COLCX METHODOLOGY FOR REDD+ PROJECTS SUSTAINABLE FOREST MANAGEMENT SFM

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UNIVERSIDAD DISTRITAL
FRANCISCO JOSÉ DE CALDAS

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Version 1.0

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1. OBJETIVES

To provide principles, requirements and guidelines for the development and implementation of REDD+ projects, with emphasis on Sustainable Forest Management (SFM) activities, in order to ensure adequate quantification, monitoring and reporting of activities aimed at the removal of Greenhouse Gases (GHG) by processes of reducing deforestation and/or forest degradation in forests that have a sustainable forest management permit, or any license that takes its place. The general considerations of this module follow the principles of REDD+ Methodology and the ColCX Standard.

In addition to the elements provided by the REDD+ methodology, this module considers the following elements:

- Mechanism to evaluate and support the additionality of a SFM project.
- Criteria for determining the baseline scenario considering Sustainable Forest Management principles.
- Additional requirements for monitoring, follow-up and control of activities related to Sustainable Forest Management.

2. SCOPE OF THE SFM MODULE

This module 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. This REDD+ activity consists of the reduction of GHG emissions due to the reduction of deforestation and/or forest degradation activities, in areas that have a management license or sustainable forest management.

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). Plataforma web de la Convención Marco de las Naciones Unidas sobre el Cambio Climático REDD+. En: https://redd.unfccc.int/

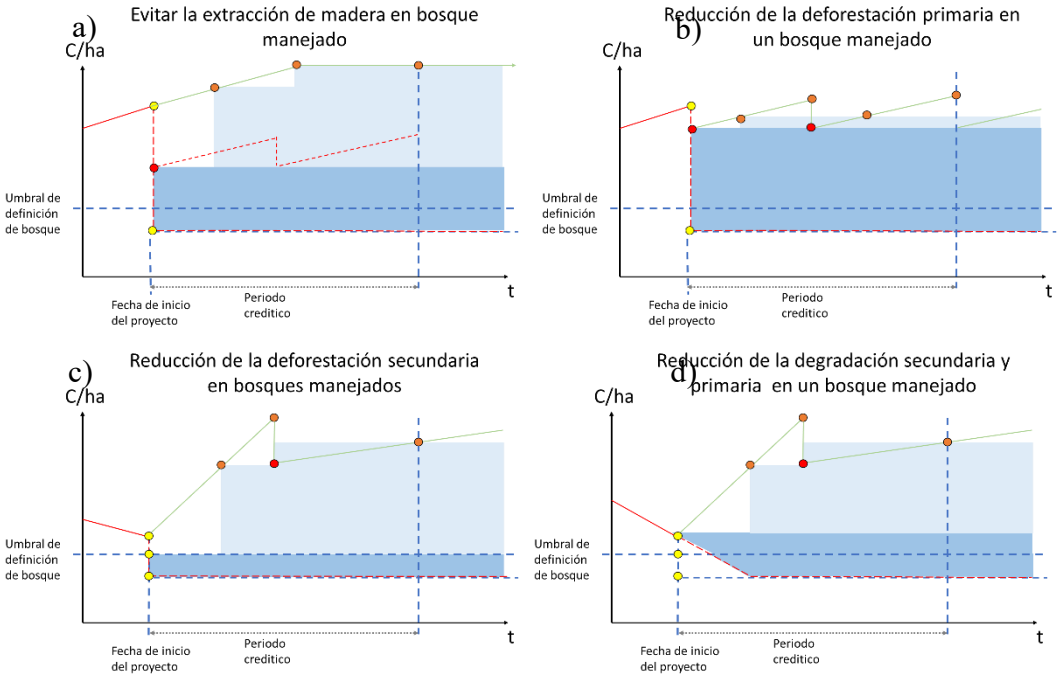

Illustration 1 *Temporal limits of a GHGMP, yellow dots show measures required in the scenario without project, red dots show measures required in the scenario with project, orange dots show measures required when carbon reserves increase is quantified. In green the line shows carbon stock projections. 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 ICR activities*[2].

3. APPLICABLE ACTIVITIES

This methodology contemplates Sustainable Forest Management only applies to permanent forests, i.e. it can only focus on reducing the impact of forest harvesting, reducing the volume harvested and/or avoiding deforestation and/or forest degradation.

4. APPLICABILITY CONDITIONS

This methodology is applicable under the following conditions:

[2] Pedroni, L. VCS Methodology VM0015 V 1.1, v.1.1 Methodology for Avoided Unplanned Deforestation; Carbon Decisions International: Washington, DC, USA; p. 184. Rescatado el 12/27/2021 de: https://verra.org/wp-content/uploads/2018/03/VM0015 V 1.1-Methodology-for-Avoided-Unplanned-Deforestation-v1.1.pdf

- Areas of degraded permanent forest in the starting year (forest remaining in this category for ten (10) years prior to the project start date), according to the official definition of forest in each country.
- It must be proven through 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.
- The drivers, agents and underlying causes of deforestation and forest degradation of permanent forest with a sustainable forest harvesting permit must be clearly identified.

This methodology is not applicable under the following conditions:

- Projects that only include GHG removal activities through ecological restoration or revegetation.
- Forest covers dominated by natural ecosystems that are periodically flooded, such as wetlands, paramos, mangroves, swamps, bacines, among others, with soils with high organic matter content.
- No activity that is legally required under the sustainable forest harvesting permit can be used as a REDD+ activity, except under specific conditions identified in the additionality section.

5. SFM AREA ELIGIBILITY

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

- The areas where the activities will be carried out must demonstrate ownership by the proponents of the property, collective territory or properties, this is guaranteed by legal documentation that shows that the owners are 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 have legal or other types of disputes.

- Prior to the start date of SFM activities, a sustainable forest harvesting permit must be issued by the competent environmental authority, identifying each of the key aspects, such as harvesting areas, cutting volumes, species to be harvested, conservation areas, among others.

- SFM activities can only be implemented in areas of permanent forest.

6. TEMPORAL AND SPACE LIMITS

The temporal and spatial limits of the GHGMP allow establishing the area and temporality in which economic benefits can be obtained by COLCERS for the removal and/or reduction of GHG.

6.1 Time Limits

The time limits of the project must be defined in the Project Design Document (PDD) and the following aspects must be considered in the PDD:

6.1.1 Project start date

In the case of SFM activities, it is a date after the sustainable forest harvesting permit is granted. This start date must be objectively supported based on the first action of the GHGMP oriented to avoid deforestation and/or degradation of permanent forests in the areas where this permit was granted. The start date of the project can be a maximum of 5 years prior to the date of submission of the validation to the VVB.

For the rest of the time limits, the criteria of the Framework methodology should be used.

6.2 Spatial Limits

The GHGMP must identify and delimit the areas that are subject to monitoring according to the REDD+ activities developed. The spatial boundaries of a GHGMP for the SFM activity are as follows:

6.2.1 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 SFM are presented only corresponds to permanent forest areas that have a license or permit for sustainable forest harvesting or any of its substitutes. It must be considered that all forest covers

that need to be permanently harvested (for Colombia single forest harvesting) due to the establishment 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 properties and 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.
- There must be a license or permit for sustainable forest harvesting (in Colombia, persistent forest harvesting) or any other that takes its place, identifying spatial limits, time limits and technical aspects.

6.2.1.1 Grouped projects

Apply the considerations of the framework methodology.

6.2.2 Reference Region

The indications of the framework methodology must be followed.

6.2.3 Potential Leakage Area

The indications of the framework methodology must be followed.

7 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 project scenario. The following is a list of reservoirs likely to be included in a GHGMP.

Table 1 Reservoirs applicable to SFM activities.

Reservoirs	SFM	Description
Aerial biomass	Yes	This reservoir should be included. It corresponds to the living biomass found on the soil, including stems, branches, bark and foliage. Expected to be maintained in conserved forest covers or to increase in areas where forest covers are established.
Belowground biomass	Yes	All living root biomass. Excludes fine roots less than 2 mm in diameter. Expected to be maintained in conserved forest covers or to increase in areas where forest covers are established.
Deadwood	Opt	Includes dead aboveground biomass, dead roots and stumps of individuals 10 cm or more in diameter. Must be significant and adequately accounted for, can be monitored.
Leaf litter	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	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	Opt	Relates to primary timber products generated because of the harvesting, extraction, transport and transformation of timber individuals, with the understanding that the harvesting of individuals does not generate the immediate release of stored carbon.

Where: SFM: Sustainable Forest Management, Opt: Optional.

8 EMISSION SOURCES

8.1 Unplanned emission 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, the different sources presented below (Table 2), should be evaluated as a minimum, and if 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 'with project' and without project scenarios. Any sources that are not significant in terms of GHG emissions should be conservatively excluded and should therefore also be excluded from monitoring in the with-project scenario.

For quantification of source emissions, equations, factors and recommendations from IPCC[3] [4] guidelines, FREL methodologies submitted by the host country or GHG inventories consistent with the project area can be used.

Table 2 Emission sources

Source	GHG	Applies Yes/No	Description
Sustainable Forest Management	CO_2	Yes	Emissions related to the extraction of timber products.
	CH_4	Opt.	It is only included if the Sustainable Forest Management plan or any other that takes its place includes activities such as controlled burns, use of fertilizers, machinery, extraction of timber products, among others, that are significant.
	N_2O	Opt.	
Change in land use	CO_2	Yes	Emissions generated in carbon reservoirs, due to change of use from forest land to other land uses.

[3] IPCC. (2003). Orientación del IPCC sobre las buenas prácticas para UTCUTS. Disponible en: kutt.it/laZFfp

[4] IPCC. (2006). Directrices del IPCC de 2006 para los inventarios nacionales de gases de efecto invernadero. Agricultura, silvicultura y otros usos de la tierra. Disponible en: kutt.it/iLd1fY

Source	GHG	Applies Yes/No	Description
			Also considered those associated with the establishment of forest fire barriers for SFM or other treatments involving selective logging or in forest areas.
	CH_4	No	Consider if there are practices such as controlled burns for SFM.
	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[5]:

$$ECH4eq_i = ECO2eq_i * \frac{11}{44} * RMCH4 * TCH4 \quad (1)$$

$ECH4eq_i$: 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.

$$ENO2eq_i = ECO2eq_i * \frac{11}{44} * RMNO2 * TCNO24 * NC \quad (2)$$

$ENO2eq_i$: 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.
$TCNO24$: Methane emission rate 0.007.
NC: Nitrogen-carbon ratio 0.01.

9. BASELINE

The indications of the framework methodology must be followed. In addition, a projection of CO_2 equivalent emissions must be made based on the volumes to be harvested year by year according to the indications of the sustainable forest harvesting plan or any other that takes its place. Disturbances that

[5] IPCC. (2003). Orientación del IPCC sobre las buenas prácticas para uso del suelo, cambio de uso del suelo y forestería. Disponible en: https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/GPG_LULUCF_FULL.pdf

would be caused at the time of sustainable forest harvesting in the carbon reservoirs should also be estimated, such as the damage to seedlings, harvesting of saplings or other merchantable trees, emissions caused by major or minor transport and any emissions due to any silvicultural treatment.

9.1 Emission Factors

The reservoir emission factors and/or emission factors to be used for SFM may use data from official studies or indexed journals applicable to the project area. Emission factors should also be measurable and verifiable to allow for monitoring, reporting and verification, considering national capabilities in accordance with decision 9/CP.19.

For the development of emission factors, calculations in carbon reservoirs should be taken into account through inventories that show an error of less than 10%, with a confidence level of 95%; local data should be generated from forest inventories. Methodological reconstructions of the processes defined by the FREL, GHG inventories or national inventories, applicable to the GHGMP, can be used to identify these emission sources. When the host country does not have any forest monitoring mechanism, this is not applicable for the development of a GHGMP according to decision 9/CP.19.

$$\Delta BA_{i,t} = (BA_{t1} - BA_{t2}) * RM * FC \quad (3)$$

ΔBA_i: Aerial biomass reservoir removal or emission factor in terms of Mg of CO_2 per hectare of stratum i, in year t.

BA_{t1}: Biomass area at initial time in terms of Mg biomass per hectare of stratum i.

BA_{t2}: Biomass area at final time in terms of Mg biomass per hectare of stratum i.

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

FC: Biomass carbon ratio constant, a value of 0.45, the Nref value, or a value that fits the project area, is recommended.

$$\Delta BS_{i,t} = (BS_{t1} - BS_{t2}) * RM * FC \quad (4)$$

ΔBS_i: Removal or emission factor of the subway biomass reservoir in terms of Mg CO_2 per hectare of stratum i, in year t.

BS_{t1}: Belowground biomass at the initial time in terms of Mg of biomass per hectare of stratum i.

BS_{t2}: Belowground biomass at the final time in terms of Mg biomass per hectare of stratum i.

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

FC: Biomass carbon ratio constant, a value of 0.45, the Nref value, or a value that fits the project area, is recommended.

$$\Delta MM_{i,t} = (MM_{t1} - MM_{t2}) * \ RM * FC \ (5)$$

ΔMM_i: Removal or emission factor of the dead biomass reservoir in terms of Mg CO_2 per hectare of stratum i, in year t.

MM_{t1}: Dead biomass at initial time in terms of Mg biomass per hectare of stratum i.

MM_{t2}: Dead biomass at final time in terms of Mg of biomass per hectare of stratum i.

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

FC: Biomass carbon ratio constant, a value of 0.45, the Nref value, or a value that fits the project area, is recommended.

$$\Delta LIT_{i,t} = (LIT_{t1} - LIT_{t2}) * \ RM * FC \ (6)$$

ΔLIT_i: Leaf litter reservoir removal or emission factor in terms of Mg of CO_2 per hectare of stratum i, in year t.

LIT_{t1}: Litterfall at initial time in terms of Mg biomass per hectare of stratum i.

LIT_{t2}: Litterfall in the final time in terms of Mg of biomass per hectare of stratum i.

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

FC: Biomass carbon ratio constant, a value of 0.45, the Nref value, or a value that fits the project area, is recommended.

$$\Delta COS_{20i,t} = \frac{(COS_{t1} - COS_{t2})}{20} * \ RM * FC \ (7)$$

ΔCOS_{20i}: Soil organic carbon reservoir removal or emission factor in terms of Mg of CO_2 per hectare of stratum i, in year t.

ΔCOS_{t1}: Soil organic carbon at the initial time in terms of Mg carbon per hectare of layer i.

ΔCOS_{t2}: Soil organic carbon at the end time in terms of Mg carbon per hectare of stratum i.

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

FC: Biomass carbon ratio constant, a value of 0.45, the Nref value, or a value that fits the project area, is recommended.

10. BASELINE SCENARIO

This scenario is built taking into account the guidelines of the framework methodology.

11. FORMULATION SCENARIO

The formulation scenario is based on projections based on modeling the increase in GHG removals and emissions calculated by forest harvesting activities year by year. For this, secondary studies or own studies can be used as a reference to show how this trend of increase in stocks and their reduction by forest stratum would be; this should be done for the lifetime of the project and is represented with the variable $\Delta CP_{T,t}$ for the increase in removals and as $\Delta EP_{T,t}$ for the emissions resulting from sustainable forest harvesting. An efficiency coefficient must be subtracted from this scenario, which must be in the order of 70% to 90% and its choice must be justified by the proponent and is called EF. This is supported by the activities generated by the proponent. The by the factor $(1 - Ef)$ must be multiplied year by year according to the total projected removals.

$$\Delta GSB_{ACTUAL,t} = (\Delta CP_{T,t} - \Delta EP_{T,t})(1 - Ef) \quad (8)$$

Where:

$\Delta GSB_{ACTUAL,t}$ *(tCO2e) = These are the projected net removals of CO2 by sinks at year t, the changes in carbon stocks, as well as their uncertainty, should be made following the guidelines of the A/R TOOL 14[6].*

$\Delta CP_{T,t}$ *(tCO2e) = Carbon reserves increase in the project's sinks projected to year t.*

$\Delta EP_{T,t}$*: These are the total emissions due to the sustainable forest harvesting activity.*

Ef *: Project efficiency ratio.*

In any case, the modeling of stock changes must be done for each applicable reservoir considering the following equation:

$$\Delta CP_{T,t} = (\Delta BA_{i,t} + \Delta BS_{i,t} + \Delta LIT_{i,t} + \Delta MM_{i,t} + \Delta COS_{20i,t}) \quad (9)$$

Where:

$ECO2eq_i$*: Emission factor of stratum i in year t.*

$\Delta BA_{i,t}$*: Emission factor of the aerial biomass reservoir in terms of Mg per hectare, in year t.*

$\Delta BS_{i,t}$*: Subway biomass reservoir emission factor in terms of Mg CO2 per hectare, year t.*

$\Delta LIT_{i,t}$*: Emission factor of the leaf litter reservoir in terms of Mg CO2 per hectare, in year t.*

[6] CDM. 2011. Methodological tool Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities. En: ar-am-tool-14-v4.2.pdf (unfccc.int)

$\Delta MM_{i,t}$: Emission factor of the dead biomass reservoir in terms of Mg of CO_2 per hectare, in year t.

$\Delta COS_{20i,t}$: Emission factor of the 20-year soil organic carbon reservoir in terms of Mg CO_2 per hectare, in year t.

Once the projection of the increase in removals in the formulation scenario has been estimated, the estimation of COLCERS, COLCX carbon certificates, is made with the following formula:

For SFM compartment:

$$COLCERSDef_t = \left(\Delta GSB_{ACTUAL,t} * FDefco\right) - \left(\Delta GSB_{ACTUAL,t} * FDefco\right) * RNP \quad (10)$$

Where:

$COLCERSDef_t$: baseline COLCX certificates that are attributable to avoided deforestation activities, in year t.

RNP: Risk of non-permanence

$FDefco$: Correction factor for the measurement of emissions from deforestation, these appear in section 18 of the framework methodology.

The considerations of the framework methodology must be considered. Additionally, the baseline scenario for GSB is calculated considering the following equations:

11.1 Forest harvesting:

The total emissions due to forest harvesting are calculated using the following formula:

$$\Delta EP_{T,t} = E_{p,t} + E_{s,t} + ETp_t \quad (11)$$

$\Delta EP_{T,t}$: *These are the total emissions due to sustainable forest harvesting activities.*

ETp,t: Emissions due to activities associated with machinery or animals at harvesting in Mg CO_2 equivalent, in year t.

Ep, t: Emissions due to quick release products, in $MgCO_2$ equivalent, in year t.

Es, t: Emissions due to moderate release products, in $MgCO_2$ equivalent, in year t.

In this case, an inventory of 100% of the individuals to be cut must be taken for each year, in addition to a previous record showing that they have been identified with GPS points, photograph and dendrometric data. There must be

an estimate of the total biomass volume derived from applicable local, regional or national allometric equations. These equations must consider at least the DBH (Diameter at 1.30 m) and the total height of the trees. It must also have calculations, as accurate as possible, of the commercial volume per tree.

The following are acceptable: own allometric equations, which have been constructed with field instruments and consider at least 10 individuals of at least 5 diameter classes per species.

The total volume of biomass that is affected by forest harvesting or any other activity, such as the construction of roads for timber extraction, will be calculated in the following way:

$$VT_{m,t} = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VT_{l,j,i,t}))) \quad (12)$$

Where:

VT_m = *Total volume of biomass affected by the activity m, in year t.*

$VT_{lj,i,t}$ = *Total biomass volume of tree l of species j in stratum i in m³, in year t.*

l = *1,2,3... sequence of individual trees.*

i = *1,2,3 ... M strata.*

j = *1,2,3 ... J tree species.*

t = *year.*

In this case, at least the volume of biomass affected by road construction and by the harvesting of forest individuals for commercial activities must be identified. When there are other activities such as the creation of firebreaks or other types of activities that require the harvesting of individuals, these must also be quantified.

Not all the biomass affected is harvested; therefore, it has two components, the remaining biomass and the harvested biomass. In the case of harvested biomass, its volume is calculated as follows:

$$VC_t = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VC_{l,j,i,t}))) \quad (13)$$

Where:

VC_t = *Total commercial volume harvested in m³, in year t.*

$VC_{l,j,i,t}$ = *Commercial volume harvested of tree l of species j in stratum i in m³, in year t..*

l = 1,2,3... sequence of individual trees.
i = 1,2,3 ... M strata.
j = 1,2,3 ... J tree species.
t = year.

In the case of remaining wood, it is calculated as follows:

$$VR_t = (\sum_{m=0}^{m} VT_{m,t}) - VC_t \ (14)$$

VR_t *= Remaining biomass volume in m³, in year t.*
VC_t *= Total commercial volume harvested, in year t.*
$VT_{m,t}$*: Total volume of biomass affected by the activity m, in year t.*
m = 1,2,3... silvicultural activity m.
t = year.

11.2 Direct emissions associated with forest harvesting:

Because there are differences in the GHG release associated with timber products, these should be calculated considering three categories.

The first category is the one that is broken down into the first three years of use. It is calculated as follows:

$$E_{p,t} = (VR_t + Vp_t) * RM * FC \ (15)$$

Ep: Emissions due to fast release products, in $MgCO_2$ *equivalent, in year t.*
VRt: Remaining biomass volume, in year t.
Vpt: Volume of short-lived timber products (1 to 3 years), in year t.
RM : Carbon dioxide and carbon dioxide molecular ratio constant given by 44/12.
FC: Biomass carbon ratio constant, a value of 0.45, the Nref value, or a value that fits the project area, is recommended.
t = year.

The second category is wood that has a life span of 3 to 100 years. This category is estimated based on the linear decomposition of 20 years.

$$E_{s,t} = Vs * RM * FC \ (16)$$

Es: Emissions due to moderate release products in $MgCO_2$ *equivalent, in year t.*
Vst: Wood volume of medium-lived products (4 to 100 years), as a function of 20-year linear decomposition, in year t.
RM : Carbon dioxide and carbon dioxide molecular ratio constant given by 44/12.
FC: Biomass carbon ratio constant, a value of 0.45, the Nref value, or a value that fits the project area, is recommended.
t = year.

The third category corresponds to those with a duration of more than 100 years. It is assumed that its carbon reserves will be permanently conserved.

11.3 Emissions due to the use of machinery for wood harvesting and processing:

A list should be made of all the machines used for the harvesting and processing of wood, considering the volume of fuel, the type of fuel used, and the emission factor of the fuel used that is used for each machine or means of transport.

This is calculated as follows:

$$ETp_t = E_{harvesting} + E_{minor\ transport} + E_{major\ transport} + E_{processing} (17)$$

ETp: Emissions due to activities associated with machinery or animals at harvesting in $MgCO_2$ equivalent, in year t.

$E_{harvesting}$: Total emissions due to the use of machinery associated with harvesting in $MgCO_2$ equivalent, year t.

$E_{major\ transport}$: Total emissions due to minor transportation of wood, for animals, consider national factors by type of animal according to IPCC[7], national inventories or FAOSAT[8] in $MgCO_2$ equivalent; in year t.

$E_{processing}$: Emissions due to electricity consumption at the sawmill in $MgCO_2$ equivalent, in year t.

For the calculation of emission factors associated with CO_2, CH_4 and N_2O for the fuel used use the IPCC default emission factors for road transport (IPCC, 2006, Volume 2, Chapter 3[9]). For electricity used for wood processing use the emission factors related to IPCC Volume 2 and Chapter 2 cited in the previous subscript.

12. IMPLEMENTATION SCENARIO

The calculations for the implementation scenario are the same as those for the formulation, except that the values for each carbon reservoir. For the case

[7] IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. https://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/vol4.html

[8] https://www.fao.org/faostat/es

[9] IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. https://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf

of aboveground biomass, the ICR module should be taken as a reference, in this same section for the calculation of $\Delta CP_{T,t}$. In the case of the variable $\Delta EP_{T,t}$, the proponent must keep a GHG inventory of all the associated variables, including emissions caused by impacts on GHG reservoirs, direct emissions due to forest harvesting and emissions due to the use of machinery. For this, the same equations of the formulation scenario must be followed, only that in this one the real values are applied. These must be supported with fuel purchase invoices, technical specifications of the machinery to be used, among others.

12.1 Estimation of the COLCERS of the scenario with project

The following equation is used to calculate the COLCERS resulting from SFM activities:

$$COLCERSDef_t = \left(\Delta GSB_{ACTUAL,t} * FDefco\right) - \left(\Delta GSB_{ACTUAL,t} * FDefco\right) * RNP \quad (18)$$

Where:

$COLCERSDef_t$ *: baseline COLCX certificates that are attributable to avoided deforestation activities.*

RNP *: Risk of non-permanence*

$FDefco$ *: Correction factor for the measurement of emissions from deforestation, these appear in section 18 of the framework methodology.*

13. 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.

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 **Table 3**.

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, and 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, leaving it under the responsibility of the proponent.

14. REDD+ SAFEGUARDS

Apply the considerations of the framework methodology.

15. UNCERTAINTY

Apply the considerations of the framework methodology.

16. ADDITIONALITY

Apply the considerations of the framework methodology.

17. RISKS OF NON-PERMANENCE

Apply the considerations of the framework methodology.

18. SDG

Apply the considerations of the framework methodology.

Table 3 *Summary of variables applicable to the project*

Variable	Description	Sections where it is mentioned	Formulas in which it is used	Units	Source	Monitoring
$ECH4eq_i$	*CH_4 emission factor per stratum i burned.*	8. Emission Sources	$ECH4eq_i = ECO2eq_i * \frac{11}{44} * RMCH4 * TCH4$ (19)	Mg CO_2 eq	Calculated	Optional, only if CH_4 is significant
$ECO2eqi$	*Emission factor of stratum i.*	8. Emission Sources	$ECH4eq_i = ECO2eq_i * \frac{11}{44} * RMCH4 * TCH4$ (20) $ENO2eq_i = ECO2eq_i * \frac{11}{44} * RMNO2 * TCNO24 * NC$ (2)	Mg CO_2	Calculated	Mandatory
$RMCH4$	*Methane to carbon molecular ratio constant given by 16/12.*	8. Emission Sources	$ECH4eq_i = ECO2eq_i * \frac{11}{44} * RMCH4 * TCH4$ (21)	-	Reference	N/A
TCHA	*Methane emission rate 0.012*	8. Emission Sources	$ECH4eq_i = ECO2eq_i * \frac{11}{44} * RMCH4 * TCH4$ (22)	Mg CO_2 eq	Reference	N/A
$ENO2eqi$	*NO_2 emission factor of stratum i burned.*	8. Emission Sources	$ENO2eq_i = ECO2eq_i * \frac{11}{44} * RMNO2 * TCNO24 * NC$ (2)	Mg CO_2 eq	Calculated	Optional, only if CH_4 or NO_2 are significant
$RMNO2$	*Molecular ratio constant of nitrogen dioxide and nitrogen given by 44/28.*	8. Emission Sources	$ENO2eq_i = ECO2eq_i * \frac{11}{44} * RMNO2 * TCNO24 * NC$ (2)	-	Reference	N/A
TCNO24	*Methane emission rate 0.007.*	8. Emission Sources	$ENO2eq_i = ECO2eq_i * \frac{11}{44} * RMNO2 * TCNO24 * NC$ (2)	Mg CO_2 eq	Reference	N/A

NC	*Nitrogen-carbon ratio 0.01*	8. Emission Sources	$ENO2eq_i = ECO2eq_i * \frac{11}{44} * RMNO2 * TCNO24 * NC$ (2)	-	Reference	N/A
ΔBA_i	*Removal or emission factor of the aerial biomass reservoir of stratum i, in year t.*	9. Baseline	$\Delta BA_{i,t} = (BA_{t1} - BA_{t2}) * RM * FC$ (3) $\Delta CP_{T,t} = (\Delta BA_{i,t} + \Delta BS_{i,t} + \Delta LIT_{i,t} + \Delta MM_{i,t} + \Delta COS_{20i,t})$ (23)	Mg of CO_2 per hectare	Calculated	Mandatory
BA_{t1}	*Biomass area at the initial time of stratum i.*	9. Baseline	$\Delta BA_{i,t} = (BA_{t1} - BA_{t2}) * RM * FC$ (3)	Mg de biomass per hectare	Monitoring data	Mandatory
BA_{t2}	*Biomass area over time of stratum i.*	9. Baseline	$\Delta BA_{i,t} = (BA_{t1} - BA_{t2}) * RM * FC$ (3)	Mg de biomass per hectare	Monitoring data	Mandatory
RM	*Carbon dioxide and carbon dioxide molecular ratio constant given by 44/12.*	9. Baseline	$\Delta BA_{i,t} = (BA_{t1} - BA_{t2}) * RM * FC$ (3) $\Delta BS_{i,t} = (BS_{t1} - BS_{t2}) * RM * FC$ (24) $\Delta MM_{i,t} = (MM_{t1} - MM_{t2}) * RM * FC$ (25) $\Delta LIT_{i,t} = (LIT_{t1} - LIT_{t2}) * RM * FC$ (26) $\Delta COS_{20i,t} = \frac{(COS_{t1} - COS_{t2})}{20} * RM * FC$ (27) $E_{p,t} = (VR_t + Vp_t) * RM * FC$ (28) $E_{s,t} = Vst * RM * FC$ (29)	-	Reference	N/A

FC	*Biomass carbon ratio constant, a value of 0.45, the Nref value, or a value that fits the project area, is recommended.*	9. Baseline	$\Delta BA_{i,t} = (BA_{t1} - BA_{t2}) * RM * FC$ (3) $\Delta BS_{i,t} = (BS_{t1} - BS_{t2}) * RM * FC$ (30) $\Delta MM_{i,t} = (MM_{t1} - MM_{t2}) * RM * FC$ (31) $\Delta LIT_{i,t} = (LIT_{t1} - LIT_{t2}) * RM * FC$ (32) $\Delta COS_{20i,t} = \frac{(COS_{t1} - COS_{t2})}{20} * RM * FC$ (33) $E_{p,t} = (VR_t + Vp_t) * RM * FC$ (34) $E_{s,t} = Vst * RM * FC$ (35)	-	Reference	N/A
ΔBS_i	*Removal or emission factor of the belowground biomass reservoir stratum i, in year t.*	9. Baseline	$\Delta BS_{i,t} = (BS_{t1} - BS_{t2}) * RM * FC$ (36) $\Delta CP_{T,t} = (\Delta BA_{i,t} + \Delta BS_{i,t} + \Delta LIT_{i,t} + \Delta MM_{i,t} + \Delta COS_{20i,t})$ (37)	Mg of CO_2 per hectare	Calculated	Mandatory if included
BS_{t1}	*Belowground biomass at the initial time of stratum i.*	9. Baseline	$\Delta BS_{i,t} = (BS_{t1} - BS_{t2}) * RM * FC$ (38)	Mg de biomass per hectare	Monitoring data	Mandatory if included
BS_{t2}	*Belowground biomass over time of stratum i.*	9. Baseline	$\Delta BS_{i,t} = (BS_{t1} - BS_{t2}) * RM * FC$ (39)	Mg de biomass per hectare	Monitoring data	Mandatory if included
ΔMM_i	*Removal or emission factor of the dead biomass reservoir stratum i, in year t.*	9. Baseline	$\Delta MM_{i,t} = (MM_{t1} - MM_{t2}) * RM * FC$ (40) $\Delta CP_{T,t} = (\Delta BA_{i,t} + \Delta BS_{i,t} + \Delta LIT_{i,t} + \Delta MM_{i,t} + \Delta COS_{20i,t})$ (41)	Mg of CO_2 per hectare	Calculated	Mandatory if included

MM_{t1}	*Dead biomass over time of stratum i.*	9. Baseline	$\Delta MM_{i,t} = (MM_{t1} - MM_{t2}) * RM * FC$ (42)	Mg de biomass per hectare	Monitoring data	Mandatory if included
MM_{t2}	*Dead biomass in the final time of stratum i.*	9. Baseline	$\Delta MM_{i,t} = (MM_{t1} - MM_{t2}) * RM * FC$ (43)	Mg de biomass per hectare	Monitoring data	Mandatory if included
ΔLIT_i	*Removal or emission factor of the litter reservoir of stratum i, in year t.*	9. Baseline	$\Delta LIT_{i,t} = (LIT_{t1} - LIT_{t2}) * RM * FC$ (44) $\Delta CP_{T,t} = (\Delta BA_{i,t} + \Delta BS_{i,t} + \Delta LIT_{i,t} + \Delta MM_{i,t} + \Delta COS_{20i,t})$ (45)	Mg of CO_2 per hectare	Calculated	Mandatory if included
LIT_{t1}	*Litterfall at the initial time of stratum i.*	9. Baseline	$\Delta LIT_{i,t} = (LIT_{t1} - LIT_{t2}) * RM * FC$ (46)	Mg de biomass per hectare	Monitoring data	Mandatory if included
LIT_{t2}	*Leaf litter in the final time of stratum i.*	9. Baseline	$\Delta LIT_{i,t} = (LIT_{t1} - LIT_{t2}) * RM * FC$ (47)	Mg de biomass per hectare	Monitoring data	Mandatory if included

ΔCOS_{20i}	*Removal or emission factor of the organic carbon reservoir in the soil of stratum i, in year t.*	9. Baseline	$\Delta COS_{20i,t} = \frac{(COS_{t1} - COS_{t2})}{20} * RM * FC$ (48) $\Delta CP_{T,t} = (\Delta BA_{i,t} + \Delta BS_{i,t} + \Delta LIT_{i,t} + \Delta MM_{i,t} + \Delta COS_{20i,t})$ (49)	Mg of CO_2 per hectare	Calculated	Mandatory if included
ΔCOS_{t1}	*Soil organic carbon at the initial time of stratum i.*	9. Baseline	$\Delta COS_{20i,t} = \frac{(COS_{t1} - COS_{t2})}{20} * RM * FC$ (50)	Mg de biomass per hectare	Monitoring data	Mandatory if included
ΔCOS_{t2}	*Soil organic carbon at the end time of layer i.*	9. Baseline	$\Delta COS_{20i,t} = \frac{(COS_{t1} - COS_{t2})}{20} * RM * FC$ (51)	Mg de biomass per hectare	Monitoring data	Mandatory if included
$\Delta GSB_{ACTUAL,t}$	*Are the projected net removals of CO_2 by sinks at year t, the changes in carbon stocks*	12. Formulation Scenario	$\Delta GSB_{ACTUAL,t} = (\Delta CP_{T,t} - \Delta EP_{T,t})(1 - Ef)$ (52) $COLCERSDef_t = (\Delta GSB_{ACTUAL,t} * FDefco) - (\Delta GSB_{ACTUAL,t} * FDefco) * RNP$ (53)	tCO_2e	Calculated	Mandatory
$\Delta CP_{T,t}$	*Carbon reserves increase in the project's sinks projected to year t.*	12. Formulation Scenario	$\Delta GSB_{ACTUAL,t} = (\Delta CP_{T.t} - \Delta EP_{T.t})(1 - Ef)$ (54) $\Delta CP_{T,t} = (\Delta BA_{i,t} + \Delta BS_{i,t} + \Delta LIT_{i,t} + \Delta MM_{i,t} + \Delta COS_{20i,t})$ (55)	tCO_2e	Calculated	Mandatory

$\Delta EP_{T,t}$	*These are the total emissions due to sustainable forest harvesting activities.*	12. Formulation Scenario	$\Delta GSB_{ACTUAL,t} = (\Delta CP_{T,t} - \Delta EP_{T,t})(1 - Ef)$ (56) $\Delta EP_{T,t} = E_{p,t} + E_{s,t} + ETp_t$(57)	tCO_2e	Calculated	Mandatory
Ef	*Project efficiency ratio.*	12. Formulation Scenario	$\Delta GSB_{ACTUAL,t} = (\Delta CP_{T,t} - \Delta EP_{T,t})(1 - Ef)$ (58)	-	-	-
$COLCERSDef_t$	*Baseline COLCX certificates that are attributable to avoided deforestation activities, in year t.*	12. Formulation Scenario	$COLCERSDef_t = (\Delta GSB_{ACTUAL,t} * FDefco) - (\Delta GSB_{ACTUAL,t} * FDefco) * RNP$ (59) $COLCERSDef_t = (\Delta GSB_{ACTUAL,t} * FDefco) - (\Delta GSB_{ACTUAL,t} * FDefco) * RNP$ (60	COLCERS	Calculated	Mandatory
RNP	*Risk of non-permanence*	12. Formulation Scenario	$COLCERSDef_t = (\Delta GSB_{ACTUAL,t} * FDefco) - (\Delta GSB_{ACTUAL,t} * FDefco) * RNP$ (61) $COLCERSDef_t = (\Delta GSB_{ACTUAL,t} * FDefco) - (\Delta GSB_{ACTUAL,t} * FDefco) * RNP$ (62	-	Calculated	Mandatory
$FDefco$	*Correction factor for the measurement of emissions from deforestation*	12. Formulation Scenario	$COLCERSDef_t = (\Delta GSB_{ACTUAL,t} * FDefco) - (\Delta GSB_{ACTUAL,t} * FDefco) * RNP$ (63) $COLCERSDef_t = (\Delta GSB_{ACTUAL,t} * FDefco) - (\Delta GSB_{ACTUAL,t} * FDefco) * RNP$ (64	-	-	-

ETp,t	*Emissions due to activities associated with machinery or animals in harvesting, in year t*	12. Formulation Scenario	$\Delta EP_{T,t} = E_{p,t} + E_{s,t} + ETp_t$ (65) $ETp_t = E_{aprovechamietno} + E_{transporte\ menor} + E_{transporte\ mayor} + E_{procesamiento}$ (66)	Mg CO_2 eq	Calculated	Mandatory
Ep, t	*Emissions due to quick-release products, in year t.*	12. Formulation Scenario	$\Delta EP_{T,t} = E_{p,t} + E_{s,t} + ETp_t$ (67) $E_{p,t} = (VR_t + Vp_t) * RM * FC$ (68)	Mg CO_2 eq	Calculated	Mandatory
Es, t	*Emissions due to moderate release products, in year t.*	12. Formulation Scenario	$\Delta EP_{T,t} = E_{p,t} + E_{s,t} + ETp_t$ (69) $E_{s,t} = Vs * RM * FC$ (70)	Mg CO_2 eq	Calculated	Mandatory
VT_m	*Total volume of biomass affected by the activity m, in year t.*	12. Formulation Scenario	$VT_{m,t} = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VT_{l,j,i,t})))$ (71)	m^3	Calculated	Mandatory
$VT_{lj,i,t}$	*Total volume of biomass of tree l of species j in stratum i in m^3, in year t.*	12. Formulation Scenario	$VT_{m,t} = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VT_{l,j,i,t})))$ (72)	m^3	Calculated	Mandatory

l	*sequence of individual trees.*	12. Formulation Scenario	$VT_{m,t} = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VT_{l,j,i,t}))) (73)$	-	Measured in the field	Mandatory
i	*1,2,3 … M strata*	12. Formulation Scenario	$VT_{m,t} = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VT_{l,j,i,t}))) (74)$	-	Established	Mandatory
j	*1,2,3 … J tree species.*	12. Formulation Scenario	$VT_{m,t} = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VT_{l,j,i,t}))) (75)$	-	Inventory data	Mandatory
t	*year.*	12. Formulation Scenario	$VT_{m,t} = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VT_{l,j,i,t}))) (76)$	-	Established	Mandatory
VC_t	*Total commercial volume harvested, in year t.*	12. Formulation Scenario	$VC_t = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VC_{l,j,i,t}))) (77)$	m^3	Calculated	Mandatory

$VC_{l,j,i,t}$	*Commercial volume harvested of tree l of species j in stratum i, in year t.*	12. Formulation Scenario	$VC_t = \sum_{i=0}^{i}(\sum_{j=1}^{j}(\sum_{l=1}^{l}(VC_{l,j,i,t})))$ (78)	m^3	Calculated	Mandatory
VR_t	*Remaining biomass volume, in year t.*	12. Formulation Scenario	$VR_t = (\sum_{m=0}^{m} VT_{m,t}) - VC_t$ (79) $E_{p,t} = (VR_t + Vp_t) * RM * FC$ (80)	m^3	Calculated	Mandatory
VC_t	*Total commercial volume harvested, in year t.*	12. Formulation Scenario	$VR_t = (\sum_{m=0}^{m} VT_{m,t}) - VC_t$ (81)	m^3	Calculated	Mandatory
$VT_{m,t}$	*Total volume of biomass affected by the activity, year t.*	12. Formulation Scenario	$VR_t = (\sum_{m=0}^{m} VT_{m,t}) - VC_t$ (82)	m^3	Calculated	Mandatory
m	*1,2,3… silvicultural activity m.*	12. Formulation Scenario	$VR_t = (\sum_{m=0}^{m} VT_{m,t}) - VC_t$ (83)	-		Mandatory

Vpt	*Volume of short-lived timber products (1 to 3 years), in year t.*	12. Formulation Scenario	$E_{p,t} = (VR_t + Vp_t) * RM * FC$ (84)	m^3	Calculated	Mandatory
Vst:	*Wood volume of medium-lived products (4 to 100 years), as a function of 20-year linear decomposition, in year t.*	12. Formulation Scenario	$E_{s,t} = Vst * RM * FC$ (85)	m^3	Calculated	Mandatory
$E_{harvesting}$	*Total emissions due to the use of machinery associated with harvesting, in year t.*	12. Formulation Scenario	$ETp_t = E_{harvesting} + E_{minor\ transport} + E_{major\ transport} + E_{processing}$ (86)	$MgCO_2e$	Calculated	Mandatory
$E_{major\ transport}$	*Total emissions due to minor timber transportation.*	12. Formulation Scenario	$ETp_t = E_{harvesting} + E_{minor\ transport} + E_{major\ transport} + E_{processing}$ (87)	$MgCO_2e$	Calculated	Mandatory
$E_{processing}$	*Emissions due to electricity consumption at the sawmill, in year t.*	12. Formulation Scenario	$ETp_t = E_{harvesting} + E_{minor\ transport} + E_{major\ transport} + E_{processing}$ (88)	$MgCO_2e$	Calculated	Mandatory

19. REFERENCES

1. Noss, R. F. (1990). Indicators for monitoring biodiversity: a hierarchical approach. Conservation biology, 4(4), 355-364.
2. SER, N. Society for ecological restoration international science & policy working group. 2004.
3. SALAMANCA, B.; CAMARGO, G. Protocolo distrital de restauración ecológica. Convenio DAMA–Fundación Bachaqueros, Bogotá, 2000, vol. 402.
4. SIMBERLOFF, Daniel y col. Corredores de movimiento: ¿gangas de conservación o malas inversiones? Biología de la conservación, 1992, vol. 6, no 4, pág. 493-504.
5. PEÑA-GONZÁLEZ, Natalia. Programa de monitoreo de restauración para áreas con aislamiento perimetral. 2017.
6. UNFCCC (2023). Plataforma web de la Convención Marco de las Naciones Unidas sobre el Cambio Climático REDD+. In: https://redd.unfccc.int/
7. Pedroni, L. VCS Methodology VM0015 V 1.1, v.1.1 Methodology for Avoided Unplanned Deforestation; Carbon Decisions International: Washington, DC, USA; p. 184. Rescatado el 12/27/2021 de: https://verra.org/wp-content/uploads/2018/03/VM0015 V 1.1-Methodology-for-Avoided-Unplanned-Deforestation-v1.1.pdf
8. IPCC. (2003). Orientación del IPCC sobre las buenas prácticas para UTCUTS. Available in: kutt.it/laZFfp
9. IPCC. (2006). Directrices del IPCC de 2006 para los inventarios nacionales de gases de efecto invernadero. Agricultura, silvicultura y otros usos de la tierra. Available in: kutt.it/iLd1fY
10. IPCC. (2003). Orientación del IPCC sobre las buenas prácticas para uso del suelo, cambio de uso del suelo y forestería. Available in: https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/GPG_LULUCF_FULL.pdf
11. Brown, Sandra; LUGO, Ariel E. Rehabilitation of tropical lands: a key to sustaining development. Restoration Ecology, 1994, vol. 2, no 2, p. 97-111.
12. BACHAQUEROS, Fundación Estación Biológica. Protocolo Distrital de Restauración Ecológica. Guía para la restauración de ecosistemas nativos en las áreas rurales de Santafé de Bogotá. Alcaldía Mayor de Santafé de Bogotá. Departamento Técnico Administrativo del Medio Ambiente. Dama, 2000.
13. According to UNFCCC decision 12/CP. 17 of the UNFCCC, FREL/NRFs should be expressed in tons of carbon dioxide equivalent per year.
14. Adapted from: CDM (2007). A/R Methodological Tool “Tool for the Demonstration and Assessment of Additionality in A/R CDM Project Activities” (Version 02). Fuente: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-01-v2.pdf

15. According to the ColCX Standard, ICR activities are carbon reserves enhancement activities and only apply to areas of permanent forest.
16. Ríos-Camey, J. M., Aguirre-Calderón, O. A., Treviño-Garza, E. J., Jiménez-Pérez, J., Alanís-Rodríguez, E., & Santos-Posadas, H. M. D. L. (2021). Crecimiento e incremento en biomasa y carbono de Pinus teocote Schltdl. et Cham. y Pinus oocarpa Schiede., Guerrero, México. Revista mexicana de ciencias forestales, 12(67), 81-108.
17. CDM. 2011. Methodological tool Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities. In: ar-am-tool-14-v4.2.pdf (unfccc.int)
18. Adaptado de: CDM (2011). A/R Methodological Tool ìEstimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activityî (Version 04.0.0). Source: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v2.pdf
19. CDM. 2011. Methodological tool Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities. In: ar-am-tool-14-v4.2.pdf (unfccc.int)
20. CDM. 2011. Methodological tool Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities. In: ar-am-tool-14-v4.2.pdf (unfccc.int)
21. Adaptado de: CDM (2011). A/R Methodological Tool ìEstimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activityî (Version 04.0.0). Source: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v2.pdf
22. Doran, G. T. (1981). "There's a S.M.A.R.T. way to write management's goals and objectives". Management Review. 70 (11): 35–36.
23. YEPES, A. P., et al. Protocolo para la estimación nacional y subnacional de biomasa-carbono en Colombia. IDEAM. Bogotá, Colombia, 2011.