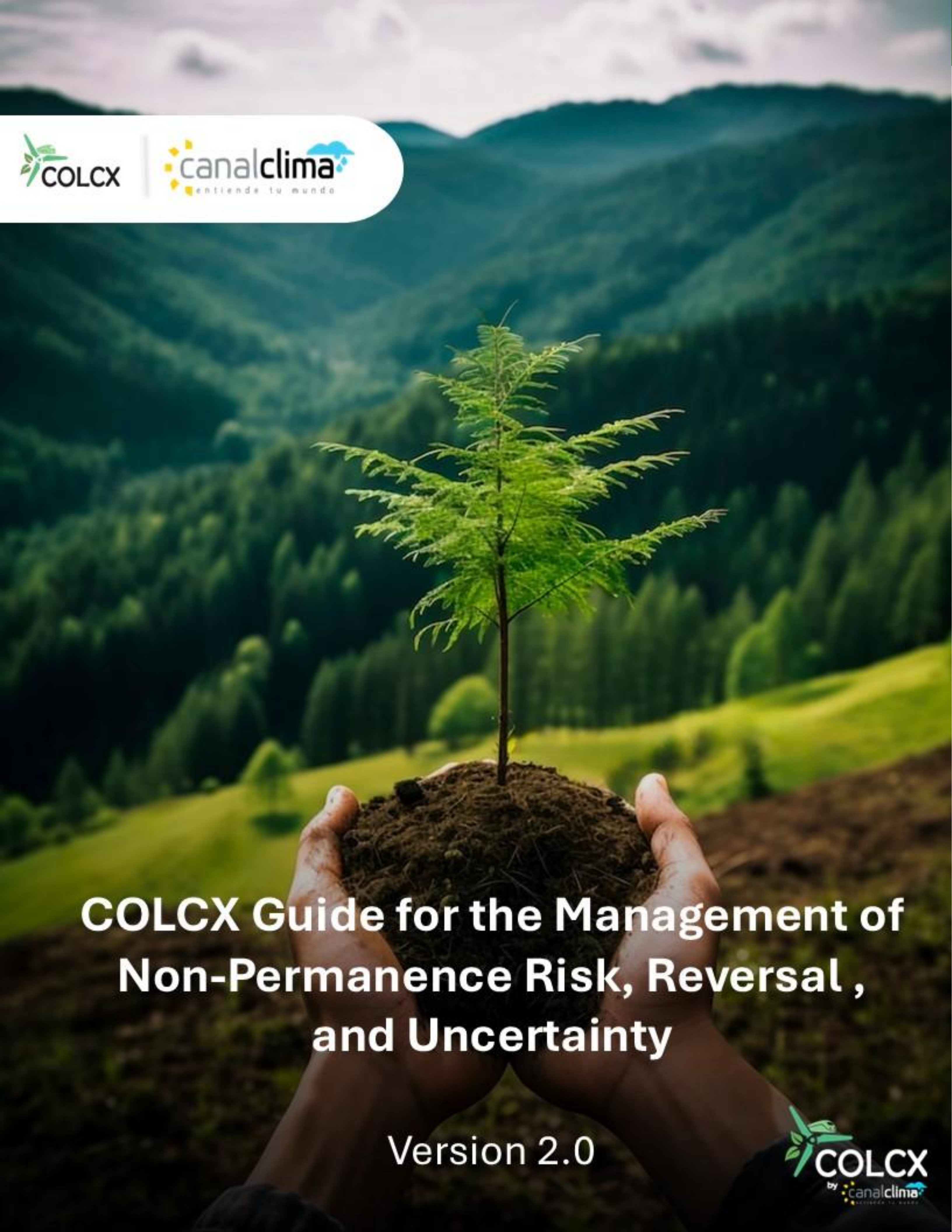

COLCX Guide for the Management of Non-Permanence Risk, Reversal , and Uncertainty

Version 2.0

COLCX Guide for the Management of Non-Permanence, Reversal and Uncertainty Risks

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Contents

TERMS AND DEFINITIONS

Credit deficit	The situation in which a project experiences reversals that, once quantified, exceed the number of credits available in the buffer and other available quantities to compensate such reversals.
Non-permanence buffer reserve	A fraction of the carbon credits generated by the project, determined through qualitative and quantitative risk assessment, and jointly managed with the program to cover the loss of carbon pools under specific causes.
Reversal	The materialization of adverse events (non-permanence risks) that may lead to the emission of carbon previously stored or reduced within the project area.
Intentional reversal	Activities involving damage or loss resulting from decisions or influence by project proponents, titleholders, landowners, or entities related to the initiative
Unintentional reversal	Activities involving damage or loss beyond the control of the actors involved or with variables that are unpredictable to estimate their occurrence.

1 INTRODUCTION

Any project exposed to internal, external, or natural factors is subject to risks. Climate change mitigation projects are no exception when facing adverse scenarios that may alter their performance. Natural or anthropogenic events such as forest fires, illegal logging, pest outbreaks, inadequate management, droughts, or landslides are among the causes that may affect the integrity of carbon pools.

Non-permanence risk refers to the probability of loss of captured or reduced carbon, affecting its existence within a specific time period. The manifestation of these losses may lead to carbon emissions, becoming a reversal. Within the commitments of the parties, safeguarding projects against carbon reversal is essential[1], making the identification, assessment, and management of risks related to project activities fundamental.

The search for mechanisms to mitigate non-permanence risks guarantees project commitment to climate action and increases confidence in their results. Accordingly, COLCX provides this Guide for the management of non-permanence risks, reversal, and uncertainty. The application of this guide will enable proponents of projects in the forestry, reforestation, natural forest, and agricultural sectors to[2]:

- Identify project risks
- Quantify the probability of occurrence and associated impacts
- Design measures to mitigate derived effects
- Determine the non-permanence risk buffer reserve

Additionally, the use of highly accurate data with low uncertainty and no overestimation constitutes best practice in project formulation. Therefore, this guide provides guidelines for determining and calculating uncertainty, based on IPCC guidance. The project proponent must apply this guide as a complement to methodological procedures, increasing precision and accuracy in the quantification of GHG mitigation results.

[1] Cancun Safeguard F – COP 16.
[2] Technology-based avoided emissions initiatives do not entail reversal risks with the same likelihood as land-use-based initiatives.

2 OBJECTIVES

Guide the project proponent in determining the non-permanence buffer reserve and uncertainty for their mitigation initiative.

- Describe the risks associated with mitigation projects in the forestry, reforestation, natural forest, and agricultural sectors.
- Quantify the effect generated at the project level for each identified risk, referred to as the non-permanence buffer reserve.
- Identify actions for mitigating the identified risks.
- State considerations for the determination of uncertainty

3 CARBON REVERSAL[3]

Reversal is the materialization of adverse events (non-permanence risks) that may lead to the emission of carbon stored or reduced within the project area. This phenomenon occurs only in project activities that generate the storage of GHGs in specific pools and that, under events, may release them.

GHG removals present a reversal when the carbon accumulated period by period in the pools decreases compared to the previous period. Likewise, reductions under specific circumstances may also be subject to reversals. For example, if a project implements actions to prevent the loss of carbon-sequestering pools, but an event results in their loss, this generates a reversal of the project activity that was intended to avoid such emissions.

In both cases, when the cumulative trend of removed or reduced emissions decreases by more than 5% compared to its last verification period, it is considered a reversal, indicating that the pool has released the carbon managed during the project implementation period. Note that not all emission reduction activities lead to increases in carbon stored in specific pools; in such cases, this is referred to as a non-reversible or permanent GHG reduction[4].

For the purposes of this guide, emissions related to reversals are quantified only for carbon within the affected pool. Gases resulting from activities associated with this reversal are quantified under the project emissions section and must be considered by the developer in project formulation, quantification, and emissions balance. For example, machinery used for extraction and maintenance, energy consumption, among others.

[3] This guide incorporates the recommendations set out in the document *Options for Addressing the Risk of Non-Permanence for Land-Based Mitigation in Carbon Crediting Programmes*. (2024). Rome: FAO.

[4] Activities whose carbon reservoir has minimal exposure to factors of damage or loss—primarily those based on technology—given that their exposure to external agents, whether natural or anthropogenic, is very low.

4 NON-PERMANENCE RISKS

In a GHG Mitigation Project (PMGEI), carbon loss risks are associated with the internal and external context in which the initiative is developed, involving political, economic, ecological, social, technological, and/or legal factors. According to the implemented activity, the proponent must identify probable risks arising from direct interaction with these areas. Developers must consider during project formulation:

1. The susceptibility of carbon pools to natural or anthropogenic factors.
2. The capacity of project activities to manage damage and loss factors affecting carbon pools.
3. The magnitude of impact on carbon pools in the event of the manifestation of one or more risks.

Under these considerations, the proponent must follow the guidelines for the evaluation of non-permanence risks defined in the "*Non-Permanence Risk Tool*", also considering risks identified through other tools such as the *No Net Harm and Safeguards Tool* in its most updated version. All risks included in this analysis must be supported and verifiable, considering assumptions and technical information from official or recognized sources, not older than five years from the date of analysis.

4.1 Reporting of Non-Permanence Risks

The risk evaluation horizon in this tool must be equal to the useful life of the initiative, so that all possible reversals and mitigation measures can be considered at scales sufficient to respond at any period. In addition to historical information, long-term impact projections designed by official entities or modeling exercises based on data appropriate to the area may be used. Climate change effects and trend scenarios must be considered in the evaluation.

The proponent must report their non-permanence risk analysis in the monitoring report. If a project fails to submit its report within the established period[5], it is assumed to have experienced reversals and must compensate a fraction of the total reductions or removals achieved. This fraction is calculated according to the non-permanence risk analysis in its highest category. If the proponent cannot justify the impact of the delay, they must compensate the total credits achieved.

When risk monitoring reveals an increase in its rating compared to the previous period, this must be justified. It is expected that through the proponent's management actions, the risk will decrease to its minimum rating. COLCX allows the developer to demonstrate during the crediting period that risks have been controlled and sufficient actions executed to prevent their manifestation, limiting evaluation in

[5] According to the program, projects have a maximum of five (5) years from their most recent verification to report results (see *COLCX Standard for the Certification of Mitigation Initiatives – Requirements Applicable to Validation and Verification*).

subsequent periods only to those risks that could not be minimized to the greatest extent.

4.2 Risk Assessment

The risk categories and subcategories that the proponent must evaluate within the *Non-Permanence Risk Tool*, to obtain the percentage of buffer reserve to be deducted from the total reductions and/or removals achieved, correspond to risks based on the following aspects[6]:

1. Probability of occurrence: Refers to the likelihood that a situation or event will occur within a given period; that is, it is related to frequency.
2. Exposure: Degree to which a system is present in an area where a threat may occur that could affect its integrity.
3. Sensitivity: Magnitude of the effects generated in a system upon the manifestation of a threat.
4. Adaptive capacity: Ability of a system to respond to adverse events that may cause potential damage.

For risk identification, proponents must consider the following key aspects:

- The risks identified in the *Non-Permanence Risk Tool* consider environmental, social, financial, cultural, regulatory, and technological factors, establishing plausible scenarios that allow for risk evaluation.
- Risk assessment must consider:
  - Preventing and eliminating risks whenever possible.
  - Mitigating the probability of occurrence and/or the impact of identified risks.
  - Implementing mitigation measures that minimize adverse effects.
  - Compensating unavoidable impacts through mechanisms that are politically, ecologically, socially, and financially viable.
- The information used to justify risks associated with project activities must originate from verifiable and updated sources, with a maximum age of five (5) years from the date of evaluation3.
- The analysis must be objective and contextualized, considering the possibility of reformulating the project based on the capacity to mitigate identified risks.
- Local-scale risks must be identified and, where applicable, those with transboundary effects that may manifest in the long term, including cumulative and synergistic impacts.
- When the spatial, social, and physical configuration of the areas presents significant differences, a separate risk analysis must be conducted for each group of areas with similar characteristics.

[6] Climate change vulnerability assessment of forests and forest-dependent people. FAO (2019). Disponible: https://openknowledge.fao.org/server/api/core/bitstreams/ab0dfffe-9f36-4a4e-9bb7-efa72d236622/content

Within the analysis proposed in the *Non-Permanence Risk Tool*, it must be considered that none of the risks may be rated with a value lower than 1. Risks shall be rated on a scale of Critical, High, Moderate, Low, and Very Low.

Based on the assigned risk ratings, a count will be performed according to the number of risks in each category. Through weighting, the overall risk level will be estimated and, finally, the non-permanence buffer reserve, which ranges between 10% and 30%, understands that a 30% corresponds to a predominance of critical risks that render project implementation unviable.

The non-permanence analysis involves the evaluation of political, economic, technical, environmental, and technological dimensions under which the project is developed (See Table 1). Each evaluated dimension will have associated subdimensions and specific risks to be assessed within the *Non-Permanence Risk Tool*, with the objective of determining the integrity of the initiative. These analytical parameters seek to determine, across all areas of implementation, the stability, continuity, vulnerability, and adaptive capacity of the initiative in the face of circumstances that may condition its performance.

Table 1 Dimensions for the Evaluation of Non-Permanence Risks

Dimension	Subdimension	Object of analysis
Political	Administrative	Institutional stability; alignment between national guidelines and initiatives; changes in public policies; political will to support conservation; continuity of related state programs; and cooperation with international institutions and those of the host country that regulate or intervene in the initiative.
	Regulatory	
	Institutional	
Economic	Market	Financial sustainability of the project; variability in carbon prices; availability of resources; alternative economic incentives; variations in revenues and costs.
	Financing	
	Revenues and Costs	
Social	Conflicts	Social acceptance of the project; community participation; expectations; social cohesion; internal conflicts; armed conflict; migration; demographic pressures; and territorial governance dynamics.
	Safeguards	
	Mobilization	
	Armed Conflict	

Dimension	Subdimension	Object of analysis
Technical and Technological	Technical Capacity	Technical capacity of the team; availability of monitoring technologies; implementation or maintenance difficulties of tools and equipment; management and traceability of collected information.
	Access to Technology	
	Information Management	
Ecological / Environmental	Ecological Integrity	Ecosystem vulnerability to pests, degradation, invasive species, biodiversity loss, natural resilience; conservation status; biodiversity displacement; pollution; and natural resource use.
	Ecosystem Degradation	
	Resource Use	
Legal	Land Tenure	Land tenure; legal clarity regarding land use rights; regulatory changes; and legal risks related to property.
Climate Change	Climate Variables	Risks derived from extreme climate events (droughts, floods, El Niño/La Niña); increased fire incidence due to climate; and climate variability affecting carbon permanence.

5 NON-PERMANENCE BUFFER

This guide applies the non-permanence buffer reserve approach to compensate losses generated by unintentional reversals manifested within the project area. Under this approach, the program retains a fraction of the carbon credits generated and manages them to cover the loss of carbon pools under specific causes.

5.1 Specifications Regarding the Reserve

The non-permanence buffer reserve in COLCX may not, under any circumstances, be used to cover intentional reversals resulting from decisions of the proponent, titleholder, or landowner. However, the proponent must compensate for the impact derived from such reversal with carbon credits from the program. If compensation cannot be carried out due to justified reasons[7], the non-permanence buffer reserve may be used as a last resort in this case.

[7] The proponent must substantiate any limitations to compensating for an intentional reversal, such as financial insolvency, limited availability of credits for compensation, among others.

The non-permanence risk may be reduced in each period to a minimum value of 10%, based on justified evidence of the performance of management measures applied to the identified risks and, consequently, a reduction in assigned risk ratings. At the end of the crediting period, the proponent must reassess risks and define those that have been overcome and include those that manifest with greater intensity due to changes in the environmental, social, economic, and/or political context in which the initiative is implemented.

5.2 Use of the Buffer

A proponent with identified reversals must quantify the losses generated by the affected carbon pools. This value in tCO_2e must be automatically compensated using the non-permanence buffer reserve. For this purpose, the proponent submits a request for the release of non-permanence buffer credits, and COLCX performs the corresponding actions in its registry.

When a project generates reversals that exceed its non-permanence buffer reserve and the reductions and/or removals achieved in the period prior to the disturbance, this is defined as a credit deficit. In such case, the project must wait until the total reversal has been fully compensated before generating new tradable COLCERs. The program will deduct credits in each successive verification period until balance is restored. If the impact is due to force majeure[8] and the proponent substantiates the magnitude of the loss, the project may request cancellation.

If the proponent is close to the end of the crediting period and reversals occur, these must be fully covered before project closure. For this reason, COLCX will maintain the non-permanence buffer reserve within the system for up to one (1) year after the project's crediting period has ended. Thus, if reversals reported during the final stage require coverage, the reserve may be released upon request by the proponent or titleholder.

6 UNCERTAINTY

The estimation of uncertainty for all mitigation initiatives certified under the COLCX standard is mandatory. For its estimation, it is recommended to use the IPCC (2006) Guidelines for National Greenhouse Gas Inventories; however, this section specifies the general process for its determination and evaluation in the various estimates of emission reductions and removals from initiatives.

Uncertainty is understood as a property associated with the lack of knowledge of the exact or true value of a variable or parameter. It depends on the amount of data associated with the variable, the quality of the data, and the knowledge of the analyst

[8] Any unforeseen event beyond the control of the holder and/or proponent, not anticipated in the non-permanence risk analysis, and whose impact involves more than 85% of the carbon reservoirs reported for the project at the time of validation.

conducting the inference analysis.[9] Thus, uncertainty represents the degree of confidence in the estimated results, and its proper estimation is essential to ensure the integrity and comparability of results.

In the determination of emission reductions and/or GHG removals, and generally in any measurement, this property is implicitly present and may be associated with factors or circumstances such as:

- Lack of completeness: Occurs when a measurement method is still unknown or underdeveloped, which may lead to incomplete or erroneous conceptualizations. This type of bias may contribute to uncertainty.
- Application of models: Models may introduce random and systematic errors due to the following situations:
    - Models function as simplifications of real systems and are therefore inherently inexact.
    - Interpolation within a defined range of input values may be valid; however, some systems perform implicit extrapolations, leading to the use of data beyond the original input conditions.
    - Extrapolation consists of extending a model beyond the range under which it was calculated, which often introduces errors.
- Absence of data: In some cases, data are simply unavailable and must be extrapolated or obtained from other sources. When this occurs, the approach to quantifying uncertainty must be documented.
- Lack of representativeness of selected data and/or samples: This uncertainty is associated with a mismatch between the conditions linked to a given data set and the broader population it is meant to represent. For example, data that are representative under specific conditions but does not reflect the entirety of the population.
- Statistical random sampling error: This error is typically associated with data variance. It can often be reduced by increasing the number of independent random samples. In this regard, it is important to distinguish between uncertainty and variability. As good practice, uncertainty analyses for emissions are recommended to be conducted annually rather than over extended time intervals, since estimating emissions over longer periods may increase inherent error.
- Measurement errors: These may be random or systematic. They occur during measurement and may be associated with human error, instrument error, errors from information sources, or errors in data processing.
- Misclassification: Also classified as bias, it reflects an unclear or erroneous estimation of an emission or absorption.

[9] IPCC. (2006). *IPCC Guidelines for National Greenhouse Gas Inventories. Volume 1: General Guidance and Reporting. Chapter 3: Uncertainties*

- Missing data: Typically associated with detection limits, meaning information that cannot be detected due to technical or technological constraints. In such cases, the most conservative scenario must always be selected.

Therefore, it is considered good practice under this guide to rigorously justify and document uncertainty, which implies estimating it and clearly supporting the reasons and causes considered in its estimation. Accordingly, this section describes the approach for estimating uncertainty in the application of COLCX standard methodologies, focusing on:

- Uncertainty in the estimation of carbon pools and changes in carbon stocks.
- Uncertainty in emission estimation

6.1 Uncertainty Calculation

The calculation of uncertainty will provide rigorous support for the precision of emissions or reductions generated by the initiative. The estimation process will be determined through a sequence of steps that allow the determination of the initiative's percentage of risk and, in turn, the non-permanence buffer reserve that the initiative must assume. Accordingly, the process consists of:

6.1.1 Identification of activities and emission factors for uncertainty calculation

Based on the defined approach to uncertainty estimation—whether for emission sources or carbon pools —the activities of the initiative are identified. For the defined activity data variables and the emission factors used, uncertainty is calculated. It is important to note that each activity data value or emission factor used must include an uncertainty calculation.

Concepts:

- Activity Data (AD): Activity data refers to the measurement (magnitude) of a parameter to be evaluated in the initiative's activities that generate emissions or removals. For example: area covered by an ecosystem (hectares), soil bulk density (g/cm^3), or sampling depth (cm or m) – Units of measurement.
- Emission factors (EF): Corresponds to a coefficient that relates to the average amount of GHG emissions or removals per activity.

Thus, the total carbon estimate or carbon change is obtained by multiplying AD × EF.

To this end, for each activity data, the uncertainty can be estimated in accordance with:

$$UR = \left(\frac{IC95}{\bar{x}}\right) \times 100$$

Where:

UR: Relative uncertainty of activity data or emission factor
$\bar{x}$: Data average
IC95: 95% Confidence Interval – Confidence limits. A critical value of 1.96 or 2 is assumed, depending on the distribution and therefore the selected probability function.

To perform this, the standard error, mean, and standard deviation of the data must first be available. When calculating uncertainty for each activity data value, the following must be reported:

a) Representativeness of the data
b) Potential bias
c) Sample size (if applicable)
d) Measurement variability

6.1.2 Calculation of total uncertainty or error propagation

Once uncertainty has been determined for each activity data value, the combination of uncertainties or error propagation must be carried out. Two methods are proposed, depending on data availability, resource availability, and the relationship between variables.

a) Uncertainty or Error Propagation

This method is based on propagating uncertainty through the error propagation equation. For this method, the mean and standard deviation of each activity data value involved in the calculation are required. If the relationship between variables is multiplicative, uncertainty combination by multiplication may be performed[10]

$$Ut = \sqrt{U^2{}_1 + U^2{}_2 + .. + U^2{}_n}$$ [11]

Where:

Ut: Total relative uncertainty resulting from the product of the related quantities (magnitudes)

U_i: Relative uncertainty of each of the related quantities (magnitudes) or data.

[10] According to the IPCC (2006), it is used for uncertainty propagation based on the relative uncertainties of activity data and/or emission factors – Rule B
[11] Equation 3.1. Combination of Uncertainties – Method 1 – Multiplication – IPCC. (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 1: General Guidance and Reporting. Chapter 3: Uncertainties

b) Monte Carlo Method[12]

When, in the error propagation calculation, multiple variables are handled that are highly correlated, or when the uncertainty calculation is diffuse (non-normal distribution), insufficient data are available, or a detailed evaluation is desired, the use of Monte Carlo Simulation is recommended.

This method is based on generating pseudo-random samples. Based on the defined probability function, multiple random iterations are performed to calculate corresponding results, thereby obtaining the final uncertainty for the confidence interval. This technique relies on the statistical representation of variability and uncertainty associated with each variable, whether derived from historical information, scientific literature data, IPCC default values, or expert judgment, allowing replication of the expected behavior of the system under analysis.

For the application of the simulation, the following are required:

- Model: Corresponding to the base formula or equation that relates to two or more variables.
- Variables: Clearly defined with their units and scope.
- Normally expected value for each variable, or value defined by technical sources. For example, emission factors with established values. Minimum and maximum admissible values may also be included.
- Associated uncertainty for each variable, normally estimated under a 95% confidence interval.
- Confidence level or interval.
- Data distribution: According to IPCC (2006), Monte Carlo simulation is primarily used for variables with non-Gaussian distributions, although any distribution that adequately represents data variability may be applied.
- Number of iterations: IPCC (2006) recommends a minimum of 10,000 iterations to ensure statistical stability.

Note: For magnitudes where sampling is not performed, such as area, uncertainty will be closely linked to the precision level of the device used, the satellite resource employed (spatial resolution), and the application of confusion matrices.

c) Confusion Matrices

Confusion matrices are a technique used to evaluate the accuracy of categorical data, typically derived from classification or typology processes. For certain activity data (especially spatial variables), uncertainty estimation may be performed by identifying commission and omission errors and constructing confidence intervals for each category, aiming for values below 10%.

For example, when analyzing forest areas based on assisted satellite image classification, this corresponds to assessing areas or points on the image that effectively correspond (or not) to forest cover, supported by control points that confirm the actual land cover. Thus, if out of 100 control points known to be forest, the assisted

[12] According to the IPCC (2006), Chapter 3.2.3.2 – Method 2: Monte Carlo Simulation.

classification identifies 95 as forest and 5 as non-forest, the classification accuracy is 95%. Both omission errors and commission errors must be considered (e.g., areas that are not forests but were classified as forests).

6.1.3 Acceptable Thresholds in Validation and Verification Reports for Initiatives Certified under COLCX

The following uncertainty thresholds are accepted according to the activity data used and reported.

- Uncertainty ≤ 15 %: Acceptable without adjustments.
- 15 % < Uncertainty ≤ 20 %: Acceptable with technical justification.
- Uncertainty > 20 %: An increase in sample size is required, or a conservative discount factor proportional to the excess uncertainty must be applied.

The uncertainty discount is applied based on the stated acceptance threshold (15%). If the justification provided is accepted by the Validation and Verification Body (VVB) and the certifier, the threshold is approved without discount. Otherwise, the excess above the accepted threshold will be discounted.

For example, if the uncertainty for an emission estimate is 18% and the justification is not approved, the difference between the obtained value and the permitted value will be discounted—in this case 3% (18% obtained – 15% permitted = 3% residual).

6.2 Requirements for Uncertainty Calculations in Monitoring and Verification Reports

Reports must include:

- Details of the formulas used.
- A table with average values, standard deviation, and Uncertainty (%).
- Measures adopted to reduce uncertainty.
- Justification if a discount is applied due to high uncertainty.

During verification, auditing entities will evaluate:

- Statistical and methodological consistency.
- Data quality and traceability.

To reduce all types of error, this guide considers the following criteria both in estimation and documentation:

- Errors originating from carbon pools and emission estimation must be identified and described.
- Based on this, the proponent must demonstrate that, year by year, for any emission estimation, the calculated uncertainty is below 15%. If higher, the corresponding discount factors shall be applied.

- The proponent must include in the monitoring report the data collection protocol, describing measuring instruments, their technical specifications, and methods expected to reduce measurement errors, such as calibration procedures and training activities, among others. This must be aligned with data management and quality provisions established in the *COLCX Standard for the certification of mitigation initiatives*.
- For project areas lacking information, the proponent must describe and justify this situation in the monitoring report and explain how these areas are treated within the initiative. Such treatment or associated information must consider criteria of conservativeness, accuracy, and completeness.
- Uncertainty in activity data must be calculated in each monitoring period.

History of the Document

Version	***Date***	***Description***
1.0	10-08- 2023	Initial version development
1.1	21-08-2024	Structural adjustments to the initial version.
2.0	29-12-2025	Update of Section 4, modifying the risk assessment method for mitigation initiatives and including the annexed “Non-Permanence Risk Tool.” Included in this Guide. Update of Section 5, modifying the definition and use of the non-permanence buffer reserve for initiatives. Update of Section 6, detailing how to perform uncertainty estimation for the various activity data of initiatives. This version applies to initiatives in formulation, design, and monitoring stages from the date of official publication. Transition shall follow the guidelines defined in the *program’s methodological adoption standard* in its current version.