COLCX METHODOLOGY FOR REDD+ PROJECTS

Version 1.0 10-Aug-2023

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Version 1.0

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ACRONYMS

ICR: Increase in Carbon Reserves
UNFCCC: United Nations Framework Convention on Climate Change
PDD: Project Design Document
FAO: Food and Agriculture Organization of the United Nations
CSR: Carbon sinks and reservoirs
GHG: Greenhouse Gases
SFM: Sustainable Forest Management
SFYM: Sustainable Forestry Managing
FREL: Forest Reference Emission Levels
VVB: Validation and Verification Bodies
GHGMP: Greenhouse Gas Mitigation Projects
RUDDA: Reducing GHG emissions from unplanned deforestation and/or forest degradation activities
RPDDA: Reducing GHG emissions from planned deforestation and/or forest degradation activities
REDD: Reducing Emissions from Deforestation and Forest Degradation
REDef: Reducing emissions due to deforestation
REDeg: Reduced emissions due to degradation
RMV: Reporting, Monitoring and Verification
GIS: Geographic Information System

INTRODUCTION

Growing concern about climate change has led the international community to seek effective solutions to reduce greenhouse gas emissions and mitigate the effects of global warming. In this context, the REDD+ (Reducing Emissions from Deforestation and Forest Degradation) project has emerged as an important tool to combat deforestation and forest degradation, recognizing the role of indigenous and tribal communities as the projectors of forests. REDD+ projects aim to reverse the amount of carbon released by poor forestry practices by promoting forest conservation and sustainable management, preventing forest loss and thereby reducing greenhouse gas emissions.

One of the main advantages of REDD+ projects is their focus on international cooperation and multi-stakeholder participation, with the United Nations playing a vital role. This is because REDD+ projects under the United Nations Framework Convention on Climate Change (UNFCCC) are a strategy to conserve tropical forests and the world's forests, addressing the objective of the UNFCCC and agreements and protocols such as Kyoto 1997 and the Paris Agreement 2015.

The methodology presented will undoubtedly have important contributions in the fight against climate change, but it will also help to promote the responsible use of natural resources, sustainable development and the human rights of the communities participating in the projects, ensuring that territorial, cultural and consultation rights are respected. Likewise, land rights, natural patrimony and labor rights must be protected, ensuring that projects are socially just and sustainable.

1. OBJECTIVES

Provide principles, requirements and guidelines for the development and implementation of REDD+ projects, to ensure the adequate quantification, monitoring and reporting of activities aimed at reducing emissions from deforestation and forest degradation, as well as the removal of Greenhouse Gases (GHG) generated by forest restoration processes according to their applicability conditions. This follows 1) the guidelines of the United Nations Framework Convention on Climate Change (UNFCCC) in relation to the reduction of GHG emissions, 2) the guidelines of the ISO 14064-2 Standard for the development of GHG mitigation and removal projects, and 3) the guidelines defined by the ColCX certification and registration program.

Given the above, the methodology provides the different actors involved in REDD+ projects with the following elements:

- Requirements for planning, identification and selection of sources and stocks.
- Criteria to determine the baseline scenario.
- Reference framework for the quantification of GHG emissions and/or removals.
- Reference framework for quantification of GHG reductions and/or enhancement of removals.
- Requirements for monitoring, follow-up and control of project activities.
- Mechanisms for the identification and management of project leaks.
- Mechanisms for managing the risk of the project's non-permanence.
- Recommendations to ensure data and information quality management, based on the evaluation of the uncertainty associated with the different processes required for the quantification of baseline and project scenarios.
- In conjunction with this methodology, guidelines should be applied for: reporting on SDOs, risks of reversal, risks of non-permanence and uncertainty; and for demonstrated additionality.

2. SCOPE OF THE METHODOLOGY

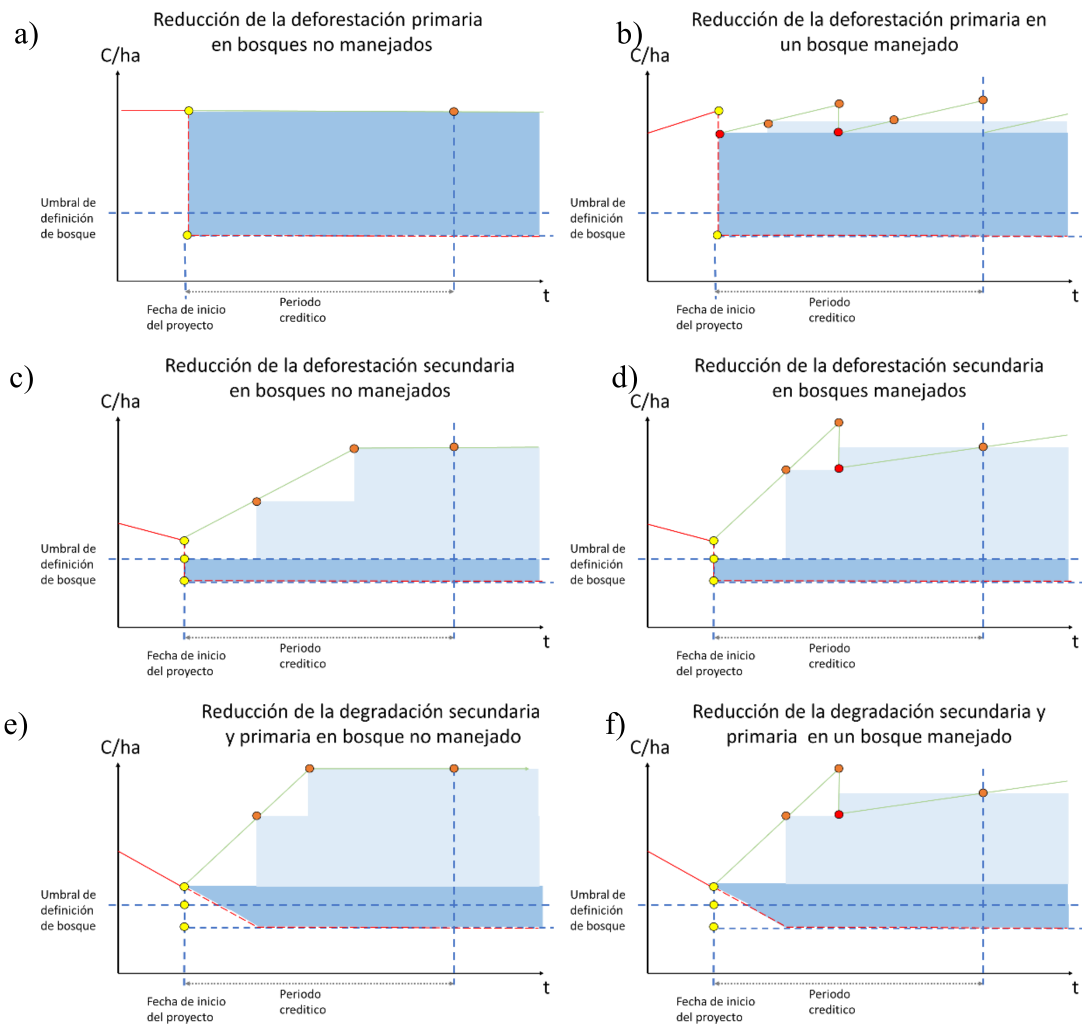
This methodology can be applied by any type of entity, person or institution that wishes or intends to establish a project that helps mitigate the effects of climate change through the establishment of projects whose main activities are REDD+, hereinafter referred to as GHGMP. Among the REDD+ activities of the GHGMP, this methodology includes Reducing GHG emissions from unplanned deforestation and/or forest degradation activities (RUDDA) and Reducing GHG emissions from planned deforestation and/or forest degradation activities (RPDDA). The difference between planned and unplanned activities depends on the existence of a documented legal authorization allowing forest conversion or extraction of timber products; normally the reduction of unplanned activities is focused on stopping deforestation and/or forest degradation of any forest type that would have occurred without the GHGMP activities.
This methodology has no geographical limits and can be applied by GHGMP located in countries that have or have not submitted their Forest Reference Emission Levels (FREL) or their equivalents to the UNFCCC; that use information consistent with national GHG inventories such as Carbon Sinks and Reservoirs (CSR), GHG emission factors, among others; whose regulatory framework allows the implementation of the GHGMP.

The REDD+ activities covered in this methodology are:

1. GHGMP Activities that Reduce Deforestation and Forest Degradation (REDD)
   a) RUDDA activities, carried out in territories with or without legal authorization for timber extraction ***Figure 1*** a), c) and e).
   b) RPDDA activities, only emission reductions due to planned deforestation are considered ***Figure 1*** b), d), f) and g).
2. RPDDA activities that provide for the reduction of emissions due to planned degradation will be considered as Sustainable Forest Management (SFM).
3. Activities that provide for the Increase of Carbon Reserves (ICR) only when there is sufficient supporting information.

Projects implementing this methodology must comply with each of the legal requirements established within the country and consider the pillars of REDD+ activities described by the UNFCCC[1].

The following are the cases where this methodology is applicable:



[1] UNFCCC (2023). United Nations Framework Convention on Climate Change REDD+ Web Platform. In: https://redd.unfccc.int/

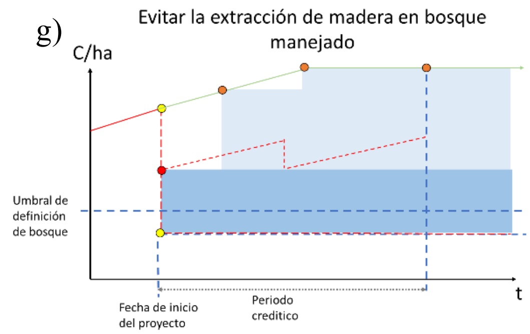


Figure 1 *Time limits of a GHGMP, yellow dots show measures required in the formulation scenario, red dots show measures required in the implementation scenario, orange dots show measures required when Increase of Carbon Reserves is quantified. In green the line shows carbon stock projections. The red line shows the historical carbon stock, and the dotted red line shows the baseline projections. The dark blue box shows the carbon credits that can be obtained from REDD activities, and the light blue box shows the carbon credits that can be obtained from ICR2 activities.*

3. DEFINITIONS

- **REDD+ activities:** Actions that aim to remove or reduce GHG emissions from deforestation and forest degradation, among the activities of this methodology will include[2]:

i) Reducing emissions from deforestation.
ii) Reducing emissions due to forest degradation.
iii) Conservation of forest carbon reserves.
iv) Sustainable forest management.
v) Increase of forest carbon reserves.

- **Additionality:** A criterion that is normally based on a methodology to clearly, effectively and directly demonstrates that emission reductions or increased GHG removals are derived from the implementation of a particular GHG removal initiative or activity if it is not constituted as a mandatory activity (e.g., 1% offsets), generating a net benefit to the atmosphere from GHG reductions or removals.

- **Forest:** Corresponds to a land cover that has thresholds associated with its attribute variables such as area measurement (minimum map unit), canopy density, minimum height of biotypes "in situ", the thresholds for each of

[2] UNFCCC (2011). Informe de la Conferencia de las Partes sobre su 16º período de sesiones, celebrado en Cancún del 29 de noviembre al 10 de diciembre de 2010. In: https://unfccc.int/resource/docs/2010/cop16/spa/07a01s.pdf

these attributes vary according to the regulations of each country. According to the Kyoto Protocol these thresholds can vary from 0.05 ha to 1.0 ha for the area, for canopy cover this must be more than 10% and for the height of the trees, these can exceed between 2 to 5 meters. In case the country where the GHGMP is implemented does not have an official definition, the following definition should be used: "*An area of land dominated by tree cover, but which may also contain shrubs, palms, guaduas, grasses and lianas. It has a minimum canopy density of 30%, a minimum canopy height (in situ) of 5 meters and a minimum area of 1.0 hectare*". Any definition does not include planted forests.

- **Permanent forest:** Corresponds to forest areas that have remained stable for a period of 10 years prior to the start date of the GHGMP. This must be identified based on multi-temporal geospatial analysis.

- **Carbon sequestration:** Storage of CO_2 in reservoirs or sinks.

- **COLCERS**: Also known as carbon credits from the COLCX program. It is the only exchange instrument within the carbon market (belonging to the capital market), which aims to contribute to the increase of GHG removals. Carbon credits are traded as: project-based verified removals and/or reductions, voluntary verified removals and/or reductions and emission permits. The credit must comply with certain conditions, principles and minimum requirements for its operation, to ensure transparency, security and efficiency in the purchase and sale of these.

- **Deforestation:** Process of anthropogenic and natural origin that causes the change of forest cover, considering the thresholds defined in the definition of forest, to another type of land use cover.

- **Primary deforestation:** This is a process that occurs in forests that have not been subject to unplanned forest degradation; therefore, the loss of its carbon stock is higher than in other types of forests that have suffered degradation (See figure 1 a). This type of degradation can occur in managed forests.

- **Deforestation of managed forests:** This process occurs in degraded forests only in a planned manner, in which the activities of the PMGEI, to avoid deforestation, have strengthened existing plans. Therefore, it is expected that these forests in the formulation scenario will have a lower carbon stock (See Figure 1 b), this concept does not apply to forests managed through the extraction of non-timber forest products that do not reduce their carbon stock.

- **Secondary deforestation:** Deforestation that occurs in a forest that does not have an approved management plan and has been subject to unplanned timber extraction (degradation), therefore its carbon stock is lower. (See figures 1 c).

- **Secondary deforestation in managed forests:** This process occurs in unplanned degraded forests, in which GHGMP activities have implemented management plans that allow the extraction of timber products (with an approved management plan) to avoid deforestation, in order to preserve and increase their carbon stock (See Figure 1 d), this concept does not apply to forests managed through the extraction of non-timber forest products that do not reduce their carbon stock.

- **Degradation:** A process that causes the loss of carbon from a forested area by affecting the ecosystem attributes of a forest (composition, function and structure). This loss of carbon, unlike deforestation, does not result in a change in forest cover or other land uses, however, it can cause changes in forest types.

- **Primary degradation:** Degradation that occurs in primary forests. Normally the trajectory of these forests in the future is the loss of their minimum attributes, therefore it is expected that in the near future they will be deforested. These forests can be managed to increase their carbon reserves in the implementation scenario (See Figures 1 e) and 1 f)).

- **Secondary degradation:** Degradation that occurs in forests that have been previously degraded. Normally the emission factors in these forests are lower than in forests with primary degradation (see Figures 1 e) and 1 f)).

- **Baseline emissions:** GHG emissions that occur or may occur in the baseline scenario.

- **Baseline scenario:** Also called reference scenario. This is the scenario that establishes the current and/or trend conditions in a given territory in the absence of a GHGMP. This scenario identifies the sources of GHGs, carbon reserves and sinks that are present to date in that territory and in the future, making it possible to compare the real impact of mitigated GHG in the atmosphere when a project is established and carried out for these purposes.

- **Formulation scenario:** Corresponds to the quantification of GHG emissions, considering the effectiveness of the proposed REDD+ activities in the project area. For this, the trends identified in the baseline scenario are used as a basis. Therefore, they correspond to a hypothetical scenario of GHGMP implementation and are used for validation.

- **Implementation scenario:** Corresponds to the quantification of GHG emissions considering information from GHGMP monitoring. The data from this GHG inventory is subject to verification.

- **Avoiding the extraction of timber products:** This activity is based on avoiding the planned logging of trees to increase forest carbon stocks (See Figure 1 g)).

- **Source of GHG emissions:** Physical process that directly releases a GHG into the atmosphere.

- **Leakage:** Corresponds to carbon losses in areas where internal project stakeholders tend to migrate, due to the commitment to avoid deforestation and/or forest degradation. These carbon losses must be monitored and subtracted from the COLCERS, according to the formulas applicable in this methodology.

- **Greenhouse gases (GHG):** Gaseous components of natural or anthropogenic origin that absorb and emit radiation at a specific wavelength of the infrared radiation spectrum, which favor global warming. Within this group are CO_2, N_2O, CH_4, HFC, PFC, SF_6, among others.

- **Mitigation:** Human activity focused on the reduction and removal of GHG emissions from the atmosphere, through activities or initiatives of GHG sinks or reservoirs.

- **Monitoring:** Periodic and standardized activities focused on the determination, characterization and evaluation of removals and/or reductions that occur or could occur from the implementation of a mitigation project (increase or decrease of GHG removals).

- **REDD+ Project:** These are programs focused on complying with the agreements reached in the UNFCCC, whose objective is to reduce GHG emissions from deforestation and forest degradation, thus guaranteeing sustainable forest management, forest conservation and economic development derived from the project.

- **Discrete parcel:** A piece of land or collective territory that is intended to be used, in this case as a GHG mitigation project.

- **Reservoirs:** It is the place different from the atmosphere where the removed GHGs are stored. This place has the capacity to both release and retain them.

- **Sink:** The process that causes the removal of GHG from the atmosphere.

- **Overlap:** This occurs when a GHGMP intends to develop GHG reduction or removal activities in execution periods and geographic areas for which there is previously another GHGMP for the same mitigation activity.

- **Land:** It is a surface or parcel of land intentionally divided for a specific purpose, this parcel is considered different from those in its surroundings, either because it will be used for different activities than those around it or because of political-administrative decisions.

- **Territory:** The geographic area that is delimited by common characteristics, such as soil composition, topography, cover or other biotic or abiotic characteristics.

- **Systematic error:** another term denoting bias and refers to lack of accuracy.

- **Accuracy:** middle ground between the true value and the average of repeated measured observations or estimates of a variable. An accurate measurement or prediction is free of bias or, equivalently, systematic error.

- **Probability Density Function (PDF):** describes the range and probability of possible values.

- **Uncertainty:** lack of knowledge of the true value of a variable that can be described as a probability density function (PDF) that characterizes the range and probability of possible values. Uncertainty depends on the analyst's level of knowledge, which in turn depends on the quality and quantity of applicable data, as well as knowledge of the underlying processes and methods of inference. The PDF can be used to describe the uncertainty of the estimate of a quantity that is a fixed constant whose value is not known exactly, or it can be used to describe the inherent variability. The purpose of uncertainty analysis for the GHG emissions inventory is to quantify the uncertainty of the unknown fixed value of total emissions, as well as emissions and activity relative to specific categories. Thus, throughout the chapter, it is assumed that the PDF is used to estimate uncertainty and not variability unless otherwise specified[3].

- **Confidence interval:** the true value of the quantity for which the interval is to be estimated is a fixed but unknown constant, such as the total annual emissions for a given country in a particular year. The confidence interval is the range that encompasses the true value of this fixed unknown quantity with a specified confidence (probability). This definition is further elaborated in the ColCX Guide for the management of reversal risks, non-permanence risks and uncertainty.

- **Precision:** middle ground between repeated measurements of the same variable. Higher precision means less random error. Precision is independent of accuracy.

[3] Intergovernmental Panel on Climate Change (IPCC). (2006 Directrices del IPCC de 2006 para los inventarios nacionales de gases de efecto invernadero. Agricultura, silvicultura y otros usos de la tierra, 4.

- **Bias:** lack of accuracy. Bias (systematic error) may occur due to a failure to capture all relevant processes included, to the available data not being representative of all real situations, or to instrument error.

- **Variability:** heterogeneity of a variable over time, space or among members of a population [4].

4. PRINCIPLES

To ensure the environmental integrity of REDD+ projects seeking to be certified by the COLCX program, in addition to the principles governing the ISO 14064-2 standard and national legislation or its equivalent in the international context, the principles defined in the *COLCX Standard for Mitigation Initiatives Certification* should be considered, highlighting the following:

- *Additionality:* GHG emission removals credited by the COLCX Program that would not have been achieved in the absence of the proposed project activity.

- *Independence:* The project activity and the GHG emission removals and/or reductions achieved must be validated or verified by an independent auditor, with the objective of providing a reasonable level of assurance that provides a high level of confidence to the intended users, stating that the information is accurate and complete in accordance with the criteria defined in ISO 14064-3.

- *Quantification of GHG emission removals/reductions:* All GHG removals and/or reductions must be quantified based on the application of quantification and measurement tools recognized by the COLCX program.

- *Compliance with legal requirements:* The project proponent must demonstrate compliance with all legal requirements applicable to the proposed project activity.

- *Avoid double counting:* GHG emission removals and/or reductions achieved by the project and issued by applying the COLCX Program shall not be considered more than once in meeting GHG mitigation or emission neutralization objectives and targets in an emission inventory.

[4] Intergovernmental Panel on Climate Change (IPCC). (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Agriculture, forestry and other land uses, 4.

- *Transparency:* Information related to project accreditation and its results shall be truthful to enable users to make decisions with reasonable confidence and be available to public stakeholders in a transparent manner.

5. APPLICABLE ACTIVITIES

The REDD+ activities covered in this methodology are as follows:

1. GHGMP Activities that Reduce Deforestation and Forest Degradation (REDD)

   a) Reducing Emissions from Deforestation (REDef): This activity is mandatory and consists of avoiding deforestation of forest cover, which would have occurred in the absence of the commitment generated with a GHG mitigation project. This activity depends on the projection of a baseline scenario (historical trend) and a scenario with activities focused on the reduction of planned and unplanned deforestation; scenario defined as a formulation scenario.
   b) Reducing Emissions from Forest Degradation (REDeg): This activity is optional and corresponds to the loss of carbon reserves due to direct human activity in forests, which continue to maintain the same category. This activity depends on changes in carbon stocks in different categories of forest cover. This methodology only applies to unplanned forest degradation.

2. Activities that improve production processes or are associated with the reduction of emissions from planned degradation are considered as Sustainable Forest Management (SFM). For the implementation of this activity use the SFM module.

3. This methodology contemplates the Increase of Carbon Reserves (ICR) only when there is sufficient supporting information. Use the ICR module to implement this activity.

6. APPLICABILITY CONDITIONS

This methodology is applicable under the following conditions:

- Areas of permanent forest in the start year (forest that remains in this category for ten (10) years prior to the start date of the project) are presented, according to the official definition of forest in each country.
- It must be proven by means of the corresponding documentation that the owner or owners of the property or properties are the legal owners of the total land area where the GHGMP will be carried out or have the right to use the land and that these properties do not present legal or other types of disputes.
- Agents, drivers and underlying causes of unplanned deforestation and forest degradation in the project area are identified.
- If management areas with forest harvesting authorization are included, only unplanned forest degradation activities apply.
- To view the SFM applicability conditions for this activity use the SFM module.
- To view the ICR applicability conditions for this activity use the ICR module.

This methodology is not applicable under the following conditions:

- Projects that only include GHG removal activities through ecological restoration or revegetation.
- Forest cover dominated by natural ecosystems that are periodically flooded, such as wetlands, paramos, mangroves, among others, which have soils with a high organic matter content.

7. GHGMP AREA ELIGIBILITY

For the eligibility of the area of a GHGMP, the following criteria must be considered:

- The areas where the activities will be carried out must demonstrate ownership by the proponents; properties, collective territories or discrete parcels must guarantee through legal documentation that the owners are the legal owners of the total land area where the GHGMP will be carried out or have the right to use the land for the duration of the project; it must also be demonstrated that these properties do not present legal or other types of disputes.
- If there are different emission reduction or removal activities in the same GHGMP, it must be ensured that the RUDDA and RPDDA activities do not overlap. For the case of the ICR activity see the ICR module.
- In the case of RUDDA and RPDDA activities, these can only be implemented in areas of permanent forest.
- For more information on RUDDA and ICR area eligibility, see SFM and ICR modules.

8. TEMPORAL AND SPATIAL LIMITS

The temporal and spatial limits of the GHGMP allow establishing the area and temporality in which economic benefits can be obtained through carbon credits, ColCERS, for the removal and/or reduction of GHG.

The following temporal and spatial limits apply for projects with RUDDA and RPDDA activities, (for ICR activities, see ICR module):

8.1 Time Limits

The time limits of the project must be defined in the Project Design Document (PDD), indicating the day, month and year of each one, keeping consistency with each minimum or maximum period of time required, additionally, the following aspects must be considered in these:

8.1.1 Project start date

In the case of RUDDA activities, this is the date on which the first action of the GHGMP aimed at reducing emissions from deforestation and/or forest degradation is implemented. This date is established based on a concrete, supportable and traceable action that generates a decrease in the rate of deforestation and/or forest degradation considering the activity data and the construction of the baseline period. The project start date can be a maximum of 5 years prior to the date of validation submission to the VVB.

8.1.2 Historical Reference Period

This is a minimum period of ten years and a maximum of 15 years prior to the start date of the GHGMP in which the agents of deforestation and/or forest degradation identified in the baseline that are found in the selected reference region cause forest degradation and/or forest cover change to other land uses. This is the period where the dynamics and trends related to deforestation/degradation in the reference region are analyzed and serves for the construction of the baseline.

8.1.3 Retroactive period

It is a period of a maximum of 5 years prior to the GHGMP validation date where the proponent can demonstrate year-to-year maintenance or implementation of REDD+ activities. This must be done in a sufficient and integrated manner, so that it can obtain ColCERS (See figure 2).

8.1.4 Projection period

Corresponds to the period in which projections of the baseline scenario are made. This is based on the analysis of the dynamics and trends related to deforestation/degradation carried out in the reference region in the historical reference period. In this period, the emissions generated in the absence of a GHGMP due to deforestation and/or degradation are estimated, which is called the baseline scenario (see Figure 2). The projection period should be based on the length of the lifetime period. This period only applies to the GHGMP formulation scenario.

8.1.5 Credit Period

This is the period in which the baseline scenario has not been revalidated and therefore corresponds to a period no longer than 10 years and includes the verification periods in which GHG reductions and/or reductions are monitored. The crediting period can be revalidated as many times as the lifetime period allows (See Figure 2).

8.1.6 Lifetime period

Corresponds to the time in which the proponent of the GHGMP commits, through a legal agreement, to carry out the activities formulated in the PDD and obtain the expected results. This period must be equal to or greater than 30 years and can be up to 100 years (See Figure 2).

8.1.7 Verification period

Time period in years, defined in the crediting period, in which actions and GHG inventories due to GHG emission reductions or removals are evaluated, this period is no longer than 5 years. The information subject to verification must come from official sources, primary project information that demonstrates integrity and consistency or from recognized sources that can objectively provide certainty of the realization of REDD+ activities of the activities formulated in the PDD; the validation date may be associated with the project start date when it is done retroactively and when it is not done retroactively corresponds to the date when the GHGMP validation audit begins (See Figure 2).

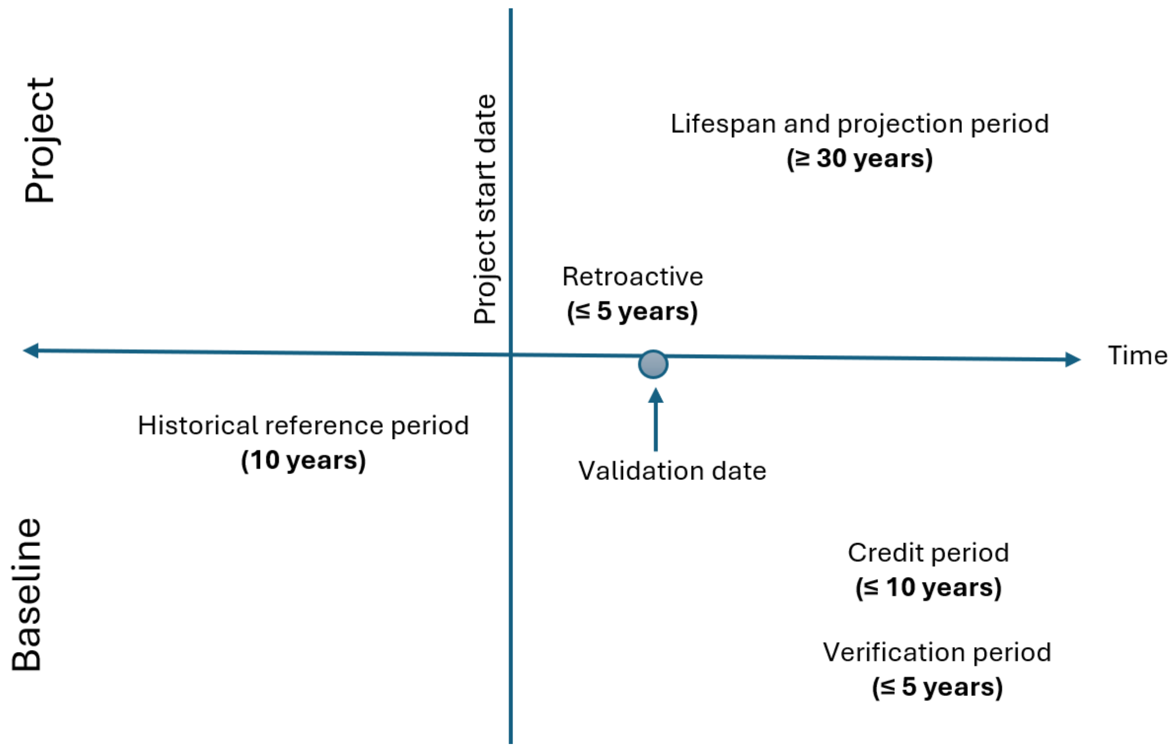


***Figure 2** Time limits of a GHGMP.*

8.2 Spatial Limits

The GHGMP must identify and delimit the areas that are subject to monitoring according to the REDD+ activities developed. It is important to highlight that all geographic information regarding spatial limits must be compiled in Shape format, indicating in its attributes the criteria to identify the project area. The spatial boundaries of a GHGMP for RPDDA and RUDDA activities are as follows:

8.2.1 Project area

This area corresponds to parcels or tracts of land over which the project proponent has the legal right to land tenure and therefore can carry out REDD+ activities. This right must be held by the proponent from the project start date. The project area where RUDDA and RPDDA activities are presented only corresponds to permanent forest areas of this methodology. It must be considered that all forest areas that are planned to be potentially deforested for the construction of infrastructure, transmission lines, or activities that have an environmental license, must be subtracted from the project area. The following criteria must be considered to identify the project area:

- Name or names of the properties or areas.
- Spatial delimitation of the project area. It can be presented in different vector formats that are applicable in a GIS (e.g., shp, Geopackage, kml, among others).
- Describe the current situation of land tenure and legal ownership of the territory.
- List all participants and their roles within the GHGMP.

The RPDDA areas differ from the RUDDA because the project proponent submits a Sustainable Use and Forest Management Plan approved by the competent environmental authority or any other authority acting in its stead, which must contemplate the extraction of timber products, using techniques such as delimitations by cutting quartiles that cause planned deforestation. Also, harvesting areas, conservation areas, and buffer areas must be clearly delimited within the Sustainable Use and Forest Management Plan. On the other hand, only those GHGMPs that have a clear traceability of the emissions caused by each of the RPDDA activities that affect the carbon reservoirs will be eligible. For more information on RPDDA activities see the SMF module.

8.2.1.1 Grouped projects

To build grouped projects, it must be considered that they must be in a similar geographic region in political, economic, social and ecological terms, for which it is suggested to use high hierarchy levels such as departments, biomes, river basins, economic regions and spatial limits defined by the FREL at the subnational level of the host country. Other criteria for acceptance of grouped projects are:

- Consistency in their REDD+ activities
- Consistency in monitoring and implementation of activities to address deforestation and forest degradation
- Similarity in the drivers, agents and underlying causes of deforestation and forest degradation, this should be supported by all the analyses requested by the present methodology in this topic.
- Consistency in applicable carbon reservoirs by activity

- Consistency in identified significant emission sources
- Each included land must have its own GHG emissions accounting and COLCERS
- Similarity between the agreements signed by the proponents with respect to REDD+ governance structure and resource management

For the identification of the potential leakage area, analyses can be performed, assuming that they are the same project area when the plots are at most 100 meters apart. For scattered plots, it will be necessary to construct a leakage belt for each territory.

For RUDDA activities, the inclusion of new territories must consider the criterion of grouping more than 500 hectares of land. For RPDDA and ICR activities, these may be more than one hectare.

When initiating a GHGMP, if it identifies new areas that can be included, a protocol can be established for their acceptance, indicating the criteria for identifying the project area. The project has a term to include these areas identified by addition until its first verification, after which the project can only include new areas by being revalidated. If, on the other hand, areas are subtracted for various reasons, the GHGMP should not be revalidated; this should only be reported to the standard.

8.2.2 Reference Region

Corresponds to the area over which deforestation and/or forest degradation trends are identified and analyzed, which will be used as the basis for projecting the GHGMP baseline. Therefore, this area should be as similar as possible to the area of the GHGMP in terms of the following similarity criteria:

- Forest and landscape types: Corresponding to classes or types of forest and slope, for this criterion there must be a similarity of at least 90% with the project area.
- Biophysical characteristics: Elevation, slope, temperature and rainfall. For this, a comparative table should be made between the reference region and the project area that identifies the characteristics described above and can demonstrate 90% similarity with the project area.
- Drivers, agents and underlying causes of deforestation and/or forest degradation: List all drivers of deforestation affecting the project area and assess their influence on the reference region according to the mobility,

dynamics and behaviors they generate. Drivers, agents and underlying causes that do not affect the project area should not be considered in the construction of the reference region.

- Land management practices and land tenure: Demonstrate that land management and tenure type in the Reference Region is prevalent and similar in the project area.
- Applicable policies and legislation: The effects of applicable policy or legislation in the project area must be the same or equivalent in the Reference Region.
- Population and infrastructure factors: Demonstrate that the reference region has rivers, access roads, municipalities, and infrastructure that can generate deforestation/degradation patterns or trends similar to the project area.

For projects that are carried out on islands and cover their entire area, an attempt should be made to find a nearby continental region or island that meets the similarity criteria previously mentioned. If it is not possible to find a reference region that meets the similarity criteria, a similarity analysis of the areas closest to the project should be carried out and an analysis should be made showing that the selected reference region is the most similar possible.

The reference region must be delimited by geographic or spatial boundaries such as river basins, micro-basins, rivers, elevations, roads, political boundaries, etc. This area must contain the entire leakage belt and the GHGMP project area, and it is based on this area that the analyses used as input for the construction of the baseline are carried out, therefore, this area must also be revalidated for each credit period. The following methodological elements are recommended for the definition of this area:

1. That this area is 5 to 7 times larger than the project area for projects with more than 100,000 ha and 20 to 40 times larger for projects with less than 100,000 ha [5]
2. It must be an area that based on modeling can be shown to be representative, for this the developer must demonstrate that the reference region, during the historical period, had a similar

[5] Brown, S., Hall, M., Andrasko, K., Ruiz, F., Marzoli, W., Guerrero, G., ... & Cornell, J. (2007). Baselines for land-use change in the tropics: application to avoided deforestation projects. Mitigation and Adaptation Strategies for Global Change, 12, 1001-1026.

deforestation behavior in an area at least twice as large as the project area

3. That, based on deforestation risk analysis, it can identify an area more than twice the size of the project area, which represents 95% of the same risk of deforestation and/or forest degradation as the project area, during the historical period

If there are reference levels submitted by the country in which the GHGMP is developed, in the UNFCCC REDD+ platform[6]. The spatial boundaries of the FREL or its levels may be used as a reference region as long as the spatial boundaries of the GHGMP overlap 100% with the FREL or regional levels (if regional levels exist, they should be used instead of the national one), and the proponent demonstrates consistency with the similarity criteria.

8.2.3 Potential Leakage Area

It is recognized as the potential area to which the drivers, agents and underlying causes related to planned or unplanned deforestation and/or forest degradation identified within the project area prior to the project start date may migrate, due to the commitment of the GHGMP activity area. It must contemplate an area of stable forest equal to or greater than that projected to be deforested as of the baseline. This area must be within the reference region and cannot overlap with the GHGMP project area.

Deforestation or forest degradation that is displaced from the project area to forest areas that are within the potential leakage area due to the implementation of REDD+ activities within the area of the GHGMP must be subtracted from the estimates of emission reductions and/or removals generated by the GHGMP. For this reason, the project must establish a leakage monitoring protocol to collect the necessary information to detect whether deforestation in this area corresponds to leakage.

To determine this area, the starting point is an analysis that should identify the displacement of actors within the project area. To this end, an analysis of the drivers, agents and underlying causes of deforestation and forest degradation must be carried out, considering the following definitions:

[6] https://redd.unfccc.int/

- The underlying causes are the motivations that may be institutional, economic, technological or social and may be the product of local, regional or national policies. These are identified as variables that allow an agent to deforest a forest or not.
- The agents correspond to individuals or groups of individuals who directly cause deforestation.
- Drivers of deforestation correspond to a process that articulates both agents and underlying causes of deforestation. These drivers are commonly associated with economic activities such as mining, illicit crops, livestock, timber extraction, among others.

Once these definitions have been taken into account, a preliminary analysis should be carried out with secondary information to identify and characterize the individuals, groups of people, communities or institutions that cause deforestation, as well as all the policies or variables that make these agents take or not the decision to deforest. This characterization, at least in the case of agents, should include information on their location, migration dynamics, labor use, technological factors and consumption; and in the case of underlying causes, information on the cost of labor, price of inputs or technologies, legal or governmental restrictions, accessibility to territories and biophysical factors[7].

Finally, a causal model should be presented, or one that allows the identification of the relationships between variables, underlying causes, and agents [8]. All information that can be used for this analysis should come from official technical documents, household surveys, stakeholder or expert interviews, census information or scientific literature from indexed journals. This will serve as input for the spatial analysis of numeral 11.1.1.4.

Based on the spatial analysis of drivers, agents and underlying causes of deforestation and forest degradation in section 11.1.1.4. a on-site corroboration of the results obtained should be done in a participatory manner with the proponent and/or stakeholders, this is done based on interviews with key stakeholders, participatory workshops to identify the timeline, which shows year by year how in the baseline scenario there were milestones regarding

[7] Other variables that affect the underlying causes can also be identified, such as: population growth or density, government policies, cultural factors, taxes, international factors, among others.

[8] Kaimowitz, A. A. (1998). Economic Models of Tropical Deforestation A Review. CIFOR.

deforestation and forest degradation and participatory social mapping that shows the location of the agents of deforestation and forest degradation. Based on this, an opportunity cost or mobility analysis is performed as appropriate; both are valid methods for estimating the boundaries of the potential leakage area.

The opportunity cost analysis should be the first option and can only be performed if more than 80% of all activities causing deforestation and/or forest degradation within the project area are financially viable, meaning that they are not livelihood activities. If it is not possible to perform an opportunity cost analysis, perform a mobility analysis. The step-by-step can be seen in the following figure:

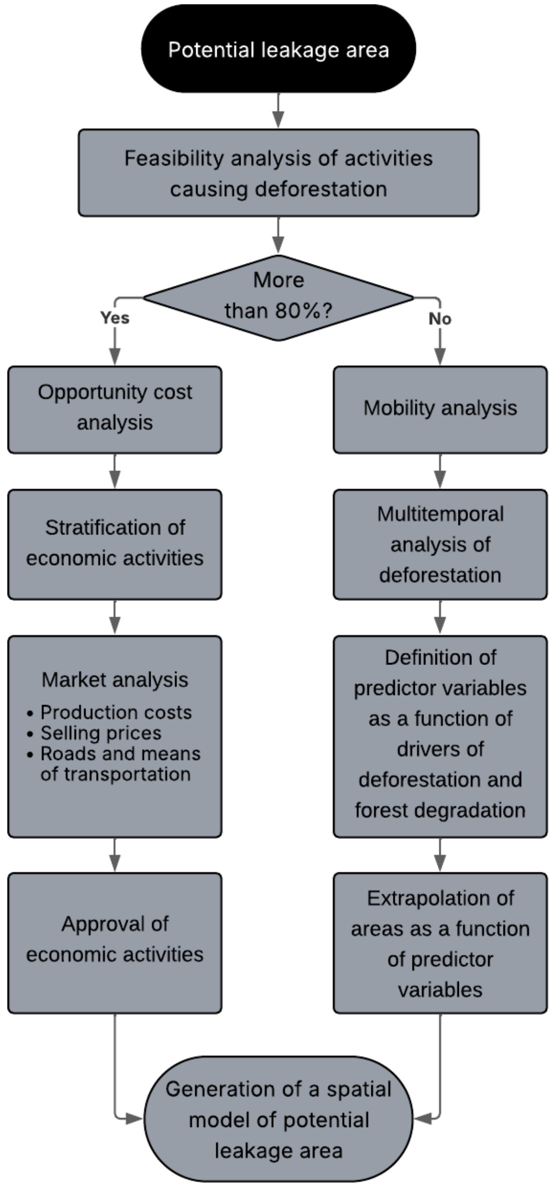


Figure 3 *Step-by-step delimitation of the potential leakage area for the GHGMP*

8.2.3.1 Opportunity cost analysis

The analysis of opportunity costs depends on the characteristics of the local market; therefore, it is necessary to:

1. Based on the analysis of drivers, agents and underlying causes of deforestation and forest degradation, once this is corroborated, based on

the stratified economic activities, it is necessary to identify and describe the characteristics of the local market for each activity to identify the production costs of products and their sales prices by activity, for this purpose the following is done:

a. First, to identify production costs and sales prices, information sources such as interviews, secondary information, or official sources can be used to establish the costs associated with the value chain of each activity, such as: use of agro-inputs, fuel costs, labor costs, location of collection centers, sales locations, transformation and distribution of products, level of transformation, transportation routes, modes of transportation, among others. Finally, the sales prices of the products of each activity should be identified.
b. Based on the production costs and sales prices of the products of the activities, previously stratified, their homologation is carried out, if the activities present similarities in their characteristics associated to the local market, always seeking for a conservative approach.

2. After this, a spatial model is made that considers the cost of transportation per kilometer depending on the type of transportation and fuel value, so that based on a road map, it can be determined to what extent the agents of each activity can be mobilized and obtain benefits from the sale of the products of each activity. This is achieved using GIS, in such a way that the leakage area corresponding to the feasibility areas, by economic activity, extrapolated outside the project area, can be determined.

$$CFF_i = Pv_i - Cp_i - (Ct_{tr} \ x \ Dt_{tr}) \quad (1)$$

Where:

CFFi= Feasible leakage area for economic activity i.

Pvi= Selling price of the goods produced by activity i.

CPi= Internal production costs of activity i.

Ctr= Transportation costs of the activity with respect to its means of transport tr (it can be by road, or river).

Dtr= Distance to where the products of the activity can be transported with respect to their means of transport tr (it can be by road or river).

With this equation, it is necessary to identify to what extent the internal production costs (CPi) of production and transportation costs (Ctr, multiplied, Dtr) are equal to the selling price quotations for activity i. The determination of the leakage area is the union of all feasible leakage areas ($CFF = CFF_1 \cup CFF_2 \cup \ldots CFF_n$), where CFF is the potential area of leakage.

8.2.3.2 Mobility analysis

Based on the analysis of drivers, agents and underlying causes of deforestation and forest degradation, once this is corroborated, based on the stratified economic activities, the geospatial predictor variables (drivers of deforestation and/or forest degradation) should be defined, such as illicit crops, livestock, agriculture, mining, infrastructure, population centers, among others. These variables should be used to identify the mobility of deforestation according to their location of deforestation and/or forest degradation, based on their distance from the defined variables. Once mobility predictors are identified for each variable, they should be extrapolated outside the project area. The extrapolated areas based on each deforestation driver should be merged to find the leakage area ($CFF = CFF_1 \cup CFF_2 \cup \ldots CFF_n$).

8.2.3.3 Leak Management Area

Area in which project activities are developed, aimed at reducing emissions from deforestation and/or forest degradation, this is located within the potential area of leakage, where the proponent or participants of the GHGMP do not have legal rights to land use, so that in these areas the proponent may generate agreements with the owners of these territories in order to avoid leakage. In this area, sustainable forestry activities can be established in non-forest areas whose objective is to provide livelihoods for displaced actors and agents in the project area. The leakage management area must be subject to monitoring, in terms of the execution of activities, limits, among others.

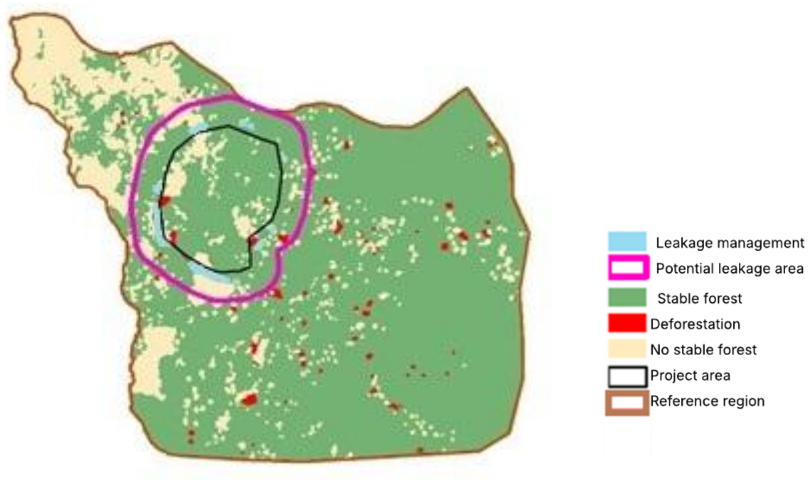


Figure 4 *Spatial limits of a GHGMP, considering only avoided deforestation activity.*

9. APPLICABLE RESERVOIRS

The carbon reservoirs included in the different activities contemplated by this methodology will be those that can be measurable and significant with respect to the GHGMP baseline. The selected reservoirs must be quantified in both the baseline scenario and the formulation scenario. The following is a list of the reservoirs that could be included in a GHGMP.

Table 1 Reservoirs applicable to RUDDA activities.

Reservoir	REDef	REDeg	Description
Aerial biomass	Yes	Yes	This reservoir should be included. It corresponds to the living biomass found on the ground, including stems, branches, bark and foliage. Expected to be maintained in conserved forest cover or to increase in areas where forest cover is established.
Belowground biomass	Yes	Opt	All living root biomass. Excludes fine roots less than 2 mm in diameter. Expected to be maintained in conserved forest cover or to increase in areas where forest cover is established.
Dead Wood	Opt	Opt	Includes dead aboveground biomass, dead roots and stumps of individuals 10 cm or more in

Reservoir	REDef	REDeg	Description
			diameter. Must be significant and adequately accounted for, can be monitored.
Leaf litter	Opt	Opt	Includes all aboveground dead plant biomass less than 10 cm in diameter. It must be justified as a significant reservoir and for its inclusion it must be possible to monitor it.
Soil Organic Carbon	Opt	Opt	Comprises all organic carbon stored in the soil; the depth of estimation must be justified by the proponent. Must be meaningful and adequately justified, can be monitored.
Timber products	No	No	It relates to the timber products generated because of harvesting, extraction, transport and transformation of timber individuals, understanding that the harvesting of individuals does not generate the immediate release of stored carbon.

Where: REDef: Reducing emissions due to deforestation, REDeg: Reduced emissions due to degradation, Opt: Optional.

10. EMISSION SOURCES

10.1 Unplanned emissions reduction activities

All emission sources must be identified in the baseline scenario and for their inclusion it must be demonstrated that they are expected to increase or be significant, coherent and consistent in the time scenarios evaluated (Formulation Scenario and Implementation Scenario). For this purpose, at least the different sources presented below must be evaluated (

Table **2**), and if they are significant, they should be monitored in turn in the project scenario. It is recommended to include emission sources that account for more than 5% of the total emissions calculated in the formulation and implementation scenario. Any sources that are not significant in terms of GHG emissions should be conservatively excluded and therefore should also be excluded from monitoring in the formulation scenario

For the quantification of emissions from sources, the equations, factors and recommendations of the IPCC guidelines[9] [10], FREL methodologies submitted by the host country or GHG inventories consistent with the project area can be used. On the other hand, it may also be valid to use emission factors or methodologies that correspond to reliable sources from indexed journals that are applicable to the context of the GHGMP if the IPCC guidelines are followed, where the choice of locally constructed parameters prevails over global ones.

Table 2 Emission sources

Source	GHG	Applies Yes/No	Description
Forest degradation	CO_2	Yes	Emissions related to changes in carbon reservoirs.
	CH_4	Opt.	It is only included if it is demonstrated that forest degradation practices such as fuelwood collection, timber extraction, grazing under the forest, illicit crops, are sufficiently documented to identify their direct impact on carbon reservoirs and their relationship with GHG.
	N_2O	Opt.	
Emissions from large- and small-scale fires	CO_2	No	The CO_2 released into the atmosphere through the occurrence of forest fires is directly evident in the project's forest areas, as these can change their class directly to non-forested areas (Deforestation) or areas that maintain their forest cover but have a low-scale impact on individuals (Degradation).
	CH_4	Opt.	

[9] IPCC. (2003). IPCC Good Practice Guidance for UTCUTS. Available at: kutt.it/laZFfp
[10] IPCC. (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Agriculture, forestry and other land uses. Available at: kutt.it/iLd1fY

Source	GHG	Applies Yes/No	Description
	N_2O	Opt.	Solo se incluye si se demuestra que las prácticas de cambio de uso de suelo implican la quema de bosques. Estas emisiones se deben omitir de manera conservadora si no existe suficiente información geoespacial que permita su cuantificación.
Change in land use	CO_2	Yes	Emissions related to changes in carbon reservoirs.
	CH_4	No	Not considered significant for the following methodology.
	N_2O	No	

Where: Opt: Optional.

When the information from the historical period regarding forest fires is sufficient and there is traceability of the areas burned for the establishment of agricultural activities, the emissions generated by these fires in terms of methane and nitrous dioxide are calculated following the IPCC guidelines[11]:

$$ECH4eq_i = ECO2eq_i * \frac{12}{44} * RMCH4 * TCH4 * PCH4 \quad (2)$$

$ECH4eq_i$: CH_4 emission factor per stratum i burned.
$ECO2eq_i$: Emission factor of stratum i.
$RMCH4$: Methane to carbon molecular ratio constant given by 16/12.
TCH4: Methane emission rate 0.012.
PCH4: Methane warming potential.

$$ENO2eq_i = ECO2eq_i * \frac{12}{44} * RMNO2 * TNO2 * NC * PNO2 \quad (3)$$

$ENO2eq_i$: NO_2 emission factor of stratum i burned.
$ECO2eq_i$: Emission factor of stratum i.
$RMNO2$: Molecular ratio constant of nitrogen dioxide and nitrogen given by 44/28.
TNO2: Methane emission rate 0.007.

[11] IPCC. (2003). IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry. Available at: https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/GPG_LULUCF_FULL.pdf

NC: Nitrogen-carbon ratio 0.01.
$PNO2$: Heating potential of nitrous dioxide.

These equations will be used as input for equations 36, 37, 38 and 39, which are found in the baseline scenario section.

11. ACTIVITY DATA

It is important to keep in mind that all processing involved in the analysis of activity data should be presented in an orderly and coherent manner. All geographic data, if taken from official sources, must be presented in their original state, indicating the place from which they were extracted. On the other hand, the geoprocessing carried out by the developer must be in shape or raster formats, which have in their attributes, the area, type of coverage, perimeter and one attribute that allows its clear identification. This can be complemented by the developer if necessary.

11.1 Land use change analysis

Activity data in the case of the GHGMP, based on IPCC guidelines, refer to the applicable areas of RUDDA and RPDDA activities in the project area. These are derived from land cover monitoring systems or SLMS. Activity data can be derived from remote sensing information or verifiable local data under consistent methodologies appropriate to the project area. Geoprocessing should be carried out based on the definition of forest applicable to the host country, permanent forest and non-permanent forest, as these parameters determine the minimum mapping unit for spatial analysis.

Based on the above, there are international guidelines that highlight the importance of monitoring land cover using medium or fine resolution images[12], for this reason, Table 3 shows some satellite inputs that can be used for the delimitation of land use cover in the project area. It is important to note that the minimum mapping unit for forests will depend on the definition of forest applicable for each country. However, the other land use categories may have a higher resolution minimum mapping unit, if so, this should be justified and mentioned in the PDD.

The land use categories should be aligned with the IPCC categories[13]. In case official national data is used, a table should be made to align these categories with the IPCC categories.

Table 3. Optical sensors that can be used for detecting deforested/degraded areas [14]

Resolution	Optical Sensor	Maximum cartographic scale	Image resolution
Medium (10-60 m)	Landsat ASTER ALOS	1:100.000 1:50.000 1: 15.000	100 m 50 m 15 m

[12] Achard, F., *et al.* (2014) A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals associated with deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation. No. COP20-1. GOFC-GOLD.

[13] https://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/pdf/4_Volume4/V4_03_Ch3_Representation.pdf

[14] Adaptado de Lencinas, J. D. & Antje S. (2009) "Relevamiento de bosques con información satelital: Resolución espacial y escala." Quebracho-Revista de Ciencias Forestales 17.1-2.101-105.

Resolution	Optical Sensor	Maximum cartographic scale	Image resolution
Fine (< 5m)	SPOT V	1: 15.000	15 m
		1: 10.000	10 m
	ALOS	1: 5.000	5 m
	SPOT V	1: 5.000	5 m
	QuickBird	1: 5.000	5 m
		1: 1.500	1,5 m
	IKONOS	1: 8.000	8 m
		1: 3.000	3 m

The above does not imply that new technologies for land use cover monitoring cannot be implemented in the GHGMP; therefore, a GHGMP that demonstrates the applicability of new GIS technologies can implement them in its different periods. The following are the steps to be followed to build the activity data for RUDDA and RPDDA activities.

11.1.1 Reducing emissions due to deforestation

To identify RUDDA and RPDDA activity data, it is necessary to make maps in recognized formats in Geographic Information Systems or GIS, where land use changes are identified annually within the reference region and the project area. The IPCC Good Practices can be followed to obtain this information. To guarantee cartographic information, for this methodology, the following steps should be carried out, at least, as follows:

11.1.1.1 Preprocessing stage

Satellite images should be selected that contain less than 20% cloud cover with respect to the area of interest and should be framed in the time frame of the historical reference period, ensuring that the images of the last two-month period are processed in their entirety. All the metadata of the downloaded images must be documented and presented in a table that allows identifying the different attributes of the images. Moreover, the following corrections should be taken into account at this stage[15]:

[15] Galindo G., Espejo O. J., Rubiano J. C., Vergara L. K., Cabrera E., 2014. Protocolo de procesamiento digital de imágenes para la cuantificación de la deforestación en Colombia. V 2.0. Instituto de Hidrología, Meteorología y Estudios Ambientales – IDEAM. Bogotá D.C., Colombia

- Geometric corrections. It must be demonstrated that the satellite images are overlapped annually in a correct way, and this is reflected in the cartography elaborated and used. The error between the two images must be less than one pixel.
- Removal or masking of clouds and cloud shadows.
- adiometric corrections, similar objects should be guaranteed to have a similar multitemporal spectral response.
- Risk reduction, a process must be guaranteed to reduce the risks of generating unreliable base information at the time of identification, it is recommended to choose information with low error and avoid the use of images with banding.

11.1.1.2 Interpretation and classification stage

Once the cartographic information has been purified, land use change categories must be generated, according to the land use classification legally recognized by the country or according to the latest version of the Corine Land Cover classification.

Techniques such as unsupervised classification, supervised classification, photo interpretation or GEOBIA Object Based Image Classification can be used to obtain the land use change maps. It is important that the PDD indicates the methods used to make this classification, such as the assumptions of the models and the software used and its version. Also, the statistical procedures that allowed the generation of thematic maps of land use changes should be documented. The information obtained in these thematic maps should, at a minimum, identify areas of forest, non-forest, deforested or degraded areas (if degradation applies), regenerated forests, commercial plantations and areas without information.

The GHGMP must generate a procedure for the management and quality of information and establish processes for the treatment of areas without information if required. All this information must be documented and identified in the PDD.

11.1.1.3 Post-processing stage

Once the thematic maps have been produced, it is necessary that at least once, the information generated is reviewed by a photo-interpreter to verify the processing of the geospatial information. For this purpose, stratified random sampling or any sampling model endorsed by recognized methodologies can be used to verify that the identified coverages are consistent with satellite images. Finally, a confusion matrix must be generated to ensure that the information quality criteria are consistent.

All this information must be documented and must consider a process that guarantees its traceability. The final product of this stage will consist of a thematic map with at least the stratification of forests at the biome level or the forest that corresponds to the FREL.

11.1.1.4 Drivers of deforestation and forest degradation analysis stage

In order to identify the drivers, agents and underlying causes of deforestation and forest degradation, the preliminary analysis developed in numeral 8.2.3 should be used as a starting point. For their identification, spatial analyses should be carried out to identify and stratify the economic activities that cause deforestation and/or forest degradation according to the identified drivers of deforestation and/or forest degradation. In this way, activities can be compiled through productive activities such as timber extraction, extensive cattle ranching, intensive cattle ranching, African palm plantations, rice cultivation, among others. It is necessary to be able to identify the corresponding economic activities at a spatial level, which must coincide with the baseline land use change maps in the project area. This analysis will be called spatial analysis of drivers, agents and underlying causes of deforestation and forest degradation.

11.1.2 Reduction of emissions due to degradation

This step only applies if activities to reduce deforestation are integrated with activities to reduce forest degradation; for this, categories of forests, landscapes or other categories must be identified that allow the stratification of these coverages according to their carbon content with respect to each carbon reservoir. For this, technologies such as LIDAR, RADAR or forest inventories, which are direct methods for estimating carbon content, can be combined[16]. Indirect methods such as biophysical criteria, disturbance

[16] Herold, M., Román-Cuesta, R. M., Mollicone, D., Hirata, Y., Van Laake, P., Asner, G. P., ... & MacDicken, K. (2011). Options for monitoring and estimating historical carbon emissions from forest degradation in the context of REDD+. *Carbon balance and management*, *6*(1), 1-7.

indicators[17], vegetation indices, landscape ecology studies[18], forest management categories or other criteria that allow the discrimination of these classes according to their carbon content can also be used. The important thing is to be able to identify the reduction of carbon stocks in these forest areas in a transparent and documented manner over time; official documents and indexed journal articles can be used for this purpose. These changes in the carbon reservoirs should be modeled in a multi-temporal manner, to identify the dynamics of change.

Maps that allow the identification of carbon reservoirs dynamically over time, for this methodology, will be referred to as carbon assets maps. Based on carbon assets maps, in the case of integration of degradation reduction activities, emission calculations must be made for both the baseline scenario and the project scenario. It is important to clarify that during the successive verifications during the crediting period of the GHGMP, different inputs can be used to determine the activity data. This can be done in the absence of sufficiently clear and high-quality sources of information or in the absence of better optical sensors at the global, national or local level to the project. If different inputs or changes in the sources of information are integrated for the delimitation of the GHGMP forest degradation activity data, the PDD should document and evidence how these inputs were used and justify why their use reduces uncertainty and is consistent with the results obtained.

To identify degradation, the use of tools such as the Landscape Fragmentation Tool[19] is recommended. Deforestation should be clearly distinguishable from forest degradation, for this the proponent can use the following classification:

[17] Mitchell, A. L., Rosenqvist, A., & Mora, B. (2017). Current remote sensing approaches to monitoring forest degradation in support of countries measurement, reporting and verification (MRV) systems for REDD+. *Carbon balance and management*, *12*(1), 1-22.

[18] Shapiro, A. C., Aguilar-Amuchastegui, N., Hostert, P., & Bastin, J. F. (2016). Using fragmentation to assess degradation of forest edges in Democratic Republic of Congo. *Carbon Balance and Management*, *11*(1), 1-15.

[19] https://clear.uconn.edu/mapping/tools/

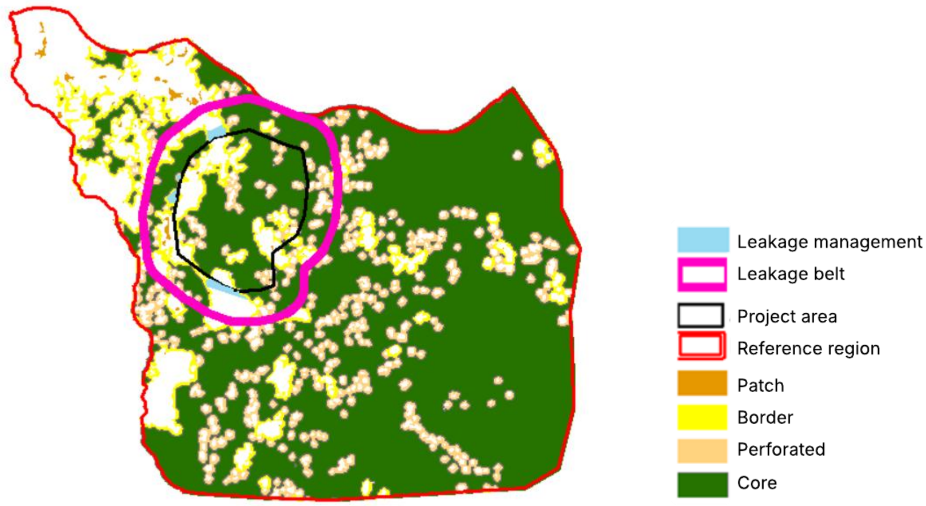


Figure 5 *Spatial limits of a GHGMP considering avoided forest degradation activity according to the Landscape Fragmentation Tool.*

Table 4. Differentiating between types of deforestation and forest degradation [20].

Coverage classes	Transition	Category
Primary or core forest	Deforestation	Primary deforestation
Degraded forest	Deforestation	Secondary deforestation
Primary forest	Degradation	Primary degradation
Degraded forest	Degradation	Secondary degradation

The product obtained from this step will consist of a thematic map showing the degradation of the forests identified in the product of step 11.1.1.3 post-processing step.

11.1.1 onsiderations for obtaining baseline information for activity data

In countries where there is an FREL that overlaps with the project area, it is recommended that the procedures for obtaining information from the institution that carried out this study be followed in a documented manner. If geographic base information, such as multitemporal maps, is available, the process under which they were obtained should be documented to ensure their official institutional origin. If FREL information is not available, local official sources can be used as long as they at least have the procedures shown in the

[20] Shapiro, A. C., Aguilar-Amuchastegui, N., Hostert, P., & Bastin, J. F. (2016). Using fragmentation to assess degradation of forest edges in Democratic Republic of Congo. *Carbon balance and management*, *11*(1), 1-15.

steps of this methodology. For this purpose, it is necessary to generate a section or annexed document that supports the performance of these procedures in detail by these entities.

11.2 Emission Factors

Emission factors for reservoirs and/or emission factors[21] that apply to deforestation and/or forest degradation activities may be derived from the latest version of the FREL of the country in which the GHGMP is being developed. For the project proponent to use emission factors provided by the FREL, they must be transparent, coherent and consistent for the different periods of the GHGMP. Emission factors must also be measurable and verifiable to allow for monitoring, reporting and verification, considering national capabilities in accordance with decision 9/CP.19. It should be emphasized that the FREL have different versions, so the GHGMP must use the data from the latest version corresponding to each verification period, in order not to underestimate or overestimate the emission reductions generated by the GHGMP.

If the data from the FREL applicable at the national, sub-national or local level present inconsistencies because they are not representative of the forest cover for the reference region and project area or present a sampling error greater than 10%, with a confidence level of 95%, local data should be generated from forest inventories. If the proponent conducts forest inventories to identify carbon reservoirs and emission factors, the proponent may perform a methodological reconstruction of the processes defined by the FREL, GHG inventories or national inventories applicable to the GHGMP. When the host country does not have any forest monitoring mechanism, it is not applicable for the development of a GHGMP according to decision 9/CP.19.

$$\Delta BA_i = (BA_{t1} - BA_{t2}) * RM * FC * FDefco \quad (4)$$

ΔBA_i: Emission factor of the aerial biomass reservoir in terms of Mg of CO2 per hectare, of stratum i.

BA_{t1}: Aerial biomass at the initial time in terms of Mg of biomass per hectare.

BA_{t2}: Aerial biomass at the final time in terms of Mg of biomass per hectare.

RM: Carbon dioxide and carbon dioxide molecular ratio constant given by $44/12$.

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[21] Según la decisión 12/CP. 17 de la CMNUCC los NREF/NRF deben ser expresados en toneladas de dióxido de carbono equivalente por año.

FC: Biomass carbon ratio constant (recommended default is 0.45, if a value applicable to the project area is available, this can be used).
$FDefco$: Correction factor according to the ColCX Guide for the identification of reversal, non-permanence and uncertainty risks; Table 6 Uncertainty discount factors.

$$\Delta BS_i = (BS_{t1} - BS_{t2}) * RM * FC * FDefco \quad (5)$$

ΔBS_i: Belowground biomass reservoir emission factor in terms of Mg of CO_2 per hectare, of stratum i.
BS_{t1}: Belowground biomass at the initial time in terms of Mg biomass per hectare.
BS_{t2}: Belowground biomass at the end time in terms of Mg biomass per hectare.
RM: Carbon dioxide and carbon dioxide molecular ratio constant given by 44/12.
FC: Biomass carbon ratio constant (recommended default is 0.45, if a value applicable to the project area is available, this can be used).
$FDefco$: Correction factor according to the ColCX Guide for the identification of reversal, non-permanence and uncertainty risks; Table 6 Uncertainty discount factors.

$$\Delta MM_i = (MM_{t1} - MM_{t2}) * RM * FC * FDefco \quad (6)$$

ΔMM_i: Emission factor of the dead biomass reservoir in terms of Mg of CO2 per hectare, of stratum i.
MM_{t1}: Dead biomass at the initial time in terms of Mg biomass per hectare.
MM_{t2}: Dead biomass in the final time in terms of Mg of biomass per hectare.
RM: Carbon dioxide and carbon dioxide molecular ratio constant given by 44/12.
FC: Biomass carbon ratio constant (recommended default is 0.45, if a value applicable to the project area is available, this can be used).
$FDefco$: Correction factor according to the ColCX Guide for the identification of risks of reversion, non-permanence and uncertainty Table 6 Uncertainty discount factors.

$$\Delta LIT_i = (LIT_{t1} - LIT_{t2}) * RM * FC * FDefco \quad (7)$$

ΔLIT_i: Emission factor of the litter reservoir in terms of Mg of CO_2 per hectare, of stratum i.
LIT_{t1}: Litterfall at the initial time in terms of Mg biomass per hectare.
LIT_{t2}: Litterfall at the final time in terms of Mg biomass per hectare.
RM: Carbon dioxide and carbon dioxide molecular ratio constant given by 44/12.
FC: Biomass carbon ratio constant (recommended default is 0.45, if a value applicable to the project area is available, this can be used).
$FDefco$: Correction factor according to the ColCX Guide for the identification of risks of reversion, non-permanence and uncertainty Table 6 Uncertainty discount factors.

$$\Delta COS_{20i} = \frac{(COS_{t1} - COS_{t2})}{20} * RM * FDefco \quad (8)$$

ΔCOS_{20i}: Soil organic carbon reservoir emission factor in terms of Mg CO_2 per hectare, of stratum i.
ΔCOS_{t1}: Soil organic carbon at the initial time in terms of Mg of biomass per hectare.
ΔCOS_{t2}: Soil organic carbon at the end time in terms of Mg biomass per hectare.
RM: Carbon dioxide and carbon dioxide molecular ratio constant given by 44/12.
$FDefco$: Correction factor according to the ColCX Guide for the identification of risks of reversion, non-permanence and uncertainty Table 6 Uncertainty discount factors.

12. BASELINE SCENARIO

The baseline scenario is based on the estimation of GHG emissions by sources and carbon stock changes in sinks associated with changes in land use or forest types, in the absence of the GHGMP. The analysis of these GHG emissions starts by determining the decrease in forest cover in the historical period, through the identification of activity data, emission factors and the analysis of drivers, agents and underlying causes of deforestation and forest degradation. This allows an adequate projection of emissions caused by deforestation and forest degradation activities.

Before performing this analysis, it must be ensured that the baseline scenario is additional to demonstrate that emission reductions and/or removals would not have occurred in the absence of the GHGMP.

12.1 Construction of the baseline scenario for RUDDA and RPDDA activities

The baseline scenario for this methodology consists of the land use change analysis that derives the carbon stock changes of the selected reservoirs in the spatial and temporal boundaries of the project. The results of this analysis should reflect a scenario as similar as possible to the most likely scenario of deforestation and/or forest degradation.

To identify the baseline scenario, the spatial limits of the project area and reference region must first be well defined. Subsequently, an analysis of historical change must be made that meets the criteria cited in the activity data section, so that the information has quality criteria and reliable sources of information. This information must be available for at least 15 years prior to the project starts date. Once the historical analysis of land use changes and drivers of deforestation and/or forest degradation have been carried out, the baseline scenario should be chosen. It is important to remember that the baseline scenario constitutes a minimum period of ten years and a maximum of 15 years and should be as close as possible to the project start date. Once these ten years have elapsed, this scenario should be readjusted, always trying to comply with the criterion of maximum similarity.

The development of a baseline scenario can be approached in two ways, the first consists of projecting the historical deforestation rate and the second consists of modeling deforestation. These analyses must consider at least three points in time. In both cases, the assumptions of the models or formulas used must be transparently documented and a model adjustment must be made to ensure that the selected baseline scenario adequately projects future deforestation in the reference region.

For this, there must be an analysis of alternatives that shows at least two baseline models generated and the choice of the most appropriate one must be supported; in any case, an analysis of the historical trend of deforestation and/or forest degradation must be carried out to establish whether it is increasing, decreasing or stable, and evidence must be provided as to why the agents of deforestation and/or forest degradation cause this behavior. In order to adjust the models in a transparent manner, the information that emerges should come from free software whose libraries have publications in indexed journals or are the product of research that is published in such journals. On the other hand, if it is paid software, the developer must have a non-trial license

In both cases the models must come from the latest published version of the software and its libraries. The use of the following software GEOMOD[22], TerrSet[23] and DinamicaEGO[24] is recommended for modeling. In any of the cases a document showing the step by step, as well as the input and output geographic information that was used for the design of any model should be available.

Finally, it must be ensured that the uncertainty generated from the calculation of emission factors and the chosen models is the minimum possible. If it is close to zero, it should be taken as zero; in other cases the uncertainty factor should be considered in the emission calculations. In the case of forest degradation, uncertainty can be evaluated based on the IPCC guidelines in its document *Guidelines for National Greenhouse Gas*

[22] https://www.geomod.fr/en/home/
[23] https://clarklabs.org/terrset/
[24] https://csr.ufmg.br/dinamica/

Inventories volume 4, chapter 4[25]. In the case of deforestation, chapters 5 to 9 of the same document can be used.

The projection of deforestation and forest degradation for the baseline scenario and the formulation scenario should be made considering the lifetime of the GHGMP:

Step 1: Calculation of cover change rates for the reference region:
To identify changes in carbon stocks in the project area, permanent forest must first be defined under the parameters and criteria previously established. If working together with degradation, forest strata or categories should be identified that allow the identification of forest areas with different carbon reservoirs. Subsequently, a matrix of cover transition from year to year for the reference region in the historical reference period should be made, so that data on changes by stratum can be obtained for the reference region. Once these annual changes in the use of cover are available, the deforestation rate is used.

The deforestation rate is calculated considering Puyravaud's equation [26], which is shown below:

$$RRTasDef_{i,t} = \left(\left(\frac{1}{t_2 - t_1}\right) * ln\frac{A_2}{A_1}\right) \qquad (9)$$

Where:

$RRTasDef_{i,t}$: the rate of deforestation for stratum i between period t1 and t2 for the reference region, is a dimensionless factor.

Di: Corresponds to the deforested area of the forest of stratum i in hectares between periods t_1 and t_2.

t_1: Initial year of the project.

t_2: Final year of the analysis period.

A_1: Forested area of stratum i at the initial time in hectares.

A_2: Forested area of stratum i at the final time in hectares.

Another approach that can be used is the scarcity function approach[27] and this should be used when including unplanned forest degradation reduction

[25] IPCC. 2006, Guidelines for National Greenhouse Gas Inventories, Volume 4, AFOLU, Chapter 4, Section 4.2 or nationally accepted standard https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf

[26] Puyravaud, J-P. (2003). Standardizing the calculation of the annual rate of deforestation. Forest ecology and management 177. 593-596.

[27] Satake, A., & Rudel, T. K. (2007). Modeling the forest transition: forest scarcity and ecosystem service hypotheses. Ecological Applications, 17(7), 2024-2036.

activities[28] in combination with unplanned deforestation reduction activities. This approach can be approached using the following formula:

$$RRTP(1 \rightarrow 2)_{t2-t1} = \frac{(RRC1_{t1} \rightarrow RRC2_{t2})}{t2-t1} \qquad (10)$$

Where:

$RRTP(1 \rightarrow 2)_{t2-t1}$: *Average transition from stratum 1 to stratum 2 from t_1 to t_2.*

$RRC1_{t1} \rightarrow RRC2_{t2}$: *Area of cover in the forest stratum (primary or degraded) RRC1 (ha) at time point t1 that has undergone transition to land classified as degraded forest stratum (can be with further degradation) RRC2 (ha) at time point t2 (ha).*

t1: Year of the first time point in the coverage transition analysis.

t2: Year of the second time point in the coverage transition analysis.

Based on the above formula, the exchange rate is calculated as follows:

$$RRTasDef_{i,t} = \frac{RRTP(1 \rightarrow 2)_{t2-t1}}{RRC1_{t1}} \qquad (11)$$

Where:

$RRTasDef_{i,t}$: *the deforestation rate for stratum i between period t_1 and t_2 for the reference region.*

$RRTP(1 \rightarrow 2)_{t2-t1}$: *Average transition from stratum 1 to stratum 2 from t_1 to t_2 of the reference region.*

$RRC1_{t1}$: *Total land classified as stratum C1 (ha) at time point t1 (ha) in the reference region.*

t1: Year of the first time point in the coverage transition analysis.

t2: Year of the second time point in the coverage transition analysis.

** This formula also works for degradation*

Step 2: Projected deforestation in the reference region in the baseline scenario:

The Puyravaud deforestation rate is used to project future deforestation with the following equation:

$$RRBDef_{i,t} = ARRB_{i,t-1} * RRTasDef_{i,t} \qquad (12)$$

Where:

$\mathrm{RRBDef}_{i,t}$ *: corresponds to the projected deforestation for stratum i in year t for the reference region, in hectares.*

$\mathrm{ARRBDef}_{i,t-1}$: *corresponds to the forest assets of stratum i in the year prior to deforestation in the reference region, in hectares.*

$RRTasDef_{i,t}$: *deforestation rate for stratum i between period t_1 and t_2 for the reference region.*

28 Angelsen, A. (2007). Forest cover change in space and time: combining the von Thünen and forest transition theories (Vol. 4117). World Bank Publications.

With the rate of forest degradation resulting from the scarcity function, future deforestation is projected with the following equation:

$$RRBDeg_{i,t} = ARRB_{i,t-1} * RRTasDeg_{i,t} \quad (13)$$

Where:

$\mathrm{RRBDeg}_{\mathrm{i,t}}$ *: corresponds to the projected forest degradation for stratum i in year t for the reference region, in hectares.*

$\mathrm{ARRB}_{\mathrm{i,t-1}}$*: corresponds to the forest assets of stratum i in the year prior to forest degradation in the reference region, in hectares.*

$RRTasDeg_{i,t}$*: the forest degradation rate for stratum i between period* t_1 *and* t_2 *for the region of reference.*

Future deforestation can also be determined by using regression models such as Poveda and Manrique's logistic regression model [29]:

$$RRDef_{i,t} = \frac{RRK}{1 - e^{a+bt}} \quad (14)$$

Where:

$\mathrm{RRBDef}_{\mathrm{i,t}}$ *: corresponds to the projected deforestation for stratum i in year t for the reference region, in hectares.*

RRK : Forest susceptible to deforestation in the reference region, in hectares.

e: euler constant

a: Corresponds to the model constant

b: rate of change for the model between periods t_1 *and* t_2 *for the reference region*

Step 3: projected rate of change of coverage for the project area, in the baseline scenario:

Based on the above rates the following equations are used.

With the Puyravaud deforestation rate for the project area, the following equation is used:

$$APBDef_{i,t} = AAPBDef_{i,t-1} * RRTasDef_{i,t} \quad (15)$$

Where:

$\mathrm{APBDef}_{\mathrm{i,t}}$ *: corresponds to the projected deforestation for stratum i in year t for the project area, in hectares.*

[29] Poveda G, H Manrique. 2007. Aplicación de la curva logística a los censos de la ciudad de Medellín. Ecos de Economía: A Latin American Journal of Applied Economics, 11(25): 7-60. Disponible en: https://publicaciones.eafit.edu.co/index.php/ecos-economia/article/view/1937/1948

$\mathrm{AAPBDef}_{i,t-1}$: *area of forest of stratum i in the year prior to the start of the project in the project area.*

$RRTasDef_{i,t}$: *the deforestation rate for stratum i between period t_1 and t_2 for the reference region.*

With the degradation rate as a product of the scarcity function it is necessary to complement it with the following equation:

$$APBDeg_{i,t} = AAPBDeg_{i,t-1} * RRTasDeg_{i,t} \qquad (16)$$

Where:

$\mathrm{APBDeg}_{i,t}$: *corresponds to the projected forest degradation for stratum i in year t for the project area, in hectares.*

$\mathrm{AAPBDeg}_{i,t-1}$: *corresponds to the forest assets of stratum i in the year prior to the start of the project, in the project area, in hectares.*

$RRTasDeg_{i,t}$: *the forest degradation rate for stratum i between period t_1 and t_2 in the reference region.*

In the case of Poveda and Manrique's logistic regression model, this projection would look like this:

$$APDef_{i,t} = \frac{APK}{1 - e^{a+bt}} \qquad (17)$$

Where:

APK : The forest susceptible to deforestation in the project area, in hectares.

e: euler constant.

a: Corresponds to the model constant.

b: It is the rate of change for the model between periods t_1 and t_2 of the reference region.

Step 4: deforestation projection in the potential leakage area of the GHGMP, in the baseline scenario:

With the Puyravaud deforestation rate for the project area, the following equation is used:

$$CFBDef_{i,t} = ACFB_{i,t-1} * (RRTasDef_{i,t}) \qquad (18)$$

Where:

$\mathrm{CFBDef}_{i,t}$: *corresponds to the projected deforestation for stratum i in year t for the leakage area, in hectares.*

$\mathrm{ACFB}_{\mathrm{i,t-1}}$: *corresponds to the forest stock of stratum i in the year prior to deforestation in the leakage area, in hectares.*
$RRTasDef_{i,t}$: *the deforestation rate for stratum i between period t_1 and t_2 for the reference region.*

With the degradation rate as a product of the scarcity function it is necessary to complement it with the following equation:

$$CFBDeg_{i,t} = ACFB_{i,t-1} * RRTasDeg_{i,t} \qquad (19)$$

Where:
$CFB\mathrm{Deg}_{\mathrm{i,t}}$: *corresponds to the projected forest degradation for stratum i in year t for the potential leakage area, in hectares.*
$\mathrm{ACFB}_{\mathrm{i,t-1}}$: *corresponds to the forest assets of stratum i in the year prior to forest degradation in the project area, in hectares.*
$RRTasDeg_{i,t}$: *the forest degradation rate for stratum i between period t_1 and t_2 in the reference region.*

In the case of Poveda and Manrique's logistic regression model [30], this projection would be as follows:

$$CFDef_{i,t} = \frac{CFK}{1 - e^{a+bt}} \qquad (20)$$

Where:
APK : The forest susceptible to deforestation in the project area, in hectares.
e: euler constant.
a: Corresponds to the model constant.
b: It is the rate of change for the model between periods t_1 and t_2 of the reference region.

Step 5: Calculation of baseline emissions:

Based on emission factors that may be the product of inventories conducted by the developer or come from indexed journals and be applicable to the project area. The sum of the applicable carbon reservoirs, in terms of biomass per carbon fraction and the Carbon - Carbon Dioxide molecular ratio, results in the emission factor of stratum i, as shown below:

$$ECO2eq_i = (\Delta BA_i + \Delta BS_i + \Delta LIT_i + \Delta MM_i + \Delta COS_{20i}) \quad (21)$$

Where:
$ECO2eq_i$: Emission factor of stratum i

[30] Poveda G, H Manrique. 2007. Aplicación de la curva logística a los censos de la ciudad de Medellín. Ecos de Economía: A Latin American Journal of Applied Economics, 11(25): 7-60. Disponible en: https://publicaciones.eafit.edu.co/index.php/ecos-economia/article/view/1937/1948

ΔBA_i: Aerial biomass reservoir emission factor in terms of Mg per hectare.
ΔBS_i: Subway biomass reservoir emission factor in terms of Mg of CO_2 per hectare.
ΔLIT_i: Emission factor of the leaf litter reservoir in terms of Mg of CO_2 per hectare.

ΔMM_i: Emission factor of the dead biomass reservoir in terms of Mg CO_2 per hectare.
ΔCOS_{20i}: Emission factor of the 20-year soil organic carbon reservoir in terms of Mg CO_2 per hectare.

Carbon accounting for forest degradation and deforestation activities should be done separately. For this, the emission factor is multiplied by the number of deforested areas projected in the formulation scenario by activity according to its strata. Emissions from deforestation and forest degradation, based on project areas, are calculated as follows:

12.2 Projected baseline emissions in the baseline region

For deforestation activity:

$$CO2RRBDef_{i,t} = (RRBDef_{i,t}) * ECO2eq_i \quad (22)$$
$$CO2RRBDef_t = \sum CO2RRBDef_{i,t} \quad (23)$$

Where:

$CO2RRBDef_t$: CO_2 equivalent emissions from deforested forest in year t, reference region.
$CO2RRBDef_{i,t}$: CO_2 equivalent emissions from deforested forest of stratum i in year t, of the reference region.

For the forest degradation activity

$$CO2RRBDeg_{i,t} = (RRBDeg_{i,t}) * ECO2eq_i \quad (24)$$
$$CO2RRBDeg_t = \sum CO2RRBDeg_{i,t} \quad (25)$$

Where:

$CO2RRBDeg_{i,t}$: CO_2 equivalent emissions from degraded forest of stratum i in year t, of the reference region.
$CO2RRBDeg_t$: CO_2 equivalent emissions from degraded forest in year t, reference region.

12.3 Projected baseline emissions in project area:

$$CO2APBDef_{i,t} = (APBDef_{i,t}) * ECO2eq_i \quad (26)$$
$$CO2APBDef_{\ t} = \sum CO2APBDef_{i,t} \quad (27)$$

Where:

$CO2APBDef_{i,t}$: *CO_2 equivalent emissions from deforested forest of stratum i in year t, from the project area.*

$CO2APBDef_t$: *CO_2 equivalent emissions from deforested forest in year t, from the project area.*

$$CO2APBDeg_{i,t} = (APBDeg_{i,t}) * ECO2eq_i \quad (28)$$
$$CO2APBDeg_t = \sum CO2APBDeg_{i,t} \quad (29)$$

Where:

$CO2APBDeg_{i,t}$: *CO_2 equivalent emissions from degraded forest of stratum i in year t, from the project area.*

$CO2APBDeg_t$: *CO_2 equivalent emissions from degraded forest in year t, from the project area.*

12.4 Projected Baseline Emissions in the Leakage Belt:

$$CO2CFBDef_{i,t} = \left(CFBDef\ _{i,t}\right) * ECO2eq_i \quad (30)$$
$$CO2CFBDef_t = \sum CO2CFBDef_{i,t} \quad (31)$$

Where:

$CO2CFBDef_{i,t}$: *CO_2 equivalent emissions from deforested forest of stratum i in year t, from the leakage belt.*

$CO2CFBDef_t$: *CO_2 equivalent emissions from deforested forest in year t, from the leakage belt.*

$$CO2CFBDeg_{i,t} = \left(CFBDeg_{i,t}\right) * ECO2eq_i \quad (32)$$
$$CO2CFBDeg_t = \sum CO2CFBDeg_{i,t} \quad (33)$$

Where:

$CO2CFBDeg_{i,t}$: *CO_2 equivalent emissions from degraded forest of stratum i in year t, from the leakage belt.*

$CO2CFBDeg_t$: *CO_2 equivalent emissions from degraded forest in year t, from the leakage belt.*

12.5 Projected baseline emissions from wildfires:

Emissions from burning would be made when burned areas are identified and when this practice is used for the establishment of economic activities such as crops. Calculations of these emissions other than CO_2 are made in the following way; they will only be added when emissions other than CO_2 exceed 10% of total CO_2 emissions by type of area; when they are significant, they must be added in equation 39 in the same way as emissions in terms of CO_2 equivalents from equations 22, 26, and 32. The following equations are used to calculate the total emissions from burning other than CO_2:

$$ERRBDef_{i,t} = (RRBDef_{i,t}) * (ECH4eq_i + ENO2eq_i) \quad (34)$$

$$ERRBDef_t = \sum ERRBDef_{i,t} \quad (35)$$

$$EAPBDef_{i,t} = (APBDef_{i,t}) * (ECH4eq_i + ENO2eq_i) \quad (36)$$

$$EAPBDef_{\ t} = \sum EAPBDef_{i,t} \quad (37)$$

$$ECFBDef_{i,t} = \left(CFBDef_{\ i,t}\right) * (ECH4eq_i + ENO2eq_i) \quad (38)$$

$$ECFBDef_t = \sum ECFBDef_{i,t} \quad (39)$$

Where:

$ERRBDef_{i,t}$: *Emissions other than CO_2 from deforested forest of stratum i in year t, of the reference region.*

$ERRBDef_t$: *Emissions other than CO_2 from deforested forest in year t, reference region.*

$EAPBDef_{i,t}$: *Emissions other than CO_2 from deforested forest of stratum i in year t, from the project area.*

$EAPBDef_t$: *Emissions other than CO_2 from deforested forest in year t, from the project area.*

$ECFBDef_{i,t}$: *Different CO_2 emissions from deforested forest of stratum i in year t, from the leakage belt.*

$ECFBDef_t$: *Different emissions of CO_2 from deforested forest in year t, from the leakage belt.*

12.6 Estimation of baseline emissions potential:

To define the emissions potential for deforestation, the following equations are followed:

$$\mathrm{PEAPBDef}_t = (\mathrm{CO2APBDef}_{\ t} + \mathrm{EAPBDef}_{\ t}) \quad (40)$$

Where:

$PEAPDef$: *emissions potential of the deforestation compartment for year t, in the project area in terms of Mg CO_2 equivalent.*

$EAPBDef_t$: *Emissions other than CO_2 from deforested forest in year t, from the project area. This only applies when significant.*

$CO2APBDef_t$: *CO_2 equivalent emissions from deforested forest in year t, from the project area.*

$$\mathrm{PECFBDef}_t = (\mathrm{CO2CFBDef}_t + \mathrm{ECFBDef}_t) \quad (41)$$

$\mathrm{PECFBDef}_t$: *emissions potential of the deforestation compartment for year t, in the leakage belt in terms of Mg CO_2 equivalent.*

$CO2CFBDef_t$: *CO_2 equivalent emissions from deforested forest in year t, from the leakage belt.*

$ECFBDef_{i,t}$: *Emissions other than CO_2 from deforested forest of stratum i in year t, from the leakage belt. This only applies when significant.*

In the case of degradation, emissions from burning are taken as non-significant.

13. FORMULATION SCENARIO

13.1 Construcción del escenario de formulación para actividades RADDNP.

The formulation scenario for the project area is based on the assumed expected efficiency of the REDD+ activities implemented. It is recommended that this indicator be in the order of 70% to 90%, however, its choice must be justified by the proponent and the project owner must explain the implications of this assumption, especially in the case of indigenous[31] or tribal communities[32]; this indicator is called Ef. To do this, follow steps 2 and 4 of the baseline scenario, but in this case multiply the rate of deforestation and forest degradation by the factor Ef, and then proceed to step 5 to calculate the expected project emissions.

Step 2: Projected deforestation in the reference region in the baseline scenario:

The Puyravaud deforestation rate is used to project future deforestation with the following equation:

$$RRBDef_{i,t} = ARRB_{i,t-1} * (RRTasDef_{i,t} * Ef) \qquad (42)$$

Where:

$RRBDef_{i,t}$ *: corresponds to the projected deforestation for stratum i in year t for the reference region, in hectares.*

$ARRBDef_{i,t-1}$*: corresponds to the forest assets of stratum i in the year prior to deforestation in the reference region, in hectares.*

$RRTasDef_{i,t}$*: deforestation rate for stratum i between period t_1 and t_2 for the reference region.*

Ef*: Efficiency factor due to RUDDA activities is 70% to 90%.*

With the rate of forest degradation resulting from the scarcity function, future deforestation is projected with the following equation:

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[31] Peoples who [are descended] from populations inhabiting the country or a geographical region to which the country belongs at the time of conquest or colonization or the establishment of present state boundaries and who, irrespective of their legal status, retain some or all of their own social, economic, cultural and political institutions; Convention 169/1989.

[32] Communities whose social, cultural and economic conditions distinguish them from other sections of the national community and which are governed wholly or partially by their own customs or by special laws" and indigenous peoples as such; Convention 169/1989.

$$RRBDeg_{i,t} = ARRB_{i,t-1} * (RRTasDeg_{i,t} * Ef) \qquad (43)$$

Where:

$RRBDeg_{i,t}$ *: corresponds to the projected forest degradation for stratum i in year t for the reference region, in hectares.*

$ARRB_{i,t-1}$*: corresponds to the forest assets of stratum i in the year prior to forest degradation in the reference region, in hectares.*

$RRTasDeg_{i,t}$*: the forest degradation rate for stratum i between period t_1 and t_2 for the region of reference.*

Ef*: Efficiency factor due to RUDDA activities is 70% to 90%*

Future deforestation can also be determined by using regression models such as Poveda and Manrique's logistic regression model [33]:

$$RRDef_{i,t} = \frac{RRK}{1 - e^{a+(b*Ef)t}} \qquad (44)$$

Where:

$RRBDef_{i,t}$ *: corresponds to the projected deforestation for stratum i in year t for the reference region, in hectares.*

RRK : Forest susceptible to deforestation in the reference region, in hectares.

e: euler constant.

a: Corresponds to the model constant.

b: It is the rate of change for the model between periods t_1 and t_2 for the reference region.

Ef*: Efficiency factor due to RUDDA activities is 70% to 90%.*

In the case of the leakage belt, steps 3, and 4 and then step 5 are followed as follows:

Step 4: deforestation projection in the potential leakage area of the GHGMP, in the baseline scenario:

With the Puyravaud deforestation rate for the project area, the following equation is used:

$$CFBDef_{i,t} = ACFB_{i,t-1} * (RRTasDef_{i,t} * (1 + FI)) \qquad (45)$$

Where:

$CFBDef_{i,t}$ *: corresponds to the projected deforestation for stratum i in year t for the leakage area, in hectares.*

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[33] Poveda G, H Manrique. 2007. Aplicación de la curva logística a los censos de la ciudad de Medellín. Ecos de Economía: A Latin American Journal of Applied Economics, 11(25): 7-60. Available in: https://publicaciones.eafit.edu.co/index.php/ecos-economia/article/view/1937/1948

$\mathrm{ACFB}_{\mathrm{i,t-1}}$: *corresponds to the forest assets of stratum i in the year prior to deforestation in the leakage area, in hectares.*
$RRTasDef_{i,t}$: *the deforestation rate for stratum i between period t_1 and t_2 for the reference region.*
FI: Increase factor for projected leakage in the formulation scenario, equivalent to 10%.

With the degradation rate as a product of the scarcity function it is necessary to complement it with the following equation:

$$CFBDeg_{i,t} = ACFB_{i,t-1} * (RRTasDeg_{i,t} * (1 + FI)) \qquad (46)$$

Where:
$CFB\mathrm{Deg}_{\mathrm{i,t}}$ *: corresponds to the projected forest degradation for stratum i in year t for the potential leakage area, in hectares.*
$\mathrm{ACFB}_{\mathrm{i,t-1}}$: *corresponds to the forest assets of stratum i in the year prior to forest degradation in the project area, in hectares.*
$RRTasDeg_{i,t}$: *the forest degradation rate for stratum i between period t_1 and t_2 in the reference region.*
FI: Factor of increase due to projected leakage in the formulation scenario, equivalent to 10%.

In the case of Poveda and Manrique's logistic regression model [34], this projection would look like this:

$$CFDef_{i,t} = \frac{CFK}{1 - e^{a+(b*(1+FI))t}} \qquad (47)$$

Where:
APK : The forest susceptible to deforestation in the project area, in hectares.
e: euler constant.
a: Corresponds to the model constant.
b: It is the rate of change for the model between periods t_1 and t_2 of the reference region.
FI: Factor of increase due to projected leakage in the formulation scenario, equivalent to 10%.

For this purpose, the following is shown in

Table 5, and the same methodology should be followed for the forest degradation stock.

These new emissions from the formulation scenario must be discounted for each land use change category for the project area, reference region and potential leakage area. The difference between the formulation scenario and the baseline scenario in terms of emissions is where the COLCERS result is obtained.

[34] Poveda G, H Manrique. 2007. Aplicación de la curva logística a los censos de la ciudad de Medellín. Ecos de Economía: A Latin American Journal of Applied Economics, 11(25): 7-60. Disponible en: https://publicaciones.eafit.edu.co/index.php/ecos-economia/article/view/1937/1948

Table 5. Calculated tradable quotas for deforestation stock.

Year t	Baseline $\mathrm{PEAPBDef}_t$	Formulation scenario $\mathrm{PEAPBDef}_t$	Baseline $\mathrm{PECFBDef}_t$	Formulation scenario $\mathrm{PECFBDef}_t$	$\Delta PET\mathrm{Def}_t$
1	X	Y	x	y	(X-Y)-(x-y)
2	.	.	.	.	.
3	.	.	.	.	.
4	.	.	.	.	.
...	...	...	...	...	...

ΔPETDeft: is the difference in terms of emissions for the deforestation compartment, considering leakage.

Once the estimation of the emissions projection in the baseline scenario and its subtraction with the formulation scenario have been made, the estimation of COLCERS, COLCX carbon certificates, is made with the following formula:

For the deforestation compartment:

$$COLCERSDef_t = ((\Delta PETDeft) - (\Delta PETDeft * RNP \;) \quad (48)$$

Where:

$COLCERSDef_t$: baseline COLCX certificates that are attributable to avoided deforestation activities.
RNP: Risk of non-permanence,

For the forest degradation compartment, it is performed as follows:

$$COLCERSDeg_t = (\Delta EPT_{Degt}) - (\Delta EPT_{Degt} * RNP) \quad (49)$$

Where:
$COLCERSDef_t$: baseline COLCX certificates that are attributable to avoided forest degradation activities.
RNP: Risk of non-permanence.

14. MONITORING AND QUANTIFICATION OF EMISSIONS AND REMOVALS OF GHG

14.1 Reducing Emissions from Deforestation (REDef)

Thematic maps and GIS-supported mapping, as mentioned in the activity data section, should be generated for the project area after the project start date. This information should be supplemented by monitoring the deforestation drivers identified in the project area and leakage belt in the baseline scenario. In this case, all activities undertaken to avoid unplanned deforestation should be properly documented. These can be based on activities framed within:

1. Capacity strengthening, these activities consist of activities or strategies that the proponent already had, but due to lack of climate finance has not been able to implement as expected. In this sense, the proponent must demonstrate that the strengthening of these strategies or policies is reducing unplanned deforestation.
2. Sustainable ethno-development strategies that impact the underlying causes of deforestation or generate livelihood opportunities for previously identified agents of deforestation within the project area or leakage belt. If these activities include the implementation of FAR or forest plantations and the project contemplate sustainable forest management (SFM) and/or Increase of Carbon Reserves, these cannot be taken as objective evidence to verify reductions, nor as a start date activity for the unplanned deforestation and forest degradation reduction activity.
3. Natural resource management programs that demonstrate that the proponent is establishing deforestation control strategies. These consist of new activities, different from the activities that the proponent had in place prior to project implementation and assist in the reduction of unplanned deforestation. They may include the implementation of new policies and the generation of new strategies to combat unplanned deforestation.
4. Strengthening of forest governance, these activities are framed in five variables: i) strengthening of legal certainty of the territory and local organizations, ii) local organization for the administration of land tenure rights and obligations, iii) management of conflicts over land tenure and natural resources, iv) land use and natural resources management, and v) territorial development plan and linkages with other key actors[35].

Monitoring of these activities should be performed on a year-to-year basis. On the other hand, if significant new emission sources are identified during the

[35] FAO. Análisis de la gobernanza de la tenencia de la tierra en comunidades y territorios indígenas. [en línea]. 2015. Consulted on October 3rd, 2022. Availabe in: https://www.fao.org/3/av206s/av206s.pdf

monitoring period, the baseline scenario should be reevaluated to maintain consistency.

14.2 Reducing Emissions from Forest Degradation (REDeg)

Where unplanned forest degradation reduction activities are implemented together with unplanned deforestation reduction activities, the activities after the project start date that fall under the four types of project activities defined in 14.1 must be demonstrated and must also have implications for reducing forest degradation.

As with the reduction of unplanned deforestation, these activities should be monitored year by year and if significant emission sources are found during the formulation scenario, the baseline scenario should be re-evaluated.

14.3 Estimation of the COLCERS of the implementation scenario

For the calculation of COLCERS resulting from forest degradation and deforestation activities in the formulation scenario, we start from the calculations of the areas of $APBDef_{i,t}$ and $CFBDef_{i,t}$ for unplanned deforestation reduction, and $APBDeg_{i,t}$ and $CFBDeg_{i,t}$ for unplanned forest degradation; for these two activities year by year in the credit period are made with primary information based on GIS analysis.

For carbon calculations, the methodology should be carried out in the same way as in the baseline scenario, except that the reports of deforested areas are based on actual and not projected data. For this, it is assumed that deforestation for each area of the GHGMP counts as projected in step 2 of the baseline methodology and then actual emissions are calculated based on the subsequent steps. The difference between the baseline scenario and the formulation scenario is made based on the formulas 42 and 43.

15. MONITORING PLAN

The proponent of the GHGMP must monitor on an annual basis the activities that are implemented in the REDD+ initiative immediately after the project start date in order to adequately track the GHG reductions and/or removals that are obtained by the execution of its activities and not by external agents or causes in the lifetime period, the behavior and control of the agents and causes of deforestation/degradation and compliance with the safeguards

This monitoring plan should be carried out in the spatial limits of each activity present in the GHGMP, to corroborate the effectiveness of each REDD+ activity, the spatial limits assigned to each activity should be georeferenced and available in a geographic information system (GIS), where the leakage management area and the potential leakage area should also be included.

Monitoring of carbon stock change and revalidation of the baseline scenario

The baseline scenario must be validated every 10 years after the start date of the PMGEI to characterize and demonstrate changes in the behavior of the agents and/or causes of deforestation/degradation, spatially adjusting the location and deforested areas according to the data monitored annually. To revalidate the baseline scenario, the historical and projection periods that best fit the verified periods should be considered, so that the uncertainty generated is minimal and the data is consistent with the number of removals/reductions credited.

Data and parameters to monitor

Data/Parameter	Area
Unit of measure	Hectares (ha).
Description	Area of permanent forest
Source of information	Indicate where the information will be obtained from.
Values applied	
Choice of data or measurement methods and procedures	Show formulas or sections of the document where these procedures are presented.
Purpose of the information	Project boundary monitoring.
Quality control and quality assurance activities	
Additional information	

The table above shows the minimum criteria to be included by the developer according to the mandatory variables shown in the annexes section **Table 6**. Summary of variables applicable to the project.

A monitoring plan proposed by the developer must be established, including a technical description of the monitoring, data to be collected, description of how the data will be collected, procedures to ensure the management and quality of the information. To ensure the traceability of the GHGMP, all information used, calculated and performed either by the developer or obtained as a reference must be documented and archived until the lifetime of the GHGMP and left under the responsibility of the proponent. All of this corresponds to documented project information, which must be preserved until at least three verifications of the GHGMP.

16. REDD+ SAFEGUARDS

The REDD+ safeguards constitute a common global framework that must be applied to REDD+ projects in accordance with decision 1/COP.16 paragraph 19. Since the UNFCCC, these safeguards have been designed to comply with human rights, environmental protection and governance obligations. These measures arise to address adverse impacts associated with an activity, in this case, those activities related to the project[36]. In this sense, their full recognition, management and handling is fundamental not only to identify and address risks but is also an opportunity to promote multiple social and environmental benefits.

There are a series of safeguards adopted by different international entities such as the Forest Carbon Partnership Facility (FCPF), the Forest Investment Program (FIP) and the Global Environment Facility (GEF), among others. However, the conformity assessment of a REDD+ project, in the first instance, is based on the UNFCCC Cancun Safeguards; and in the second instance, on each country's interpretation of these safeguards, since the Cancun safeguards are general principles, and each country must be responsible for interpreting their scope based on its national context[37].

Therefore, for the following methodology, the Cancun safeguards apply over any international interpretation or document that may contain different concepts on safeguards, including those of a national nature. To give adequate treatment to these safeguards it is necessary to consider the following principles:

- Guarantee of the ethnic and differential approach
- Guarantee of the free, prior and informed consent of the community or communities in decision making
- Full and effective participation of the community or communities
- Respect and recognition of the ancestral and legal authorities of the communities
- Management and maintenance of documented project information

The following diagram illustrates the articulation of the products necessary to comply with the Cancun safeguards according to the COLCX standard. The products are identified by color according to the corresponding Safeguard and are written in a reduced form, so it is necessary to read this section:

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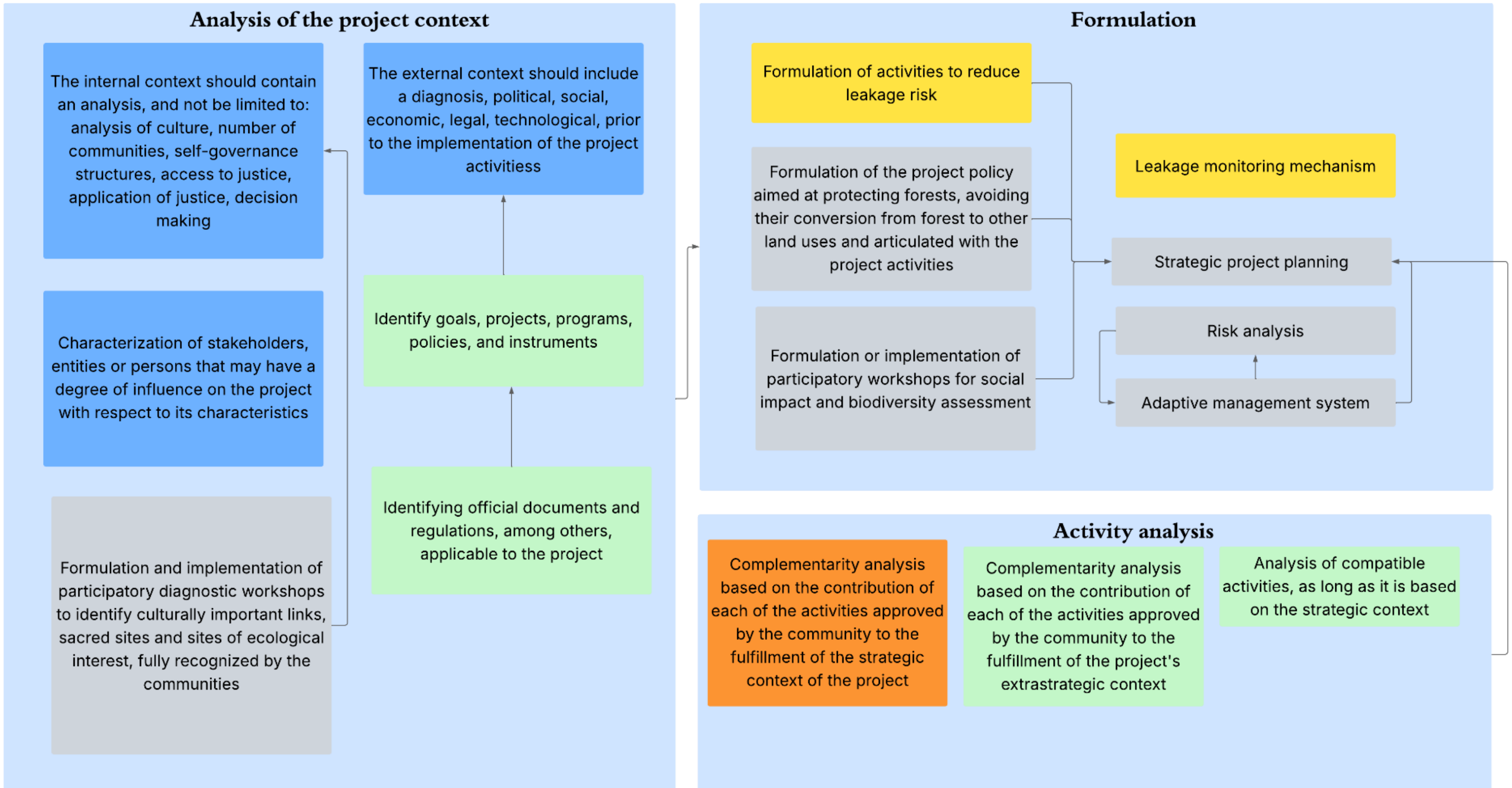
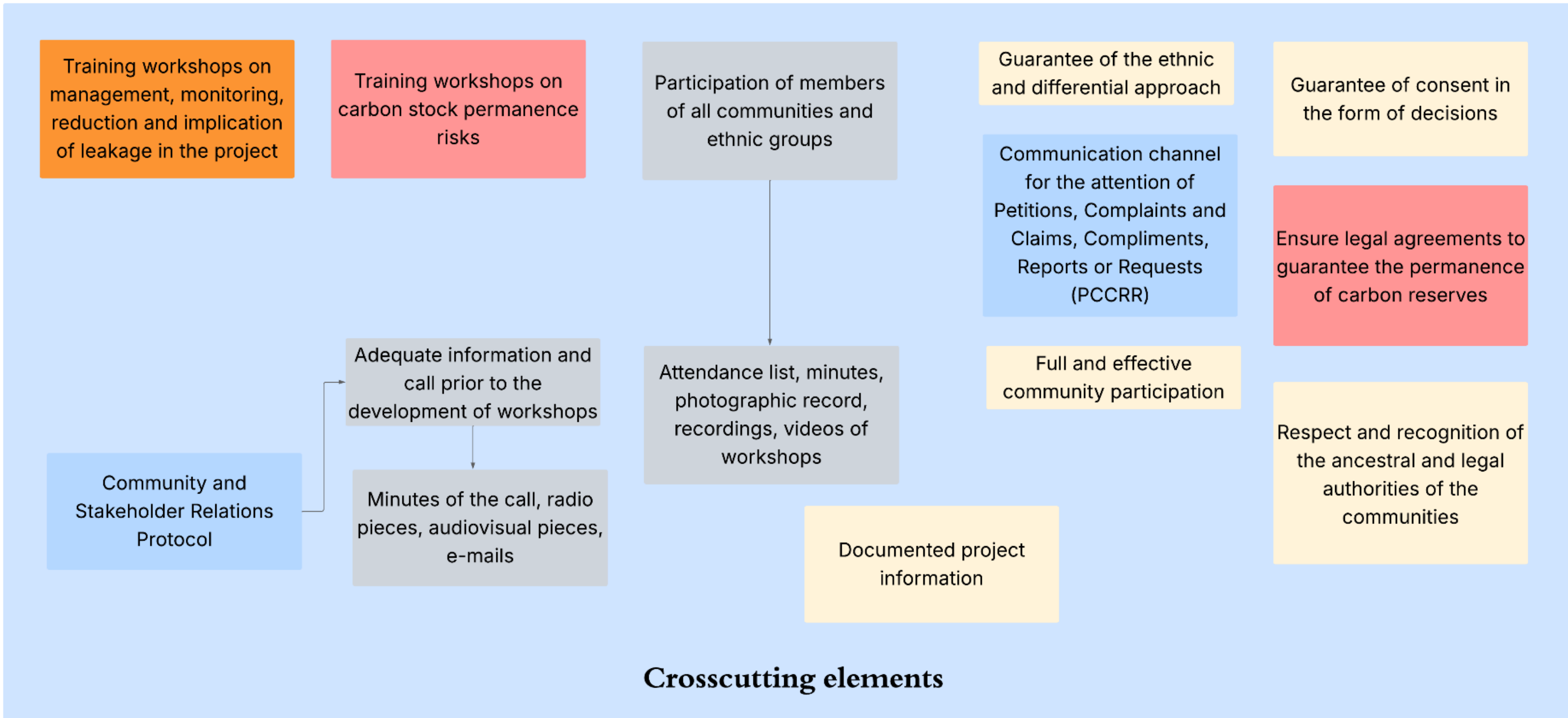
[36] Rey, D., Roberts, J., Korwin, S., Rivera, L., and Ribet, U. (2013) Guía para Comprender e Implementar las Salvaguardas REDD+ de la CMNUCC. ClientEarth, Londres, Reino Unido.

[37]https://unfccc.int/resource/docs/2010/cop16/spa/07a01s.pdf


Analysis of the project context
The internal context should contain an analysis, and not be limited to: analysis of culture, number of communities, self-governance structures, access to justice, application of justice, decision making
The external context should include a diagnosis, political, social, economic, legal, technological, prior to the implementation of the project activitiess
Characterization of stakeholders, entities or persons that may have a degree of influence on the project with respect to its characteristics
Identify goals, projects, programs, policies, and instruments
Formulation and implementation of participatory diagnostic workshops to identify culturally important links, sacred sites and sites of ecological interest, fully recognized by the communities
Identifying official documents and regulations, among others, applicable to the project
Formulation
Formulation of activities to reduce leakage risk
Leakage monitoring mechanism
Formulation of the project policy aimed at protecting forests, avoiding their conversion from forest to other land uses and articulated with the project activities
Strategic project planning
Formulation or implementation of participatory workshops for social impact and biodiversity assessment
Risk analysis
Adaptive management system
Activity analysis
Complementarity analysis based on the contribution of each of the activities approved by the community to the fulfillment of the strategic context of the project
Complementarity analysis based on the contribution of each of the activities approved by the community to the fulfillment of the project's extrastrategic context
Analysis of compatible activities, as long as it is based on the strategic context



Conventions

Safeguard a: The complementarity or compatibility of the measures with the objectives of national forest programs and international conventions and agreements on the subject;

Safeguard b: Transparency and effectiveness of national forest governance structures, taking into account national legislation and sovereignty;

Respect for the knowledge and rights of indigenous peoples and members of local communities, taking into consideration relevant international obligations and national circumstances and legislation, and bearing in mind that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Communities;

The full and effective participation of stakeholders, in particular indigenous peoples and local communities, in the measures referred to in paragraphs 70 and 72 of this decision;

The compatibility of the measures with the conservation of natural forests and biological diversity, ensuring that the measures identified in paragraph 70 of this decision are not used for the conversion of natural forests, but instead serve to incentivize the protection and conservation of these forests and their ecosystem services and to enhance other social and environmental benefits;

The adoption of measures to address the risks of reversion;

The adoption of measures to reduce the displacement of emissions

Project principles

Figure 6 *Diagram of relationship between products and principles to comply with the Cancun Safeguards.*

a. The complementarity or compatibility of the measures with the objectives of national forestry programs and international conventions and agreements on the matter.

To comply with this safeguard, the developer must conduct an analysis of all applicable national policies, programs or projects, from the international to the local level. To do so, the following steps must be followed:

1. All official documents and regulations applicable to the project must be identified, considering their spatial scope and policies regarding climate change, REDD+, forests, economic activities, ecological restoration, land management plans, forest management plans, life plans, among others.
2. Once the applicable programs, projects, policies and management instruments have been identified, their goals, objectives and/or scope should be identified (this will be called the strategic context of the project; this context should be used as the political diagnosis of the external context).
3. After this, to support the compatibility of the project, the project developer must justify how the project activities, one by one, are compatible with the strategic context of the project. For this purpose, an analysis must be carried out to justify how the project activities contribute to the fulfillment of the goals, objectives and/or scope of the project's strategic context; this analysis must be carried out to contribute to the project's strategic planning.
4. Finally, to demonstrate complementarity, the project may propose other actions that are related to the strategic context of the project, such as agroforestry systems, sustainable livestock, more efficient governance processes, among others. For this purpose, another analysis must be carried out to demonstrate that these new activities do not go against the goals, objectives and/or scope of the project's strategic context; this analysis must be carried out to contribute to the project's strategic planning.

b. Transparency and effectiveness of national forest governance structures, considering national legislation and sovereignty.

The project proponent must demonstrate that the governance arrangements created by the REDD+ project, or those prior to the implementation of activities, as well as the treatment of information, comply with the legal criteria of the country where the project is developed.

To ensure the transparency and effectiveness of forest governance structures, an analysis of the project context should be carried out. This should be based on:

1. The internal context should include, and not be limited to, an analysis of internal project factors such as culture, number of communities, governance structures, internal processes such as access to justice, decision making, enforcement of justice, among others.
2. The external context should consider a political, social, economic, ecological, legal and technological diagnosis prior to the implementation of the project activities.
3. Characterization of the stakeholders, entities or persons that may have a degree of influence on the project, taking into account whether they are: 1) natural or legal; 2) local, regional, national or international; 3) the degree of influence and relationship with the project; 4) their relationship with the forest resource; 5) the relationships that exist with other identified stakeholders.

This context analysis should be used to generate the community and stakeholder engagement protocol, formulation of leakage risk reduction activities, formulation of project policy, training workshops on carbon reserves permanence risks, training workshops on project leakage management, monitoring, reduction and implication of leakage, and project risk analysis.

In any case, the project must demonstrate the differential approach through the development of a protocol for relations with the communities and stakeholders based on the analysis of the project context. This protocol must include at least: 1) the use of translators and appropriate language; 2) respect for the uses, customs and traditions of the communities and stakeholders; 4) the use of educational materials that must be promoted through media such as the internet, radio, television, brochures, banners, workshops, etc.

The project must guarantee the implementation and maintenance during its lifetime of a communication channel for the attention of Petitions, Complaints, Claims, Compliments, Reports, or Inquiries (PCCCRI), which must be socialized to the communities and stakeholders. This channel must consider a protocol for handling PCCCRI, such as response times, response forms, mechanisms for access to justice, information processing and an adaptive management system. At the time of the conformity assessment, the project must demonstrate that the PCCCRI system is fully operational.

To evidence compliance with this safeguard, the project must keep copies of audio and/or video of the development of workshops with communities and stakeholders, attendance lists, minutes of workshops, e-mails sent, web pages used, recordings of video calls, recordings of radio spots or radio pieces, and copies of products obtained from workshops such as survey responses, billboards, among others.

Finally, a clause should be included in the contract with the project owner to prevent any type of information from being concealed from the audit process, in accordance with ISO 14604-3. It is also recommended that a confidentiality contract be drawn up with the entity in order to reduce the risk of information leakage.

c. Respect for the knowledge and rights of indigenous peoples and members of local communities, taking into consideration relevant international obligations and national circumstances and legislation, and bearing in mind the adoption by the United Nations General Assembly of the United Nations Declaration on the Rights of Indigenous Peoples.

Based on the analysis of the project context and the protocol for community relations, participatory diagnostic workshops should be conducted to identify places of cultural importance, sacred sites and sites of ecological interest that are fully recognized by the communities. This diagnosis should be used to provide a cultural analysis of the community. This should be done through participatory social mapping workshops. Once these places or sites are recognized, the developer and the proponent must develop activities that promote their restoration, conservation or preservation.

Social and Biodiversity Impact Assessment workshops should be conducted using recognized methodologies. These workshops should identify social and biodiversity issues, their impact on vulnerable social groups and groups of interest, as well as the activities needed to solve them based on the experience of the community and guidance from the developer. In any case, it must be ensured that all project activities arise from the community, with guidance from the developer, and respond to the solution of local problems. This workshop should be used to provide cultural analysis of the community. To carry out this workshop, at least the following steps should be considered:

1. The context of the project must be clear, for this a preliminary analysis must be made to frame the internal context, which should already consider the participatory diagnostic workshops to identify places of cultural importance, sacred sites and sites of ecological interest, the analysis of the eternal context and the characterization of the stakeholders.

2. Issues should be clearly grouped into general topics of interest in a participatory manner for the community that lead to deforestation occurring directly or indirectly, such as access to food, education, health, gender equity, forest management, self-governance, and monitoring, reporting and verification. These names may vary according to the community's cosmovision and context. It is recommended to hold working groups by interest groups or focus groups to speed up the definition of the general topics of interest in a participatory manner.

3. Also, in a participatory manner, a causal diagram of problems that lead to the deterioration of the general topic of interest should be generated. Methodologies such as problem flowcharts, problem trees, fishbone diagrams, among others, can be used. The important thing is to clearly identify the problem, its effects and causes.

4. The results proposed by the community, with guidance from the developer, provide solutions to the problems, trying to attack the causes that generate them. Once the activities and their timing, short, medium and long term, have been identified, a risk analysis of the activities should be carried out, trying to identify strengths and opportunities that may arise in the face of

threats or vulnerabilities of carrying out an activity; this risk analysis is recommended to be developed in a participatory manner. Finally, using the theory of change demonstrates that these activities will achieve the expected impact[38].

Once the activities and their risk analysis have been identified, it is necessary to carry out strategic planning to ensure harmony among the proposed activities to avoid reprocesses and guarantee objectives. In this sense, the following steps are followed:

1. Group activities into strategies by topics of interest, which will be defined as strategic objectives.
2. Strategic alignment should be carried out to ensure that the objectives of the strategies do not contradict or are the same as those of other strategies of the same project; and to guarantee that the people of the communities understand the possible impact that the implementation of the strategies may have. This is achieved by homologating activities that are very similar, eliminating activities that do not address the causes of the problems, or changing the focus of an activity or strategy to another topic of interest with which it is better articulated.
3. A budget analysis of the implementation of the strategies for the life of the project should be carried out. This can include an analysis of the economic viability recognized for the project's proposed activities.

4. An internal control system should be established that identifies those responsible for the implementation of the strategy(s) and its products or issues of interest. This internal control system should be articulated with the systems of access to justice and the community's own mechanisms to exercise justice.

In the strategic planning of the project, emphasis should be placed on those proposed activities that promote traditional uses and the strengthening of the culture of the ethnic group(s). All project activities must be agreed upon and consented to by the community, and this must be supported by recordings of workshops held, workshop minutes and attendance lists.

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[38] Rogers, P. (2014). Theory of change. Methodological briefs: Impact evaluation, 2(16), 1-14.

The ancestral decision-making and legal figures for signing contracts, such as the legal representative, representative or holder of the community, who are recognized and registered by the competent state entity, must always be identified and respected.

The principle of private autonomy and the self-determination of the people must be respected, therefore, any agreement between private parties cannot be subject to interpretations or interventions by third parties such as conformity assessment bodies or certifiers, as this is framed in private law.

d. The full and effective participation of stakeholders, in particular indigenous peoples and local communities, in the measures referred to in paragraphs 70 and 72 of this decision [decision 1/COP.16].

The participation of the communities and ethnic groups identified during the internal context analysis must be guaranteed. To this end, the attendance of the communities and/or ethnic groups at the participatory social mapping workshops and biodiversity social impact assessment workshops must be guaranteed. This should be supported by workshop minutes, recordings and, most importantly, attendance lists that clearly identify the ethnic origin, community and allow for clear identification of the person participating in these workshops.

Adequate information and notice must always be given prior to the development of workshops, activities, implementation of the PCCCRI system, in a clear and transparent manner, taking into account a reasonable time frame. For this purpose, the developer can use socialization minutes prior to the development of activities that show, through photographic record, the previous information and call for the development of activities; radio pieces; audiovisual pieces; e-mail messages as long as the differential approach is considered.

e. The compatibility of measures with the conservation of natural forests and biological diversity, ensuring that the measures identified in paragraph 70 of the present decision are not used for the conversion of natural forests, but instead serve to incentivize the protection and conservation of these forests and their ecosystem services and to enhance other social and environmental benefits.

The definition of the project policy must be carried out in a participatory manner, in this sense it is necessary that all activities formulated by the project are harmonized with it, so that the policy allows the identification of the spatial, temporal and activity limits of the project, as well as the criteria used for the development of the project. The project policy must be oriented to the protection of forests, avoid the conversion of forests to other land uses and must be articulated with the project activities and reduce the risks of non-permanence of carbon reserves. This policy must be internalized by the project participants and must be actively disseminated in each community.

An analysis should be presented that shows the affinity of each activity agreed upon with the community with the project's policy. Strategic planning of project activities should be carried out considering methodologies such as the logical framework matrix, trying to identify programs, projects and indicators for each activity.

f. Adoption of measures to address the risks of reversion.

During the risk identification of project activities in step 4 of safeguard 'c', the possibility that any project activity may generate or promote deforestation or forest degradation should be considered. Activities should also be formulated based on the analysis of drivers, agents and underlying causes of deforestation and/or forest degradation that address the causes of deforestation and/or forest degradation.

An adaptive management system should be in place for the accuracy of project indicators and activities, so that these are more responsive to project needs and are not causing deforestation or forest degradation. This system should be reported in the PDD.

Within the legal agreements with the community or communities, decisions that promote the permanence of carbon reserves and avoid the conversion of forests into other types of uses in the short and long term must be guaranteed.

This should be clearly established in the contract or agreements made with the community that are legal or binding in nature.

Workshops or sections within training workshops should be carried out to provide the community or communities with clarity on the risks of reversion and non-permanence and their main implications for the project. This is supported by workshop minutes and attendance lists that demonstrate the full and effective participation of the communities in these workshops.

g. Adoption of measures to reduce the displacement of emissions.

A mechanism for monitoring leakage should be in place so that leakage can be properly identified. In this sense, deforestation and forest degradation activities that, based on solid evidence, are not caused by internal project agents should not be quantified as leakage.

Activities should be established within the strategic planning of the project to reduce leakage.

Workshops or sections within training workshops should be conducted to provide the community or communities with clarity on leakage, leakage monitoring mechanisms, leakage reduction activities and their main implications for the project. This is supported by workshop minutes and attendance lists that demonstrate the full and effective participation of the communities.

17. ADDITIONAL

For the COLCX program, the concept of additionality and the process for its evaluation was developed based on the generation methods defined by the Clean Development Mechanism (CDM) and specifically for the Colombian context by the criteria of Resolution 1447 of 2018.

The mechanisms for demonstrating the additionality of a GHGMP are as follows:

- Identification of alternative land use scenarios to the GHGMP: Identify alternative land use scenarios to the GHGMP activities.
- Investment Analysis and/or Barrier Analysis Selection.

Investment Analysis: Determine whether the activities proposed by the GHGMP are financially feasible, without considering COLCERS funding, and that these activities are less financially attractive compared to the consistent scenarios.

Barrier analysis: Can be performed instead of or as an extension of the investment analysis. If this step is used, determine whether the proposed project activity faces barriers that:

a) Avoid implementation of this type of proposed project activity without the proceeds from the sale of GHG credits; and

b) Do not prevent the implementation of at least one of the alternative land use scenarios.

- Analysis of common REDD+ practices: Identify similar activities that have been implemented before or are currently underway. Similar activities are defined as those activities that are similar to those of the PMGEI in terms of scale, setting, regulatory framework.

The proponent of the mitigation initiative shall demonstrate the additionality of the project activity through the application of the COLCX Guide to Demonstrate Additionality as defined by the COLCX Program, so that if the mitigation initiative meets the evaluation criteria defined in the referred instrument, it may be considered additional.

18. MANAGEMENT OF REVERSION RISKS, NON-PERMANENCE RISKS AND UNCERTAINTIES

The coverage of reversal risks for the ColCX program consists of monitoring key indicators that allow identifying the integrity of carbon stocks in the long term. This is done through the calculation of non-permanence risks and the buffer mechanism, which, once carbon losses greater than the projected reductions or removals are reported, the program will deduct these emissions from the buffer.

In a GHGMP, non-permanence risks are defined based on the internal and external context on which political, economic, ecological, social, technological and legal factors depend, as described in the *ColCX Guide for the management of reversal risks, non-permanence risks and uncertainty*.

Likewise, to reduce all types of errors, this methodology considers the following criteria:

- Uncertainties will be calculated based on IPCC guidelines. On the other hand, errors from carbon reservoirs should be clearly identified and described.
- Based on this, the proponent must demonstrate that year to year for any given emissions estimate, the calculated uncertainty is less than 10%.
- A statement of uncertainty should be made, considering a clear conceptualization of the measurements and ways of measuring the different variables involved in carbon accounting.
- The bidder must include a protocol for data collection in the field, including the measurement instruments, their technical specifications and the ways in which measurement errors are expected to be reduced, such as calibration methods, training, among others.
- The proponent should make a clear identification of the uncertainty related to the models used in the analysis of alternatives for the construction of the baseline scenario. The uncertainty in the models should be key to the choice of the most appropriate model. To ensure that its absolute percentage error (MAPE) is the minimum possible.
- For activity data, the proponent must perform confusion matrices, identify based on these errors of commission and omission, construct confidence intervals for each category and ensure that these are less than 10%. The uncertainty in the activity data should be calculated year by year.
- In the case of areas without information, the proponent must have a protocol for the treatment of these areas. This protocol must consider the criteria of conservatism, accuracy and integrity.

The GHGMP must follow the guidelines defined in the most recent version of the “ColCX Guide for the management of reversal risks, non-permanence risks and uncertainty”.

19. CONTRIBUTION TO THE SDG

The proponent of the mitigation initiative shall indicate in detail how the proposed GHG emissions removal activity contributes to sustainable development in the area of influence, taking as a reference the indicators associated with the SDG of the United Nations, taking them to a local scale.

Likewise, if there are sustainable development objectives or indicators specific to the proponent's host country or specific to the mitigation initiative, the contribution to these will also be validated.

The GHGMP must consider the criteria defined in the **“ColCX Guidelines for Reporting Contributions to the Sustainable Development Goals – SDG”** in its most updated version.

20. ANNEXES

Table 6 *Summary of variables applicable to the project*

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
$ECH4eq_i$	CH4 emission factor per stratum i burned	10.1 Unplanned emission reduction activities	(2) $ECH4eqi = ECO2eqi * 12/44 * RMCH4 * TCH4$ (34) $ERRBDef_{i,t} = (RRBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$ (36) $EAPBDef_{i,t} = (APBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$ (38) $ECFBDef_{i,t} = (CFBDef_{\ i,t}) * (ECH4eq_i + ENO2eq_i)$	$ECH4eq_i$	CH4 emission factor per stratum i burned	10.1 Unplanned emission reduction activities
$\mathbf{ECO2eq_i}$	Emission factor of stratum i	10.1 Unplanned emission reduction activities	(2) $ECH4eqi = ECO2eqi * 12/44 * RMCH4 * TCH4$ (3) $ENO2eqi = ECO2eqi * 12/44 * RMNO2 * TNO24 * NC$ (21) $ECO2eq_i = (\Delta BA_i + \Delta BS_i + \Delta LIT_i + \Delta MM_i + \Delta COS_{20i})$ (22) $CO2RRBDef_{i,t} = (RRBDef_{i,t}) * ECO2eq_i$ (24) $CO2RRBDeg_{i,t} = (RRBDeg_{i,t}) * ECO2eq_i$ (26) $CO2APBDef_{i,t} = (APBDef_{i,t}) * ECO2eq_i$ (28) $CO2APBDeg_{i,t} = (APBDeg_{i,t}) * ECO2eq_i$ (30) $CO2CFBDef_{i,t} = (CFBDef_{\ i,t}) * ECO2eq_i$ (32) $CO2CFBDeg_{i,t} = (CFBDeg_{i,t}) * ECO2eq_i$	$\mathbf{ECO2eq_i}$	Emission factor of stratum i	10.1 Unplanned emission reduction activities
$RMCH4$	Methane to carbon molecular ratio constant given by 16/12	10.1 Unplanned emission reduction activities	(2) $ECH4eqi = ECO2eqi * 12/44 * RMCH4 * TCH4$	$RMCH4$	Methane to carbon molecular ratio constant given by 16/12	10.1 Unplanned emission reduction activities
TCH4	Methane emission rate 0,012	10.1 Unplanned emission reduction activities	(2) $ECH4eqi = ECO2eqi * 12/44 * RMCH4 * TCH4$	**TCH4**	Methane emission rate 0,012	10.1 Unplanned emission reduction activities

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
$ENO2eq_i$	NO2 emission factor of stratum i burned	10.1 Unplanned emission reduction activities	(3) $ENO2eqi = ECO2eqi * 12/44 * RMNO2 * TNO24 * NC$ (34) $ERRBDef_{i,t} = (RRBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$ (36) $EAPBDef_{i,t} = (APBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$ (38) $ECFBDef_{i,t} = (CFBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$	$ENO2eq_i$	NO2 emission factor of stratum i burned	10.1 Unplanned emission reduction activities
$RMNO2$	Molecular ratio constant of nitrogen dioxide and nitrogen given by 44/28	10.1 Unplanned emission reduction activities	(3) $ENO2eqi = ECO2eqi * 12/44 * RMNO2 * TNO24 * NC$	$RMNO2$	Molecular ratio constant of nitrogen dioxide and nitrogen given by 44/28	10.1 Unplanned emission reduction activities
$TNO24$	Methane emission rate 0,007	10.1 Unplanned emission reduction activities	(3) $ENO2eqi = ECO2eqi * 12/44 * RMNO2 * TNO24 * NC$	$TNO24$	Methane emission rate 0,007	10.1 Unplanned emission reduction activities
NC	Nitrogen-carbon ratio 0,01	10.1 Unplanned emission reduction activities	(3) $ENO2eqi = ECO2eqi * 12/44 * RMNO2 * TNO24 * NC$	NC	Nitrogen-carbon ratio 0,01	10.1 Unplanned emission reduction activities
ΔBA_i	Aerial biomass reservoir emission factor	11.2 Emission Factors	(4) $\Delta BA_i = (BA_{t1} - BA_{t2}) * RM * FC$ (21) $ECO2eq_i = (\Delta BA_i + \Delta BS_i + \Delta LIT_i + \Delta MM_i + \Delta COS_{20i})$	ΔBA_i	Aerial biomass reservoir emission factor	11.2 Emission Factors
BA_{t1}	Aerial biomass in the initial time	11.2 Emission Factors	(4) $\Delta BA_i = (BA_{t1} - BA_{t2}) * RM * FC$	BA_{t1}	Aerial biomass in the initial time	11.2 Emission Factors

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
BA_{t2}	Aerial biomass in the final time	11.2 Emission Factors	(4) $\Delta BA_i = (BA_{t1} - BA_{t2}) * RM * FC$	**BA_{t2}**	Aerial biomass in the final time	11.2 Emission Factors
RM	Carbon dioxide and carbon dioxide molecular ratio constant given by 44/12.	11.2 Emission Factors	(4) $\Delta BA_i = (BA_{t1} - BA_{t2}) * RM * FC$ (5) $\Delta BS_i = (BS_{t1} - BS_{t2} * RM * FC$ (6) $\Delta MM_i = (MM_{t1} - MM_{t2}) * RM * FC$ (7) $\Delta LIT_i = (LIT_{t1} - LIT_{t2}) * RM * FC$ (8) $\Delta COS_{20i} = \frac{(COS_{t1} - COS_{t2})}{20} * RM * FC$	**RM**	Carbon dioxide and carbon dioxide molecular ratio constant given by 44/12.	11.2 Emission Factors
FC	Biomass carbon ratio constant 0,45.	11.2 Emission Factors	(4) $\Delta BA_i = (BA_{t1} - BA_{t2}) * RM * FC$ (5) $\Delta BS_i = (BS_{t1} - BS_{t2} * RM * FC$ (6)$\Delta MM_i = (MM_{t1} - MM_{t2}) * RM * FC$ (7) $\Delta LIT_i = (LIT_{t1} - LIT_{t2}) * RM * FC$	**FC**	Biomass carbon ratio constant 0,45.	11.2 Emission Factors
ΔBS_i:	Belowground biomass reservoir emission factor	11.2 Emission Factors	(5) $\Delta BS_i = (BS_{t1} - BS_{t2} * RM * FC$ (21) $ECO2eq_i = (\Delta BA_i + \Delta BS_i + \Delta LIT_i + \Delta MM_i + \Delta COS_{20i})$	**ΔBS_i:**	Belowground biomass reservoir emission factor	11.2 Emission Factors
BS_{t1}	Belowground biomass at initial time	11.2 Emission Factors	(5) $\Delta BS_i = (BS_{t1} - BS_{t2} * RM * FC$	**BS_{t1}**	Belowground biomass at initial time	11.2 Emission Factors
BS_{t2}	Belowground biomass at the end of time	11.2 Emission Factors	(5) $\Delta BS_i = (BS_{t1} - BS_{t2}) * RM * FC$	**BS_{t2}**	Belowground biomass at the end of time	11.2 Emission Factors
ΔMM_i	Emission factor of dead biomass reservoir	11.2 Emission Factors	(6) $\Delta MM_i = (MM_{t1} - MM_{t2}) * RM * FC$ (21) $ECO2eq_i = (\Delta BA_i + \Delta BS_i + \Delta LIT_i + \Delta MM_i + \Delta COS_{20i})$	**ΔMM_i**	Emission factor of dead biomass reservoir	11.2 Emission Factors

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
$\mathbf{MM_{t1}}$	Dead biomass at initial time	11.2 Emission Factors	(6) $\Delta MM_i = (MM_{t1} - MM_{t2}) * RM * FC$	$\mathbf{MM_{t1}}$	Dead biomass at initial time	11.2 Emission Factors
$\mathbf{MM_{t2}}$	Dead biomass at end time	11.2 Emission Factors	(6) $\Delta MM_i = (MM_{t1} - MM_{t2}) * RM * FC$	$\mathbf{MM_{t2}}$	Dead biomass at end time	11.2 Emission Factors
$\mathbf{\Delta LIT_i}$	Leaf litter reservoir emission factor	11.2 Emission Factors	(7) $\Delta LIT_i = (LIT_{t1} - LIT_{t2}) * RM * FC$ (21) $ECO2eq_i = (\Delta BA_i + \Delta BS_i + \Delta LIT_i + \Delta MM_i + \Delta COS_{20i})$	$\mathbf{\Delta LIT_i}$	Leaf litter reservoir emission factor	11.2 Emission Factors
$\mathbf{LIT_{t1}}$	Leaf litter in the initial time	11.2 Emission Factors	(7) $\Delta LIT_i = (LIT_{t1} - LIT_{t2}) * RM * FC$	$\mathbf{LIT_{t1}}$	Leaf litter in the initial time	11.2 Emission Factors
$\mathbf{LIT_{t2}}$	Leaf litter at the end time	11.2 Emission Factors	(7) $\Delta LIT_i = (LIT_{t1} - LIT_{t2}) * RM * FC$	$\mathbf{LIT_{t2}}$	Leaf litter at the end time	11.2 Emission Factors
$\mathbf{\Delta COS_{20i}}$	Soil organic carbon reservoir emission factor	11.2 Emission Factors	(8) $\Delta COS_{20i} = \frac{(COS_{t1} - COS_{t2})}{20} * RM$ (21) $ECO2eq_i = (\Delta BA_i + \Delta BS_i + \Delta LIT_i + \Delta MM_i + \Delta COS_{20i})$	$\mathbf{\Delta COS_{20i}}$	Soil organic carbon pool emission factor	11.2 Emission Factors
$\mathbf{COS_{t1}}$	Soil organic carbon at initial time	11.2 Emission Factors	(8) $\Delta COS_{20i} = \frac{(COS_{t1} - COS_{t2})}{20} * RM * FC$	$\mathbf{COS_{t1}}$	Soil organic carbon at initial time	11.2 Emission Factors
$\mathbf{COS_{t2}}$	Soil organic carbon at end time	11.2 Emission Factors	(8) $\Delta COS_{20i} = \frac{(COS_{t1} - COS_{t2})}{20} * RM * FC$	$\mathbf{COS_{t2}}$	Soil organic carbon at end time	11.2 Emission Factors

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
$RRTasDef_{i,t}$	Deforestation rate for stratum i between period t_1 and t_2 or the Reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(9) $RRTasDef_{i,t} = \left(\left(\frac{1}{t_2 - t_1}\right) * ln\frac{A_1}{A_1 - D}\right)$ (11) $RRTasDef_{i,t} = \frac{RRTP(1 \rightarrow 2)_{t2-t1}}{RRC1_{y1}}$ (15) $APBDef_{i,t} = AAPBDef_{i,t-1} * RRTasDef_{i,t}$	**$RRTasDef_{i,}$**	Deforestation rate for stratum i between period t_1 and t_2 or the Reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
D	Corresponds to the deforested area in Hectares between periods t_1 and t_2	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(9) $RRTasDef_{i,t} = \left(\left(\frac{1}{t_2 - t_1}\right) * ln\frac{A_2}{A_1}\right)$	**D**	Corresponds to the deforested area in Hectares between periods t_1 and t_2	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
t_1	This is the initial year of the Project.	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(9) $RRTasDef_{i,t} = \left(\left(\frac{1}{t_2 - t_1}\right) * ln\frac{A_2}{A_1}\right)$	**t_1**	This is the initial year of the Project.	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
t_2	It is the final year of the analysis period.	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(9) $RRTasDef_{i,t} = \left(\left(\frac{1}{t_2 - t_1}\right) * ln\frac{A_2}{A_1}\right)$	**t_2**	It is the final year of the analysis period.	13.1 Construction of baseline scenario for RUDDA and RPDDA activities

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
A_1	Wooded area at the initial moment	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(9) $RRTasDef_{i,t} = \left(\left(\frac{1}{t_2 - t_1}\right) * ln\frac{A_2}{A_1}\right)$	**A_1**	Wooded area at the initial moment	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
A_2	Forested area at the end of the year	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(9) $RRTasDef_{i,t} = \left(\left(\frac{1}{t_2 - t_1}\right) * ln\frac{A_2}{A_1}\right)$	**A_2**	Forested area at the end of the year	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
$RRTP(1 \rightarrow 2)_{t2-t1}$	Average transition from stratum 1 to stratum 2 from t_1 to t_2	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(10) $RRTP(1 \rightarrow 2)_{t2-t1} = \frac{(RRC1_{t1} \rightarrow RRC2_{t2})}{t1 - t2}$ (11) $RRTasDef_{i,t} = \frac{RRTP(1 \rightarrow 2)_{t2-t1}}{RRC1_{y1}}$	**$RRTP(1 \rightarrow 2)_{t2-t1}$**	Average transition from stratum 1 to stratum 2 from t_1 to t_2	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
$RRC1_{t1} \rightarrow RRC2_{t2}$	Area of cover in stratum RRC1 (ha) at time point t1 that has undergone transition to land classified as stratum RRC2 (ha) at	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(10) $RRTP(1 \rightarrow 2)_{t2-t1} = \frac{(RRC1_{t1} \rightarrow RRC2_{t2})}{t1 - t2}$	**$RRC1_{t1} \rightarrow RRC2_{t2}$**	Area of cover in stratum RRC1 (ha) at time point t1 that has undergone transition to land classified as	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
	time point t_2 (ha).				stratum RRC2 (ha) at time point t_2 (ha).	
t1	Year of the first time point in the coverage transition analysis	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(10) $RRTP(1 \rightarrow 2)_{t2-t1} = \frac{(RRC1_{t1} \rightarrow RRC2_{t2})}{t1 - t2}$ (11) $RRTasDef_{i,t} = \frac{RRTP(1 \rightarrow 2)_{t2-t1}}{RRC1_{t1}}$	**t1**	Year of the first time point in the coverage transition analysis	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
t2	Year of the second time point in the coverage transition analysis	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(10) $RRTP(1 \rightarrow 2)_{t2-t1} = \frac{(RRC1_{t1} \rightarrow RRC2_{t2})}{t1 - t2}$ (11) $RRTasDef_{i,t} = \frac{RRTP(1 \rightarrow 2)_{t2-t1}}{RRC1_{t1}}$	**t2**	Year of the second time point in the coverage transition analysis	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
$RRC1_{t1}$	Total land classified as stratum C1 (ha) at time point t1 (ha) in the Reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(11) $RRTasDef_{i,t} = \frac{RRTP(1 \rightarrow 2)_{t2-t1}}{RRC1_{t1}}$	**$RRC1_{t1}$**	Total land classified as stratum C1 (ha) at time point t1 (ha) in the Reference region	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
$RRBDef_{i,t}$	Projected deforestation for stratum i of year t for Reference region	13.1 Construction of baseline scenario for RUDDA and	(12) $RRBDef_{i,t} = ARRB_{i,t-1} * RRTasDef_{i,t}$ (14) $RRBDef_{i,t} = \frac{RRK}{1 - e^{a+bt}}$ (22) $CO2RRBDef_{i,t} = (RRBDef_{i,t}) * ECO2eq_i$ (34) $ERRBDef_{i,t} = (RRBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$	**$RRBDef_{i,t}$**	Projected deforestatio n for stratum i of year t for	13.1 Constructio n of baseline scenario for RUDDA and

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
		RPDDA activities			Reference region	RPDDA activities
$\mathbf{ARRBDef_{i,t-1}}$	Forest assets of stratum i of the year prior to deforestation in the Reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(12) $RRBDef_{i,t} = ARRB_{i,t-1} * RRTasDef_{i,t}$ (42)$RRBDef_{i,t} = ARRB_{i,t-1} * (RRTasDef_{i,t} * Ef)$	$\mathbf{ARRBDef_{i,t}}$	Forest stock of stratum i of the year prior to deforestation in the Reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
$\mathbf{RRBDeg_{i,t}}$	Projected forest degradation for stratum i of the year t for the reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(13) $RRBDeg_{i,t} = ARRB_{i,t-1} * RRTasDeg_{i,t}$ (24) $CO2RRBDeg_{i,t} = (RRBDeg_{i,t}) * ECO2eq_i$ (43) $RRBDeg_{i,t} = ARRB_{i,t-1} * (RRTasDeg_{i,t} * \mathrm{Ef})$	$\mathbf{RRBDeg_{i,t}}$	Projected forest degradation for stratum i of the year t for the reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
$\mathbf{ARRB_{i,t-1}}$	Forest assets of stratum i of the year prior to forest degradation in the Reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(13) $RRBDeg_{i,t} = ARRB_{i,t-1} * RRTasDeg_{i,t}$	$\mathbf{ARRB_{i,t-1}}$	Forest stock of stratum i of the year prior to forest degradation in the Reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
$\mathbf{RRTasDeg_{i,t}}$	Forest degradation rate for stratum i between period t_1 and t_2 for the	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(13) $RRBDeg_{i,t} = ARRB_{i,t-1} * RRTasDeg_{i,t}$ (16) $APBDeg_{i,t} = AAPBDeg_{i,t-1} * RRTasDeg_{i,t}$ (19) $CFBDeg_{i,t} = ACFB_{i,t-1} * RRTasDeg_{i,t}$	**RRTasDe**	Forest degradation rate for stratum i between period t_1 and t_2 for the	13.1 Construction of baseline scenario for RUDDA and RPDDA activities

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
	reference region.				reference region.	
RRK	Forest susceptible to deforestation in the reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(14) $RRBDef_{i,t} = \frac{RRK}{1 - e^{a+bt}}$	**RRK**	Forest susceptible to deforestation in the reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
e	Euler's constant	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(14) $RRBDef_{i,t} = \frac{RRK}{1 - e^{a+bt}}$ (17) $APBDef_{i,t} = \frac{APK}{1 - e^{a+bt}}$ (20) $CFBDef_{i,t} = \frac{CFK}{1 - e^{a+bt}}$	**e**	Euler's constant	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
a	Model constant	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(14) $RRBDef_{i,t} = \frac{RRK}{1 - e^{a+bt}}$ (17) $APBDef_{i,t} = \frac{APK}{1 - e^{a+bt}}$ (20) $CFBDef_{i,t} = \frac{CFK}{1 - e^{a+bt}}$	**a**	Model constant	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
b	It is the rate of change for the model between the periods t_1 and t_2 for the reference region	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(14) $RRBDef_{i,t} = \frac{RRK}{1 - e^{a+bt}}$ (17) $APBDef_{i,t} = \frac{APK}{1 - e^{a+bt}}$ (20) $CFBDef_{i,t} = \frac{CFK}{1 - e^{a+bt}}$	**b**	It is the rate of change for the model between the periods t_1 and t_2 for the	13.1 Construction of baseline scenario for RUDDA and RPDDA activities

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
					reference region	
$APBDef_{i,t}$	Projected deforestation for stratum i in year t for project area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(15) $APBDef_{i,t} = AAPBDef_{i,t-1} * RRTasDef_{i,t}$ (17) $APBDef_{i,t} = \frac{APK}{1 - e^{a+bt}}$ (26) $CO2APBDef_{i,t} = (APBDef_{i,t}) * ECO2eq_i$ (36) $EAPBDef_{i,t} = (APBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$	**$APBDef_{i,t}$**	Projected deforestation for stratum i in year t for project area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
$AAPBDef_{i,t-1}$	Area of forest of stratum i in the year prior to the project start date in the project area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(15) $APBDef_{i,t} = AAPBDef_{i,t-1} * RRTasDef_{i,t}$	**$AAPBDef_{i,t-}$**	Area of forest of stratum i in the year prior to the project start date in the project area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
$APBDeg_{i,t}$	Projected forest degradation for stratum i in year t for project area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(16) $APBDeg_{i,t} = AAPBDeg_{i,t-1} * RRTasDeg_{i,t}$	**$APBDeg_{i,t}$**	Projected forest degradation for stratum i in year t for project area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities
$AAPBDeg_{i,t-1}$	Forest assets of stratum i for the year prior to the project start date in the project area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(16) $APBDeg_{i,t} = AAPBDeg_{i,t-1} * RRTasDeg_{i,t}$ (28) $CO2APBDeg_{i,t} = (APBDeg_{i,t}) * ECO2eq_i$	**$AAPBDeg_{i,t}$**	Forest stock of stratum i for the year prior to the project start date in the project area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
APK	Forest susceptible to deforestation in the project area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(17) $APBDef_{i,t} = \frac{APK}{1 - e^{a+bt}}$	**APK**	Forest susceptible to deforestatio n in the project area	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
FI	Leakage increase factor for project implementati on in formulation scenario	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(18) $CFBDef_{i,t} = ACFB_{i,t-1} * RRTasDef_{i,t} * (1 + FI)$	**FI**	Leakage increase factor for project implementa tion in formulation scenario	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
$CFBDef_{i,t}$	Projected deforestation for stratum i in year t for the area of leakage	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(18) $CFBDef_{i,t} = ACFB_{i,t-1} * RRTasDef_{i,t} * (1 + FI)$ (20) $CFBDef_{i,t} = \frac{CFK}{1 - e^{a+bt}}$ (30) $CO2CFBDef_{i,t} = (CFBDef_{\ i,t}) * ECO2eq_i$ (38) $ECFBDef_{i,t} = (CFBDef_{\ i,t}) * (ECH4eq_i + ENO2eq_i)$	**$CFBDef_{i,t}$**	Projected deforestatio n for stratum i in year t for the area of leakage	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
$ACFB_{i,t-1}$	Forest assets of stratum i in the year prior to deforestation in the leakage area	13.1 Construction of baseline scenario for RUDDA and RPDDA activities	(18) $CFBDef_{i,t} = ACFB_{i,t-1} * RRTasDef_{i,t} * (1 + FI)$ (19) $CFBDeg_{i,t} = ACFB_{i,t-1} * RRTasDeg_{i,t}$	**$ACFB_{i,t-1}$**	Forest stock of stratum i in the year prior to deforestatio n in the leakage area	13.1 Constructio n of baseline scenario for RUDDA and RPDDA activities
CFK	Forest susceptible to deforestation	13.1 Construction of baseline	(20) $CFBDef_{i,t} = \frac{CFK}{1 - e^{a+bt}}$	**CFK**	Forest susceptible to	13.1 Constructio n of

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
	in the leakage area	scenario for RUDDA and RPDDA activities			deforestation in the leakage area	baseline scenario for RUDDA and RPDDA activities
$CO2RRBDef_{i,t}$	CO_2 equivalent emissions from deforested forest of stratum i in year t, from the reference region.	13.2 Projected baseline emissions in the reference region	(22) $CO2RRBDef_{i,t} = (RRBDef_{i,t}) * ECO2eq_i$ (23) $CO2RRBDef_t = \sum CO2RRBDef_{i,t}$	**CO2RRBDe**	CO_2 equivalent emissions from deforested forest of stratum i in year t, from the reference region.	13.2 Projected baseline emissions in the reference region
$CO2RRBDef_t$	CO_2 equivalent emissions from deforested forest in year t, from the region of reference	13.2 Projected baseline emissions in the reference region	(23) $CO2RRBDef_t = \sum CO2RRBDef_{i,t}$	**CO2RRBDe**	CO_2 equivalent emissions from deforested forest in year t, from the region of reference	13.2 Projected baseline emissions in the reference region
$CO2RRBDeg_{i,t}$	CO_2 emissions equivalent of degraded forest of stratum i in year t, from reference region	13.2 Projected baseline emissions in the reference region	(24) $CO2RRBDeg_{i,t} = (RRBDeg_{i,t}) * ECO2eq_i$ (25) $CO2RRBDeg_t = \sum CO2RRBDeg_{i,t}$	**CO2RRBDe**	CO_2 emissions equivalent of degraded forest of stratum i in year t, from reference region	13.2 Projected baseline emissions in the reference region

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
$CO2RRBDeg_t$	CO_2 equivalent emissions from degraded forest in year t, from the reference region	13.2 Projected baseline emissions in the reference region	(25) $CO2RRBDeg_t = \sum CO2RRBDeg_{i,t}$	**CO2RRBDe**	CO_2 equivalent emissions from degraded forest in year t, from the reference region	13.2 Projected baseline emissions in the reference region
$CO2APBDef_{i,t}$	CO_2 equivalent emissions from deforested forest of stratum i in year t, of the project area.	13.3 Projected baseline emissions in project area	(26) $CO2APBDef_{i,t} = (APBDef_{i,t}) * ECO2eq_i$ (27) $CO2APBDef_t = \sum CO2APBDef_{i,t}$	**CO2APBDe**	CO_2 equivalent emissions from deforested forest of stratum i in year t, of the project area.	13.3 Projected baseline emissions in project area
$CO2APBDef_t$	CO_2 equivalent emissions from deforested forest in year t, from the project area.	13.3 Projected baseline emissions in project area	(27) $CO2APBDef_t = \sum CO2APBDef_{i,t}$ (39) $\mathrm{PEDef}_t = (\mathrm{CO2APBDef}_t + \mathrm{EAPBDef}_t) - (\mathrm{CO2CFBDef}_t + \mathrm{ECFBDef}_t)$	**CO2APBDe**	CO_2 equivalent emissions from deforested forest in year t, from the project area.	13.3 Projected baseline emissions in project area
$CO2APBDeg_{i,t}$	CO_2 equivalent emissions from degraded forest of	13.3 Projected baseline emissions in project area	(28) $CO2APBDeg_{i,t} = (APBDeg_{i,t}) * ECO2eq_i$ (29) $CO2APBDeg_t = \sum CO2APBDeg_{i,t}$	**CO2APBDe**	CO_2 equivalent emissions from degraded forest of	13.3 Projected baseline emissions in project area

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
	stratum i in year t, from the project area.				stratum i in year t, from the project area.	
$CO2APBDeg_t$	CO_2 equivalent emissions from degraded forest in year t, of the project area.	13.3 Projected baseline emissions in project area	(29) $CO2APBDeg_t = \sum CO2APBDeg_{i,t}$ (41) $PEDeg = (CO2APBDeg_t) - (CO2CFBDeg_t)$	**CO2APBDe**	CO_2 equivalent emissions from degraded forest in year t, of the project area.	13.3 Projected baseline emissions in project area
$CO2CFBDef_{i,t}$:	CO_2 equivalent emissions from deforested forest of stratum i in year t, from the leakage belt.	13.4 Projected baseline emissions in the leakage belt:	(30) $CO2CFBDef_{i,t} = (CFBDef_{i,t}) * ECO2eq_i$ (31) $CO2CFBDef_t = \sum CO2CFBDef_{i,t}$	**CO2CFBDe :**	CO_2 equivalent emissions from deforested forest of stratum i in year t, from the leakage belt.	13.4 Projected baseline emissions in the leakage belt:
$CO2CFBDef_t$	CO_2 equivalent emissions from deforested forest in year t, from the leakage belt.	13.4 Projected baseline emissions in the leakage belt	(31) $CO2CFBDef_t = \sum CO2CFBDef_{i,t}$ (40) $PEDef_t = (CO2APBDef_t + EAPBDef_t) - (CO2CFBDef_t + ECFBDef_t)$	**CO2CFBDe**	CO_2 equivalent emissions from deforested forest in year t, from the leakage belt.	13.4 Projected baseline emissions in the leakage belt
$CO2CFBDeg_{i,t}$	CO_2 equivalent emissions	13.4 Projected baseline	(32) $CO2CFBDeg_{i,t} = (CFBDeg_{i,t}) * ECO2eq_i$ (33) $CO2CFBDeg_t = \sum CO2CFBDeg_{i,t}$	**CO2CFBDe**	CO_2 equivalent emissions	13.4 Projected baseline

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
	from degraded forest of stratum i in year t, from the leakage belt.	emissions in the leakage belt			from degraded forest of stratum i in year t, from the leakage belt.	emissions in the leakage belt
$(\mathbf{CFBDeg_{i,t}})$	Projected degradation for stratum i in year t for the area of leakage	13.4 Projected baseline emissions in the leakage belt	(32) $CO2CFBDeg_{i,t} = (CFBDeg_{i,t}) * ECO2eq_i$	$(\mathbf{CFBDeg_{i,t}})$	Projected degradation for stratum i in year t for the area of leakage	13.4 Projected baseline emissions in the leakage belt
CO2CFBDeg	CO_2 equivalent emissions from degraded forest in year t, from the leakage belt	13.4 Projected baseline emissions in the leakage belt	(33) $CO2CFBDeg_t = \sum CO2CFBDeg_{i,t}$	**CO2CFBDe**	CO_2 equivalent emissions from degraded forest in year t, from the leakage belt	13.4 Projected baseline emissions in the leakage belt
$\mathbf{ERRBDef_{i,t}}$	Different CO_2 emissions from deforested forest of stratum i in year t, reference region.	13.5 Projected baseline emissions from wildfires	(34) $ERRBDef_{i,t} = (RRBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$ (35) $ERRBDef_t = \sum ERRBDef_{i,t}$	$\mathbf{ERRBDef_{i,t}}$	Different CO_2 emissions from deforested forest of stratum i in year t, reference region.	13.5 Projected baseline emissions from wildfires
ERRBDef	Different CO_2 emissions from	13.5 Projected baseline	(35) $ERRBDef_t = \sum ERRBDef_{i,t}$	**ERRBDef**	Different CO_2 emissions	13.5 Projected baseline

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
	deforested forest in year t, of the reference region.	emissions from wildfires			from deforested forest in year t, of the reference region.	emissions from wildfires
$EAPBDef_{i,t}$	Emissions other than CO_2 from deforested forest of stratum i in year t, from the project area.	13.5 Projected baseline emissions from wildfires	(36) $EAPBDef_{i,t} = (APBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$ (37) $EAPBDef_{t} = \sum EAPBDef_{i,t}$	**$EAPBDef_{i,t}$**	Emissions other than CO_2 from deforested forest of stratum i in year t, from the project area.	13.5 Projected baseline emissions from wildfires
$EAPBDef_t$	Emissions other than CO_2 from deforested forest in year t, from the project area.	13.5 Projected baseline emissions from wildfires	(37) $EAPBDef_{t} = \sum EAPBDef_{i,t}$ (40) $\mathrm{PEDef}_t = (\mathrm{CO2APBDef}_t + \mathrm{EAPBDef}_t) - (\mathrm{CO2CFBDef}_t + \mathrm{ECFBDef}_t)$	**$EAPBDef_t$**	Emissions other than CO_2 from deforested forest in year t, from the project area.	13.5 Projected baseline emissions from wildfires
$ECFBDef_{i,t}$	Different CO_2 emissions from deforested forest of stratum i in year t, from the leakage belt	13.5 Projected baseline emissions from wildfires	(38) $ECFBDef_{i,t} = (CFBDef_{i,t}) * (ECH4eq_i + ENO2eq_i)$ (39) $ECFBDef_t = \sum ECFBDef_{i,t}$	**$ECFBDef_{i,t}$**	Different CO_2 emissions from deforested forest of stratum i in year t, from the leakage belt	13.5 Projected baseline emissions from wildfires

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
$\mathbf{ECFBDef_t}$	Different emissions of CO_2 from deforested forests in year t, from the leakage belt.	13.5 Projected baseline emissions from wildfires	(39) $ECFBDef_t = \sum ECFBDef_{i,t}$ (40) $\mathrm{PEAPDef}_t = (\mathrm{CO2APBDef}_{\,t} + \mathrm{EAPBDef}_{\,t})$	$\mathbf{ECFBDef_t}$	Different emissions of CO_2 from deforested forests in year t, from the leakage belt.	13.5 Projected baseline emissions from wildfires
$\mathbf{PEAPDef_t}$	emissions potential of the deforestation compartment for year t, in the project area in terms of Mg CO_2 equivalent	13.6 Estimation of potential emissions	(40) $\mathrm{PEAPDef}_t = (\mathrm{CO2APBDef}_{\,t} + \mathrm{EAPBDef}_{\,t}))$	$\mathbf{PEAPDef_t}$	emissions potential of the deforestatio n compartme nt for year t, in the project area in terms of Mg CO_2 equivalent	13.6 Estimation of potential emissions
ΔPETDeft	Difference in terms of emissions for the deforestation compartment	14.1 Construction of the baseline scenario for RUDDA activities.	(48) $COLCERSDef_t = (\Delta EPTDeft) - (\Delta EPTDeft * RNP)$ (49) $COLCERSDeg_t = (\Delta EPTDegt) - (\Delta EPTDegt * RNP)$	**ΔPETDeft**	Difference in terms of emissions for the deforestatio n compartme nt	14.1 Constructio n of the baseline scenario for RUDDA activities.
$\mathbf{COLCERSDef_t}$	Baseline COLCX certificates that are attributable to avoided	14.1 Construction of the baseline scenario for RUDDA activities.	(48) $COLCERSDef_t = (\Delta EPTDeft) - (\Delta EPTDeft * RNP)$	**COLCERSD**	Baseline COLCX certificates that are attributable to avoided	14.1 Constructio n of the baseline scenario for RUDDA activities.

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
	deforestation activities.				deforestatio n activities.	
$COLCERSDeg_t$	Baseline COLCX certificates attributable to avoided forest degradation activities.	14.1 Construction of the baseline scenario for RUDDA activities.	(49) $COLCERSDeg_t = (\Delta EPTDegt) - (\Delta EPTDegt * RNP)$	**COLCERSD**	Baseline COLCX certificates attributable to avoided forest degradation activities.	14.1 Constructio n of the baseline scenario for RUDDA activities.
CFFi	Feasible leakage area for economic activity i.	8.2.3.1 Opportunity cost analysis	(1) $CFF_i = Pv_i - Cp_i - (Ct_{tr}\ x\ Dt_{tr})$	**CFFi**	Feasible leakage area for economic activity i.	8.2.3.1 Opportunity cost analysis
Pvi	Selling price of items of activity i	8.2.3.1 Opportunity cost analysis	(1) $CFF_i = Pv_i - Cp_i - (Ct_{tr}\ x\ Dt_{tr})$ (1) $CFF_i = Pv_i - Cp_i - (Ct_{tr}\ x\ Dt_{tr})$	**Pvi**	Selling price of items of activity i	8.2.3.1 Opportunity cost analysis
CPi	Internal production costs of activity i	8.2.3.1 Opportunity cost analysis	(1) $CFF_i = Pv_i - Cp_i - (Ct_{tr}\ x\ Dt_{tr})$	**CPi**	Internal production costs of activity i	8.2.3.1 Opportunity cost analysis
Ct	Transportatio n costs of the activity with respect to its mode of transportatio n tr	8.2.3.1 Opportunity cost analysis	(1) $CFF_i = Pv_i - Cp_i - (Ct_{tr}\ x\ Dt_{tr})$	**Ct**	Transportat ion costs of the activity with respect to its mode of transportati on tr	8.2.3.1 Opportunity cost analysis
Dtr	Distance to where the products of the activity	8.2.3.1 Opportunity cost analysis	(1) $CFF_i = Pv_i - Cp_i - (Ct_{tr}\ x\ Dt_{tr})$	**Dtr**	Distance to where the products of the activity	8.2.3.1 Opportunity cost analysis

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Variable	Description	Sections where it is mentioned
	can be transported with respect to their means of transport tr				can be transported with respect to their means of transport tr	
Ef	Efficiency factor due to RUDDA activities is 70% to 90%.	13.1 Construction of the formulation scenario for RUDDA activities.	(42) $RRBDef_{i,t} = ARRB_{i,t-1} * (RRTasDef_{i,t} * Ef)$ (43) $RRBDeg_{i,t} = ARRB_{i,t-1} * (RRTasDeg_{i,t} * Ef)$ (44) $RRDef_{i,t} = \frac{RRK}{1 - e^{a+(b*Ef)t}}$	***Ef***	Efficiency factor due to RUDDA activities is 70% to 90%.	13.1 Construction of the formulation scenario for RUDDA activities.
FI	Factor of increase due to projected leakage in the formulation scenario, equivalent to 10%.	13.1 Construction of the formulation scenario for RUDDA activities.	(45) $CFBDef_{i,t} = ACFB_{i,t-1} * (RRTasDef_{i,t} * (1 + FI))$ (46) $CFBDeg_{i,t} = ACFB_{i,t-1} * (RRTasDeg_{i,t} * (1 + FI))$ (47) $CFDef_{i,t} = \frac{CFK}{1 - e^{a+(b*(1+FI))t}}$	**FI**	Factor of increase due to projected leakage in the formulation scenario, equivalent to 10%.	13.1 Construction of the formulation scenario for RUDDA activities.

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