3,991.56 |
| 5 | 946.23 | 946.23 | 4,937.79 |
| 6 | 928.26 | 928.26 | 5,866.05 |
| 7 | 910.61 | 910.61 | 6,776.66 |
| 8 | 893.38 | 893.38 | 7,670.04 |
| 9 | 876.40 | 876.40 | 8,546.43 |
| 10 | 859.74 | 859.74 | 9,406.17 |
| 11 | 843.40 | 843.40 | 10,249.58 |
| 12 | 827.43 | 827.43 | 11,077.00 |
| 13 | 811.69 | 811.69 | 11,888.70 |
| 14 | 796.28 | 796.28 | 12,684.98 |
| 15 | 781.14 | 781.14 | 13,466.12 |

| Project year t | Stratum I in the refrence region | Total | |
|---|---|---|---|
| | 1 | annual | cumulative |
| | ABSLRRi,t | ABSLRRt (Annual area of baseline deforestation in the reference region at year t) | ABSLRR (cumulative area of baseline deforestation in the reference region at year t) |
| | ha | ha | ha |
| 16 | 766.36 | 766.36 | 14,232.48 |
| 17 | 751.67 | 751.67 | 14,984.14 |
| 18 | 737.45 | 737.45 | 15,721.60 |
| 19 | 723.40 | 723.40 | 16,444.99 |
| 20 | 709.54 | 709.54 | 17,154.53 |
| 21 | 696.22 | 696.22 | 17,850.75 |
| 22 | 683.03 | 683.03 | 18,533.78 |
| 23 | 670.04 | 670.04 | 19,203.82 |
| 24 | 657.28 | 657.28 | 19,861.10 |
| 25 | 644.79 | 644.79 | 20,505.89 |
| 26 | 632.56 | 632.56 | 21,138.45 |
| 27 | 620.55 | 620.55 | 21,759.01 |
| 28 | 608.73 | 608.73 | 22,367.73 |
| 29 | 597.23 | 597.23 | 22,964.96 |
| 30 | 1,021.67 | 1,021.67 | 23,986.63 |

**Table 15. Annual area of deforestation in the Project Area in the baseline scenario (VM0015 Table 9.b).**

| Project year t | Stratum I of the reference region in the project area | Total | |
|---|---|---|---|
| | 1 | annual | cumulative |
| | ABSLPAi,t (Annual area of baseline deforestation in sratum i within the project area at year t) | ABSLPAt (Annual area of baseline deforestation in the project area at year t) | ABSLPA (Cumulative area of baseline deforestation in the project area at year t) |
| | ha | ha | ha |
| 1 | 11.73 | 11.73 | 11.73 |
| 2 | 10.23 | 10.23 | 21.95 |
| 3 | 10.03 | 10.03 | 31.98 |
| 4 | 9.92 | 9.92 | 41.90 |
| 5 | 10.81 | 10.81 | 52.71 |
| 6 | 10.25 | 10.25 | 62.96 |
| 7 | 10.91 | 10.91 | 73.87 |
| 8 | 12.12 | 12.12 | 85.99 |
| 9 | 10.31 | 10.31 | 96.29 |
| 10 | 11.71 | 11.71 | 108.00 |
| 11 | 10.44 | 10.44 | 118.45 |
| 12 | 12.89 | 12.89 | 131.33 |
| 13 | 14.40 | 14.40 | 145.73 |
| 14 | 12.09 | 12.09 | 157.82 |

| Project year t | Stratum I of the reference region in the project area | Total | |
|---|---|---|---|
| | 1 | annual | cumulative |
| | ABSLPAi,t (Annual area of baseline deforestation in sratum i within the project area at year t) | ABSLPAt (Annual area of baseline deforestation in the project area at year t) | ABSLPA (Cumulative area of baseline deforestation in the project area at year t) |
| | ha | ha | ha |
| 15 | 14.20 | 14.20 | 172.02 |
| 16 | 12.00 | 12.00 | 184.02 |
| 17 | 11.16 | 11.16 | 195.18 |
| 18 | 12.54 | 12.54 | 207.72 |
| 19 | 11.97 | 11.97 | 219.69 |
| 20 | 10.29 | 10.29 | 229.98 |
| 21 | 9.74 | 9.74 | 239.72 |
| 22 | 12.02 | 12.02 | 251.75 |
| 23 | 12.19 | 12.19 | 263.94 |
| 24 | 9.70 | 9.70 | 273.64 |
| 25 | 9.65 | 9.65 | 283.29 |
| 26 | 11.32 | 11.32 | 294.61 |
| 27 | 10.18 | 10.18 | 304.78 |
| 28 | 10.29 | 10.29 | 315.07 |
| 29 | 9.36 | 9.36 | 324.44 |

| Project year t | Stratum I of the reference region in the project area | Total | |
|---|---|---|---|
| | 1 | annual | cumulative |
| | ABSLPAi,t (Annual area of baseline deforestation in sratum i within the project area at year t) | ABSLPAt (Annual area of baseline deforestation in the project area at year t) | ABSLPA (Cumulative area of baseline deforestation in the project area at year t) |
| | ha | ha | ha |
| 30 | 10.99 | 10.99 | 335.42 |

**Table 16. Annual area of deforestation in the Leakage Belt in the baseline scenario (VM0015 Table 9.c).**

| Project year t | Stratum I of the reference region in the leakage belt | Total | |
|---|---|---|---|
| | 1 | annual | cumulative |
| | ABSLLKi,t (Annual area of baseline deforestation in stratum i within the leakage belt at year t) | ABSLLKt (Annual area of baseline deforestation within the leakage belt at year t) | ABSLLK (Cumulative area of baseline deforestation within the leakage belt at year t ) |
| | ha | ha | ha |
| 1 | 214.88 | 214.88 | 214.88 |
| 2 | 209.65 | 209.65 | 424.54 |
| 3 | 205.44 | 205.44 | 629.97 |
| 4 | 209.01 | 209.01 | 838.98 |

| Project year t | Stratum I of the reference region in the leakage belt | Total | |
|---|---|---|---|
| | 1 | annual | cumulative |
| | ABSLLKi,t (Annual area of baseline deforestation in stratum i within the leakage belt at year t) | ABSLLKt (Annual area of baseline deforestation within the leakage belt at year t) | ABSLLK (Cumulative area of baseline deforestation within the leakage belt at year t ) |
| | ha | ha | ha |
| 5 | 197.44 | 197.44 | 1,036.43 |
| 6 | 204.46 | 204.46 | 1,240.89 |
| 7 | 197.39 | 197.39 | 1,438.28 |
| 8 | 198.42 | 198.42 | 1,636.70 |
| 9 | 190.32 | 190.32 | 1,827.02 |
| 10 | 190.32 | 190.32 | 2,017.34 |
| 11 | 184.70 | 184.70 | 2,202.04 |
| 12 | 190.13 | 190.13 | 2,392.17 |
| 13 | 191.94 | 191.94 | 2,584.11 |
| 14 | 190.48 | 190.48 | 2,774.59 |

| Project year t | Stratum I of the reference region in the leakage belt | Total | |
|---|---|---|---|
| | 1 | annual | cumulative |
| | ABSLLKi,t (Annual area of baseline deforestation in stratum i within the leakage belt at year t) | ABSLLKt (Annual area of baseline deforestation within the leakage belt at year t) | ABSLLK (Cumulative area of baseline deforestation within the leakage belt at year t ) |
| | ha | ha | ha |
| 15 | 186.42 | 186.42 | 2,961.01 |
| 16 | 179.41 | 179.41 | 3,140.41 |
| 17 | 183.79 | 183.79 | 3,324.20 |
| 18 | 176.71 | 176.71 | 3,500.91 |
| 19 | 178.54 | 178.54 | 3,679.45 |
| 20 | 170.67 | 170.67 | 3,850.12 |
| 21 | 168.96 | 168.96 | 4,019.07 |
| 22 | 176.25 | 176.25 | 4,195.32 |
| 23 | 172.75 | 172.75 | 4,368.07 |
| 24 | 168.57 | 168.57 | 4,536.65 |

| Project year t | Stratum I of the reference region in the leakage belt | Total | |
|---|---|---|---|
| | 1 | annual | cumulative |
| | ABSLLKi,t (Annual area of baseline deforestation in stratum i within the leakage belt at year t) | ABSLLKt (Annual area of baseline deforestation within the leakage belt at year t) | ABSLLK (Cumulative area of baseline deforestation within the leakage belt at year t ) |
| | ha | ha | ha |
| 25 | 165.56 | 165.56 | 4,702.20 |
| 26 | 162.50 | 162.50 | 4,864.70 |
| 27 | 156.49 | 156.49 | 5,021.19 |
| 28 | 165.75 | 165.75 | 5,186.94 |
| 29 | 160.07 | 160.07 | 5,347.01 |
| 30 | 214.33 | 214.33 | 5,561.33 |

**Step 4.2: Projection of the location of future deforestation**

The results of the analysis of the future deforestation location (Figure 23) were generated through modelling in Dinamica EGO with the deforestation factor maps (Figure 22) and the best possible model parameters[55].

Factors include:

– Distance categories of paved and unpaved roads.

[55] See supporting document *Future deforestation methodology*

- Distance categories to population centers.
- Distance categories to mining operations.
- Categories of land surface gradient (slope).
- Categories from the DEM.

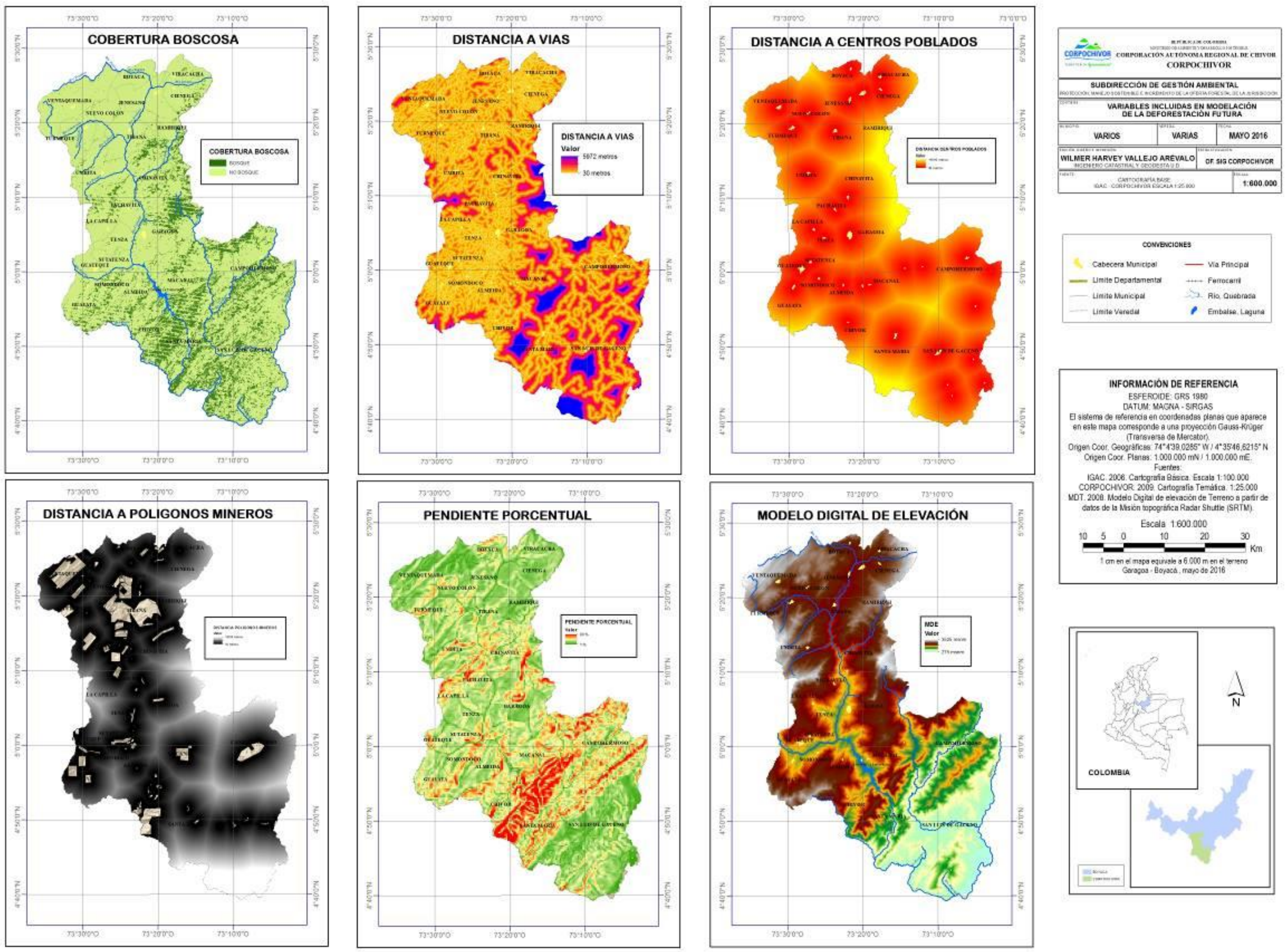


**Figure 22. Factor maps**

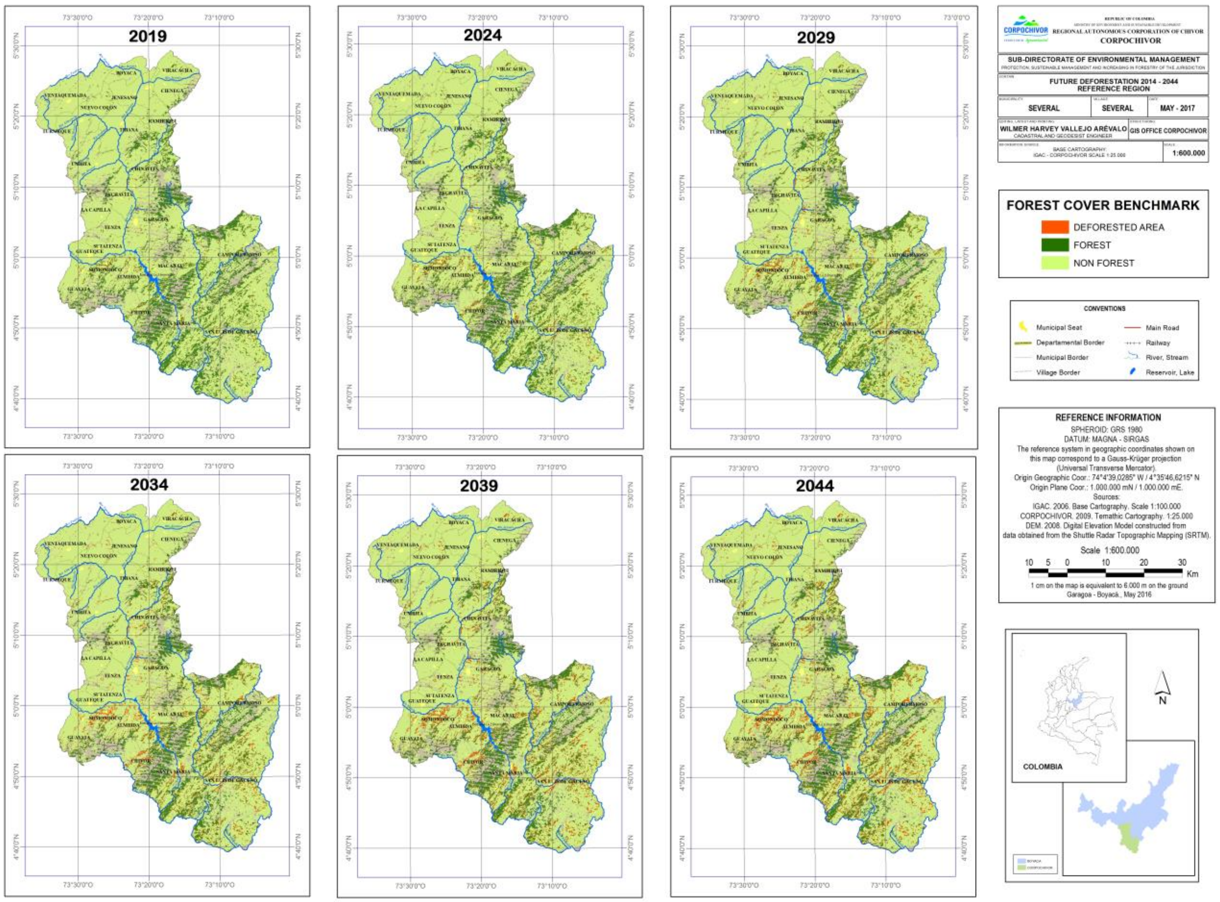


**Figure 23. Deforestation under the risk model over the project lifetime in 5-year time lapse**

### 3.1.5. STEP 5: DEFINITION OF THE LAND-USE AND LAND-COVER CHANGE COMPONENT OF THE BASELINE

**Step 5.1: Calculation of baseline activity data per forest class**

To determine the annual area deforested ("activity data") for each forest class, the results of the spatial deforestation model (Table 14, Table 15 and table 16) were superimposed of the 2010 Land Use/Land Cover Map through the use of Geographic Information Systems (GIS). Each table in the following series presents the surface of forest area estimated to be converted to non-forest in each of the Life Zones (Table 17, Table 18 and Table 19). The forest classes employed in the calculation of deforested areas were:

- moist montane forest
- moist lower-montane forest
- moist pre-montane forest
- moist tropical forest
- wet montane forest
- wet lower-montane forest
- wet pre-montane forest
- wet tropical forest
- montane rainforest
- pre-montane Rainforest
- dry lower-montane forest

**Table 17. Annual deforestation by forest class (*icl*) in the Reference Region baseline scenario.**

| Area deforested per forest class icl within the reference region | | | | | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDicl > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Name> | Montane moist forest (bh-M) | Lower montane moist forest (bh-MB) | Premontane humid forest (bh-PM) | Tropical moist forest (bh-T) | Montane wet forest (bmh-M) | Lower montane wet forest (bmh-MB) | Premontane wet forest (bmh-PM) | Tropical wet forest (bmh-T) | Montane rain forest (bp-M) | Premontane rain forest (bp-PM) | Lower montane dry forest (bs-MB) | ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t) | ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 1 | 39.01 | 154.65 | 157.93 | 83.62 | 20.93 | 113.61 | 86.24 | 299.92 | 0.82 | 69.75 | 14.99 | 1041.46 | 1041.46 |
| 2 | 35.06 | 147.39 | 154.84 | 80.18 | 17.71 | 116.66 | 75.22 | 287.49 | 1.05 | 72.73 | 13.99 | 1002.32 | 2043.78 |
| 3 | 33.66 | 142.48 | 158.85 | 79.24 | 17.21 | 110.34 | 75.73 | 282.43 | 0.90 | 71.22 | 11.19 | 983.25 | 3027.03 |
| 4 | 29.52 | 139.47 | 153.85 | 81.28 | 16.43 | 108.64 | 72.07 | 281.97 | 0.45 | 67.55 | 13.30 | 964.53 | 3991.56 |
| 5 | 31.78 | 141.45 | 134.54 | 79.26 | 19.92 | 101.93 | 75.60 | 279.19 | 0.99 | 69.31 | 12.25 | 946.23 | 4937.79 |
| 6 | 33.05 | 140.33 | 125.43 | 77.66 | 19.60 | 102.97 | 71.89 | 274.02 | 0.89 | 71.54 | 10.89 | 928.26 | 5866.05 |
| 7 | 32.29 | 130.94 | 126.31 | 79.16 | 18.22 | 100.14 | 73.28 | 272.98 | 0.45 | 68.13 | 8.70 | 910.61 | 6776.66 |
| 8 | 29.70 | 139.24 | 111.61 | 74.42 | 17.56 | 105.53 | 76.10 | 263.09 | 0.80 | 68.80 | 6.53 | 893.38 | 7670.04 |

| Area deforested per forest class icl within the reference region | | | | | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDicl > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Name> | Montane moist forest (bh-M) | Lower montane moist forest (bh-MB) | Premontane humid forest (bh-PM) | Tropical moist forest (bh-T) | Montane wet forest (bmh-M) | Lower montane wet forest (bmh-MB) | Premontane wet forest (bmh-PM) | Tropical wet forest (bmh-T) | Montane rain forest (bp-M) | Premontane rain forest (bp-PM) | Lower montane dry forest (bs-MB) | ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t) | ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 9 | 29.12 | 137.02 | 118.37 | 75.45 | 16.67 | 102.53 | 69.56 | 257.42 | 0.72 | 62.92 | 6.62 | 876.40 | 8546.43 |
| 10 | 26.87 | 130.11 | 103.31 | 77.28 | 15.40 | 105.63 | 68.52 | 263.85 | 0.84 | 62.28 | 5.65 | 859.74 | 9406.17 |
| 11 | 24.75 | 125.18 | 98.09 | 73.48 | 17.66 | 106.25 | 69.68 | 257.18 | 0.54 | 64.22 | 6.38 | 843.40 | 10249.58 |
| 12 | 28.16 | 128.73 | 86.93 | 74.74 | 15.78 | 103.60 | 60.72 | 261.94 | 1.01 | 60.83 | 4.98 | 827.43 | 11077.00 |
| 13 | 22.96 | 124.19 | 79.35 | 81.54 | 17.59 | 101.27 | 64.52 | 252.59 | 0.98 | 62.10 | 4.60 | 811.69 | 11888.70 |
| 14 | 23.90 | 124.83 | 73.46 | 73.89 | 15.28 | 100.25 | 63.80 | 252.73 | 1.35 | 64.10 | 2.68 | 796.28 | 12684.98 |
| 15 | 24.74 | 129.41 | 62.80 | 73.96 | 16.10 | 100.27 | 64.61 | 244.77 | 0.63 | 60.39 | 3.46 | 781.14 | 13466.12 |
| 16 | 23.83 | 126.55 | 62.08 | 70.26 | 14.63 | 104.81 | 64.45 | 230.72 | 0.48 | 65.44 | 3.12 | 766.36 | 14232.48 |
| 17 | 21.88 | 131.76 | 53.46 | 69.83 | 15.44 | 100.63 | 63.32 | 230.70 | 1.16 | 61.57 | 1.93 | 751.67 | 14984.14 |

| Area deforested per forest class icl within the reference region | | | | | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDicl > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Name> | Montane moist forest (bh-M) | Lower montane moist forest (bh-MB) | Premontane humid forest (bh-PM) | Tropical moist forest (bh-T) | Montane wet forest (bmh-M) | Lower montane wet forest (bmh-MB) | Premontane wet forest (bmh-PM) | Tropical wet forest (bmh-T) | Montane rain forest (bp-M) | Premontane rain forest (bp-PM) | Lower montane dry forest (bs-MB) | ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t) | ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 18 | 21.71 | 131.61 | 50.29 | 65.45 | 15.21 | 98.90 | 64.06 | 224.87 | 1.07 | 61.82 | 2.47 | 737.45 | 15721.60 |
| 19 | 21.92 | 127.37 | 49.80 | 64.88 | 15.26 | 106.06 | 63.02 | 213.60 | 1.08 | 58.14 | 2.26 | 723.40 | 16444.99 |
| 20 | 19.14 | 125.14 | 42.60 | 67.44 | 14.30 | 108.71 | 65.30 | 205.85 | 0.64 | 58.87 | 1.54 | 709.54 | 17154.53 |
| 21 | 16.92 | 129.73 | 37.32 | 65.65 | 14.63 | 106.27 | 60.52 | 204.94 | 0.67 | 57.86 | 1.71 | 696.22 | 17850.75 |
| 22 | 17.38 | 129.70 | 36.59 | 59.47 | 12.54 | 105.28 | 63.21 | 198.11 | 1.09 | 58.11 | 1.54 | 683.03 | 18533.78 |
| 23 | 18.97 | 127.25 | 31.59 | 61.49 | 14.49 | 102.61 | 59.26 | 193.32 | 1.34 | 58.37 | 1.36 | 670.04 | 19203.82 |
| 24 | 17.96 | 126.64 | 28.01 | 66.00 | 14.89 | 94.97 | 60.59 | 190.47 | 0.81 | 55.09 | 1.85 | 657.28 | 19861.10 |
| 25 | 17.84 | 129.17 | 25.89 | 62.63 | 13.96 | 96.25 | 56.64 | 189.68 | 1.07 | 50.06 | 1.61 | 644.79 | 20505.89 |
| 26 | 18.92 | 126.83 | 18.31 | 61.98 | 15.57 | 97.67 | 52.18 | 185.17 | 1.19 | 53.76 | 0.99 | 632.56 | 21138.45 |

| Area deforested per forest class icl within the reference region | | | | | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDicl > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Name> | Montane moist forest (bh-M) | Lower montane moist forest (bh-MB) | Premontane humid forest (bh-PM) | Tropical moist forest (bh-T) | Montane wet forest (bmh-M) | Lower montane wet forest (bmh-MB) | Premontane wet forest (bmh-PM) | Tropical wet forest (bmh-T) | Montane rain forest (bp-M) | Premontane rain forest (bp-PM) | Lower montane dry forest (bs-MB) | ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t) | ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 27 | 18.49 | 126.23 | 20.73 | 65.52 | 12.03 | 98.98 | 47.58 | 179.25 | 0.81 | 49.86 | 1.08 | 620.55 | 21759.01 |
| 28 | 16.64 | 124.86 | 18.60 | 61.15 | 12.40 | 97.65 | 46.06 | 178.71 | 1.72 | 50.23 | 0.72 | 608.73 | 22367.73 |
| 29 | 15.27 | 123.66 | 16.38 | 60.75 | 14.91 | 93.01 | 49.86 | 165.22 | 1.24 | 56.28 | 0.63 | 597.23 | 22964.96 |
| 30 | 36.08 | 153.50 | 159.26 | 83.95 | 20.46 | 114.13 | 83.36 | 287.09 | 0.81 | 68.70 | 14.32 | 1021.67 | 23986.63 |

**Table 18. Annual deforestation by forest class (*icl*) in the Project Area baseline scenario.**

| Area deforested per forest class icl within the reference region | | | | | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDicl > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Name > | Montane moist forest (bh-M) | Lower montane moist forest (bh-MB) | Premontane humid forest (bh-PM) | Tropical moist forest (bh-T) | Montane wet forest (bmh-M) | Lower montane wet forest (bmh-MB) | Premontane wet forest (bmh-PM) | Tropical wet forest (bmh-T) | Montane rain forest (bp-M) | Premontane rain forest (bp-PM) | Lower montane dry forest (bs-MB) | ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t) | ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 1 | 0.00 | 1.30 | 0.00 | 2.91 | 0.42 | 2.13 | 0.45 | 3.40 | 0.00 | 1.11 | 0.00 | 11.73 | 11.73 |
| 2 | 0.00 | 1.82 | 0.00 | 1.66 | 0.08 | 2.29 | 0.38 | 2.85 | 0.00 | 1.15 | 0.00 | 10.23 | 21.95 |
| 3 | 0.00 | 1.66 | 0.00 | 2.12 | 0.18 | 1.30 | 0.18 | 3.56 | 0.00 | 1.04 | 0.00 | 10.03 | 31.98 |
| 4 | 0.00 | 1.19 | 0.00 | 1.97 | 0.09 | 1.55 | 0.34 | 3.99 | 0.00 | 0.78 | 0.00 | 9.92 | 41.90 |
| 5 | 0.00 | 1.68 | 0.00 | 2.51 | 0.29 | 1.83 | 0.57 | 3.14 | 0.00 | 0.78 | 0.00 | 10.81 | 52.71 |
| 6 | 0.00 | 2.40 | 0.00 | 2.19 | 0.13 | 1.77 | 0.00 | 2.98 | 0.00 | 0.78 | 0.00 | 10.25 | 62.96 |
| 7 | 0.00 | 1.84 | 0.00 | 2.03 | 0.12 | 2.05 | 0.37 | 3.60 | 0.00 | 0.90 | 0.00 | 10.91 | 73.87 |

| Area deforested per forest class icl within the reference region | | | | | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDicl > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Name > | Montane moist forest (bh-M) | Lower montane moist forest (bh-MB) | Premontane humid forest (bh-PM) | Tropical moist forest (bh-T) | Montane wet forest (bmh-M) | Lower montane wet forest (bmh-MB) | Premontane wet forest (bmh-PM) | Tropical wet forest (bmh-T) | Montane rain forest (bp-M) | Premontane rain forest (bp-PM) | Lower montane dry forest (bs-MB) | ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t) | ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 8 | 0.00 | 1.80 | 0.00 | 2.07 | 0.12 | 2.58 | 0.30 | 4.26 | 0.00 | 0.98 | 0.00 | 12.12 | 85.99 |
| 9 | 0.00 | 1.21 | 0.00 | 2.50 | 0.09 | 1.95 | 0.27 | 3.61 | 0.06 | 0.61 | 0.00 | 10.31 | 96.29 |
| 10 | 0.00 | 1.65 | 0.00 | 1.90 | 0.25 | 1.36 | 0.62 | 4.89 | 0.00 | 1.04 | 0.00 | 11.71 | 108.00 |
| 11 | 0.00 | 1.45 | 0.00 | 1.54 | 0.20 | 1.73 | 0.45 | 3.96 | 0.00 | 1.11 | 0.00 | 10.44 | 118.45 |
| 12 | 0.00 | 1.94 | 0.00 | 1.85 | 0.00 | 2.08 | 0.27 | 5.23 | 0.00 | 1.52 | 0.00 | 12.89 | 131.33 |
| 13 | 0.00 | 2.77 | 0.00 | 2.10 | 0.09 | 1.65 | 0.40 | 5.75 | 0.00 | 1.65 | 0.00 | 14.40 | 145.73 |
| 14 | 0.00 | 2.72 | 0.00 | 1.89 | 0.00 | 2.01 | 0.34 | 3.18 | 0.00 | 1.94 | 0.00 | 12.09 | 157.82 |
| 15 | 0.00 | 1.81 | 0.00 | 2.18 | 0.09 | 2.20 | 0.25 | 5.83 | 0.00 | 1.84 | 0.00 | 14.20 | 172.02 |
| 16 | 0.00 | 2.36 | 0.00 | 1.43 | 0.10 | 1.78 | 0.16 | 4.40 | 0.00 | 1.76 | 0.00 | 12.00 | 184.02 |

| Area deforested per forest class icl within the reference region | | | | | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDicl > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Name > | Montane moist forest (bh-M) | Lower montane moist forest (bh-MB) | Premontane humid forest (bh-PM) | Tropical moist forest (bh-T) | Montane wet forest (bmh-M) | Lower montane wet forest (bmh-MB) | Premontane wet forest (bmh-PM) | Tropical wet forest (bmh-T) | Montane rain forest (bp-M) | Premontane rain forest (bp-PM) | Lower montane dry forest (bs-MB) | ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t) | ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 17 | 0.00 | 1.51 | 0.00 | 1.21 | 0.23 | 1.83 | 0.09 | 5.07 | 0.09 | 1.12 | 0.00 | 11.16 | 195.18 |
| 18 | 0.00 | 2.48 | 0.00 | 1.17 | 0.00 | 1.84 | 0.24 | 4.66 | 0.00 | 2.16 | 0.00 | 12.54 | 207.72 |
| 19 | 0.00 | 2.39 | 0.00 | 1.53 | 0.00 | 1.51 | 0.35 | 3.91 | 0.09 | 2.19 | 0.00 | 11.97 | 219.69 |
| 20 | 0.00 | 2.23 | 0.00 | 1.39 | 0.20 | 1.61 | 0.00 | 3.80 | 0.00 | 1.05 | 0.00 | 10.29 | 229.98 |
| 21 | 0.00 | 1.99 | 0.00 | 1.22 | 0.00 | 1.19 | 0.33 | 3.43 | 0.00 | 1.56 | 0.00 | 9.74 | 239.72 |
| 22 | 0.00 | 3.77 | 0.00 | 1.04 | 0.11 | 1.81 | 0.17 | 3.52 | 0.00 | 1.61 | 0.00 | 12.02 | 251.75 |
| 23 | 0.00 | 3.65 | 0.00 | 1.26 | 0.13 | 1.67 | 0.16 | 3.89 | 0.09 | 1.33 | 0.00 | 12.19 | 263.94 |
| 24 | 0.00 | 2.53 | 0.00 | 1.63 | 0.17 | 0.95 | 0.15 | 2.54 | 0.00 | 1.73 | 0.00 | 9.70 | 273.64 |
| 25 | 0.00 | 2.84 | 0.00 | 0.57 | 0.27 | 2.19 | 0.22 | 2.23 | 0.00 | 1.34 | 0.00 | 9.65 | 283.29 |

| Area deforested per forest class icl within the reference region | | | | | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **IDicl >** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | | |
| **Name >** | **Montane moist forest (bh-M)** | **Lower montane moist forest (bh-MB)** | **Premontane humid forest (bh-PM)** | **Tropical moist forest (bh-T)** | **Montane wet forest (bmh-M)** | **Lower montane wet forest (bmh-MB)** | **Premontane wet forest (bmh-PM)** | **Tropical wet forest (bmh-T)** | **Montane rain forest (bp-M)** | **Premontane rain forest (bp-PM)** | **Lower montane dry forest (bs-MB)** | **ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t)** | **ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t)** |
| **Project year t** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** |
| 26 | 0.00 | 3.01 | 0.00 | 1.33 | 0.15 | 2.40 | 0.08 | 2.40 | 0.00 | 1.94 | 0.00 | 11.32 | 294.61 |
| 27 | 0.00 | 4.12 | 0.00 | 1.11 | 0.09 | 1.86 | 0.08 | 1.92 | 0.00 | 1.00 | 0.00 | 10.18 | 304.78 |
| 28 | 0.00 | 2.32 | 0.00 | 2.19 | 0.10 | 1.27 | 0.27 | 2.30 | 0.00 | 1.83 | 0.00 | 10.29 | 315.07 |
| 29 | 0.00 | 3.55 | 0.00 | 0.84 | 0.07 | 2.44 | 0.06 | 1.20 | 0.00 | 1.20 | 0.00 | 9.36 | 324.44 |
| 30 | 0.00 | 2.10 | 0.00 | 2.11 | 0.09 | 1.95 | 0.27 | 3.46 | 0.00 | 1.01 | 0.00 | 10.99 | 335.42 |

**Table 19. Annual deforestation by forest class (*icl*) in the leakage belt baseline scenario.**

| Area deforested per forest class icl within the leakage belt | | | | | | | | | | | | Total baseline deforestation in the leakage belt | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **IDicl >** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | | |
| **Name>** | **Montane moist forest (bh-M)** | **Lower montane moist forest (bh-MB)** | **Premontane humid forest (bh-PM)** | **Tropical moist forest (bh-T)** | **Montane wet forest (bmh-M)** | **Lower montane wet forest (bmh-MB)** | **Premontane wet forest (bmh-PM)** | **Tropical wet forest (bmh-T)** | **Montane rain forest (bp-M)** | **Premontane rain forest (bp-PM)** | **Lower montane dry forest (bs-MB)** | **ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t)** | **ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t)** |
| **Project year t** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** |
| 1 | 0.76 | 22.95 | 0.10 | 21.32 | 2.34 | 26.49 | 20.11 | 92.89 | 0.72 | 27.21 | 0.00 | 214.88 | 214.88 |
| 2 | 0.99 | 23.92 | 0.27 | 19.40 | 2.74 | 26.52 | 15.80 | 92.92 | 0.54 | 26.55 | 0.00 | 209.65 | 424.54 |
| 3 | 0.83 | 22.40 | 0.36 | 20.23 | 2.94 | 24.51 | 16.63 | 89.23 | 0.63 | 27.67 | 0.00 | 205.44 | 629.97 |
| 4 | 0.90 | 22.97 | 0.07 | 20.77 | 2.09 | 26.03 | 14.53 | 96.19 | 0.36 | 25.09 | 0.00 | 209.01 | 838.98 |
| 5 | 0.63 | 22.51 | 0.18 | 19.20 | 3.12 | 23.82 | 14.45 | 86.27 | 0.54 | 26.72 | 0.00 | 197.44 | 1036.43 |
| 6 | 0.67 | 24.07 | 0.09 | 19.31 | 2.64 | 25.19 | 14.31 | 89.13 | 0.78 | 28.27 | 0.00 | 204.46 | 1240.89 |
| 7 | 0.81 | 19.17 | 0.27 | 20.50 | 2.20 | 24.95 | 13.91 | 89.61 | 0.27 | 25.70 | 0.00 | 197.39 | 1438.28 |
| 8 | 0.90 | 20.03 | 0.00 | 18.77 | 2.44 | 28.12 | 15.39 | 86.38 | 0.45 | 25.93 | 0.00 | 198.42 | 1636.70 |

| Area deforested per forest class icl within the leakage belt | | | | | | | | | | | | Total baseline deforestation in the leakage belt | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDicl > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Name> | Montane moist forest (bh-M) | Lower montane moist forest (bh-MB) | Premontane humid forest (bh-PM) | Tropical moist forest (bh-T) | Montane wet forest (bmh-M) | Lower montane wet forest (bmh-MB) | Premontane wet forest (bmh-PM) | Tropical wet forest (bmh-T) | Montane rain forest (bp-M) | Premontane rain forest (bp-PM) | Lower montane dry forest (bs-MB) | ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t) | ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 9 | 0.54 | 22.71 | 0.05 | 18.64 | 2.97 | 26.27 | 13.87 | 82.11 | 0.54 | 22.62 | 0.00 | 190.32 | 1827.02 |
| 10 | 0.54 | 20.38 | 0.09 | 18.69 | 1.93 | 25.84 | 14.01 | 85.44 | 0.69 | 22.70 | 0.00 | 190.32 | 2017.34 |
| 11 | 0.53 | 19.64 | 0.12 | 17.40 | 2.47 | 25.80 | 13.84 | 82.71 | 0.18 | 22.03 | 0.00 | 184.70 | 2202.04 |
| 12 | 0.60 | 22.61 | 0.18 | 19.11 | 1.79 | 26.78 | 14.16 | 83.07 | 0.74 | 21.07 | 0.00 | 190.13 | 2392.17 |
| 13 | 0.45 | 22.25 | 0.17 | 19.31 | 3.43 | 24.77 | 14.63 | 84.04 | 0.62 | 22.28 | 0.00 | 191.94 | 2584.11 |
| 14 | 0.72 | 22.72 | 0.00 | 19.91 | 1.30 | 24.92 | 14.37 | 81.42 | 0.90 | 24.21 | 0.00 | 190.48 | 2774.59 |
| 15 | 0.45 | 21.23 | 0.18 | 17.88 | 2.34 | 28.06 | 15.81 | 78.07 | 0.54 | 21.85 | 0.00 | 186.42 | 2961.01 |
| 16 | 0.36 | 19.88 | 0.33 | 17.61 | 1.61 | 25.96 | 15.35 | 72.80 | 0.48 | 25.02 | 0.00 | 179.41 | 3140.41 |
| 17 | 0.54 | 24.58 | 0.20 | 18.01 | 2.76 | 27.60 | 13.59 | 74.62 | 0.86 | 21.02 | 0.00 | 183.79 | 3324.20 |

| Area deforested per forest class icl within the leakage belt | | | | | | | | | | | | Total baseline deforestation in the leakage belt | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **IDicl >** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | | |
| **Name>** | **Montane moist forest (bh-M)** | **Lower montane moist forest (bh-MB)** | **Premontane humid forest (bh-PM)** | **Tropical moist forest (bh-T)** | **Montane wet forest (bmh-M)** | **Lower montane wet forest (bmh-MB)** | **Premontane wet forest (bmh-PM)** | **Tropical wet forest (bmh-T)** | **Montane rain forest (bp-M)** | **Premontane rain forest (bp-PM)** | **Lower montane dry forest (bs-MB)** | **ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t)** | **ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t)** |
| **Project year t** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** | **ha** |
| 18 | 0.36 | 24.64 | 0.18 | 16.69 | 1.71 | 26.16 | 16.58 | 68.88 | 0.60 | 20.89 | 0.00 | 176.71 | 3500.91 |
| 19 | 0.45 | 22.24 | 0.14 | 18.52 | 2.22 | 28.25 | 15.23 | 69.77 | 0.63 | 21.08 | 0.00 | 178.54 | 3679.45 |
| 20 | 0.92 | 22.37 | 0.26 | 16.43 | 1.85 | 30.35 | 14.97 | 63.95 | 0.18 | 19.41 | 0.00 | 170.67 | 3850.12 |
| 21 | 0.55 | 24.40 | 0.00 | 14.79 | 1.84 | 26.09 | 13.93 | 64.95 | 0.54 | 21.88 | 0.00 | 168.96 | 4019.07 |
| 22 | 0.81 | 25.42 | 0.09 | 14.16 | 2.13 | 26.66 | 15.38 | 68.70 | 0.91 | 21.99 | 0.00 | 176.25 | 4195.32 |
| 23 | 0.32 | 28.44 | 0.18 | 16.64 | 2.09 | 24.71 | 13.24 | 63.77 | 1.34 | 22.03 | 0.00 | 172.75 | 4368.07 |
| 24 | 0.77 | 25.93 | 0.30 | 19.56 | 2.42 | 24.21 | 15.29 | 58.89 | 0.45 | 20.75 | 0.00 | 168.57 | 4536.65 |
| 25 | 0.27 | 26.68 | 0.00 | 16.87 | 2.10 | 25.22 | 14.20 | 60.21 | 0.62 | 19.40 | 0.00 | 165.56 | 4702.20 |
| 26 | 0.36 | 28.28 | 0.00 | 16.76 | 2.42 | 24.77 | 12.89 | 54.85 | 0.74 | 21.44 | 0.00 | 162.50 | 4864.70 |

| Area deforested per forest class icl within the leakage belt | | | | | | | | | | | | Total baseline deforestation in the leakage belt | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IDicl > | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| Name> | Montane moist forest (bh-M) | Lower montane moist forest (bh-MB) | Premontane humid forest (bh-PM) | Tropical moist forest (bh-T) | Montane wet forest (bmh-M) | Lower montane wet forest (bmh-MB) | Premontane wet forest (bmh-PM) | Tropical wet forest (bmh-T) | Montane rain forest (bp-M) | Premontane rain forest (bp-PM) | Lower montane dry forest (bs-MB) | ABSLRRt annual (Annual area of baseline deforestation in the reference region at year t) | ABSLRR cumulative (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 27 | 0.54 | 28.51 | 0.25 | 19.28 | 2.19 | 22.44 | 11.73 | 53.98 | 0.45 | 17.10 | 0.00 | 156.49 | 5021.19 |
| 28 | 0.90 | 27.79 | 0.09 | 20.52 | 2.29 | 24.43 | 12.51 | 55.86 | 1.07 | 20.29 | 0.00 | 165.75 | 5186.94 |
| 29 | 0.63 | 29.75 | 0.09 | 19.77 | 2.34 | 23.36 | 12.89 | 49.41 | 1.06 | 20.76 | 0.00 | 160.07 | 5347.01 |
| 30 | 0.72 | 25.48 | 0.38 | 20.94 | 2.20 | 26.69 | 18.18 | 92.94 | 0.54 | 26.26 | 0.00 | 214.33 | 5561.33 |

### Step 5.2: Calculation of baseline activity per post-deforestation forest class

Method 1 (Historical LU/LC-change) was employed to calculate the area to which the project would apply in the post-deforestation scenario. It assumes that this historical change will be representative of future trends. The results of the historical analysis were used to apply a proportional change factor to represent conversion of forest zones to post-deforestation classes.

Philips *et al* (2011) described that climatic and physical variation, as well as changes in vegetation type can influence the spatial distribution patterns of aboveground biomass at local and regional scales. The tropics experience fluctuations in temperature, solar radiation, and atmospheric pressure, all of which strongly depend on altitudinal variation and influence the vegetation characteristics. Other environmental conditions including but not limited to the availability of light, precipitation, humidity, and soil fertility covary along small elevation gradients, which are in part due to topography.

After considering the forest types (according to the Life Zones proposed by Holdridge 1967 and adapted to Colombia by Phillips *et al.* IDEAM 2011) and the information provided by the Corporation regarding the potential estimated carbon storage of aboveground biomass in the jurisdiction of CORPOCHIVOR (generated by Valero, 2014), the Reference Region was divided into seven post-deforestation zones (Table 20). Climatic requirements, especially the parameters of altitude (m.a.m.s.l.) and temperature (°C), were also considered in the delimitation of these zones. Zones are sometimes referred to by their acronyms in Spanish.

**Table 20. Post-deforestation zones in the Reference Region.**

| | |
|---|---|
| Zone 1 | Moist montane forest (bh-M), wet montane forest (bmh-M), montane Rainforest (bp-M) |
| Zone 2 | Moist lower-montane forest (bh-MB), dry lower-montane forest (bs-MB) |
| Zone 3 | Moist Pre-montane forest (bh-PM), wet Pre-montane forest (bmh-PM) |

| | |
|---|---|
| Zone 4 | Moist Tropical forest (bh-T) |
| Zone 5 | wet lower-montane forest (bmh-MB) |
| Zone 6 | wet Tropical forest (bmh-T) |
| Zone 7 | Pre-montane Rainforest (bp-PM) |

Based on the analysis, it was determined that the likely post-deforestation scenarios applicable to the project are pasture, secondary vegetation, shrubs, heterogeneous agricultural lands, forest plantation, and permanent cropland. The proportion of the area devoted to these uses was then calculated to estimate the resulting area of post-deforestation classes in the baseline scenario of the CORPOCHIVOR project. The areas and percentages of the final classes (*fcl*) are presented in Table 21 and Table 22.

**Table 21.Reference region zones that represent different combinations of post-deforestation classes.**

| Zone | | Name: grassland | | Name: Heterogeneous farmland | | Name: Crops | | Total of all other LU/LC classes present in the Zone | |
|---|---|---|---|---|---|---|---|---|---|
| | | IDfcl | 12 | IDfcl | 16 | IDfcl | 18 | | |
| | | Area | % of Zone % | Area | % of Zone % | Area | % of Zone % | Area | % of Zone % |
| IDz | Name | ha | | ha | | ha | | ha | |
| 1 | Zone 1 | 227,00 | 4,67% | 576,51 | 8,21% | 41,03 | 7,69% | 844,54 | 6,80% |
| 2 | Zone 2 | 922,26 | 18,97% | 992,25 | 14,13% | 133,00 | 24,91% | 2047,50 | 16,49% |
| 3 | Zone 3 | 1397,11 | 28,74% | 1542,78 | 21,97% | 317,24 | 59,42% | 3257,13 | 26,23% |
| 4 | Zone 4 | 317,81 | 6,54% | 485,35 | 6,91% | 1,17 | 0,22% | 804,33 | 6,48% |
| 5 | Zone 5 | 411,79 | 8,47% | 1206,24 | 17,18% | 28,98 | 5,43% | 1647,01 | 13,26% |
| 6 | Zone 6 | 1344,93 | 27,66% | 1650,06 | 23,50% | 12,38 | 2,32% | 3007,37 | 24,22% |
| 7 | Zone 7 | 240,93 | 4,96% | 568,62 | 8,10% | 0,07 | 0,01% | 809,62 | 6,52% |
| Total area of each class fcl | | **4861,82** | **39,15%** | **7021,800942** | **56,55%** | **533,87** | **4,30%** | **12417** | **100,00%** |

The areas of each zone projected to be deforested are presented for the Reference Region (Table 22), Project Area (Table 23), and Leakage Belt (Table 24). These tables are equivalent to Tables 13.a, 13.b, and 13.c of Methodology VM0015, respectively.

**Table 22. Annual area measurements of post-deforestation classes in the Reference Region (VM0015 Table 13.a).**

| Area established after deforestation per zone within the reference region | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|
| IDz> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| Name> | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | ABSLRRt (Annual area of baseline deforestation in the reference region at year t) | ABSLRR (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 1 | 60,75 | 169,64 | 244,17 | 83,62 | 113,61 | 299,92 | 69,75 | 1041,46 | 1041,46 |
| 2 | 53,82 | 161,39 | 230,05 | 80,18 | 116,66 | 287,49 | 72,73 | 1002,32 | 2043,78 |
| 3 | 51,77 | 153,67 | 234,58 | 79,24 | 110,34 | 282,43 | 71,22 | 983,25 | 3027,03 |
| 4 | 46,41 | 152,76 | 225,91 | 81,28 | 108,64 | 281,97 | 67,55 | 964,53 | 3991,56 |
| 5 | 52,70 | 153,70 | 210,14 | 79,26 | 101,93 | 279,19 | 69,31 | 946,23 | 4937,79 |
| 6 | 53,54 | 151,22 | 197,32 | 77,66 | 102,97 | 274,02 | 71,54 | 928,26 | 5866,05 |
| 7 | 50,97 | 139,64 | 199,59 | 79,16 | 100,14 | 272,98 | 68,13 | 910,61 | 6776,66 |
| 8 | 48,06 | 145,77 | 187,70 | 74,42 | 105,53 | 263,09 | 68,80 | 893,38 | 7670,04 |
| 9 | 46,51 | 143,64 | 187,93 | 75,45 | 102,53 | 257,42 | 62,92 | 876,40 | 8546,43 |
| 10 | 43,11 | 135,76 | 171,83 | 77,28 | 105,63 | 263,85 | 62,28 | 859,74 | 9406,17 |
| 11 | 42,95 | 131,55 | 167,77 | 73,48 | 106,25 | 257,18 | 64,22 | 843,40 | 10249,58 |
| 12 | 44,95 | 133,71 | 147,66 | 74,74 | 103,60 | 261,94 | 60,83 | 827,43 | 11077,00 |
| 13 | 41,52 | 128,79 | 143,88 | 81,54 | 101,27 | 252,59 | 62,10 | 811,69 | 11888,70 |
| 14 | 40,53 | 127,51 | 137,27 | 73,89 | 100,25 | 252,73 | 64,10 | 796,28 | 12684,98 |
| 15 | 41,48 | 132,87 | 127,41 | 73,96 | 100,27 | 244,77 | 60,39 | 781,14 | 13466,12 |
| 16 | 38,94 | 129,67 | 126,53 | 70,26 | 104,81 | 230,72 | 65,44 | 766,36 | 14232,48 |
| 17 | 38,48 | 133,69 | 116,78 | 69,83 | 100,63 | 230,70 | 61,57 | 751,67 | 14984,14 |
| 18 | 37,99 | 134,08 | 114,35 | 65,45 | 98,90 | 224,87 | 61,82 | 737,45 | 15721,60 |

| Area established after deforestation per zone within the reference region | | | | | | | | Total baseline deforestation in the reference region | |
|---|---|---|---|---|---|---|---|---|---|
| IDz> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| Name> | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | ABSLRRt (Annual area of baseline deforestation in the reference region at year t) | ABSLRR (cumulative area of baseline deforestation in the reference region at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 19 | 38,27 | 129,63 | 112,82 | 64,88 | 106,06 | 213,60 | 58,14 | 723,40 | 16444,99 |
| 20 | 34,08 | 126,67 | 107,91 | 67,44 | 108,71 | 205,85 | 58,87 | 709,54 | 17154,53 |
| 21 | 32,22 | 131,44 | 97,84 | 65,65 | 106,27 | 204,94 | 57,86 | 696,22 | 17850,75 |
| 22 | 31,02 | 131,24 | 99,79 | 59,47 | 105,28 | 198,11 | 58,11 | 683,03 | 18533,78 |
| 23 | 34,80 | 128,61 | 90,85 | 61,49 | 102,61 | 193,32 | 58,37 | 670,04 | 19203,82 |
| 24 | 33,67 | 128,48 | 88,60 | 66,00 | 94,97 | 190,47 | 55,09 | 657,28 | 19861,10 |
| 25 | 32,86 | 130,78 | 82,54 | 62,63 | 96,25 | 189,68 | 50,06 | 644,79 | 20505,89 |
| 26 | 35,68 | 127,82 | 70,49 | 61,98 | 97,67 | 185,17 | 53,76 | 632,56 | 21138,45 |
| 27 | 31,32 | 127,31 | 68,31 | 65,52 | 98,98 | 179,25 | 49,86 | 620,55 | 21759,01 |
| 28 | 30,75 | 125,58 | 64,66 | 61,15 | 97,65 | 178,71 | 50,23 | 608,73 | 22367,73 |
| 29 | 31,43 | 124,30 | 66,24 | 60,75 | 93,01 | 165,22 | 56,28 | 597,23 | 22964,96 |
| 30 | 57,36 | 167,81 | 242,63 | 83,95 | 114,13 | 287,09 | 68,70 | 1021,67 | 23986,63 |

**Table 23. Annual area measurements of post-deforestation classes in the Project Area (VM0015 Table 13.b).**

| Area established after deforestation per zone within the project area | | | | | | | | Total baseline deforestation in the project area | |
|---|---|---|---|---|---|---|---|---|---|
| IDz> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| Name> | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | ABSLPAt (Annual area of baseline deforestation in the project area at year t) | ABSLPA (Cumulative area of baseline deforestation in the project area at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 1 | 0.42 | 1.30 | 0.45 | 2.91 | 2.13 | 3.40 | 1.11 | 11.73 | 11.73 |
| 2 | 0.08 | 1.82 | 0.38 | 1.66 | 2.29 | 2.85 | 1.15 | 10.23 | 21.95 |
| 3 | 0.18 | 1.66 | 0.18 | 2.12 | 1.30 | 3.56 | 1.04 | 10.03 | 31.98 |
| 4 | 0.09 | 1.19 | 0.34 | 1.97 | 1.55 | 3.99 | 0.78 | 9.92 | 41.90 |
| 5 | 0.29 | 1.68 | 0.57 | 2.51 | 1.83 | 3.14 | 0.78 | 10.81 | 52.71 |
| 6 | 0.13 | 2.40 | 0.00 | 2.19 | 1.77 | 2.98 | 0.78 | 10.25 | 62.96 |
| 7 | 0.12 | 1.84 | 0.37 | 2.03 | 2.05 | 3.60 | 0.90 | 10.91 | 73.87 |
| 8 | 0.12 | 1.80 | 0.30 | 2.07 | 2.58 | 4.26 | 0.98 | 12.12 | 85.99 |
| 9 | 0.15 | 1.21 | 0.27 | 2.50 | 1.95 | 3.61 | 0.61 | 10.31 | 96.29 |
| 10 | 0.25 | 1.65 | 0.62 | 1.90 | 1.36 | 4.89 | 1.04 | 11.71 | 108.00 |
| 11 | 0.20 | 1.45 | 0.45 | 1.54 | 1.73 | 3.96 | 1.11 | 10.44 | 118.45 |
| 12 | 0.00 | 1.94 | 0.27 | 1.85 | 2.08 | 5.23 | 1.52 | 12.89 | 131.33 |
| 13 | 0.09 | 2.77 | 0.40 | 2.10 | 1.65 | 5.75 | 1.65 | 14.40 | 145.73 |
| 14 | 0.00 | 2.72 | 0.34 | 1.89 | 2.01 | 3.18 | 1.94 | 12.09 | 157.82 |
| 15 | 0.09 | 1.81 | 0.25 | 2.18 | 2.20 | 5.83 | 1.84 | 14.20 | 172.02 |
| 16 | 0.10 | 2.36 | 0.16 | 1.43 | 1.78 | 4.40 | 1.76 | 12.00 | 184.02 |
| 17 | 0.32 | 1.51 | 0.09 | 1.21 | 1.83 | 5.07 | 1.12 | 11.16 | 195.18 |
| 18 | 0.00 | 2.48 | 0.24 | 1.17 | 1.84 | 4.66 | 2.16 | 12.54 | 207.72 |
| 19 | 0.09 | 2.39 | 0.35 | 1.53 | 1.51 | 3.91 | 2.19 | 11.97 | 219.69 |
| 20 | 0.20 | 2.23 | 0.00 | 1.39 | 1.61 | 3.80 | 1.05 | 10.29 | 229.98 |

| Area established after deforestation per zone within the project area | | | | | | | | Total baseline deforestation in the project area | |
|---|---|---|---|---|---|---|---|---|---|
| IDz> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| Name> | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | ABSLPAt (Annual area of baseline deforestation in the project area at year t) | ABSLPA (Cumulative area of baseline deforestation in the project area at year t) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 21 | 0.00 | 1.99 | 0.33 | 1.22 | 1.19 | 3.43 | 1.56 | 9.74 | 239.72 |
| 22 | 0.11 | 3.77 | 0.17 | 1.04 | 1.81 | 3.52 | 1.61 | 12.02 | 251.75 |
| 23 | 0.22 | 3.65 | 0.16 | 1.26 | 1.67 | 3.89 | 1.33 | 12.19 | 263.94 |
| 24 | 0.17 | 2.53 | 0.15 | 1.63 | 0.95 | 2.54 | 1.73 | 9.70 | 273.64 |
| 25 | 0.27 | 2.84 | 0.22 | 0.57 | 2.19 | 2.23 | 1.34 | 9.65 | 283.29 |
| 26 | 0.15 | 3.01 | 0.08 | 1.33 | 2.40 | 2.40 | 1.94 | 11.32 | 294.61 |
| 27 | 0.09 | 4.12 | 0.08 | 1.11 | 1.86 | 1.92 | 1.00 | 10.18 | 304.78 |
| 28 | 0.10 | 2.32 | 0.27 | 2.19 | 1.27 | 2.30 | 1.83 | 10.29 | 315.07 |
| 29 | 0.07 | 3.55 | 0.06 | 0.84 | 2.44 | 1.20 | 1.20 | 9.36 | 324.44 |
| 30 | 0.09 | 2.10 | 0.27 | 2.11 | 1.95 | 3.46 | 1.01 | 10.99 | 335.42 |

**Table 24. Annual area measurements of post-deforestation classes in the Leakage Belt (VM0015 Table 13.c).**

| Area established after deforestation per zone within the leakage belt | | | | | | | | Total baseline deforestation in the leakage belt | |
|---|---|---|---|---|---|---|---|---|---|
| IDz> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| Name> | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | ABSLLKt (Annual area of baseline deforestation within the leakage belt at year t) | ABSLLK (Cumulative area of baseline deforestation within the leakage belt at year t ) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 1 | 3.82 | 22.95 | 20.21 | 21.32 | 26.49 | 92.89 | 27.21 | 214.88 | 214.88 |
| 2 | 4.28 | 23.92 | 16.07 | 19.40 | 26.52 | 92.92 | 26.55 | 209.65 | 424.54 |

| Area established after deforestation per zone within the leakage belt | | | | | | | | Total baseline deforestation in the leakage belt | |
|---|---|---|---|---|---|---|---|---|---|
| IDz> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| Name> | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | ABSLLKt (Annual area of baseline deforestation within the leakage belt at year t) | ABSLLK (Cumulative area of baseline deforestation within the leakage belt at year t ) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 3 | 4.41 | 22.40 | 16.98 | 20.23 | 24.51 | 89.23 | 27.67 | 205.44 | 629.97 |
| 4 | 3.36 | 22.97 | 14.60 | 20.77 | 26.03 | 96.19 | 25.09 | 209.01 | 838.98 |
| 5 | 4.29 | 22.51 | 14.63 | 19.20 | 23.82 | 86.27 | 26.72 | 197.44 | 1036.43 |
| 6 | 4.09 | 24.07 | 14.40 | 19.31 | 25.19 | 89.13 | 28.27 | 204.46 | 1240.89 |
| 7 | 3.28 | 19.17 | 14.18 | 20.50 | 24.95 | 89.61 | 25.70 | 197.39 | 1438.28 |
| 8 | 3.79 | 20.03 | 15.39 | 18.77 | 28.12 | 86.38 | 25.93 | 198.42 | 1636.70 |
| 9 | 4.05 | 22.71 | 13.92 | 18.64 | 26.27 | 82.11 | 22.62 | 190.32 | 1827.02 |
| 10 | 3.17 | 20.38 | 14.10 | 18.69 | 25.84 | 85.44 | 22.70 | 190.32 | 2017.34 |
| 11 | 3.18 | 19.64 | 13.95 | 17.40 | 25.80 | 82.71 | 22.03 | 184.70 | 2202.04 |
| 12 | 3.14 | 22.61 | 14.34 | 19.11 | 26.78 | 83.07 | 21.07 | 190.13 | 2392.17 |
| 13 | 4.49 | 22.25 | 14.80 | 19.31 | 24.77 | 84.04 | 22.28 | 191.94 | 2584.11 |
| 14 | 2.93 | 22.72 | 14.37 | 19.91 | 24.92 | 81.42 | 24.21 | 190.48 | 2774.59 |
| 15 | 3.34 | 21.23 | 15.99 | 17.88 | 28.06 | 78.07 | 21.85 | 186.42 | 2961.01 |
| 16 | 2.45 | 19.88 | 15.68 | 17.61 | 25.96 | 72.80 | 25.02 | 179.41 | 3140.41 |
| 17 | 4.17 | 24.58 | 13.79 | 18.01 | 27.60 | 74.62 | 21.02 | 183.79 | 3324.20 |
| 18 | 2.68 | 24.64 | 16.77 | 16.69 | 26.16 | 68.88 | 20.89 | 176.71 | 3500.91 |
| 19 | 3.30 | 22.24 | 15.37 | 18.52 | 28.25 | 69.77 | 21.08 | 178.54 | 3679.45 |
| 20 | 2.95 | 22.37 | 15.23 | 16.43 | 30.35 | 63.95 | 19.41 | 170.67 | 3850.12 |
| 21 | 2.93 | 24.40 | 13.93 | 14.79 | 26.09 | 64.95 | 21.88 | 168.96 | 4019.07 |
| 22 | 3.85 | 25.42 | 15.47 | 14.16 | 26.66 | 68.70 | 21.99 | 176.25 | 4195.32 |
| 23 | 3.74 | 28.44 | 13.42 | 16.64 | 24.71 | 63.77 | 22.03 | 172.75 | 4368.07 |

| Area established after deforestation per zone within the leakage belt | | | | | | | | Total baseline deforestation in the leakage belt | |
|---|---|---|---|---|---|---|---|---|---|
| IDz> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| Name> | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | ABSLLKt (Annual area of baseline deforestation within the leakage belt at year t) | ABSLLK (Cumulative area of baseline deforestation within the leakage belt at year t ) |
| Project year t | ha | ha | ha | ha | ha | ha | ha | ha | ha |
| 24 | 3.65 | 25.93 | 15.59 | 19.56 | 24.21 | 58.89 | 20.75 | 168.57 | 4536.65 |
| 25 | 2.98 | 26.68 | 14.20 | 16.87 | 25.22 | 60.21 | 19.40 | 165.56 | 4702.20 |
| 26 | 3.52 | 28.28 | 12.89 | 16.76 | 24.77 | 54.85 | 21.44 | 162.50 | 4864.70 |
| 27 | 3.19 | 28.51 | 11.98 | 19.28 | 22.44 | 53.98 | 17.10 | 156.49 | 5021.19 |
| 28 | 4.25 | 27.79 | 12.60 | 20.52 | 24.43 | 55.86 | 20.29 | 165.75 | 5186.94 |
| 29 | 4.04 | 29.75 | 12.98 | 19.77 | 23.36 | 49.41 | 20.76 | 160.07 | 5347.01 |
| 30 | 3.47 | 25.48 | 18.56 | 20.94 | 26.69 | 92.94 | 26.26 | 214.33 | 5561.33 |

## 3.1.6. STEP 6: ESTIMATION OF BASELINE CARBON STOCK CHANGES AND NON-$CO_2$ EMISSIONS

### Step 6.1: Estimation of baseline carbon stock changes

This step allows for estimation of the baseline stocks by calculating the average carbon stocks of each LU/LC class, determining the carbon stock change factors, and then calculating the baseline carbon stock changes. Non-$CO_2$ emissions are not considered because their inclusion is optional and their exclusion is conservative.

### *Average carbon stocks*

Average carbon stocks were estimated for the forest classes that exist within the Project Area, the forest classes within the Leakage Belt, the post-deforestation classes projected to exist in the Project Area in the baseline case, the post-deforestation classes projected to exist in the Leakage Belt in the project case, and the non-forest classes existing in Leakage Management Areas.

As previously mentioned, the initial forest classes are divided with respect to Holdridge Life Zones, both in the Project Area and in the Leakage Belt. The carbon stocks in the initial forest classes were estimated based on the type of forests found within these two areas (project area and leakage belt). The main source of the carbon stock estimation data was Valero *et al.* (2014) [56].

*Sourcing of missing carbon stock estimation data*

Above-ground biomass / carbon content data as described in Yepes *et al* (2011)[57] were employed in the calculations. In the case of natural forests, an estimated value was used for each forest type in a manner that approximates an IPCC Tier 2 estimate. For covers other than natural forest, the data was obtained from reports in the scientific literature with preference given to studies conducted in Colombia. When this was not possible, values were selected from studies that examined countries with similar biophysical conditions to those that exist in Colombia.

For below-ground biomass, the accepted IPCC default conversion factor (root-shoot ratio) for tropical forests / moist sub-tropical forest of 0.24 from Monkany (2006) was employed.

The carbon stocks existing in each forest class in the Project Area prior to the year of baseline deforestation were calculated according to the requirements of the VM0015, assuming that carbon stocks and boundaries of the forest classes remain the same. Tables 15.a and 15.b of the Methodology were used for reporting the results.

**Step 6.1.1: Estimation of the average carbon stocks of each LU/LC class**

As previously stated, the initial forest classes are organized in relation to their respective Life Zones. Carbon stocks for the initial forest classes were estimated based on the types of forests found in the Project Area and the

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[56] Valero, F. 2014 Estimaciones de las reservas potenciales de Carbono almacenado en la biomasa aérea en los bosques naturales ubicados en el sur oriente del departamento de Boyacá-Colombia, jurisdicción de la Corporación Autónoma Regional de Chivor, CORPOCHIVOR, y su potencial como sumideros de Carbono.

[57] Yepes, A., Navarrete D.A., Phillips J.F., Duque, A.J., Cabrera, E., Galindo, G., Vargas, D., García, M.C y Ordoñez, M.F. 2011. Estimación de las emisiones de dióxido de carbono generadas por deforestación durante el periodo 2005-2010. Instituto de Hidrología, Meteorología, y Estudios Ambientales-IDEAM-. Bogotá D.C., Colombia. 32 pp.

Leakage Belt. The information was sourced from Valero (2014)[58] and Yepes (2011)[59].

**Table 25. Presence of each forest type in the Project Area and the Leakage Belt (Yes / No).**

| forest Type | Project Area | Leakage Belt |
|---|---|---|
| Montane moist forest (bh-M) | No | Yes |
| Lower montane moist forest (bh-MB) | Yes | Yes |
| Premontane humid forest (bh-PM) | No | Yes |
| Tropical moist forest (bh-T) | Yes | Yes |
| Montane wet forest (bmh-M) | Yes | Yes |
| Lower montane wet forest (bmh-MB) | Yes | Yes |
| Premontane wet forest (bmh-PM) | Yes | Yes |
| Tropical wet forest (bmh-T) | Yes | Yes |
| Montane rain forest (bp-M) | Yes | Yes |
| Premontane rain forest (bp-PM) | Yes | Yes |
| Lower montane dry forest (bs-MB) | No | No |

The steps taken and the sources of the measurements in the jurisdiction of CORPOCHIVOR correspond to the results of the study published by Valero (2014). A total of 271 temporary plots were evaluated (in 2011), covering a total area of 30.24 hectares distributed throughout the municipalities in the study

[58] Valero, F. 2014 Estimaciones de las reservas potenciales de Carbono almacenado en la biomasa aérea en los Forests naturales ubicados en el sur oriente del departamento de Boyacá-Colombia, jurisdicción de la Corporación Autónoma Regional de Chivor, CORPOCHIVOR, y su potencial como sumideros de Carbono.
[59] Yepes, A., Navarrete D.A., Phillips J.F., Duque, A.J., Cabrera, E., Galindo, G., Vargas, D., García, M.C y Ordoñez, M.F. 2011. Estimación de las emisiones de dióxido de carbono generadas por deforestación durante el periodo 2005-2010. Instituto de Hidrología, Meteorología, y Estudios Ambientales-IDEAM-. Bogotá D.C., Colombia. 32 pp.

area (Figure 24). For those classes of forest not sampled, the values from Yepes *et al*. (2010) were employed.

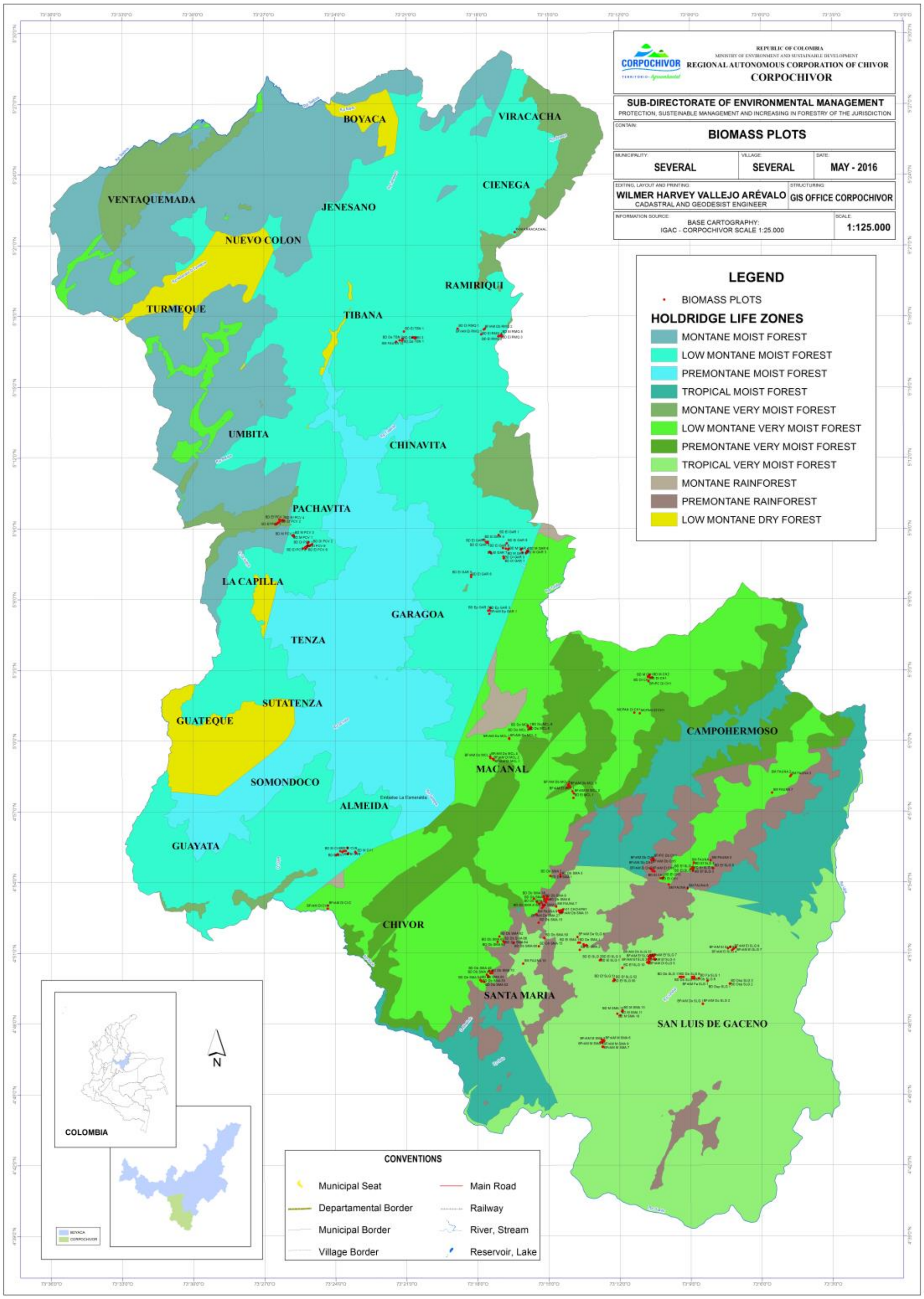


**Figure 24. Map of the distribution of measured plots.**

The following results were obtained via the previous step:

**Table 26. Summary of the emission factors for aboveground biomass by forest type.**

| forest Type | AGBj (t/ha) | $tCO_2$/ha | S.D. (t/ha) | %SE (tCO2/ ha) | NC 90% | NC + | NC - | U |
|---|---|---|---|---|---|---|---|---|
| Moist Tropical forest (bh-T) | 133.98 | 230.9 | 5.1 | 0.13 | 2.37 | 233.27 | 228.52 | 1.03% |
| Wet Tropical forest (bmh-T) | 130.13 | 224.26 | 20.42 | 0.02 | 17.4 | 241.65 | 206.86 | 7.76% |
| Wet Premontane forest (bmh-PM) | 267.46 | 460.92 | 20.51 | 0.03 | 10.59 | 471.51 | 450.32 | 2.30% |
| Premontane Rainforest (bp-PM) | 305.66 | 526.76 | 43.32 | 0.01 | 25.01 | 551.77 | 501.75 | 4.75% |
| Moist lower montane forest (bh-MB) | 203.22 | 350.22 | 15.74 | 0.04 | 8 | 358.22 | 342.22 | 2.28% |
| Wet lower montane forest (bmh-MB) | 258.31 | 445.16 | 0.2 | 0.2 | 0.12 | 445.29 | 445.04 | 0.03% |
| wet montane forest (bmh-M) | 103.36 | 178.13 | 33.89 | 0.02 | 28.87 | 206.99 | 149.26 | 16.21 % |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Moist montane forest (bh-M) | 145.5 | 250.75 | 23.3 | 0.01 | 29.49 | 280.24 | 221.25 | |
| Moist Premontane forest (bh-PM) | 114.1 | 196.63 | 37.6 | 0.17 | 9.76 | 206.4 | 186.87 | 11.76 % |
| dry lower montane forest (bs-MB) | 216 | 372.24 | 64.9 | 0 | 92.01 | 464.25 | 280.23 | 4.97% |
| montane Rainforest (bp-M) | 106.4 | 183.36 | 3.8 | 0.05 | 3.8 | 187.16 | 179.57 | 24.72 % |

*AGB = Aboveground Biomass; S.D. = Standard Deviation; S.E. = Standard Error; C 90% = 90% Confidence Level; CL+ and CL- = Upper/lower Confidence Bounds. U = Uncertainty.*

**Table 27. Summary of emissions factors for below-ground biomass (BGB).**

| Factor | Value | Source |
|---|---|---|
| R (Tropical, moist, deciduous forest) | 0.24 | IPCC Guidelines for National Greenhouse Gas Inventories. 2006. Table 4.3. |
| n | 10 | Mokany. 2006 |
| Standard Error | 0.011 | Mokany. 2006 |
| % Error | 4.58% | |
| Standard Deviation | 0.035 | |
| NC 90% | 0.020 | |
| NC + | 0.260 | |
| NC - | 0.220 | |
| U | 8.40% | |

***Post-deforestation carbon stocks***

The post deforestation LU/LC classes are defined as:

- Pasture
- Heterogeneous Agricultural Land
- Crops

The "Heterogeneous Agricultural Land" class consists of a mosaic of pasture and temporary cultivation which is not possible to further define given the scale of the data. In this case, values for annual crops were employed in the calculations, a decision which was considered to be conservative.

The proportion of pasture established in a post-deforestation scenario was assumed to remain fixed and not to degrade over time. This is a conservative scenario given the deforestation rate in this region. No studies have been conducted in this region to examine the dynamics of post-deforestation land cover over a span of twenty years. Given the scarcity of studies undertaken with respect to this theme, a conservative assumption was employed.

*Carbon stock*

Default values defined by the IPCC were used to estimate the behavior and estimation of carbon stocks for the post-deforestation LU/LC classes. The upper limit of the confidence interval was chosen for the sake of a more conservative estimation.

**Table 28. Carbon stocks for post-deforestation classes.**

| Post-deforestation classes. | Units | Reference |
|---|---|---|
| **Pasture** | Tons dry matter / ha | |
| AGB | 6.2 | IPCC Chapter 6 |
| BGB | 1.6 | |
| AGB Error | 75% | |
| AGB Upper Limit (tC) | 5.10 | |
| BGB Error | 30% | |

| Post-deforestation classes. | Units | Reference |
|---|---|---|
| BGB Upper Limit (tC) | 10.61 | |
| **Cropland** | Accumulation Rate | |
| AGB | 2.6 | IPCC Chapter 5 |
| BGB | 0.25 | Huggins, D.R. y D.J. Fuch. 1997. Long-term N management effects on corn yield and soil C of an aquic Haplustoll in Minnesota. P. 121-128. En: Allmaras, R.R., D.R. Linden y C.E. Clapp. 2004. Corn residue transformation into root and soil carbon as related to nitrogen, tillage, and stover management. Soil Science Society of America 68: 1366-1375 |
| AGB Error | 75% | |
| AGB Upper Limit (tC) | 4.55 | |
| BGB Upper Limit (tC) | 1.14 | |
| **Heterogeneous Agricultural Land** | Carbon stock value in the year after deforestation. | |
| AGB | 5 | IPCC Chapter 5 |
| BGB | 0.25 | Huggins, D.R. y D.J. Fuch. 1997. Long-term N management effects on corn yield and soil C of an aquatic Haplustoll in Minnesota. P. 121-128. En: Allmaras, R.R., D.R. Linden y C.E. Clapp. 2004. Corn residue transformation into root and soil carbon as related to nitrogen, tillage, and stover management. Soil Science Society of America 68: 1366-1375 |
| AGB Error | 75% | |
| AGB Upper Limit (tC) | 8.75 | |
| BGB Upper Limit (tC) | 2.2 | |

### Step 6.1.2: Calculation of carbon stock change factors

The methodology includes detailed formulas for calculating change factors for each carbon pool. Tables 20.a and 20.b of the methodology VM0015 are presented below

### Step 6.1.3: Calculation of baseline carbon stock changes

The baseline carbon stock changes were calculated by combining the annual areas of projected deforestation with each of the forest classes.

**Table 29. Net changes in aboveground biomass in the baseline scenario – Project Area.**

| Project year t | Total net carbon stock change in the above -ground biomass of the project area | |
|---|---|---|
| | ∆Cab BSLPA t annual | ∆Cab BSLPA cumulative |
| | tCO2-e | tCO2-e |
| 1 | -3,684.71 | -3,684.71 |
| 2 | -3,453.15 | -7,137.86 |
| 3 | -3,075.17 | -10,213.03 |
| 4 | -3,007.34 | -13,220.37 |
| 5 | -3,362.27 | -16,582.64 |
| 6 | -3,180.59 | -19,763.22 |
| 7 | -3,434.23 | -23,197.45 |
| 8 | -3,814.68 | -27,012.14 |
| 9 | -3,070.57 | -30,082.71 |
| 10 | -3,499.82 | -33,582.52 |
| 11 | -3,252.99 | -36,835.52 |
| 12 | -4,034.81 | -40,870.33 |
| 13 | -4,443.57 | -45,313.90 |

| Project year t | Total net carbon stock change in the above -ground biomass of the project area | |
|---|---|---|
| | **∆Cab BSLPA t annual** | **∆Cab BSLPA cumulative** |
| | **tCO2-e** | **tCO2-e** |
| 14 | -4,077.74 | -49,391.64 |
| 15 | -4,417.85 | -53,809.49 |
| 16 | -3,851.68 | -57,661.16 |
| 17 | -3,340.61 | -61,001.78 |
| 18 | -4,140.85 | -65,142.62 |
| 19 | -3,964.72 | -69,107.35 |
| 20 | -3,151.19 | -72,258.53 |
| 21 | -3,154.71 | -75,413.24 |
| 22 | -3,992.17 | -79,405.41 |
| 23 | -3,892.41 | -83,297.83 |
| 24 | -3,161.28 | -86,459.10 |
| 25 | -3,347.94 | -89,807.04 |
| 26 | -3,956.13 | -93,763.17 |
| 27 | -3,436.32 | -97,199.49 |
| 28 | -3,412.88 | -100,612.37 |
| 29 | -3,371.33 | -103,983.70 |
| 30 | -3,445.19 | -107,428.89 |

**Table 30. Net changes in below-ground biomass in the baseline scenario – Project Area.**

| Project year t | Total net carbon stock change in the below -ground biomass of the project area | |
|---|---|---|
| | ∆Cab BSLPA t annual | ∆Cab BSLPA cumulative |
| | tCO2-e | tCO2-e |
| 1 | -80.71 | -80.71 |
| 2 | -156.59 | -237.30 |
| 3 | -223.57 | -460.87 |
| 4 | -288.78 | -749.65 |
| 5 | -366.69 | -1,116.35 |
| 6 | -441.76 | -1,558.10 |
| 7 | -517.42 | -2,075.52 |
| 8 | -601.54 | -2,677.07 |
| 9 | -669.61 | -3,346.67 |
| 10 | -746.13 | -4,092.81 |
| 11 | -737.50 | -4,830.30 |
| 12 | -750.47 | -5,580.77 |
| 13 | -780.78 | -6,361.55 |
| 14 | -807.11 | -7,168.67 |
| 15 | -826.69 | -7,995.36 |
| 16 | -837.30 | -8,832.66 |
| 17 | -835.34 | -9,668.01 |
| 18 | -843.28 | -10,511.29 |
| 19 | -863.91 | -11,375.19 |

| Project year t | Total net carbon stock change in the below -ground biomass of the project area | |
|---|---|---|
| | ∆Cab BSLPA t annual | ∆Cab BSLPA cumulative |
| | tCO2-e | tCO2-e |
| 20 | -857.61 | -12,232.80 |
| 21 | -856.09 | -13,088.89 |
| 22 | -856.14 | -13,945.03 |
| 23 | -845.04 | -14,790.06 |
| 24 | -824.90 | -15,614.96 |
| 25 | -803.05 | -16,418.02 |
| 26 | -806.96 | -17,224.97 |
| 27 | -810.43 | -18,035.40 |
| 28 | -795.58 | -18,830.97 |
| 29 | -783.55 | -19,614.53 |
| 30 | -790.03 | -20,404.56 |

**Table 31. Net changes in aboveground biomass in the baseline scenario – Leakage Belt.**

| Project year | Total net carbon stock change in the above -ground biomass of the leakage belt area | |
|---|---|---|
| | ∆Cab BSLLK t annual | ∆Cab BSLLK cumulative |
| | tCO2-e | tCO2-e |
| 1 | -69,801.66 | -69,801.66 |
| 2 | -67,322.61 | -137,124.27 |
| 3 | -66,070.87 | -203,195.13 |

| Project year | Total net carbon stock change in the above -ground biomass of the leakage belt area | |
|---|---|---|
| | ∆Cab BSLLK t annual | ∆Cab BSLLK cumulative |
| | tCO2-e | tCO2-e |
| 4 | -65,840.05 | -269,035.19 |
| 5 | -62,940.94 | -331,976.12 |
| 6 | -65,258.68 | -397,234.80 |
| 7 | -61,978.75 | -459,213.55 |
| 8 | -63,237.00 | -522,450.55 |
| 9 | -59,781.56 | -582,232.11 |
| 10 | -59,277.97 | -641,510.08 |
| 11 | -57,705.10 | -699,215.18 |
| 12 | -59,319.55 | -758,534.73 |
| 13 | -59,700.97 | -818,235.70 |
| 14 | -60,046.42 | -878,282.12 |
| 15 | -59,244.61 | -937,526.74 |
| 16 | -57,919.98 | -995,446.72 |
| 17 | -58,217.01 | -1,053,663.73 |
| 18 | -57,016.30 | -1,110,680.02 |
| 19 | -57,338.58 | -1,168,018.60 |
| 20 | -55,524.35 | -1,223,542.95 |
| 21 | -54,941.22 | -1,278,484.17 |
| 22 | -57,199.49 | -1,335,683.66 |
| 23 | -55,874.39 | -1,391,558.05 |

| Project year | Total net carbon stock change in the above -ground biomass of the leakage belt area | |
|---|---|---|
| | ∆Cab BSLLK t annual | ∆Cab BSLLK cumulative |
| | tCO2-e | tCO2-e |
| 24 | -54,688.34 | -1,446,246.39 |
| 25 | -53,657.94 | -1,499,904.33 |
| 26 | -53,392.35 | -1,553,296.68 |
| 27 | -50,028.15 | -1,603,324.83 |
| 28 | -53,619.18 | -1,656,944.01 |
| 29 | -52,595.08 | -1,709,539.08 |
| 30 | -67,857.51 | -1,777,396.60 |

**Table 32. Net changes in below-ground biomass in the baseline scenario – Leakage Belt.**

| Project year | Total net carbon stock change in the below -ground biomass of the leakage belt area | |
|---|---|---|
| | ∆Cab BSLLK t annual | ∆Cab BSLLK cumulative |
| | tCO2-e | tCO2-e |
| 1 | -1,491.96 | -1,491.96 |
| 2 | -2,935.11 | -4,427.08 |
| 3 | -4,357.65 | -8,784.72 |
| 4 | -5,774.65 | -14,559.37 |
| 5 | -7,139.18 | -21,698.55 |
| 6 | -8,558.72 | -30,257.27 |
| 7 | -9,909.08 | -40,166.35 |

| Project year | Total net carbon stock change in the below -ground biomass of the leakage belt area | |
|---|---|---|
| | ∆Cab BSLLK t annual | ∆Cab BSLLK cumulative |
| | tCO2-e | tCO2-e |
| 8 | -11,294.16 | -51,460.51 |
| 9 | -12,606.90 | -64,067.41 |
| 10 | -13,910.62 | -77,978.02 |
| 11 | -13,688.34 | -91,666.36 |
| 12 | -13,548.92 | -105,215.28 |
| 13 | -13,437.13 | -118,652.41 |
| 14 | -13,342.46 | -131,994.87 |
| 15 | -13,283.00 | -145,277.87 |
| 16 | -13,144.95 | -158,422.82 |
| 17 | -13,078.57 | -171,501.40 |
| 18 | -12,952.31 | -184,453.71 |
| 19 | -12,907.34 | -197,361.06 |
| 20 | -12,834.71 | -210,195.77 |
| 21 | -12,782.49 | -222,978.26 |
| 22 | -12,741.96 | -235,720.22 |
| 23 | -12,668.53 | -248,388.75 |
| 24 | -12,558.99 | -260,947.74 |
| 25 | -12,442.25 | -273,389.99 |
| 26 | -12,348.69 | -285,738.68 |
| 27 | -12,174.93 | -297,913.62 |

| Project year | Total net carbon stock change in the below -ground biomass of the leakage belt area | |
|---|---|---|
| | ∆Cab BSLLK t annual | ∆Cab BSLLK cumulative |
| | tCO2-e | tCO2-e |
| 28 | -12,107.24 | -310,020.86 |
| 29 | -12,011.38 | -322,032.24 |
| 30 | -12,260.52 | -334,292.75 |

**Step 6.2. Baseline non-CO2 emissions from forest fires**

There is evidence that forest fires caused by agents of deforestation are a critical component of deforestation in the Project Area. However, the inclusion of emissions from GHGs other than CO2 is not obligatory, as their exclusion is conservative. For this reason, the decision was made not to account for non-CO2 GHGs in the project baseline. Because of this decision, the parameters of the VM0015 methodology, Section 6.1.3 were not used and the corresponding calculation tables are not presented (Tables 23 and 24 of the VM0015 methodology).

## 3.2 Project Emissions

### 3.2.1. STEP 7: EX-ANTE ESTIMATION OF ACTUAL CARBON STOCK CHANGES AND NON-$CO_2$ EMISSIONS IN THE PROJECT AREA

**Step 7.1: Ex ante estimation of actual carbon stock changes**

***Activities planned within the Project Area***

No deforestation activities are planned within the Project Area.

***Ex-ante estimation of uncontrollable emissions in the Project Area***

The *ex-ante* estimations of emissions that are outside of the control of the Project were made based on the Effectiveness Index for the Project, established as 55% according to the management of CORPOCHIVOR.

$$\Delta CUDdPA_t = \Delta CBSL_t * (1 - EI)| = \Delta CUDdPA_t = \Delta CBSL_t * (1 - 45\%)|$$

**Table 33. *Ex-ante* estimation of net changes in carbon in the Project Area under the Project Scenario.**

| Project year t | Total carbon stock decrease due to planned activities | | Total carbon stock increase due to planned activities | | Total carbon stock decrease due to unavoided unplanned deforestation | | Total carbon stock change in the project case | |
|---|---|---|---|---|---|---|---|---|
| | annual | cumulative | annual | cumulative | annual | cumulative | annual | cumulative |
| | ∆CPAdPAt (Total decrease in carbon stock due to all planned activities at year t in the project area) | ∆CPAdPA (Cumulative decrease in carbon stock due to all planned activities at year t in the project area) | ∆CPAdPAt (Total decrease in carbon stock due to all planned activities at year t in the project area) | ∆CPAiPA | ∆CUDdPAt (Total actual carbon stock change due to unavoided unplanned deforestation at year t in the project area) | ∆CUDdPA (Cumulative actual carbon stock change due to unavoided unplanned deforestation at year t in the project area) | ∆CPSPAt (Total project carbon stock change within the project area at year t) | ∆CPSPA (Cumulative project carbon stock change within the project area at year t) |
| | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e |
| 1 | | | | | -1,694.44 | -1,694.44 | -1,694.44 | -1,694.44 |
| 2 | | | | | -1,624.38 | -3,318.82 | -1,624.38 | -3,318.82 |
| 3 | | | | | -1,484.43 | -4,803.25 | -1,484.43 | -4,803.25 |
| 4 | | | | | -1,483.26 | -6,286.51 | -1,483.26 | -6,286.51 |
| 5 | | | | | -1,678.03 | -7,964.54 | -1,678.03 | -7,964.54 |
| 6 | | | | | -1,630.06 | -9,594.60 | -1,630.06 | -9,594.60 |
| 7 | | | | | -1,778.24 | -11,372.84 | -1,778.24 | -11,372.84 |
| 8 | | | | | -1,987.30 | -13,360.14 | -1,987.30 | -13,360.14 |
| 9 | | | | | -1,683.08 | -15,043.22 | -1,683.08 | -15,043.22 |
| 10 | | | | | -1,910.68 | -16,953.90 | -1,910.68 | -16,953.90 |
| 11 | | | | | -1,795.72 | -18,749.62 | -1,795.72 | -18,749.62 |
| 12 | | | | | -2,153.37 | -20,902.99 | -2,153.37 | -20,902.99 |
| 13 | | | | | -2,350.96 | -23,253.95 | -2,350.96 | -23,253.95 |
| 14 | | | | | -2,198.18 | -25,452.14 | -2,198.18 | -25,452.14 |

| Project year t | Total carbon stock decrease due to planned activities | | Total carbon stock increase due to planned activities | | Total carbon stock decrease due to unavoided unplanned deforestation | | Total carbon stock change in the project case | |
|---|---|---|---|---|---|---|---|---|
| | annual | cumulative | annual | cumulative | annual | cumulative | annual | cumulative |
| | ∆CPAdPAt (Total decrease in carbon stock due to all planned activities at year t in the project area) | ∆CPAdPA (Cumulative decrease in carbon stock due to all planned activities at year t in the project area) | ∆CPAdPAt (Total decrease in carbon stock due to all planned activities at year t in the project area) | ∆CPAiPA | ∆CUDdPAt (Total actual carbon stock change due to unavoided unplanned deforestation at year t in the project area) | ∆CUDdPA (Cumulative actual carbon stock change due to unavoided unplanned deforestation at year t in the project area) | ∆CPSPAt (Total project carbon stock change within the project area at year t) | ∆CPSPA (Cumulative project carbon stock change within the project area at year t) |
| | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e |
| 15 | | | | | -2,360.04 | -27,812.18 | -2,360.04 | -27,812.18 |
| 16 | | | | | -2,110.04 | -29,922.22 | -2,110.04 | -29,922.22 |
| 17 | | | | | -1,879.18 | -31,801.40 | -1,879.18 | -31,801.40 |
| 18 | | | | | -2,242.86 | -34,044.26 | -2,242.86 | -34,044.26 |
| 19 | | | | | -2,172.88 | -36,217.14 | -2,172.88 | -36,217.14 |
| 20 | | | | | -1,803.96 | -38,021.10 | -1,803.96 | -38,021.10 |
| 21 | | | | | -1,804.86 | -39,825.96 | -1,804.86 | -39,825.96 |
| 22 | | | | | -2,181.74 | -42,007.70 | -2,181.74 | -42,007.70 |
| 23 | | | | | -2,131.85 | -44,139.55 | -2,131.85 | -44,139.55 |
| 24 | | | | | -1,793.78 | -45,933.33 | -1,793.78 | -45,933.33 |
| 25 | | | | | -1,867.95 | -47,801.28 | -1,867.95 | -47,801.28 |
| 26 | | | | | -2,143.39 | -49,944.66 | -2,143.39 | -49,944.66 |
| 27 | | | | | -1,911.04 | -51,855.70 | -1,911.04 | -51,855.70 |
| 28 | | | | | -1,893.80 | -53,749.50 | -1,893.80 | -53,749.50 |
| 29 | | | | | -1,869.70 | -55,619.20 | -1,869.70 | -55,619.20 |
| 30 | | | | | -1,905.85 | -57,525.05 | -1,905.85 | -57,525.05 |

## 3.3. Leakage

### 3.3.1. STEP 8: EX ANTE ESTIMATION OF LEAKAGE

**Step 8.1: Ex ante estimation of the decrease in carbon stocks and increase in GHG emissions due to leakage prevention measures**

Leakage may not be significant in this project. The project does not anticipate that there will be a decrease in carbon stocks or increase in emissions resulting from the planned leakage prevention measures. The analysis of the Leakage Belt has been conducted following the guidance provided by the Section 1.1.3 of the Methodology VM0015 using Option II (Mobility analysis).

Among the most crucial factors determining the mobility of deforestation agents throughout the Project Area and the Reference Region are the habits and practices of the rural farmers and the availability of new land for colonization.

The practices and the land use practices employed by these agents make it possible to obtain basic, subsistence resources close to their homes, thus eliminating the need for traversing large distances. In addition, given the high proportion of land ownership in the region, it is assumed to be unlikely that the agents would move towards private property to implement production activities that result in deforestation (livestock or agriculture), as this would generate conflict between the involved parties. At the same time, the region managed by CORPOCHIVOR contains a significant area of vacant land (35,889.41 hectares) which is considered to be at the highest immediate risk of colonization. In this case, vacant land is defined as land within the public domain that is not under exploitation. It should be noted that much of this land is paramo and therefore does not have forest. Those vacant lands that do contain forests are located outside of the Project Area boundary but within the Reference Region, as they are considered to be the highest potential sites for forest degradation.

The expansion of the agricultural and grazing frontier is the most likely factor that could cause deforestation to surpass the rate projected in the baseline scenario. If the population within the Project Area does choose to use vacant or private lands outside of the project area for establishing crops or grazing livestock, it is expected that the maximum distance they would travel to do so would not exceed that traveled to obtain firewood[60]. This is probable, given that such activities require much physical effort and rural farmers in this region do not typically spend much time away from the home, where they have to tend their family and their subsistence crops.

Based on these mobility constraints, the Leakage Belt was determined by first establishing a two-kilometer buffer along the perimeter of the Project Area. This buffer was then adjusted to account for physical restrictions, including the following factors:

- Access roads, including trails in both paved and unpaved primary, secondary and tertiary roads.
- Distance to vacant forested lands, given that those lands are more likely to be converted than those on private property.
- Proximity to population centers, assuming that the areas closest to population centers are at higher risk of being deforested.

The slope of hills, as shallower slopes allow for greater mobility of deforestation agents.

[60] In 2015, CORPOCHIVOR evaluated supply and demand of firewood in the Reference Region. This assessment demonstrated that the majority of the population (60%) collects firewood from its own property, traveling between zero and one kilometer to do so. Fifteen percent of families were found to travel up to two kilometers to obtain wood resources. See supporting document, “Selection of Cookstoves Users_ Socioeconomic_Executive report.”

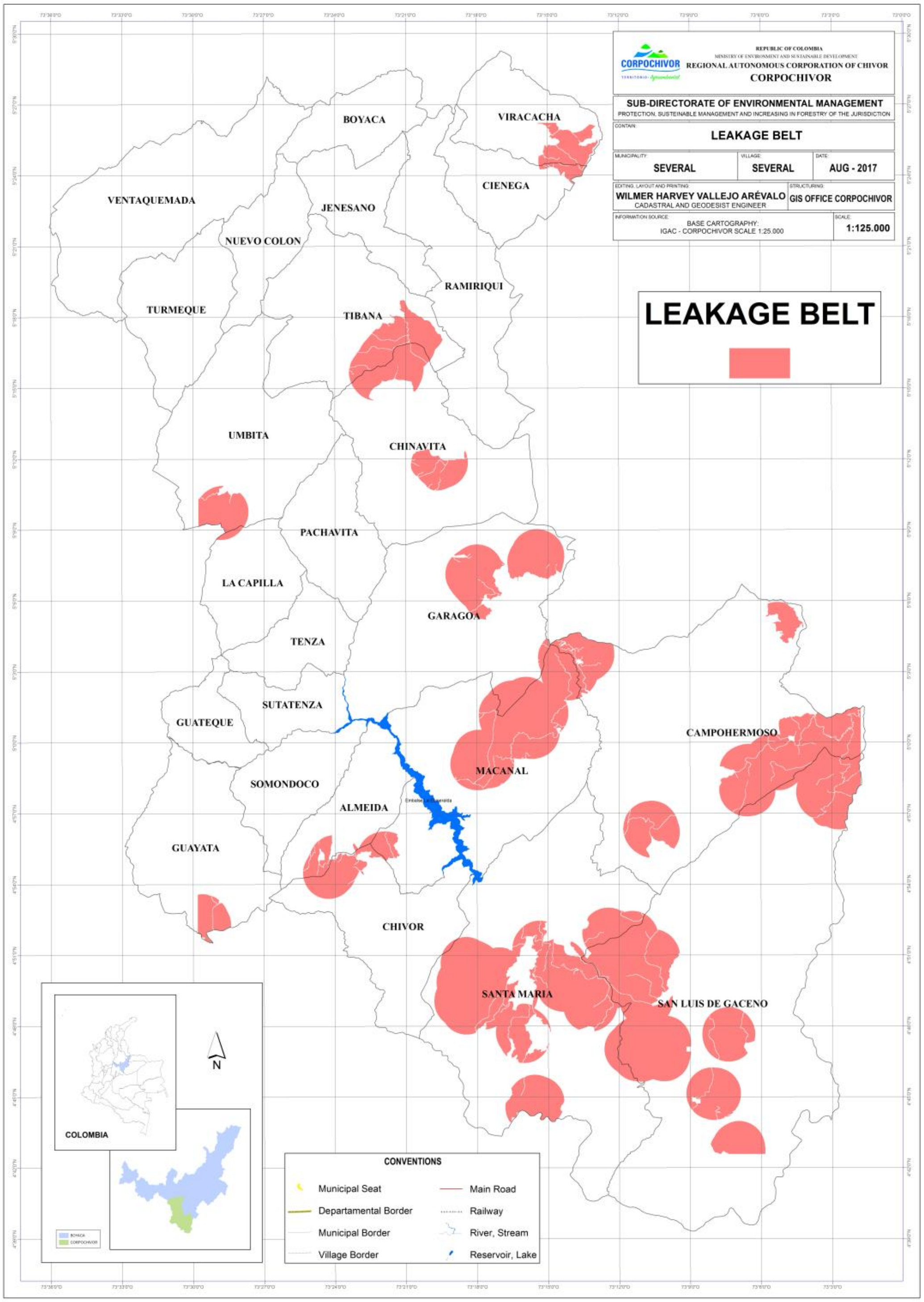


**Figure 25. Leakage Belt for the CORPOCHIVOR REDD+ Project.**

***Decrease in carbon stocks and increase in GHG emissions associated with leakage prevention measures:***

- Leakage management measures would not cause any decrease in carbon stocks or increases in GHG emissions.
- Legal logging is allowed when permitted by Corpochivor.
- The non-forested areas correspond to the Leakage Management Areas. The activities to be carried out in these areas are considered alongside the project activities prior to the signing of the conservation agreements.
- Non-forest classes presented in the Leakage Management Areas consist of the same non-forest classes present in the Project Area.
- The carbon stocks of the Leakage Management Areas are the same as for the Project Area post-deforestation classes.
- The project does not anticipate that changes in carbon stocks within the Leakage Management Areas will result from project activities.

Based on the factors described above, decreases in carbon stocks and increases in GHG emissions associated with leakage prevention measures were excluded from the accounting.

**Step 8.2: Ex ante estimation of the decrease in carbon stocks and increase in GHG emissions due to activity displacement leakage:**

- The *ex-ante* calculation for estimating carbon stock changes and GHG emissions due to activity displacement leakage is based on the "Displacement Leakage Factor" (DLF), which is an estimate of leakage emissions as a percentage of Avoided Unplanned Deforestation that occurs because of project activities. The DLF estimate for this project is 5%.
- This does not represent a significant reduction of carbon stocks and/or an increase in GHG emissions relative to the baseline scenario. Therefore, leakage emissions associated with the leakage prevention measures were not accounted and *ex-post* monitoring will not be undertaken.

**Table 34.** ***Ex-ante*** **estimation of activity displacement leakage.**

| Project year t | Total ex ante estimated decrease in carbon stocks due to displaced deforestation | | Total ex ante estimated increase in GHG emissions due to displaced forest fires | |
|---|---|---|---|---|
| | annual | cumulative | annual | cumulative |
| | ∆CADLK t (Total decrease in carbon stocks due to displaced deforestation at year t) | ∆CADLK (Cumulative total decrease in carbon stocks due to displaced deforestation) | EADLKt (Total ex ante increase in GHG emissions due to displaced forest fires at year t) | EADLK (Cumulative total increase in GHG emissions due to displaced forest fires) |
| | tCO2-e | tCO2-e | tCO2-e | tCO2-e |
| 1 | -188.27 | -188.27 | n.a | n.a |
| 2 | -180.49 | -368.76 | n.a | n.a |
| 3 | -164.94 | -533.69 | n.a | n.a |
| 4 | -164.81 | -698.50 | n.a | n.a |
| 5 | -186.45 | -884.95 | n.a | n.a |
| 6 | -181.12 | -1,066.07 | n.a | n.a |
| 7 | -197.58 | -1,263.65 | n.a | n.a |
| 8 | -220.81 | -1,484.46 | n.a | n.a |
| 9 | -187.01 | -1,671.47 | n.a | n.a |
| 10 | -212.30 | -1,883.77 | n.a | n.a |
| 11 | -199.52 | -2,083.29 | n.a | n.a |
| 12 | -239.26 | -2,322.55 | n.a | n.a |
| 13 | -261.22 | -2,583.77 | n.a | n.a |
| 14 | -244.24 | -2,828.02 | n.a | n.a |
| 15 | -262.23 | -3,090.24 | n.a | n.a |

| Project year t | Total ex ante estimated decrease in carbon stocks due to displaced deforestation | | Total ex ante estimated increase in GHG emissions due to displaced forest fires | |
|---|---|---|---|---|
| | annual | cumulative | annual | cumulative |
| | ∆CADLK t (Total decrease in carbon stocks due to displaced deforestation at year t) | ∆CADLK (Cumulative total decrease in carbon stocks due to displaced deforestation) | EADLKt (Total ex ante increase in GHG emissions due to displaced forest fires at year t) | EADLK (Cumulative total increase in GHG emissions due to displaced forest fires) |
| | tCO2-e | tCO2-e | tCO2-e | tCO2-e |
| 16 | -234.45 | -3,324.69 | n.a | n.a |
| 17 | -208.80 | -3,533.49 | n.a | n.a |
| 18 | -249.21 | -3,782.70 | n.a | n.a |
| 19 | -241.43 | -4,024.13 | n.a | n.a |
| 20 | -200.44 | -4,224.57 | n.a | n.a |
| 21 | -200.54 | -4,425.11 | n.a | n.a |
| 22 | -242.42 | -4,667.52 | n.a | n.a |
| 23 | -236.87 | -4,904.39 | n.a | n.a |
| 24 | -199.31 | -5,103.70 | n.a | n.a |
| 25 | -207.55 | -5,311.25 | n.a | n.a |
| 26 | -238.15 | -5,549.41 | n.a | n.a |
| 27 | -212.34 | -5,761.74 | n.a | n.a |
| 28 | -210.42 | -5,972.17 | n.a | n.a |
| 29 | -207.74 | -6,179.91 | n.a | n.a |
| 30 | -211.76 | -6,391.67 | n.a | n.a |

## 3.4. Net GHG Emission Reductions and Removals

### 3.4.1. STEP 9: EX ANTE TOTAL NET ANTHROPOGENIC GHG EMISSION REDUCTION

**Step 9.1: Significance assessment**

Under the rules of the Methodology VM0015, each decrease in carbon stock or increase in GHG emissions due to project activities must be included if concluded to be significant. The methodology recommends that this determination be made using the most recent CDM-approved CDM- and VCS-approved "Tool for testing significance of GHG emissions in A/R CDM project activities." This tool is used to test the significance of the possible GHG emissions from each potential source. For A/R CDM project activities, sources defined as "significant" are those that would contribute to at least 5% of the total generated GHG emissions. The following equation can be used to test significance:

$$RC_{Ei} = \frac{E_i}{\sum_{i=1}^{I} E_i}$$

Where:

***i*** indicates the individual sources of project/leakage GHG emissions (I = the complete set of sources "*i* considered);

***RC_EI*** is the relative contribution of each source "*i*" to the sum of project and leakage GHG emissions (proportion of the total);

***Ei*** represents the GHG emissions for each source, the estimated possible decreases in carbon pools and increases in emissions due to leakage from source *i*.

The sources considered to contribute significantly to emissions are the ones that, when summed, together reach a threshold of no less than 0.95 (95% of the total project and leakage emissions); the other pools are not considered to be significant and may be conservatively excluded.

Once the relative contributions ($RC_{Ei}$) were obtained for each pool, the sources of emissions associated with project activities (e.g. unplanned deforestation, activity displacement leakage, etc.) were organized based on their relative contribution to overall emissions.

The sources determined to be significant and therefore selected for inclusion in this project are leakage and unplanned deforestation. Together, they account for 100% of the combined project and leakage emissions, with 90% coming from unplanned deforestation and 10% from leakage due to displacement.

**Step 9.2: Calculation of ex-ante estimation of total net GHG emissions reductions**

The project followed the calculation given in the VM0015 v1.1 for calculating the *ex-ante* estimation of total net GHG emissions. Result are show below:

$$\Delta REDDt = (\Delta CBSLPAt + EBBBSLPAt) - (\Delta CPSPAt + EBBPSPAt) - (\Delta CLKt + ELKt)$$

Where:

**ΔREDDt** = Net *ex-ante* estimated anthropogenic GHG emissions reductions attributable to the AUD project activity at year *t*; tCO2e

**ΔCBSLPAt** = Sum of baseline carbon stock changes in the Project Area at year *t*; tCO2e. Note: The absolute value of CBSLPAt shall be used in Equation 19.

**EBBBSLPAt** = Sum of baseline emissions from biomass burning in the Project Area at year *t*; tCO2e

**ΔCPSPAt** = Sum of *ex-ante* estimated actual carbon stock changes in the Project Area at year *t*; tCO2e*. Note: If CPSPAt represents a net increase in carbon stocks, a negative sign before the absolute value of CPSPAt shall be used. If CPSPAt represents a net decrease, a positive sign shall be used.*

**EBBPSPAt** = Sum of (*ex-ante* estimated) actual emissions from biomass burning in the Project Area at year *t*; tCO2e.

**ΔCLKt** = Sum of *ex-ante* estimated net carbon stock changes due to leakage at year *t*; tCO2e.

Note: If the cumulative sum of CLKt within a fixed baseline period is > 0, CLKt shall be set to zero.

**ELKt** = Sum of *ex-ante* estimated leakage emissions in year *t*; tCO2e

***t*** = 1, 2, 3 … T, a year of the proposed project crediting period; dimensionless

**Step 9.3. Calculation of ex-ante Verified Carbon Units (VCUs)**

The number of Verified Carbon Units (VCUs) to be generated through the proposed AUD project activity at year *t* is calculated according to the VM0015 methodology. The Risk Factor used is 18% as was determined in the VCS Non-Permanence Risk Report.

$$VCUt = \Delta REDDt - VBCt$$

$$VBCt = (\Delta CBSLPAt - \Delta CPSPAt) * RFt$$

Where:

**VCUt** = Number of Verified Carbon Units that can be traded at time *t*; t CO2-e

**ΔREDDt** = *Ex-ante* estimated net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year *t*; t CO2e / ha.

**VBCt** = Number of Buffer Credits deposited in the VCS Buffer at time *t*; t CO2-e

**ΔCBSLPAt** = Sum of baseline carbon stock changes in the Project Area at year t; tCO2e

**ΔCPSPAt** = Sum of ex-ante estimated actual carbon stock changes in the Project Area at year t; tCO2-e ha-1

**RFt** = Risk factor used to calculate VCS buffer credits; 20%

***t*** = 1, 2, 3 … T, a year of the proposed project crediting period; dimensionless

**Table 35. *Ex-ante* estimation of net anthropogenic GHG emissions reductions (ΔREDD) and Verified Carbon Units (VCU).**

| Ex ante net anthropogenic GHG emissions reductions | | Ex ante buffer credits | | Ex ante VCUs tradable | |
|---|---|---|---|---|---|
| annual | cumulative | annual | cumulative | annual | cumulative |
| ∆REDDt (Net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t) | ∆REDD (Cumulative met anthropogenic greenhouse gas emission reduction attributable to the AUD project activity) | Number of Buffer Credits deposited in the VCS Buffer at time t;) | VBC (Number of Buffer Credits deposited in the VCS Buffer at time t;) | VCUt (Number of Verified Carbon Units (VCUs) to be made available for trade at time t) | VCU (Number of Verified Carbon Units (VCUs) to be made available for trade at time t) |
| tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e |
| 1,882 | 1,882 | 414 | 414 | 1,468 | 1,468 |
| 1,804 | 3,686 | 397 | 811 | 1,407 | 2,875 |
| 1,649 | 5,335 | 362 | 1,173 | 1,287 | 4,162 |
| 1,648 | 6,983 | 362 | 1,535 | 1,286 | 5,448 |
| 1,864 | 8,847 | 410 | 1,945 | 1,454 | 6,902 |
| 1,811 | 10,658 | 398 | 2,343 | 1,413 | 8,315 |
| 1,975 | 12,633 | 434 | 2,777 | 1,541 | 9,856 |
| 2,208 | 14,841 | 485 | 3,262 | 1,723 | 11,579 |
| 1,870 | 16,711 | 411 | 3,673 | 1,459 | 13,038 |
| 2,122 | 18,833 | 467 | 4,140 | 1,655 | 14,693 |
| 1,995 | 20,828 | 438 | 4,578 | 1,557 | 16,250 |
| 2,392 | 23,220 | 526 | 5,104 | 1,866 | 18,116 |
| 2,612 | 25,832 | 574 | 5,678 | 2,038 | 20,154 |
| 2,442 | 28,274 | 537 | 6,215 | 1,905 | 22,059 |
| 2,622 | 30,896 | 576 | 6,791 | 2,046 | 24,105 |
| 2,344 | 33,240 | 515 | 7,306 | 1,829 | 25,934 |
| 2,087 | 35,327 | 459 | 7,765 | 1,628 | 27,562 |
| 2,492 | 37,819 | 548 | 8,313 | 1,944 | 29,506 |

| Ex ante net anthropogenic GHG emissions reductions | | Ex ante buffer credits | | Ex ante VCUs tradable | |
|---|---|---|---|---|---|
| annual | cumulative | annual | cumulative | annual | cumulative |
| ∆REDDt (Net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t) | ∆REDD (Cumulative met anthropogenic greenhouse gas emission reduction attributable to the AUD project activity) | Number of Buffer Credits deposited in the VCS Buffer at time t;) | VBC (Number of Buffer Credits deposited in the VCS Buffer at time t;) | VCUt (Number of Verified Carbon Units (VCUs) to be made available for trade at time t) | VCU (Number of Verified Carbon Units (VCUs) to be made available for trade at time t) |
| tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e | tCO2-e |
| 2,414 | 40,233 | 531 | 8,844 | 1,883 | 31,389 |
| 2,004 | 42,237 | 440 | 9,284 | 1,564 | 32,953 |
| 2,005 | 44,242 | 441 | 9,725 | 1,564 | 34,517 |
| 2,424 | 46,666 | 533 | 10,258 | 1,891 | 36,408 |
| 2,368 | 49,034 | 521 | 10,779 | 1,847 | 38,255 |
| 1,993 | 51,027 | 438 | 11,217 | 1,555 | 39,810 |
| 2,075 | 53,102 | 456 | 11,673 | 1,619 | 41,429 |
| 2,381 | 55,483 | 523 | 12,196 | 1,858 | 43,287 |
| 2,123 | 57,606 | 467 | 12,663 | 1,656 | 44,943 |
| 2,104 | 59,710 | 462 | 13,125 | 1,642 | 46,585 |
| 2,077 | 61,787 | 457 | 13,582 | 1,620 | 48,205 |
| 2,117 | 63,904 | 465 | 14,047 | 1,652 | 49,857 |

## 4. Monitoring

### 4.1. Data and Parameters Available at Validation

| Data / Parameter | Thrp |
|---|---|
| Data unit | Yr |

| | |
|---|---|
| Description | Duration of the historical reference period |
| Source of data | Defined. See VCS Annex - Section 2 |
| Value applied | 9 |
| Justification of choice of data or description of measurement methods and procedures applied | Defined by the methodology and the information available |
| Purpose of Data | Calculation of baseline emissions |
| Comments | Provide any additional comments |

| | |
|---|---|
| Data / Parameter | a1 and a2 |
| Data unit | ha |
| Description | Sample plot area |
| Source of data | Temporary plots established by the PO in 2011. See VCS Annex - Section 6.1.1 |
| Value applied | Rectangular sample plots with a fixed width of 10 m but with a variable length according to the site characteristics. The length proposed was 100 m. |
| Justification of choice of data or description of measurement methods and procedures applied | Valero, F. (2014) Estimaciones de las reservas potenciales de Carbono almacenado en la biomasa aérea en los Forests naturales ubicados en el sur oriente del departamento de Boyacá-Colombia, jurisdicción de la Corporación Autónoma Regional de Chivor, CORPOCHIVOR, y su potencial como sumideros de Carbono. Tesis de Magister no publicada. Tadeo Lozano, Bogotá, DC., Colombia. |
| Purpose of Data | Calculation of baseline emissions |
| Comments | Estimate of aboveground biomass |

| Data / Parameter | ARRi |
|---|---|
| Data unit | ha |
| Description | Total forest area in stratum i within the reference region at the project start date |
| Source of data | Calculated, see Anexo VCS |
| Value applied: | There is only one stratum: 310,092.86 |
| Justification of choice of data or description of measurement methods and procedures applied | Based on the results of satellite image processing as described in VCS Annex |
| Purpose of Data | Calculation of baseline emissions |
| Comments | Benchmark forest cover used to assess emissions reductions. |

| Data / Parameter | ABSLRRt |
|---|---|
| Data unit | ha |
| Description | Annual area of baseline deforestation within the RR at year t |
| Source of data | Calculated, see Anexo VCS |
| Value applied: | Table 9a, 11a VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of the VM0015 v1.1. See VCS Annex |
| Purpose of Data | Calculation of baseline emissions |

| | |
|---|---|
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | ABSLRR |
| Data unit | ha |
| Description | Cumulative area of baseline deforestation in the reference region at year t |
| Source of data | Calculated, see VCS Annex |
| Value applied: | Table 9a,11a VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of VM0015 v1.1. See VCS Annex |
| Purpose of Data | Calculation of baseline emissions |
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | ABSLPAt |
| Data unit | ha |
| Description | Annual area of baseline deforestation in the project area at year t |
| Source of data | Calculated, see VCS Annex |
| Value applied: | Table 9b, 11b, 13b of VM0015 |
| Justification of choice of data or description of | Calculated according to requirements of VM0015 v1.1. See VCS Annex |

| | |
|---|---|
| measurement methods and procedures applied | |
| Purpose of Data | Calculation of baseline emissions |
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | ABSLPAicl,t |
| Data unit | ha |
| Description | Area of initial (pre-deforestation) forest class icl deforested at time t within the project area in the baseline |
| Source of data | Calculated, see VCS Annex |
| Value applied: | Table 11b of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of VM0015 v1.1, 5.1 by applying land cover map to the result of Table 9b |
| Purpose of Data | Calculation of baseline emissions |
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | ABSLPAi,t |
| Data unit | ha |
| Description | Annual area of baseline deforestation within stratum (i) of the project area at year t |
| Source of data | Calculated, see VCS Annex |

| | |
|---|---|
| Value applied: | Table 9b of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of VM0015 v1.1, 4.1.2.2. See VCS Annex |
| Purpose of Data | Calculation of baseline emissions |
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | ABSLPA |
| Data unit | ha |
| Description | Cumulative area of baseline deforestation within the project area at year t |
| Source of data | Calculated, see VCS Annex |
| Value applied: | Table 9b, Table 11b, Table 13b of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of the VM0015 v1.1. See VCS Annex |
| Purpose of Data | Calculation of baseline emissions |
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | ABSLPAz,t |
| Data unit | ha |

| | |
|---|---|
| Description | Area of the zone z “deforested” at time t within the project area in the baseline case; ha |
| Source of data | Calculated, see Anexo VCS |
| Value applied: | Table 13b of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | Equal to values of Table 11b grouped by zones. |
| Purpose of Data | Calculation of baseline emissions |
| Comments | Calculating net GHG emissions via post-deforestation C-stocks |

| | |
|---|---|
| Data / Parameter | ABSLLKt |
| Data unit | ha |
| Description | Annual area of baseline deforestation within the leakage belt at year t |
| Source of data | Calculated, see VCS Annex |
| Value applied: | Table 9c, 11c, 13c of VM0015. |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of VM0015 v1.1. see VCS Annex |
| Purpose of Data | Calculation of leakage |
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | $ABSLLK_{icl,t}$ |
| Data unit | ha |
| Description | Area of initial (post-deforestation) forest class fcl deforested at time t within the leakage belt in the baseline case |
| Source of data | Calculated, see VCS Annex |
| Value applied: | Table 11c of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of VM0015 v1.1, 5.1 by applying land cover map to the result of Table 9c |
| Purpose of Data | Calculation of leakage |
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | $ABSLLK_{I,t}$ |
| Data unit | ha |
| Description | Annual area of deforestation in stratum (i) within the leakage belt at year t |
| Source of data | Calculated. See VCS annex – section 4 |
| Value applied | Table 9c, 11c, 13c of VM0015. |
| Justification of choice of data or description of measurement methods and procedures applied | Activity data for calculating GHG emissions. Calculated according to requirements of VM0015 v1.1. See VCS annex – section 4 |
| Purpose of Data | Calculation of leakage |

| | |
|---|---|
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | ABSLLK |
| Data unit | ha |
| Description | Cumulative area of baseline deforestation within the leakage belt at year t |
| Source of data | Calculated, see VCS Annex - Section 1.1.3 and 4.1.2.2 |
| Value applied | Table 9c, 11c, 13c of VM0015. |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of VM0015 v1.1. See VCS Annex |
| Purpose of Data | Calculation of leakage |
| Comments | Activity data for calculating GHG emissions in the baseline scenario |

| | |
|---|---|
| Data / Parameter | CFj |
| Data unit | Dimensionless |
| Description | Carbon fraction for tree tr, of species, group of species or forest type j |
| Source of data | IPCC GPG 2006 Chapter 6 |
| Value applied | forest classes: 0.5<br>Post-deforestation classes: 0.47 |

| | |
|---|---|
| Justification of choice of data or description of measurement methods and procedures applied | Default values IPCC GPG 2006, Chapter 6 |
| Purpose of Data | Calculation of baseline emission |
| Comments | Conversion from biomass to CO2e |

| | |
|---|---|
| Data / Parameter | $Cab_{cl}$ |
| Data unit | t $CO_2$e $ha^{-1}$ |
| Description | Average carbon stock per hectare in the above-ground biomass carbon pool of LU/LC class cl |
| Source of data | Calculated, see VCS Annex |
| Value applied | forest class:<br>bh-M: 250.75<br>bh-MB: 350.22<br>bh-PM: 196.63<br>bh-T: 230.90<br>bmh-M: 178.13<br>bmh-MB: 445.16<br>bmh-PM: 460.92<br>bmh-T: 224.26<br>bp-M: 183.36<br>bp-PM: 526.76<br>bs-MB: 372.24 |

| | |
|---|---|
| Justification of choice of data or description of measurement methods and procedures applied | Derived from forest inventory data. See VCS Annex. |
| Purpose of Data | Calculation of baseline emission |
| Comments | Emissions factors for estimating GHG emissions from deforestation. |

| | |
|---|---|
| Data / Parameter | Rj |
| Data unit | % |
| Description | Root shoot ratio |
| Source of data | IPCC/Literature value |
| Value applied | 0.24 |
| Justification of choice of data or description of measurement methods and procedures applied | Default value of 0.24 from IPCC/Mokany 2006 |
| Purpose of Data | Calculation of baseline emission |
| Comments | Belowground biomass estimation |

| | |
|---|---|
| Data / Parameter | $Cbb_{cl}$ |
| Data unit | t $CO_2e$ $ha^{-1}$ |
| Description | Average carbon stock per hectare in the below-ground biomass carbon pool of LU/LC class cl |
| Source of data | Calculated, see VCS Annex |

| | |
|---|---|
| Value applied | forest class:<br>bh-M: 60.18<br><br>bh-MB: 84.05<br><br>bh-PM: 47.19<br><br>bh-T: 55.42<br><br>bmh-M: 42.75<br><br>bmh-MB: 106.84<br><br>bmh-PM: 110.62<br><br>bmh-T: 53.82<br><br>bp-M: 44.01<br><br>bp-PM: 126.42<br><br>bs-MB: 89.34 |
| Justification of choice of data or description of measurement methods and procedures applied | Default value of 0.24 from IPCC/Mokany 2006 |
| Purpose of Data | Calculation of baseline emission |
| Comments | Emissions factors for estimating GHG emissions from deforestation. |

| | |
|---|---|
| Data / Parameter | Ctot_(icl) |
| Data unit | t $CO_2$e $ha^{-1}$ |
| Description | Average carbon stock per hectare in all accounted carbon pools of LU/LC class cl |

| | |
|---|---|
| Source of data | Calculated, see VCS Annex 6.1.1 |
| Value applied | forest class:<br>bh-M: 310.93<br>bh-MB: 434.27<br>bh-PM: 243.82<br>bh-T: 286.32<br>bmh-M: 220.88<br>bmh-MB: 552.00<br>bmh-PM: 571.54<br>bmh-T: 278.08<br>bp-M: 227.37<br>bp-PM: 653.18<br>bs-MB: 461.58 |
| Justification of choice of data or description of measurement methods and procedures applied | Derived from various forest inventory data. See VCS Annex - Section 6.1.1. |
| Purpose of Data | Calculation of baseline emission |
| Comments | Emissions factors for estimating GHG emissions from deforestation. |

| | |
|---|---|
| Data / Parameter | $Ctot_{icl,t}$ |
| Data unit | t $CO_2$e $ha^{-1}$ |

| | |
|---|---|
| Description | Average carbon stock of all accounted carbon pools in forest class icl at time t |
| Source of data | Calculated, see Anexo VCS Section 9.1 |
| Value applied | Deemed de-minimus |
| Justification of choice of data or description of measurement methods and procedures applied | Significance analysis. Table “Significancia” in “VM0015 tables_Corpochivor” |
| Purpose of Data | Calculation of baseline emission |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | $Cab_{fcl}$ |
| Data unit | t $CO_2$e $ha^{-1}$ |
| Description | Average carbon stock per hectare in the above-ground biomass carbon pool of final post-deforestation class fcl |
| Source of data | Calculated, see VCS Annex |
| Value applied | Grassland: 17.95<br><br>Heterogeneous farmland: 26.76<br><br>Crops: 21.78 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of VM0015 v1.1. See VCS Annex |
| Purpose of Data | Calculation of baseline emission |
| Comments | Calculate GHG emissions from deforestation |

| Data / Parameter | $Cab_z$ |
|---|---|
| Data unit | t $CO_2$e $ha^{-1}$ |
| Description | Average carbon stock per hectare in the above-ground biomass carbon pool per zone z |
| Source of data | Calculated, see VCS Annex |
| Value applied | Zone 1: 204.08<br>Zone 2: 361.23<br>Zone 3: 328.77<br>Zone 4: 230.90<br>Zone 5: 445.16<br>Zone 6: 224.26<br>Zone 7: 526.76 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of VM0015 v1.1. See VCS Annex |
| Purpose of Data | Calculation of baseline emission |
| Comments | Growth factors in post-deforestation classes used for calculating net GHG emissions. |

| Data / Parameter | $Ctot_z$ |
|---|---|
| Data unit | t $CO_2$e $ha^{-1}$ |

| | |
|---|---|
| Description | Average carbon stock of all accounted carbon pools per zone z |
| Source of data | Calculated, see VCS Annex |
| Value applied | Zone 1: 253.06<br><br>Zone 2: 447.93<br><br>Zone 3: 407.68<br><br>Zone 4: 286.32<br><br>Zone 5: 552.00<br><br>Zone 6: 278.08<br><br>Zone 7: 653.18 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated according to requirements of the VM0015 v1.1. See VCS Annex |
| Purpose of Data | Calculation of baseline emission |
| Comments | Growth factors in post-deforestation classes used for calculating net GHG emissions. |

| | |
|---|---|
| Data / Parameter | Cp |
| Data unit | t $CO_2$e $ha^{-1}$ |
| Description | Average carbon stock per hectare in the carbon pool p |
| Source of data | Table 20.a |
| Value applied | Table 20.a. VM0015 |

| | |
|---|---|
| Justification of choice of data or description of measurement methods and procedures applied | Requirements of the VM0015 sec. 6.1.2. |
| Purpose of Data | Calculation of baseline emission |
| Comments | Baseline GHG emissions estimates |

| | |
|---|---|
| Data / Parameter | $Ctot_{fcl, t}$ |
| Data unit | t $CO_2$e $ha^{-1}$ |
| Description | Average carbon stock of all accounted carbon pools in non-forest class fcl at time t; |
| Source of data | n.a. |
| Value applied | n.a. |
| Justification of choice of data or description of measurement methods and procedures applied | Sec. 8.1.1 Anexo VCS. Leakage management activities do not decrease carbon stocks. |
| Purpose of Data | Calculation of baseline emission |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔCabABSLKK |
| Data unit | t $CO_2$e |
| Description | Cumulative baseline carbon stock changes for the above-ground biomass pool in the leakage belt |
| Source of data | Table 21.c.1 of VM0015 |

| | |
|---|---|
| Value applied | See Table 21.c.1 of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | GHG accounting in the leakage belt. |
| Purpose of Data | Calculation of leakage |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔCbbABSLKK |
| Data unit | t $CO_2e$ |
| Description | Cumulative baseline carbon stock changes for the below-ground biomass pool in the leakage belt |
| Source of data | Table 21.c.1 of VM0015 |
| Value applied | See Table 21.c.1 of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | GHG accounting in the leakage belt. |
| Purpose of Data | Calculation of leakage |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔCabBSLPA |
| Data unit | t $CO_2e$ |
| Description | Cumulative baseline carbon stock changes for the above-ground biomass pool in the project area |

| | |
|---|---|
| Source of data | Table 21.b.1 of VM0015 |
| Value applied | See Table 21.b.1 of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | GHG accounting in the project area. |
| Purpose of Data | Calculation of baseline emissions |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔCbbBSLPA |
| Data unit | t $CO_2$e |
| Description | Cumulative baseline carbon stock changes for the below-ground biomass pool in the project area |
| Source of data | Table 21.b.1 of VM0015 |
| Value applied | See Table 21.b.1 of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | GHG accounting in the project area |
| Purpose of Data | Calculation of baseline emissions |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔCADLK |
| Data unit | t $CO_2$-e |

| | |
|---|---|
| Description | Cumulative total decrease in carbon stocks due to displaced deforestation |
| Source of data | Table 34, 35 of VM0015 |
| Value applied | See Table 34, 35 of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | GHG accounting from displaced leakage |
| Purpose of Data | Calculation of leakage |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔCBSLPA |
| Data unit | t $CO_2$-e |
| Description | Total baseline carbon stock changes in the project area |
| Source of data | Table 36 of VM0015 |
| Value applied | See Table 36 of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | GHG accounting in the project area |
| Purpose of Data | Calculation of leakage |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔCBSLPA |

| | |
|---|---|
| Data unit | t $CO_2$-e |
| Description | Total baseline carbon stock changes in the project area |
| Source of data | Table 36 of VM0015 |
| Value applied | See Table 36 of VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | GHG accounting in the project area |
| Purpose of Data | Calculation of baseline emissions |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔCPSPA |
| Data unit | t $CO_2$-e |
| Description | Cumulative project carbon stock change within the project area at year t |
| Source of data | Table 27, 36 VM0015 |
| Value applied | Table 27, 36 VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculation of net GHG emissions reductions |
| Purpose of Data | Calculation of baseline emissions |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔCUDdPA |
| Data unit | t $CO_2$-e |
| Description | Cumulative actual carbon stock change due to unavoided unplanned deforestation at year t in the project area |
| Source of data | Table 27 VM0015. Section 7.1.2 Anexo VCS |
| Value applied | Effectiveness index: 45% |
| Justification of choice of data or description of measurement methods and procedures applied | Measure of project effectiveness |
| Purpose of Data | Calculation of project emissions |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ΔREDDt |
| Data unit | t $CO_2$-e |
| Description | Net anthropogenic greenhouse gas emission reduction attributable to the AUD project activity at year t |
| Source of data | T36 VM0015 |
| Value applied | T36 VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | The cumulative result of applying the VM0015 methodology, see section 9.2 of Anexo VCS |
| Purpose of Data | Calculation of project emissions |
| Comments | Final GHG calculations |

| | |
|---|---|
| Data / Parameter | DLF |
| Data unit | % |
| Description | Displacement leakage factor |
| Source of data | Table 34 VCS Annex |
| Value applied | 5 |
| Justification of choice of data or description of measurement methods and procedures applied | ex-ante leakage |
| Purpose of Data | Calculation of leakage |
| Comments | n.a |

| | |
|---|---|
| Data / Parameter | EI |
| Data unit | % |
| Description | *ex-ante* estimated Effectiveness Index |
| Source of data | Estimate generated by the project |
| Value applied | 0.45 |
| Justification of choice of data or description of measurement methods and procedures applied | Estimate generated by the project |
| Purpose of Data | Calculation of project emissions |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | ELK |
| Data unit | t $CO_2$-e |
| Description | Cumulative sum of *ex-ante* estimated leakage emissions at year t |
| Source of data | Table 35,36 VM0015 Annex VCS |
| Value applied | Table 35,36 VM0015 Annex VCS |
| Justification of choice of data or description of measurement methods and procedures applied | The cumulative result of applying the VM0015 methodology, see section 8 of Annex VCS |
| Purpose of Data | Calculation of leakage |
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | RFt |
| Data unit | % |
| Description | Risk factor used to calculate VCS buffer credits |
| Source of data | VCS Non Permanence Risk analysis |
| Value applied | 20 |
| Justification of choice of data or description of measurement methods and procedures applied | see VCS Non-Permanence Risk Analysis |
| Purpose of Data | Calculation of project emissions |

| | |
|---|---|
| Comments | n.a. |

| | |
|---|---|
| Data / Parameter | VBCt |
| Data unit | t $CO_2$-e |
| Description | Number of Buffer Credits deposited in the VCS Buffer at time t; |
| Source of data | Table 36 VM0015 |
| Value applied | Table 36 VM0015 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated. Section 9.3 |
| Purpose of Data | Buffer calculation |
| Comments | |

## 4.2. Monitoring Plan

### PART 3: METHODOLOGY FOR MONITORING AND RE-VALIDATION OF THE BASELINE

Monitoring will be carried out by CORPOCHIVOR, but other governmental and non-governmental institutions may also participate in the process of field data collection. The data generated during monitoring will be managed and stored by the Corporation. CORPOCHIVOR will be responsible for the gathering and processing of all field data necessary for climate monitoring during future VCS verification events. A quality control process will occur continuously over time, increasing in scrutiny before each verification event. Any inconsistencies discovered during the internal auditing exercises will be documented, communicated, and resolved within three months of their detection.

The objective of climate monitoring is to obtain the information necessary to estimate the quantity of GHG emissions avoided during the crediting period. CORPOCHIVOR will produce land cover maps that help quantify the effectiveness of the project in terms of the area of forest cover that remains intact and free from anthropogenic disturbance.

The project monitoring and baseline re-validation procedures have been designed according to the requirements of VCS Methodology VM0015, with emphasis placed on:

- Calculating carbon stock changes and GHG emissions for periodic verifications within the fixed baseline period; and
- Monitoring key baseline parameters for revisiting the baseline at the end of the fixed baseline period.

### 4.3.1. TASK 1: MONITORING OF CARBON STOCK CHANGES AND GHG EMISSIONS FOR PERIODICAL VERIFICATIONS

As per the VCS Methodology VM0015, this project can be monitored by fulfilling the three main monitoring tasks:

Task 1.1: Monitoring of actual carbon stock changes and GHG emissions within the Project Area.

Task 1.2: Monitoring leakage.

Task 1.3: *Ex-post* calculation of net anthropogenic GHG emission reductions.

**Task 1.1. Monitoring of actual carbon stock changes and GHG emissions within the Project Area.**

*This task involves:*

- **Monitoring project implementation** – Project activities implemented within the Project Area will be monitored to determine if they are consistent with the management plans and the PD. All maps and records (including pictures, testimonies, additional specific reports, etc.) generated during project implementation will be stored by

CORPOCHIVOR and will be made available to VCS verifiers for inspection at verification.

- **Monitoring of land-use and land-cover change within the Project Area** – The project will collect satellite imagery data and develop a spatial classification to provide information concerning land use and land cover change. Among the parameters measured will be the area of forest converted to non-forest and the area of forestland undergoing carbon stock decrease, both of which will be characterized for the entire Reference Region and Leakage Belt using the LU/LC change classes. To ensure the quality of the results obtained, the project will ground truth the LU/LC classification within the project boundaries. These procedures will be carried out periodically at verification in one of the following two ways:

    a. If Colombia has at that time developed a jurisdictional program or an approved MRV system, the project will use the MRV data generated by such a program.

    b. If no such system yet exists, the Project Proponent will complete the Land-Use and Land-Cover change analysis for the period since the last verification / monitoring event. The procedures used will reproduce those used for the validation of the historical analysis, in order to ensure consistency with the completion of the baseline.

- **Monitoring of carbon stock changes and non-CO2 emissions from forest fires** – In case uncontrolled forest fires or other catastrophic events occur within the Project Area, this project commits to estimate the resulting carbon stock losses as soon as possible. If planned and significant carbon stock decrease occurs in Leakage Management Areas in the project scenario, CORPOCHIVOR will be charged with estimating the change in carbon stocks at least once after the planned event has occurred.

    In most cases, the *ex-ante* estimated average carbon stocks per LU/LC class (or carbon stock change factors per LU/LC change category) will not change during the fixed baseline period, and monitoring of carbon stocks will not be necessary.

The methodology VM0015 guidelines will be followed when accounting for emissions that result from a significant decrease in the carbon stock within the Project Area or in the Leakage Management Area. The same holds true for any increase in emissions due to leakage management activities. That said, the project does not anticipate that a decrease in carbon stocks or increased emissions will result from project activities or leakage prevention measures.

None of the optional cases of carbon stock increase from leakage management described in the methodology VM0015 will be monitored. The project does not expect an increase in carbon stocks within the Project Area or within the Leakage Belt after catastrophic events. This monitoring is therefore not necessary.

- **Monitoring impacts of natural disturbances and other catastrophic events** – Decreases in carbon stocks and increases in GHG emissions will be subject to monitoring and must be accounted for in the project scenario when significant. If the event occurs in areas that have already generated VCUs in past verifications, the field personnel of CORPOCHIVOR will conduct field measurement in the affected area within three months of the event. The measurements will allow for the estimation of the net change in carbon stocks and resulting GHG emissions in the area. The project will then cancel an equivalent amount of VCUs from the VCS buffer.

- **Total *ex-post* estimated actual net carbon stock changes and GHG emissions in the project area**– All *ex-post* estimations in the Project Area will be summarized using Table 29 of the VCS methodology VM0015.

**Task 1.2: Monitoring of leakage**

Monitoring of leakage will be done periodically prior to any verification. This project will monitor the following sources of leakage:

- **Decreases in carbon stocks and increases in GHG emissions associated with leakage prevention activities** – Leakage prevention measures in this project may include tree planting, agricultural intensification, fertilization and/or fodder production. As a result, temporary, significant reductions in carbon stocks and/or increases in

GHG emissions relative to the baseline scenario may occur. If this is the case, this project will account for and monitor these sources of leakage emissions.

- **Decreases in carbon stocks and increases in GHG emissions due to activity displacement leakage** – Deforestation above the baseline in the Leakage Belt will be considered activity displacement leakage. Leakage will be calculated as the difference between the *ex-ante* and *ex-post* assessments of the area of forest converted to non-forest in the Leakage Belt. Monitoring will be undertaken following the same approach as used in the monitoring of land-use and land-cover change within the Project Area. The project will collect data in the form of satellite imagery and develop spatial classification that will offer information about the area of forestland converted to non-forest and the area of forest land undergoing carbon stock decrease in the Leakage Belt by LU/LC change class. Emissions from forest fires were not included in the baseline, as they were considered not to be significant.

**Task 1.3: *Ex post* net anthropogenic GHG emission reductions**

This project will generate a map showing the Cumulative Areas Credited within the Project Area, which will be updated and presented to VCS verifiers at each verification event. The cumulative area that has already been considered for the generation of VCUs will be excluded in future periods.

## 4.3.2. Monitoring Plan

### *4.3.2.1. Technical description of the monitoring tasks*

With respect to the monitoring of current carbon stocks, only aboveground and belowground tree biomass established in the project will be monitored. Aboveground biomass is the only pool required for monitoring under the carbon biomass estimation protocol for Colombia[61] because this is the pool most affected by deforestation and forest degradation[62]. Below-ground biomass (thick roots with diameters > 5 mm) will also be considered, as this pool

[61] Yepes A.P., Navarrete D.A., Duque A.J., Phillips J.F., Cabrera K.R., Álvarez, E., García, M.C., Ordóñez, M.F. 2011. Protocolo para la estimación nacional y subnacional de biomasa - carbono en Colombia. Instituto de Hidrología, Meteorología, y Estudios Ambientales-IDEAM-. Bogotá D.C., Colombia. 162 p.
[62] BioCarbon Fund, 2008. Methodology for Estimating Reductions of GHG Emissions from Mosaic Deforestation. RED-NM-001/Version 01.111p. Cited by IDEAM 2011.

represents a large component of total forest biomass[63]. The inclusion of other pools will mainly depend on the availability of financial resources. Regardless, exclusion of these pools is conservative.

Aboveground biomass (AGB) will be calculated based on the Life Zone of the assessed forest using allometric equations recommended for the AGB pool by IDEAM[64]. These equations were selected through a statistical analysis that compared the precision of aboveground biomass estimations completed using various equations for natural forests of Colombia as found in the scientific literature. Below-ground biomass will be estimated by applying a factor from the literature theoretical value to the aboveground biomass. Each pool will be measured following the methodology procedures and IPCC Good Practice Guidance for LULUCF (2003)[65].

The monitoring periods will be conducted with the frequency according to verification intervals, which are expected to be every five years. However, it will depend on consultation and coordination among the project instances.

Before beginning field measurements, thorough preparation for field work should occur. This includes a literature review of the studies conducted in this zone, interviews with locals, establishment of contact with stakeholders to introduce them to the process being undertaken, preparation of data collection sheets, stratification for a more precise estimation, prepare maps and necessary equipment for measurements, etc. More information can be found in supporting document "Monitoring Plan".

A first fieldwork was done in 2011by Corpochivor. They established 271 plots in total, which represents a total sample area of 30.24 ha, including 8 municipalities of the project area (Please refer to Step 6 of the PD Annex). Therefore, the biomass information for the reference area was estimated by applying allometric equation of biomass for each life zone to the data collected from the fieldwork. For post-measurement and further verification, the GPS

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[63] Yepes A.P., Navarrete D.A., Duque A.J., Phillips J.F., Cabrera K.R., Álvarez, E., García, M.C., Ordóñez, M.F. 2011. Protocolo para la estimación nacional y subnacional de biomasa - carbono en Colombia. Instituto de Hidrología, Meteorología, y Estudios Ambientales-IDEAM-. Bogotá D.C., Colombia. 162 p.
[64] *Idem* fuente anterior
[65] Penman, J., Gytarsky, M., Hiraishi, T., Krug, T., Kruger, D., Pipatti, R., & Wagner, F. (2003). Good practice guidance for land use, land-use change and forestry. Good practice guidance for land use, land-use change and forestry.

point of the plots will be used as a point reference for measurement of the new forest changes. This monitoring starts since the project start date, and in addition, new plots will be implemented in the project area. The plots will be established with a random distribution with the help of GPS and precision compasses and correction for slope when necessary. The plots should be correctly marked and signed to ensure that they can be relocated for future measuring and monitoring purposes. Details concerning the establishment and marking of plots can be found in supporting document "Monitoring Plan".

Five circular plots will be established in a "+" shaped arrangement, with sub-plots for measuring individuals with smaller diameters arranged in a concentric, nested manner within each plot (**Figure 26**). The size of the sub-plots has different sizes that relate to the diameter and height class (small, medium, and large), as explained in the following table:

| Category | Individual Size |
|---|---|
| Sapling ("Brinzal") | 30 cm - 1.5 m Total Height |
| Small ("Latizal") | ≥ 2.5 – 9.9 cm DBH |
| Medium ("Fustal") | ≥ 10 – 29.9 cm DBH |
| Large ("Fustal Grande") | ≥ 30 cm DBH |

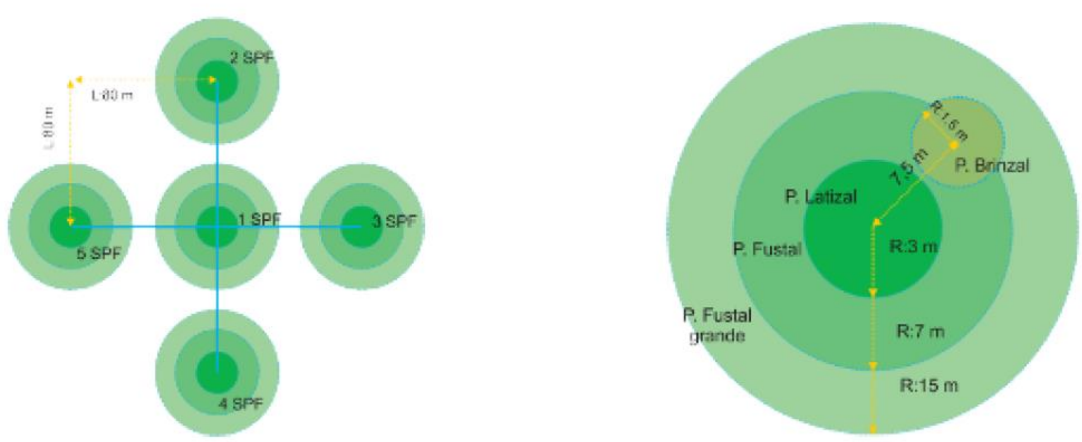


**Figure 26. Layout of a permanent monitoring plot for REDD+ activities.**

The number of plots will be established in the manner suggested by the methodology VM0015, which structures plots based on the biomass variation coefficient (taken from the assemblage of existing plots in the Project Area) and an error of 10% (suggested by the methodology). The details of calculating this value are explained in supporting document document “Monitoring Plan”.

Standard procedures for marking trees and measuring each variable within the plots have been developed and are described in the supporting document “Monitoring Plan”.

The technical details for monitoring leakage and emissions is described in the previous section.

#### *4.3.2.2. Data to be collected*

Regarding the actual carbon stock changes, Permanent Sample Plots (PSPs) will be used to measure and monitor changes of the relevant carbon stocks over time. Permanent plots will be installed prior to the first verification but may not be installed by time 0. The PSPs will be measured at each monitoring event. In the case of extraordinary circumstances (e.g., forest fires, uneven growth), additional PSPs may be created.

For all trees, the diameter at breast height (DBH) measurement will be taken at a height of 1.3 m above the ground. This is a standard practice in forest inventory and assures consistency in measurement. The field data forms for every PSP shall be recorded and kept in the PSP file.

All woody stems with a normal diameter (at DBH) greater or equal to 10 cm should be included in the 2,500 $m^2$ plot. Only those individuals that are rooted within the plot should be included. The height of 40% of the individuals within the plot should be measured with a laser hypsometer or clinometer, with the height of the remaining individuals modeled through a regression analysis. Visual estimations shall not be used for any reason.

If the project proponents wish to record individuals with diameters between 1 cm and 10 cm, these trees should be recorded and monitored within the previously mentioned 400 $m^2$ sub-plot. This sub-plot should be treated in the same manner as the other sub-plots and follow the process described in supporting document “Monitoring Plan”.

All data should be collected on a standardized form. The information required by these data sheets should be recorded in a complete, clear, and concise manner.

Leakage monitoring will be carried out using satellite images to be downloaded (See Task 2).

#### *4.3.2.3. Overview of data collection procedures*

Data collection and current carbon stock estimation procedures are detailed in supporting document "Monitoring Plan".

#### *4.3.2.4. Quality control and quality assurance procedures*

The project will follow the IPCC Good Practice Guidelines for Quality Assurance (QA) and Quality Control (QC), using two types of procedures to ensure that the inventory estimates and resulting data are of high quality[66,67,68]. Since a QA/QC plan is fundamental for building project credibility, one will be developed that outlines QA/QC activities and includes a scheduled time frame to apply from preparation through final reporting. The plan will describe specific QC procedures in addition to special QA review procedures. The QA/QC plan is an internal document to organize, plan, and implement QA/QC activities and will be represented here only in summary form. Some QA/QC plan features are listed below[69,70].

a) Standard Operating Procedures (SOP) will be established for all procedures, such as GIS analysis, field measurement, data entry, data documentation, and data storage.

b) Training courses concerning all data collection and analysis procedures will be held for all relevant personnel.

c) Steps will be taken to develop a credible plan for measuring and monitoring carbon stock change in the project context and control for

[66] IPCC GPG for LULUCF; Chapter 5.5 Quality assurance and quality control
[67] IPCC GPG and Uncertainty management in National GHG Inventories; Ch. 8 QA and QC
[68] IPCC GPG for LULUCF; Chapter 3.2 forest land
[69] IPCC GPG for LULUCF; Chapter 5.5 Quality assurance and quality control
[70] IPCC GPG and Uncertainty management in National GHG Inventories; Ch. 8 QA and QC

errors in sampling and data analysis. The same procedures shall be used during the project lifespan to ensure continuity.

Regarding field data collection:

d) The personnel involved in the measurement of carbon pools will be fully trained in field data collection and analysis.

e) Prior to the start of the inventory, all equipment to be used during fieldwork shall be checked and calibrated. The project will evaluate uncertainties in sampling to mitigate such sources of error.

f) A minimum of 10% of the plots will be randomly selected for re-measurement to verify that plots have been installed and measured correctly. This process will be carried out by a supervisor with a team that was not involved in the initial sampling.

g) The re-measurement data will be compared with the original measurement data. Any errors found will be recorded and corrected. The degree of error observed will be calculated and reported using this equation:

$$Error(\%) = \frac{(Estimate1 - Estimate2)}{Estimate2} * 100$$

h) Proper data entry into the analysis spreadsheets is required to produce reliable carbon estimates.

i) Due to the long-term nature of the project and the speed at which technology changes, data archiving will be an essential component. Data will be archived in several formats, and copies of all data will be provided to each project participant.

j) Original copies of the field measurements (data sheets and electronic files) and laboratory data will be stored in a secure location.

k) Copies of all data analysis and models, final estimates of the amount of carbon sequestered, any GIS products, and the measuring and monitoring reports will be safe stored, preferably offsite.

l) Electronic copies of all data and reports will be updated periodically and converted to any new format required by future software or hardware. A project participant involved in the field measurements will be assigned to implement these updates.

m) The data collected shall be archived for a period of at least two years after the end of the last crediting period of the project activity.

Corpochivor is managing the project and will be responsible for the centralized documentation of all project planning and implementation. QA/QC procedures will be implemented to ensure that all GIS and remote sensing materials and biomass and leakage data are measured and monitored precisely, credibly, verifiably, and transparently. Corpochivor will coordinate QA/QC activities and is responsible for documenting QA/QC procedures. For this purpose, Corpochivor will designate a QA/QC coordinator; for each verification.

The main QC activities for data collection and processing are under development.

#### *4.3.2.5. Data archiving*

The personnel involved in the measurement of carbon pools will be fully trained in field data collection and analysis by the technical manager. Standard Operation Procedures (SOPs) will be developed for each step of the field measurements and followed so that measurements are comparable over time. If different interpretations of the SOPs exist among the sampling teams, they will be jointly revised to resolve issues and facilitate clearer guidance.

The project entity shall make the necessary arrangements for registry form data entry. The forms shall be both paper and electronic to ensure that the information is stored in multiple formats. Furthermore, the entity shall ensure that the transfer of data to the spreadsheet database occurs at the required intervals outlined in the monitoring methodology. The data shall be archived using acceptable standards and stored in a manner that complies with the instructions of the project information management system. The electronic data shall be stored securely at multiple locations using backup procedures. All GHG related information shall be collected and aggregated.

All data sheets will include a “Data recorded by” field, to indicate the field technician who collected the data. Communication between all personnel involved in measuring and analyzing data will take place to resolve any apparent anomalies before final analysis of the monitoring data can be completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot will not be used in the analysis. Additionally, field data will be reviewed by the technical manager or a GIS team leader to ensure that the data are accurate and analyses are realistic.

Due to the long duration of the project and the speed at which technology changes, data archiving will be an essential component of the project. Data will be archived in several forms: all original field data sheets are saved with multiple copies stored in a separate file as a backup. All documents are stored in the office of Corpochivor.

With respect to leakage monitoring and carbon estimations, digital copies will be made for all files and stored online to avoid the permanent loss of any information.

#### *4.3.2.6. Organization and responsibilities of the involved parties*

The carbon monitoring required by VCS will be undertaken by Corpochivor. Data will be stored on local servers using Microsoft Excel. This furthers the project's accuracy and transparency and minimizes data loss.

The monitoring of the current carbon stocks will be the responsibility of a **forestry expert**, who will have knowledge in:

- Organizing field crews;
- Training field crews;
- Organizing and planning fieldwork, in particular the mobilization and preparation of necessary resources and equipment, such as vehicles, and the arrangement and design of plots;
- Monitoring and backstopping fieldwork, including technical and logistic support to field crews, in order to ensure data quality and homogeneity among different crews;
- Controlling and validating field forms;
- Controlling data and evaluating its quality;

- Compiling databases; and
- Reporting and disseminating results.

Taking into account the amount of information to be collected and the tasks required, forest inventory field crews will be composed of at least two members. The project owners will implement the proposed REDD activities with experienced, locally available staff. The activities are to be implemented under the supervision of the technical team. The technical team organizes technical training and consultation and is responsible for the organization and coordination of measuring and monitoring the actual GHG removals by carbon sinks.

It is intended that some of the field crew be hired locally and act as guides in the field. One member of each crew must be experienced in the identification of tree species.

The responsibilities of each crew member must be clearly defined. Their tasks are as follows:

The **crew leader** is responsible for organizing all the phases of the fieldwork, from the preparation to the data collection. He/she has the responsibility of contacting and maintaining good relationships with local stakeholders and has a good overview of the progress achieved in the fieldwork. He/she will specifically:

- Prepare the fieldwork by carrying out bibliographic research, preparing field forms and maps;
- Plan the work for the crew;
- Contact local stakeholders (e.g. authorities) to introduce the survey objectives and the work plan and request their assistance if needed;
- Administer the location of plots;
- Take care of logistics of the crew by organizing and obtaining information on accommodation facilities, recruiting local workers, organizing access to the strata;
- Ensure that field forms are properly filled in and that collected data are reliable;
- Organize meetings after fieldwork in order to sum up daily activities; and
- Ensure the safety of fieldwork.

The **assistant to the crew leader** will:

- Help the crew leader to carry out his/her task;
- Take necessary measurements and observations;
- Make sure that field equipment crew is always complete and operational; and
- Supervise and direct workers.

The **workers** are assigned the following tasks, according to their skills and knowledge of local species and practices:

- Help to measure distances;
- Open paths to facilitate access and visibility for technicians;
- Provide the common/local name of forest species;
- Provide information concerning access to field sites;
- Provide information about forest uses and management; and
- Carry the equipment.

Training of the crews on the survey methodology is undertaken at the beginning of the fieldwork in theoretical and practical sessions where techniques of different forest and tree measurements are explained and practiced.

Under the proposed REDD project activities, each project proponent will provide technical instruction on forest management. They will supervise the implementation of the proposed REDD activities, collect specific activity data on a routine basis, be responsible for measuring and monitoring the real GHG removals by sinks, establish an expert team when necessary (e.g., to address any technical issues), conduct checks, and verify the accuracy of measured and monitored data.

Leakage monitoring will be carried out by Corpochivor, who will organize GIS forestry experts responsible for the collection, processing, and interpretation of satellite imagery.

*Ex-post* calculations of GHG emissions reductions will be the responsibility of the forestry expert leading the field team.

### 4.3.3. TASK 2: REVISITING THE BASELINE PROJECTIONS FOR FUTURE FIXED BASELIND PERIOD

The baseline will be revisited every ten years.

**Updated information on agents, drivers and underlying causes of deforestation –** The personnel of CORPOCHIVOR, in collaboration with other Colombian institutions, NGOs and Governmental Organizations, will conduct ongoing surveillance and monitoring of deforestation threats, agents and drivers. All relevant information, data, reports, and legal documents collected will be kept by CORPOCHIVOR. Step 3 of the *ex-ante* methodology will be reassessed. As this project used a spatial model to locate the risk of future deforestation, new data on the spatial driver variables will be collected and new "Factor Maps" will be generated for the subsequent fixed baseline periods. All information collected will be used during each baseline revisiting to conduct a complete analysis of agents, drivers, and causes of deforestation, in the same way that was pursued for validation.

**Adjustment of the land-use and land-cover change component of the baseline** – If new VCS requirements on regional baselines become available, the project will use the most recent version. No further adjustments are needed in the case of this project, as the proponent anticipates the use of a sub-national baseline and inclusion within a jurisdictional scenario by the time that the baseline will have to be revisited.

**Adjustment of the carbon component of the baseline** – If improved carbon stock data have become available over time, this project will use the most up-to-date information.

## 5. Safeguards

### 5.1. No Net Harm

It is expected that the implementation of project activities does not generate negative impacts in any of the owners, local communities and other stakeholders identified. On the contrary, these activities are proposed as the way to achieve improved livelihoods of project beneficiaries and offer attractive alternatives to the unsustainable use of natural resources.

Despite some risks perceived by the community were identified during the consultation process, the net effects expected due to project activities are positive (see PD CCB, section CM2.1):

**Table 36. Identification of the net impacts of the project on the community, community groups and other stakeholders.**

| Activity | Stakeholders benefiting | Without Project | With Project | Net impacts |
|---|---|---|---|---|
| Environmental education | Community, community groups and other stakeholders. | Currently livestock farming practices are not sustainable due to overuse of agrochemicals and tillage practices that generate erosion (soil loss). | The training workshops and competitions will create greater environmental awareness in the community. This will improve agricultural and livestock practices in the area and generate a rational use of natural resources. | The training will not generate any negative impact on the community. The farmer will benefit of the recommendations in the long-term of the implementation. It will improve their income production and reduce soil degradation. |
| Conservation, restoration and sustainable management of strategic ecosystems | Community, community groups and other stakeholders. | The loss of ecosystems associated with water resources, as riparian areas and headwaters, will remain an important factor. Deforestation in these areas will create many problems such as erosion and | By protecting all ecosystems that provide ecosystem services in the area, the local community will continue to use benefits such as flow regulation and decrease vulnerability due to natural disasters caused by soil erosion. | By protecting the most important ecosystems, the community will ensure the supply of ecosystem services over time. Additionally, activities that will improve land productivity without expanding the agricultural |

| Activity | Stakeholders benefiting | Without Project | With Project | Net impacts |
|---|---|---|---|---|
| | | loss of flow regulation, affecting the local population. | | frontier will be implemented. |
| Crops improvement | Community and community groups | The crop productivity will only be improved with the application of higher amounts of chemicals and fertilizers, which undoubtedly will degrade the soil. | Implementation of technological packages will improve crop production without damaging the soil. This ensures the sustainability of the soil resource. | The implementation of new production systems could be difficult for the farmer due to the change on the traditional ways of farming. However, the move for achieving best practices will ensure the long-term use of the resources without compromising its current production. At the same time, the new best practices will help to improve the quality of life of farmers. In addition, through training, it will be achieved access to new green markets. |

| Activity | Stakeholders benefiting | Without Project | With Project | Net impacts |
|---|---|---|---|---|
| | | | | Community groups will benefit from the strengthening of the productive chain. |
| Home vegetable gardens | Community | Families that have no home vegetable garden are more prone to having nutritional problems because they must spend more money and invest more time to get the basic food. | Implementation and / or improvement of the home vegetable garden provides food security and reduces the costs associated with obtaining food and transportation. | The impacts of this activity are clearly positive as the farmer produce food for their own consumption, generating a benefit to the household economy. In addition, they have no charge for intermediaries or transportation costs, plus they have immediate availability of the food. |
| Silvopastoral systems | Community | Current grazing systems are often extensive, which strongly degrades the soil. | The implementation of silvopastoral systems improve livestock production as the tree species used in these systems in | The project will provide advice and inputs required for the proper implementation and management of silvopastoral system, thus, productivity and profitability of |

| Activity | Stakeholders benefiting | Without Project | With Project | Net impacts |
|---|---|---|---|---|
| | | | addition to being a food source for livestock, provides shade and shelter. These two features improve the quality of meat and milk. | their land under this mixed system will improve. |
| Ecotourism | Community and community groups | Unplanned tourism deteriorates the ecosystem due to the production of waste and lack of marked trails. This causes soil compaction and disturbance of fragile ecosystems (*paramos*). | Its implementation creates dynamism and improve the income of organizations with ecotourism focus in the region. | The benefits are clearly positive, as sustainable tourism in the region is encouraged, as well as the ability to organize ecotourism groups is strengthened. In addition, direct revenues from the realization of this activity will increase, improving the quality of life of the local community and surrounding communities (indirect benefit) and potentially the municipality. |

## 5.2. Environmental Impact

The clearing of forests for the expansion of the agricultural frontier can generate fragmentation of remaining forests with high conservation values. Therefore, the project activities dedicated to increase sustainable productivity of farms may decrease the phenomena of fragmentation.

As noted Gasca and Torres 2013[71], the strategy for biodiversity conservation within the National Biodiversity Plan in Colombia includes reducing processes involving loss of natural resources by human activities, ecosystem restoration, conservation and recovery populations of threatened or vulnerable wildlife species and finally promoting conservation plans in situ species. However, they note that these conservation actions will never become effective if education and participation of local communities and the support of both governmental actors are implemented.

Therefore, it can be expected that the strategies proposed in the project have a positive effect on changes in biodiversity as they are key elements mentioned in the strategy for biodiversity conservation. Project activities provide education and community participation, restoration of forests and reduction of human activities.

The impact of activities on biodiversity is presented in the following table. Education activity mainly generates indirect benefits and is transverse to the other actions, as all these involve technical support, education and improvements in agricultural practices. Another effect is expected to be positive in all activities is the decreased pressure on forests. This can be achieved including activities that generate community sustainable long-term income.

[71] Gasca y Torres, 2013. Conservation of biodiversity in Colombia, a reflection for a goal: meet and educate to preserve. Biodiversity notebooks 42 (2013): 31-37. Available in http://cibio.ua.es/Cuadernos/42/42-3.pdf

**Table 37. Impact on biodiversity through the implementation of project activities.**

| Activities of the project | Impact on Biodiversity | Type of impact |
|---|---|---|
| Crop improvements<br>Silvopastoral systems<br>Cook stoves<br>Ecotourism | Decreased threat to natural habitats for birds and mammals, endemic and migratory species. | Positive, indirect, foreseen |
| Crop improvements<br>Silvopastoral systems<br>Ecotourism | Pressure decreased on timber low frequency and with high commercial value | Positive, indirect, foreseen |
| Crop improvements<br>Silvopastoral systems<br>Restauration | Decreased pressure on wildlife, to preserve or protect the vertical structure of vegetation | Positive, indirect, foreseen |
| | Decreased threat to soil organisms that play important roles of predators, decomposers and parasitism. | Positive, direct, foreseen |
| | Decreased threat to aquatic wildlife, protect water sources | Positive, indirect, foreseen |
| Silvopastoral systems<br>Restauration | Decreased pressure on native species intolerant to intensive livestock. | Positive, direct, foreseen |
| Restauration<br>Cook stoves[72] | Improved habitat quality and capacity of natural forest regeneration. | Positive, direct and real (restauration activities);<br>Positive, indirect and foreseen (cook stoves activities) |
| Restauration | Increased forest cover and connectivity of biological corridors | Positive, direct, real |

[72] Concha, María Cecilia; Pabón, Giovanni; Cerón Viviana - Ministry of Environment, Housing and Territorial Development, 2015. Guidelines for a national program of cookstoves for cooking with firewood. Bogotá, D.C.: Colombia. 48 p.

| Activities of the project | Impact on Biodiversity | Type of impact |
|---|---|---|
| Ecotourism | Protection of the fauna and flora, from the awareness of local actors and visitors of ecotourism areas. | Positive, indirect, foreseen |
| | Affectation of natural ecosystems by creating infrastructure for the operation of ecotourism programs | Negative, direct, foreseen |
| | Affectation of natural ecosystems by increasing access of the population to fragile areas. | Negative, indirect, foreseen |

On the other hand, there may be some negative effects related to ecotourism because of human intervention in fragile natural areas and deterioration in the natural environment by visitor traffic, including environmental, visual and noise pollution habitat[73].

## 5.3. Local Stakeholder Consultation

To ensure that the key communities and stakeholders in the planning and implementation of the REDD+ CORPOCHIVOR project had access to project information and documentation, social consultation workshops were held. These events were designed to present and discuss the main objectives and expected impacts of the project and to solicit feedback and suggestions regarding the perspectives of potential beneficiaries. All of this was done with the aim of improving the project design for the satisfaction of beneficiaries and to ensure its success. These workshops helped identify and establish channels for communication between the parties to ensure that any doubts or concerns that may arise can be promptly addressed and that information can be effectively disseminated among stakeholders when necessary.

The consultation processes were spearheaded by the project developer in conjunction with the project proponent (CORPOCHIVOR). These groups

[73] Orgaz, 2014. Negative impacts in ecotourism. Economic, social and environmental aspects: a review of literature. *Nómadas*. Magazine Critique of Social Sciences and Law | 42 (2014.2). http://dx.doi.org/10.5209/rev_NOMA.2014.v42.n2.48781

conducted a mass distribution of information to communities and stakeholders, ensuring that said groups became aware of the actions being taken by the Corporation to decrease deforestation. Among the information provided were the schedule of local consultations and the various means by which further relevant information would be communicated (See Table 38). The sessions were conducted with interested parties during April 2016 and November 2016 to May 2017. These meetings were held in the municipalities of Chinavita, Chivor, Ciénega, Garagoa Guayatá, La Capilla, Macanal, Tibaná, Úmbita, Viracachá, Santa María, San Luis de Gaceno and Campohermoso (See the Stakeholder Consultation Report).

**Table 38. Methods of information dispersal.**

| Stakeholder(s) | Method of dispersal |
|---|---|
| "Campesino" (rural, agricultural) communities, surrounding landowners, community leaders, and inhabitants of the area | Radio spots |
| | Calls with community leaders |
| | Letters of invitation to community leaders |
| | Vehicle-mounted loudspeaker |
| | Word of mouth |
| Institutions and entities related to forest conservation and/or of a governmental nature, e.g. Community Action Boards (JAC), Water Distribution Boards; Rural Community Boards; cooperatives and trade groups. | Letters of invitation |
| | Calls |
| | Official e-mail messages |

Project documentation and other relevant information were dispersed to the community through a reciprocal, three-step social consultation process. The steps consisted of: (1) an initial presentation by CORPOCHIVOR, (2) an explanation of the project, and finally, (3) rounds of questions and comments (see the Stakeholder Consultation Report).

- **Step 1**: Fell under the responsibility of a member of the CORPOCHIVOR staff. They first presented the institution and explained the role that each involved party would play in the project's development. Next, they presented the project name and the background for this initiative, based on the "Plan de Gobernanza y Ordenación forestal – PGOF" (Plan for forestry Planning and Governance).

- **Step 2**: Fell under the responsibility of the project development team. The team explained the key concepts that are foundational for these types of projects, including *inter alia* the greenhouse (gas) effect, climate change and its consequences, environmental benefits and services provided by forests, and the importance of forest conservation. In this step, stakeholders were also introduced to the idea of forest carbon projects, the specific activities planned for this project, and the project participants (see the Stakeholder Consultation Report).

- **Step 3**: It was in this step that all comments, concerns, worries, and perspectives of attendees were recorded, in order to ensure that this project was both transparent and realistic in scope. In addition, by gathering the perspectives of the community this step served to more accurately identify the interests of landowners and project participants with regard to the proposed project activities.

The documentation and information related to the project were presented in the clearest form possible in order to facilitate the knowledge and understanding of the project and its implications among the general population. This end was achieved by employing straightforward, comprehensible language that was adjusted to the educational background of the target audience; the majority of the population has a primary-school level of education. The information was presented in an audiovisual format (digital projection of presentations). In cases where projection was not possible due to lack of electricity or other inhibiting factors, the main concepts and ideas were demonstrated to the audience using physical materials including posters and display boards (See Figure 27).

Finally, attendees were provided the contact information (name, telephone number, and e-mail) for the people in charge of project documentation (i.e. the project developers) as well as a representative of CORPOCHIVOR, cementing a permanent and reliable link for communicating any worries, questions, or comments to those managing the project. At the end of the local consultation session, the attendees were informed that they will be provided the project document as soon as it becomes ready and that they will be notified once the document is published on the CCB website for open public comment.

**Figure 27. Supporting materials used for the presentation.**

When the Project Document is finished, CORPOCHIVOR will organize meetings for experience-sharing and the transfer of knowledge to key stakeholders. In addition, the CORPORATION will use its official means of communication to publish the progress and the results of the project and will generate printed material (brochures/pamphlets) with the intention of widely disseminating this information.

The fundamental role of CORPOCHIVOR, as the regional environmental authority, is to contribute to the protection, conservation, and regeneration of ecosystems under its jurisdiction. However, that responsibility cannot be carried out in isolation. That is to say that rural communities, because they impact ecosystems, must actively participate in the process of formulating and implementing a successful REDD+ project regardless of whether the impacts they have are beneficial or detrimental. For that reason, the consultation process was established as a means of assessing the comments and concerns of those community members whose interests can be affected by the proposed project (see the Stakeholder Consultation Report).

The objective of the consultations is to provide a constructive and participatory space for building links between the project proponent and relevant stakeholders. The channels of communication opened through these consultations allow attendees to convey their doubts and worries and allow the Corporation to prioritize project activities in response to this feedback. Due to the critical role that they play, these spaces must be real and allow the community to create concrete changes to project plans throughout the decision-making process. The project proponent and developers understand that a consultation can only be considered legitimate if the demands and contributions of participants are allowed to be heard and are subsequently incorporated into the project plans. They also understand that, in addition to consultation and information collection, effective participation means that, the project beneficiaries are provided a guarantee that they will be included in decision making that affects them either directly or indirectly through impacts on the ecosystems with which they interact.

A Registry of Project Comments and Observations was created to document this information for the project's development as well as to optimize the benefits generated for communities and other stakeholders (see Table 39). This was created in addition to the aforementioned "questions and comments" section of the consultation. The registry includes group comments that were recorded whenever a meeting exceeded ten individuals and when the education level ranged from medium to low. Individual comments were typically recorded when the meeting was held in a population center. Original versions of these documents can be found in the folder "Comments".

**Table 39: Main comments received from the communities during the consultation process.**

| Municipality | What do you like about the project? | What do you not like about the project? | What would you like to change about the project? |
|---|---|---|---|
| **Guayatá** | Ecosystem conservation.<br>Water conservation, ensuring the food supply<br>Project duration<br>Invites other authorities and groups to participate<br>The involvement of the Water Distribution Board. | Lack of adequate announcement.<br><br>More publicity is needed. | - |
| **Ciénega** | Motivates the community to conserve the natural environment. | The payments for forest carbon should be stable and increase yearly. | That it should offer more options for property owners |

| Municipality | What do you like about the project? | What do you not like about the project? | What would you like to change about the project? |
|---|---|---|---|
| | The role of cooperation in environmental management. | - | More publicity through all available media. |
| | | | Inscriptions should be open at least until the end of 2016. |
| | An opportunity to conserve our flora and fauna. | Ability to participate in the project depends on the characteristics of your property. | - |
| | That the project is showing us how to protect our forests and paramos and at the same time bringing awareness of environmental conservation to our children. | - | More focus should be placed on Andean forests. |
| | The protection of the environment, increase in the water supply, and inclusion of the community. | - | - |
| **Viracachá** | Supports rural inhabitants. | - | To provide training in the project formulation. |
| | That a plan is being created to take complaints and register claims. | They do not buy land. | Conduct a real inventory of forest reserves to decrease the costs of property taxes. |
| | Attention and rapid response to complaints. | - | - |
| **La Capilla** | That the project must contribute positively to the welfare of our community. | - | - |

| Municipality | What do you like about the project? | What do you not like about the project? | What would you like to change about the project? |
|---|---|---|---|
| | That it is long-term. It is important that the project is being monitored and that it benefits the environment. | - | Improve the image of the Corporation, which has erroneously been sullied. |
| | That we are creating a consciousness that the future depends on forest and water resources by educating members of the community about the benefits they provide. | That it will just be one more in a long list of other projects which did little. | Finance more reservoirs and ponds to decrease the extraction of water from streams. |
| | Greater integration and cooperation between professionals, children, heads of household, the local government, and CORPOCHIVOR. | That people will not come to listen to CORPOCHIVOR representatives, due to their lack of credibility within the community. | Greater exchange of ideas with the people and explanation of conservation benefits, as these resources are the basis for the success of future generations. |
| | Conserves forests, protects paramos, improves the environment, and mitigates damage to ecosystems. | That it is only for properties with forests. | The project should be viable and sponsors and supports the construction of lakes and reservoirs. |
| Macanal | Protection of water sources. | - | Construct electric fences to protect trees, improve the cattle genetics, and create sanitary septic systems. |
| | That all activities are followed through. | - | Build support among those in the satellite villages, as distance to the population centers prevents these people from attending the meetings. |

The comments from the first consultation workshop were integrated into the design of the project. They also allowed for the planning of another round of consultations, because they clarified the effectiveness of different channels of communication and the viability of meeting dates and times. These meetings were also useful for generating short-term activities that would allow for the inclusion of those who would not otherwise be able to participate in the first stage of the project because they do not manage forests of high conservation priority.

### 5.4 Public Comments

*The PD will be published for public comments.*

Esquema de Retribución por Servicios Ambientales

(ERSA) | para la Conservación de los Bosques y Gestión de Fuentes Hídricas en la jurisdicción de CORPOCHIVOR

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