TERO.007 – ALM

VERSION 1.0

METHODOLOGY, AFOLU, AGRICULTURE

TERO CARBON AVALIAÇÕES E CERTIFICAÇÕES S.A.

IDENTIFICATION

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STANDARD	Tero Carbon Avaliações e Certificações S.A. (contato@terocarbon.com)
SOLUTION	Nature-Based Solutions (NBS)
SECTOR	Agriculture, Forestry and Other Land Use (AFOLU)
TYPE	Agriculture
ASSET GENERATED	Verified Carbon Unit (VCU) - Carbon Credit Asset
PROJECT ACTIVITIES	• Soil Organic Carbon (SOC) Accumulation • Carbon Accumulation in Perennial/Semi-perennial Crop Biomass (AGB_perennial/BGB_perennial) • Carbon Accumulation in Cyclical Crop Biomass (via LTCS) • Reduction of Greenhouse Gas Emissions associated with agricultural management (EMIS)
GHG MITIGATION	• Reduction • Removal

LIST OF ACRONYMS

AFOLU	Agriculture, Forestry and Other Land Use
AGB	Above-Ground Biomass
ALM	Agricultural Land Management
BAU	Business as usual
BGB	Below-Ground Biomass
BP	Buffer Pool
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CRVE	Verified Emission Reduction or Removal Certificate (from the SBCE)
CS	Carbon Stock
DBH	Diameter at Breast Height
DDW	Down Dead Wood
EMIS	GHG emissions from agricultural management
EUC	Emissions Unit Criteria
FI	Fractional Issuance
GHG	Greenhouse Gas
ICROA	International Carbon Reduction and Offsetting Alliance
IPCC	Intergovernmental Panel on Climate Change
KPI	Key Performance Indicator
LRA	Legal Reserve Area
LTCS	Long-Term Cyclical Stock
MRV	Measurement, Reporting, and Verification
MUA	Multiple-Use Area
NBS	Nature-based Solutions
PA	Project Area

PB	Property Boundary
PDD	Project Design Document
PPA	Permanent Preservation Area
QA/QC	Quality Assurance /Quality Control
SBCE	Brazilian Greenhouse Gas Emissions Trading System (*Sistema Brasileiro de Comércio de Emissões de Gases de Efeito Estufa*)
SDG	Sustainable Development Goals
SOC	Soil Organic Carbon
TAC	Term of Conduct Adjustment (*Termo de Ajustamento de Conduta*)
VCU	Verified Carbon Unit - Carbon Credit Asset
VVB	Validation/Verification Body

LIST OF PROGRAMS

ID	NAME
DC.CER.001	Certification Program
DC.MET.001	Methodologies Program
DC.REG.001	Asset Program

LIST OF SUPPORTING DOCUMENTS

ID	NAME	SOLUTION
DC.COM.001	Definitions	All
DC.COM.003	Stakeholder Consultation Procedure	All
DC.GOV.001	Tero Carbon Governance Structure	All
DC.GOV.004	Grievance Management Procedure	All
DC.CER.002	Land Tenure Compliance Manual and Tero Carbon Seals for NBS Projects	NBS
DC.CER.003	Technical Guidelines for Carbon Quantification in AFOLU Projects	NBS
FR.CER.001	Project Scale Analysis Tool	All
FR.CER.002	Social and Environmental Safeguards Analysis Tool	All
FR.CER.003	Project Additionality Demonstration Tool	All
FR.CER.004	Non-Permanence Risk Analysis and Guarantee Mechanism Tool	NBS
FR.CER.005	Leakage Assessment and Management Tool for NBS VCU Projects	NBS
FR.CER.007	Acceptance Criteria Analysis Tool for Project Verification	All
TP.CER.004	[Template] Zero Deforestation Declaration	NBS
TP.CER.005	[Template] Leakage Risk Assessment and Negligibility Justification Form for Small-Scale NBS VCU Projects	NBS
Law n° 15.042/2024	Establishes the Brazilian Greenhouse Gas Emissions Trading System (SBCE)	All

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1. INTRODUCTION

This methodology, **TERO.007 - ALM** (Agricultural Land Management), establishes the requirements and procedures for the quantification of Greenhouse Gas (GHG) removals and emission reductions resulting from the implementation of sustainable agricultural management practices on agricultural lands. It is intended for Nature-Based Solutions (NBS) projects in the Agriculture, Forestry, and Other Land Use (AFOLU) sector that seek the generation of Verified Carbon Units (VCUs) under the Tero Carbon Certification Program.

The ALM activities covered by this methodology include practices that promote the accumulation of soil organic carbon (SOC), the increase of carbon in agricultural biomass (AGB/BGB), and the reduction of GHG emissions associated with conventional management. The objective is to encourage the transition to more resilient, productive agricultural systems with a lower climate impact, especially for small-scale projects that traditionally face technical and financial barriers to accessing the carbon market.

This methodology was developed to ensure the environmental integrity, transparency, and credibility of the generated VCUs, based on international best practices such as the guidelines of the Intergovernmental Panel on Climate Change (IPCC). Although Tero Carbon does not yet have formal accreditation with bodies such as the International Carbon Reduction and Offsetting Alliance (ICROA) or the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), it is preparing all its documentation and processes with a view to this future accreditation, ensuring that its assets meet high quality standards and are suitable for the voluntary carbon market.

Additionally, this methodology was prepared considering Law No. 15,042, of December 11, 2024, which establishes the Brazilian Greenhouse Gas Emissions Trading System (SBCE). The aim is thus to provide a technical framework that is not only robust for the voluntary market but can also facilitate the eventual accreditation of this methodology and the recognition of the Verified Emission Reduction or Removal Certificates (CRVEs) generated by projects that use it within the scope of the SBCE, as per Art. 25 and Art. 44 of the said Law.

This methodology is the intellectual property of Hdom Engenharia e Projetos Ambientais Ltda and was developed and registered under the Tero Carbon “Methodologies Program (DC.MET.001)”. It **MUST** be used in conjunction with the Tero Programs (“Certification Program (DC.CER.001)”, “Methodologies Program (DC.MET.001)”, “Asset Program (DC.REG.001)”) and their complementary documents (Tools, Policies, Manuals, Procedures, and Templates). These documents provide mandatory and detailed requirements for crucial aspects such as additionality (FR.CER.003), land tenure compliance (DC.CER.002), non-permanence risk analysis and guarantee mechanisms (FR.CER.004), leakage

assessment (FR.CER.005), application of social and environmental safeguards (FR.CER.002), stakeholder consultation (DC.COM.003), and the validation and verification processes. This document and its application operate under the principles of the "Tero Carbon Governance Structure (DC.GOV.001)", aiming to ensure the environmental integrity and credibility of the generated VCUs.

2. SCOPE, ACCEPTANCE CRITERIA, AND ACTIVITIES

2.1. Scope

This methodology applies to projects in the AFOLU sector that promote the removal and/or reduction of GHG emissions through the adoption of sustainable agricultural practices in areas of consolidated agricultural use. It covers carbon accumulation in the soil, in the biomass of perennial/semi-perennial crops, in the biomass of annual/cyclical crops (through the concept of Long-Term Cyclical Stock - LTCS), and the reduction of management emissions. This methodology explicitly excludes projects whose main focus is pasture management.

2.2. Acceptance Criteria

This methodology is applicable exclusively to sustainable agricultural management projects that meet the following criteria:

i. **Land Tenure Compliance:** The project must be implemented on rural properties with proven land tenure regularity, according to the "Land Tenure Compliance Manual and Tero Carbon Seals for NBS Projects (DC.CER.002)".
ii. **Territorial Configuration:** The project area can be contiguous or composed of multiple parcels within the same property or on adjacent properties under the same proponent, as long as it forms a cohesive management unit.
iii. **Project Area Location and Additionality:** The Project Area (PA) must be located within the Multiple-Use Area (MUA) of the property. The activities proposed by the project cannot be required by legislation, judicial decisions, or formal commitments such as Terms of Conduct Adjustment (TACs) or environmental compensations. Additionality must be demonstrated according to the "Project Additionality Demonstration Tool (FR.CER.003)".
iv. **Additional Social and Environmental Impacts:** In addition to GHG mitigation, the project must demonstrate, through clear and measurable indicators, the occurrence of at least two additional social and environmental co-benefits (SDGs, excluding SDG 13), according to the "Social and Environmental Safeguards Analysis Tool (FR.CER.002)".

v. **Compliance with Social and Environmental Safeguards:** The project must fully comply with the social and environmental safeguards established by the "Social and Environmental Safeguards Analysis Tool (FR.CER.002)".

vi. **Clear Identification of Key Roles:** The project must explicitly present the identification of the main parties responsible for its implementation (Lead Proponent, Developer, Generator, Implementer), according to the requirements of the "Certification Program (DC.CER.001)".

vii. Area Eligibility and Land Use History:

- Agricultural areas (excluding pastures as the project's primary activity) with continuous use for annual, short-cycle, semi-perennial, or perennial crops for at least two (2) years before the project start date.
- The area must not be associated with deforestation of native vegetation after December 31, 2008. If the conversion of native vegetation for agricultural use occurred after this date, the respective valid environmental licenses must be presented, along with a justification that the conversion was legal and does not disqualify the project. Projects aiming for the SBCE should be aware that the regulation may impose additional restrictions on areas with a history of recent deforestation.
- Degraded areas undergoing agricultural recovery, where the project's practices aim to restore productive capacity and carbon stocks.
- The area cannot be under an active environmental embargo that prevents the proposed activities.

viii. **Long-Term Commitment (for LTCS):** If the project includes the accounting of carbon in the biomass of cyclical crops (LTCS), the proponent must demonstrate a commitment to maintain the agricultural practices that support the LTCS for a Project Commitment Period (Pc) defined and justified in the PDD, according to the "Non-Permanence Risk Analysis and Guarantee Mechanism Tool (FR.CER.004)".

2.3. Project Activities

This methodology provides for the generation of VCUs (removal and/or emission reduction) through the following eligible sustainable agricultural management activities:

I. **Soil Organic Carbon (SOC) Accumulation:** Adoption or intensification of practices that increase the input of organic matter to the soil and/or reduce its decomposition rate. Includes, but is not limited to:

- No-till or minimum tillage.
- Diversified crop rotation, including cover crops and/or green manuring.

- Use of perennial or long-cycle cover crops.
- Application of composted organic residues, biochar (if the biochar production meets sustainability criteria and does not generate significant net emissions), or other bio-inputs that demonstrably increase SOC.
- Reduction of erosion through conservation practices.

II. **Carbon Accumulation in Perennial/Semi-perennial Crop Biomass (`AGB_perennial/BGB_perennial`):** Increase in the carbon stock in the above-ground (AGB_perennial) and/or below-ground (BGB_perennial) biomass of long-duration perennial or semi-perennial crops. Includes:

- Implementation or improvement of the management of perennial/semi-perennial crops (e.g., fruit farming, coffee, cocoa, non-timber agricultural forestry).
- Agroforestry systems (AFS) or agrosilvopastoral systems (if the pastoral component is not the primary focus and emissions are duly accounted for), where the perennial/semi-perennial component is the focus of biomass accounting.
- Increase in planting density or introduction of cultivars with higher biomass accumulation potential in perennial/semi-perennial crops.
- **This component uses a Buffer Pool as a permanence mechanism.**

III. **Carbon Accumulation in Cyclical Crop Biomass (via LTCS):** Increase or maintenance of a Long-Term Cyclical Stock (LTCS) in the above-ground and/or below-ground biomass of annual or short-cycle crops (e.g., soy, corn, cotton, specific cover crops).

- Implies the adoption of a sustainable and continuous agricultural management system that maintains an average level of biomass throughout the annual cycles.
- The biomass of residues left in the field and the biomass of cover crops not explicitly included in the LTCS can contribute to SOC (see item 1) and emission reduction (see item 4).
- **This component uses Fractional Issuance (FI) as a permanence mechanism.**

IV. **Reduction of Greenhouse Gas Emissions associated with agricultural management (EMIS):** Adoption of practices that decrease direct or indirect emissions of N_2O, CH_4, or CO_2 from the production system. Includes:

- Optimized management of nitrogen fertilizers (e.g., use of slow-release sources, split application, precision agriculture, nitrification/urease inhibitors).

- Reduction of synthetic fertilizer use through substitution with organic sources or biological nitrogen fixation.
- Efficient management of water and energy use in irrigated systems (reducing pumping emissions or from anaerobic soils).
- Reduction of the frequency or intensity of soil tillage (decreasing CO_2 emissions from SOC oxidation).
- Avoidance of burning agricultural residues.

3. BASELINE, ADDITIONALITY, AND QUANTIFICATION

3.1. Selection of Project Activity Implementation Areas

The Project Area (PA) must be geographically identified (**Figure 1**), along with the main geographical polygons of the rural property: Property Boundary (PB), Permanent Preservation Area (PPA), Multiple-Use Area (MUA), and Legal Reserve Area (LRA), as applicable.

Figure 1. Map with the identification of the main geographical polygons of the project: Hydrography, Property Boundary (PB), Project Area (PA), Permanent Preservation Area (PPA); Multiple-Use Area (MUA), and Legal Reserve Area (LRA).

3.2. Selection of Carbon Pools and GHG Emission Sources

The project must identify and justify the carbon pools and GHG emission sources considered.

Carbon Pools: Table 1 presents the accepted pools.

Table 1. Types of carbon pools and emission sources accepted by the ALM methodology.

COMPONENT	ACRONYM	MANDATORY / OPTIONAL	DESCRIPTION AND CONSIDERATIONS
POOLS (for Removal)			
Soil Organic Carbon	SOC	Mandatory	Carbon stock in soil organic matter, typically at a depth of 0-30 cm. Can be extended if justified and methodologically robust. Quantified by direct measurement or validated modeling (e.g., RothC).
Above-Ground Biomass (Perennial/Semi-perennial Crops)	AGB_ perennial	Optional	Carbon in the above-ground part of perennial/semi-perennial crops or woody components of integrated systems.
Below-Ground Biomass (Perennial/Semi-perennial Crops)	BGB_ perennial	Optional	Carbon in the roots of perennial/semi-perennial crops or woody components.
Cyclical Crop Biomass (LTCS - AGB_cyclical + BGB_cyclical)	LTCS	Optional	Long-Term Cyclical Stock in the above-ground and below-ground biomass of annual/short-cycle crops. Quantified as an average stock maintained over time. The inclusion of AGB_cyclical requires the inclusion of BGB_cyclical.

COMPONENT	ACRONYM	MANDATORY / OPTIONAL	DESCRIPTION AND CONSIDERATIONS
EMISSION SOURCES (for Reduction)			
Soil Emissions	N_2O_{soil}	Mandatory	N_2O emissions from the application of synthetic and organic nitrogen fertilizers, and from the decomposition of crop residues.
	CO_{2soil}	Optional	CO_2 emissions from the application of lime and urea; CO_2 emissions from SOC oxidation due to tillage.
Biomass Burning Emissions	$CH_{4burning}$ $N_2O_{burning}$	Optional	Emissions from the burning of agricultural residues (if applicable in the baseline scenario and avoided in the project).
Fossil Fuel Emissions	CO_{2fuel}	Optional	Emissions from the use of fuels in agricultural machinery. Can be included if the project leads to a significant and verifiable reduction.
Irrigation Emissions	CH_{4irrig}, $CO_{2energy}$	Optional	CH_4 emissions from flooded soils (e.g., rice) or CO_2 from energy consumption for pumping (if the source is fossil fuel).

Note: The AGB_perennial/BGB_perennial pools are mutually exclusive with the LTCS pool for the same cultivation area. A project must choose the appropriate biomass approach for the predominant crop type in the respective activity.

The emission sources and greenhouse gases (GHG) considered in the accounting of the project activities are described in **Table 2**.

Table 2. Emission sources and GHGs considered in the accounting of the project activities.

STAGE	SOURCE	GHG	USED	JUSTIFICATION
Baseline	Emissions from the use of nitrogen fertilizers	N_2O	Yes	Direct emission resulting from nitrification and denitrification in the soil.
	Application of agricultural lime	CO_2	Yes	Direct emission from the chemical reaction of acidity neutralization.
	Fossil fuel combustion (e.g., diesel)	CO_2	Optional	Direct emission from mechanized agricultural operations.
	Emissions from phosphorus, potassium, and gypsum	CO_2	No	Indirect emissions, outside the project scope (occur before the farm gate).
	Emissions from anaerobic fermentation or flooded soils	CH_4	No	Conservatively excluded; applicable only with technical justification (e.g., irrigated rice).
With Project	Efficient use of nitrogen fertilizers	N_2O	Yes	Emission reduction through the adoption of optimized management (rate, timing, type).
	Use of lime in lower doses or with substitutes	CO_2	Yes	Reduction of liming or substitution with practices requiring less correction.
	Reduction of diesel consumption through operational improvement	CO_2	Optional	Can be considered if there is an effective and demonstrable change in operation.

STAGE	SOURCE	GHG	USED	JUSTIFICATION
With Project	Renewable energy replacing fossil fuel grid	CO_2	Optional	Inclusion possible with technical proof of the energy source used.
	Burning of plant biomass	CO_2, CH_4, N_2O	Optional/ conditional	Conservatively excluded due to difficulty in measurement and MRV control. However, in crops where this is a common practice, it must be included.

3.3. Additionality Demonstration and Baseline Selection

The demonstration of additionality is a central pillar of carbon credit integrity, as required by standards like ICROA and CORSIA, and is a fundamental criterion for the accreditation of methodologies and projects under the SBCE (Art. 25, II and Art. 44 of Law No. 15,042/2024). The reference year for the analysis of practices that were not a consolidated standard in Brazil is 2024, aligned with the SBCE Law.

- **Additionality:** The Project Developer MUST fully apply the Tero Carbon "Project Additionality Demonstration Tool (FR.CER.003)", following the appropriate flow and tests for the project's scale and type. The analysis must be particularly robust for projects aiming for recognition in the SBCE. The complete analysis, including all justifications and evidence, **MUST** be presented in the Project Design Document (PDD).
- **Baseline Scenario:** Represents the agricultural practices and the changes in carbon stocks and GHG emissions that would occur in the absence of the project. It should reflect the prevailing practices in the project area or region for the specific cropping system, before the implementation of the project activities.
    - **Field-collected data:** The baseline should be established using historical data from the project area itself, whenever available and reliable (e.g., previous soil analyses, input use records, productivity).
    - **Use of regional benchmarks to establish the baseline in cases of pre-existing sustainable practices:** As per item "Additionality of Pre-Existing Sustainable Agricultural Practices" below, if it is proven that sustainable practices adopted by the proponent before the start of the carbon project (or before 2024) were additional at the time of their

implementation, the baseline for the project should reflect the conventional scenario that existed before the adoption of these pioneering practices. For this, the use of regional benchmarks or technical literature from the period is recommended to characterize the emissions or carbon stocks of the typical conventional management in the region for the specific crop, thus avoiding penalizing producers who adopted good practices earlier.

- **Biophysical modeling as a supplementary option:** Soil carbon dynamics models (e.g., RothC) may be used, provided they are duly calibrated for local conditions and fed with field-collected data.
- **Exclusive focus on direct emissions and removals:** Only the emission and carbon sequestration processes that occur within the production unit will be considered in the construction of the baseline.
- For SOC, the baseline may represent a trend of maintenance or gradual decline of SOC under conventional management, or a stable equilibrium level.
- For agricultural biomass in perennial crops, the baseline may be the existing stock before new practices or, for new plantings, zero. For annual crops, the above-ground biomass of the main crop in the baseline is generally not considered for biomass removal credit, but rather for its potential contribution to SOC.
- For GHG emissions, the baseline should reflect the emissions associated with conventional practices of fertilization, tillage, etc.

The baseline **MUST** be constructed separately for the following components:

1. Soil Organic Carbon (SOC) Accumulation.
2. Carbon Accumulation in Perennial/Semi-perennial Crop Biomass (AGB_perennial/BGB_perennial).
3. Carbon Accumulation in Cyclical Crop Biomass (LTCS).
4. Reduction of Greenhouse Gas Emissions associated with agricultural management (EMIS).

3.3.1. Additionality of Pre-Existing Sustainable Agricultural Practices

For ALM projects where the proponent had already implemented some of the sustainable agricultural practices proposed by the project **before the formal start date of the carbon project or before the reference year of 2024** (SBCE Law), the additionality of these specific practices must be evaluated considering the context at the **time of their original implementation**.

The Project Developer must demonstrate, as part of the application of the "Project Additionality Demonstration Tool (FR.CER.003)", that at the time such practices were adopted:

1. **They were not Common Practice:** The practices were not considered common practice for the specific crop and geographic region of the project. The common practice analysis (as per FR.CER.003, Step 5) must be applied retrospectively for the period of the practice's adoption.
2. **They faced Significant Barriers:** Their adoption faced barriers (investment, technological, knowledge, prevailing practice, etc., as per the tests in FR.CER.003) that were overcome by the proponent in a way that would not be expected in the BAU scenario of the time.
3. **They represented Proven Innovation or Improvement:** The practices represented an innovation or a significant improvement over the typical conventional management of the region at the time, with clear potential to generate the GHG mitigation benefits (SOC increase, biomass increase, EMIS reduction) that the project now seeks to credit.

The proof of these points must be robust and based on verifiable evidence, such as:

- Historical regional data on the adoption of the technology/practice (e.g., IBGE, agricultural censuses, data from producer associations, surveys by Embrapa or state research institutions).
- Scientific literature, technical articles, or sectoral reports from the period that describe the status of the practice.
- The proponent's own documentation (if available and auditable) that demonstrates the challenges and pioneering spirit in the adoption (e.g., old investment plans, records of difficulties, technical consultations from the time).

If it is demonstrated that the pre-existing practices were additional at the time of their implementation, they can be included in the project's activities for crediting, provided that all other criteria of the methodology and the Tero Certification Program are met. The “Project Additionality Demonstration Tool (FR.CER.003)” will provide the framework for this analysis, and the Project Design Document (PDD) must detail this specific demonstration for pre-existing practices.

3.4. Baseline Quantification

The carbon stocks and GHG emissions in the baseline (BSL) scenario must be estimated for each relevant component.

3.4.1. Baseline for Soil Carbon Stock (SOC_BSL_n)

The soil organic carbon stock in the baseline (SOC_BSL_n) represents the stock that would exist in verification period "n" in the absence of the project. It is calculated from the initial stock (SOC_0) and a projection of its expected change (ΔSOC_BSL_n) under baseline practices.

$$SOC_{BSL\,n} = SOC_0 + \Delta SOC_{BSL\,n} \quad (1)$$

Where:

SOC_BSL_n	=	Soil Organic Carbon stock in the baseline in verification period "n" (tCO_2e).
SOC_0	=	Initial soil organic carbon stock in the project area at the project start (t_0) (tCO_2e).
ΔSOC_BSL_n	=	Projected change in the SOC stock over period "n" under baseline practices (can be negative, indicating decline) (tCO_2e).

Note on Conservatism: As per DC.CER.003, uncertainty must be applied to the final result of net removals. Therefore, the estimate of SOC_BSL_n should be the mean, and the uncertainty will be propagated to the final calculation of NR_PROJ_SOC_n (Section 3.7.1), from which the lower bound of the confidence interval will be used for crediting.

The procedures for determining SOC_0, ΔSOC_BSL_n, and the uncertainty analysis must follow the Technical Guidelines for Carbon Quantification in AFOLU Projects (DC.CER.003).

3.4.2. Baseline for Carbon Stock in Perennial/Semi-perennial Crop Biomass (CS_Perennial_BSL_n)

For ALM projects that include perennial/semi-perennial crops:

- If the project involves the transition from an existing perennial/semi-perennial crop to new management or a new perennial/semi-perennial crop, CS_Perennial_BSL_n is the carbon stock in the biomass of the existing crop in verification period "n" (can be considered constant if management would not change).

- If the baseline is the implementation of a conventional perennial/semi-perennial crop, `AGB_perennial_BSL_n` can be modeled based on typical growth rates.
- If the baseline is an annual crop or bare soil before the implementation of a perennial/semi-perennial crop by the project, `CS_Perennial_BSL_n = 0`.

3.4.2.1. Baseline for Carbon Stock in Cyclical Crop Biomass (LTCS_BSL_n)

In the baseline scenario for annual/cyclical crops, it is assumed that there is no long-term commitment to maintain a Long-Term Cyclical Stock (LTCS) that is additional. Therefore, for the purposes of crediting LTCS removal:

$$LTCS_{BSL\,n} = 0 \quad (2a)$$

(Or a very low value, robustly justified if pre-existing practices already maintained a minimum LTCS, but which would not be maintained or was not additional in the absence of the carbon project).

3.4.3. Baseline for GHG Emissions from Management (`EMIS_BSL_n`)

The GHG emissions in the baseline in period "n" (`EMIS_BSL_n`) are the sum of emissions from relevant sources in the scenario without the project. To ensure conservatism (resulting in lower creditable emission reductions), the final value should be the lower bound of the confidence interval of the estimate.

$$EMIS_{BSL\,n} = \Sigma\left(E_{source,k,\,BSL\,n}\right) - IC_{EMIS\,BSL\,n} \quad (2b)$$

Note: Subtracting the uncertainty margin (`IC_EMIS_BSL_n`) from the mean baseline emissions results in a lower baseline value, which in turn leads to a smaller amount of creditable emission reductions (`EMIS_BSL_n - EMIS_PROJ_n`), ensuring conservatism.

Where:

`EMIS_BSL_n`	=	Total GHG emissions from agricultural management in the baseline in verification period "n" (tCO_2e).
`E_source,k,BSL_n`	=	GHG emissions from each source k (e.g., N fertilizer, lime) in the baseline scenario in period "n" (tCO_2e), calculated as per DC.CER.003, Section 6.5.
`IC_EMIS_BSL_n`	=	One-sided Confidence Interval margin associated with the total estimate of baseline emissions, applied to obtain the lower bound of the CI.

3.5. Project Scenario Quantification

3.5.1. Project Soil Carbon Stock (`SOC_PROJ_n`)

The SOC stock in the project area in verification period "`n`" under the project practices. Estimated by direct measurement in monitoring plots or validated modeling (DC.CER.003).

3.5.2. Carbon Stock in Project Perennial/Semi-perennial Crop Biomass (`CS_Perennial_PROJ_n`)

The carbon stock in the biomass of perennial/semi-perennial crops or woody components (`CS_Perennial_PROJ_n`) in verification period "`n`" under the project practices. Estimated by inventory, allometric equations, or modeling (DC.CER.003).

3.5.2.1. Carbon Stock in Project Cyclical Crop Biomass (`LTCS_PROJ_n`)

The `LTCS_PROJ_n` is the Long-Term Cyclical Stock (including `AGB_cyclical` and `BGB_cyclical`) maintained in the project area in verification period "`n`" due to the project's practices.

Its determination `MUST` follow the procedures of the "Technical Guidelines for Carbon Quantification in AFOLU Projects (DC.CER.003)". It is essential that DC.CER.003 or a specific methodological annex of this ALM methodology details the methods for:

- Estimating the peak biomass (or cycle average) of annual/cyclical crops (`AGB_cyclical` and `BGB_cyclical`).
- Calculating the LTCS based on data from multiple cycles, literature, or validated modeling, representing the average carbon stock maintained over several cultivation cycles under the project's practices.
- Considering the proportion of residue biomass that remains in the field and contributes to SOC, to avoid double counting between LTCS and SOC.

3.5.3. GHG Emissions from Project Management (`EMIS_PROJ_n`)

The GHG emissions in the project scenario in verification period "`n`" (in tCO_2e/ha/year), calculated similarly to `EMIS_BSL_n`, but based on the activity rates and practices implemented by the project.

3.5.4. GHG Emissions from Project Activities (`E_PROJ_n`)

GHG emissions that are a direct consequence of the implementation of the project activities and that would not occur in the baseline (e.g., emissions from

the transport of biochar to the area, if biochar was not used before). If the project emissions are already covered in `EMIS_PROJ_n` (e.g., a change in fuel use already reflected), `E_PROJ_n` can be zero to avoid double counting.

3.6. Leakage

The assessment and accounting of leakage (LK_n) are mandatory for all ALM projects seeking to generate VCUs using this methodology. The Project Developer **MUST** fully apply the procedures and requirements established in the Tero Carbon Leakage Assessment and Management Tool for NBS VCU Projects (FR.CER.005).

The Developer should focus on demonstrating:

1. **No displacement of emitting activities within the property.**
2. **Maintenance or increase of the total agricultural productivity of the property.**

If both points are robustly demonstrated, `LK_n` can be considered zero. Otherwise, or if the project is Large-Scale, a more detailed analysis or a standard discount factor will be applied as per FR.CER.005. The Developer must use the "[Template] Leakage Risk Assessment and Negligibility Justification Form for Small-Scale NBS VCU Projects (TP.CER.005)" when applicable.

The result of this analysis will be a Net Leakage (`LK_n`) value for each verification period "`n`", which will be used to adjust the project's net removals/reductions. The entire leakage assessment approach **MUST** be fully presented, justified, and documented in the PDD.

Additionally, the assessment and mitigation of leakage is a fundamental integrity requirement for programs like ICROA (Criterion 5.5.2.b) and CORSIA (EUC 3.6), and an important principle for the credibility of CRVEs in the SBCE (Art. 2, XXXV of Law No. 15,042/2024 defines leakage).

3.7. Calculation of Net GHG Removals and Reductions by the Project

The net removals and reductions are calculated for each component before applying leakage and permanence adjustments.

3.7.1. Net SOC Removals (`NR_PROJ_SOC_n`)

$$NR_{PROJ\,SOC\,n} = \left(SOC_{PROJ\,n} - SOC_{BSL\,n}\right) - E_{PROJ\,SOC\,n} \quad (3a)$$

Where:

NR_PROJ_SOC_n	=	Net SOC removals in period "n" (tCO_2e).
SOC_PROJ_n	=	Project SOC stock in period "n" (tCO_2e).
SOC_BSL_n	=	Baseline SOC stock in period "n" (tCO_2e).
E_PROJ_SOC_n	=	Project emissions associated with SOC removal activities in period "n" (tCO_2e).

3.7.2. Net Perennial/Semi-perennial Biomass Removals (NR_PROJ_Perennial_n)

$$NR_{PROJ\ Perennial\ n} = \left(CS_{Perennial\ PROJ\ n} - CS_{Perennial\ BSL\ n}\right) - E_{PROJ\ Perennial\ n} \quad (3b)$$

Where:

NR_PROJ_Perennial_n	=	Net perennial/semi-perennial biomass removals in period "n" (tCO_2e)
CS_Perennial_PROJ_n	=	Carbon stock in project perennial/semi-perennial biomass in period "n" (tCO_2e).
CS_Perennial_BSL_n	=	Carbon stock in baseline perennial/semi-perennial biomass in period "n" (tCO_2e).
E_PROJ_Perennial_n	=	Project emissions associated with perennial biomass removal activities in period "n" (tCO_2e).

3.7.3. Net Cyclical Biomass Removals (NR_PROJ_LTCS_n)

$$NR_{PROJ\ LTCS\ n} = \left(LTCS_{PROJ\ n} - LTCS_{BSL\ n}\right) - E_{PROJ\ LTCS\ n} \quad (3c)$$

Where:

NR_PROJ_LTCS_n	=	Net cyclical biomass (LTCS) removals in period "n" (tCO_2e).
LTCS_PROJ_n	=	Project LTCS stock in period "n" (tCO_2e).

LTCS_BSL_n	=	Baseline LTCS stock in period "n" (usually 0) (tCO_2e).
E_PROJ_LTCS_n	=	Project emissions associated with LTCS activities in period "n" (tCO_2e).

3.7.4 Net Emission Reductions from Management (NR_PROJ_EMIS_n)

$$NR_{PROJ\ EMIS\ n} = \left(EMIS_{BSL\ n} - EMIS_{PROJ\ n}\right) - E_{PROJ\ EMIS\ n} \quad (3d)$$

Where:

NR_PROJ_EMIS_n	=	Net emission reductions from management in period "n" (tCO_2e).
EMIS_BSL_n	=	Management emissions in the baseline in period "n" (tCO_2e).
EMIS_PROJ_n	=	Project management emissions in period "n" (tCO_2e).
E_PROJ_EMIS_n	=	Project emissions associated with EMIS reduction activities in period "n" (tCO_2e).

3.7.5. Calculation of Leakage-Adjusted Net Reductions/Removals

First, the total net removals/reductions of the project before leakage are calculated:

$$NR_{PROJ\ n} = NR_{PROJ\ SOC\ n} + NR_{PROJ\ Perennial\ n} + NR_{PROJ\ LTCS\ n} + NR_{PROJ\ EMIS\ n} \quad (4a)$$

The total value of the Project's Net Reductions/Removals Adjusted for Leakage (VCU_adj_LK_n) is calculated as:

$$VCU_{adj\ LK\ n} = NR_{PROJ\ n} - LK_n \quad (4b)$$

Where:

VCU_adj_LK_n	=	Total net removals/reductions of the project in period "n", adjusted for leakage (tCO_2e).

NR_PROJ_n	=	Total net removals/reductions of the project in period "n", before leakage (tCO_2e), as per Equation 4a.
LK_n	=	Total net leakage of the project in period "n", quantified as per FR.CER.005 (tCO_2e).

Next, the total adjusted value (VCU_adj_LK_n) is allocated back to the components. The standard allocation is proportional to the contribution of each component to the total removals/reductions.

If NR_PROJ_n is greater than zero, the adjusted value for each component i is calculated as:

$$VCU_{adj\ LK\ i\ n} = \frac{NR_{PROJ\ i\ n}}{NR_{PROJ\ n}} \times VCU_{adj\ LK\ n} \quad (4c)$$

If NR_PROJ_n is zero or negative, then VCU_adj_LK_i_n = 0 for all components.

Confidence Interval (CI): For each VCU_adj_LK_i_n (where "i" represents SOC, Perennial, LTCS, EMIS), the uncertainty must be propagated. The final value to be carried over to Section 3.9 **MUST** be the lower bound of the confidence interval, ensuring conservatism.

3.8. Non-Permanence Risk (NPR) and Guarantee Mechanisms

Guaranteeing the permanence of GHG removals and reductions is a crucial quality criterion for carbon credits, especially in NBS projects like ALM. Programs such as ICROA (Criterion 5.3) and CORSIA (EUC 3.5) require mechanisms to address the risk of non-permanence (reversal). The SBCE, through Art. 21, § 1º, V of Law No. 15,042/2024, also provides for mechanisms to protect against the reversal of removals.

The permanence guarantee mechanisms are applied according to the type of removal/reduction and **MUST** follow the "Non-Permanence Risk Analysis and Guarantee Mechanism Tool (FR.CER.004)".

1. **For Soil Organic Carbon (SOC) Removals and Perennial/Semi-perennial Crop Biomass Removals (AGB_perennial/BGB_perennial):**
    - The mandatory mechanism is the **Buffer Pool (BP)**.
    - The Developer MUST apply FR.CER.004 to assess the Non-Permanence Risk (NPR_total) specific for these components and calculate the

fraction of VCUs to be allocated to the Buffer Pool (respectively, `NPR_buffer_SOC` and `NPR_buffer_Perennial`).

2. **For Cyclical Crop Biomass Removals (LTCS):**

   - The mandatory mechanism is **Fractional Issuance (FI)**, as per Section 6 of FR.CER.004.
   - The base value for FI (`VCU_base_FI_n`) will be the portion of `VCU_adj_LK_n` attributable to the LTCS component.
   - The Equivalence Factor (Ef) will be `1/Pc`, where `Pc` is the Project Commitment Period for maintaining the practices that support the LTCS.
   - An assessment of NPR_total for LTCS must still be performed as per FR.CER.004 (Section 4) for informational and risk management purposes.

3. **For Emission Reductions from Management (EMIS):**

   - Generally, the Non-Permanence Risk is considered zero (`NPR_buffer_EMIS = 0`), unless the reduction practice is easily reversible and FR.CER.004 determines the need for a buffer.

3.9. Calculation of Generated Carbon Credits (VCUs) (`pVCU_n`)

The permanent VCUs generated in verification period "`n`" (`pVCU_n`) are the sum of the VCUs from each component, after adjustment for leakage, application of the CI, and the respective permanence mechanism.

- **Calculation for Removal Components with Buffer Pool (SOC and Perennial Biomass):**

For each removal component "`i`" (SOC, Perennial), the increment (`ΔNR_i_n`) is calculated using the "high-water mark" principle:

$$\Delta NR_{i\,n} = MAX\left(0; VCU_{adj\,LK\,i\,n} - CTOT_{REM\,i\,max\,(n-1)}\right) \quad (5a)$$

The permanent VCUs and the contribution to the buffer are:

$$pVCU_{i\,n} = \Delta RR_{net\,i\,n} \times \alpha_i \quad (5b)$$

$$Buffer_{i\,n} = \Delta NR_{i\,n} \times \left(1 - \alpha_i\right) \quad (5c)$$

After issuance, the value of `CTOT_REM_i_max` is updated: `CTOT_REM_i_max_n = MAX(CTOT_REM_i_max_n-1; VCU_adj_LK_i_n)`.

- **Calculation for Removal Component with Fractional Issuance (LTCS):**

$$pVCU_{LTCS\,n} = VCU_{adj\,LK\,LTCS\,n} \times Ef_{LTCS} \times \Delta t_n \quad (6)$$

- **Calculation for Emission Reduction Component (EMIS):**

$$pVCU_{EMIS\,n} = VCU_{asj\,LK\,EMIS\,n} \quad (7)$$

Note: Assuming zero Non-Permanence Risk for EMIS, therefore α=1.

- **Total VCU Generated in Period "n" (`pVCU_n`):**

$$pVCU_n = pVCU_{SOC\,n} + pVCU_{Perennial\,n} + pVCU_{LTCS\,n} + pVCU_{EMIS\,n} \quad (8)$$

Where (summary of main variables):

`VCU_adj_LK_i_n`	=	Net removals/reductions of component "`i`", adjusted for leakage and with conservative application of the confidence interval.
`CTOT_REM_i_max_n-1`	=	The highest level of accumulated carbon stock (`VCU_adj_LK_i`) for which VCUs have already been issued in any previous verification period. For the first verification, its value is zero.
`α_i`	=	Permanent fraction for component "`i`", determined as per FR.CER.004.
`Ef_LTCS`	=	Equivalence Factor for LTCS (`1/Pc_LTCS`), as per FR.CER.004.
`Δt_n`	=	Duration of verification period "`n`".
`Buffer_i_n`	=	Contribution to the Buffer Pool for component "`i`".

3.10. Definition of Project Scale

The project's scale (Small or Large-Scale) **MUST** be determined using the Tero Carbon "Project Scale Analysis Tool (FR.CER.001)", based on the annual estimate of `pVCU_n` generation. The scale classification and its justification **MUST** be presented in the PDD.

3.11. Project Start Date and Retroactivity

The Project Start Date (`t_0`) is defined by the Developer in the PDD. ALM projects may have a retroactive `t_0`.

The ability to credit retroactive removals/reductions is a feature of some carbon programs. However, for compliance with schemes like CORSIA, there may be restrictions on the eligibility of very old vintages. Developers should be aware of the specific requirements of the markets their credits are intended for. Within the SBCE, the regulation may establish specific rules on retroactivity for CRVEs.

For VCUs to be issued for periods prior to validation, the Developer **MUST** meet the MRV evidence requirements for the entire retroactive period, as detailed in the "Certification Program (DC.CER.001)". This includes robust evidence of the implementation of practices, data for quantifying carbon stocks and emissions since t_0 (e.g., soil analyses, input records). The maximum retroactivity period allowed for the first issuance of VCUs is **15 years** prior to the PDD submission date for validation, conditioned on the robustness of the evidence.

4. MONITORING PROCEDURE

4.1. Monitoring Plan

The Project Developer **MUST** prepare and implement a detailed Monitoring Plan, which will be an integral part of the Project Design Document (PDD). This plan is fundamental to ensure the quality, traceability, transparency, and integrity of the project's results over time, to verify continued compliance with the requirements of this methodology and the Tero Programs, and to meet the Measurement, Reporting, and Verification (MRV) standards required by high-integrity markets and the SBCE (Art. 2, XVIII of Law No. 15,042/2024). The plan **MUST** cover, at a minimum:

1. **Maintenance of Acceptance Criteria:** Continuous verification of compliance.

2. **Monitoring of Carbon Stocks:**

   - **SOC:** SOC levels, implementation of practices. Methodology: As per DC.CER.003, including soil sampling, frequency (usually at each verification period), QA/QC.
   - **AGB_perennial/BGB_perennial (Perennial/Semi-perennial Crops):** Growth and biomass. Methodology: As per DC.CER.003, including inventory, allometric equations, frequency, QA/QC.
   - **LTCS (Cyclical Crops):** Area cultivated with project practices, type of cyclical crop(s), planting/harvesting dates, productivity, peak biomass samples, residue management. Methodology: As per DC.CER.003 and specific annexes/sections of this ALM methodology for LTCS. Sampling to verify/update the LTCS in each verification period.

3. **Monitoring of GHG Emissions from Management (`EMIS_PROJ`):**

   - Quantification of activity rates (e.g., use of fertilizers, lime, fuel) and application of emission factors. Input records, field notebooks.

4. **Monitoring of Leakage (`LK_n`):**

   - As per "Leakage Assessment and Management Tool for NBS VCU Projects (FR.CER.005)". For Small-Scale with justification of negligibility, reconfirm the conditions (no internal displacement, maintenance/increase of farm productivity) at each verification.

5. **Monitoring of Non-Permanence Risk (NPR) and Guarantee Mechanism:**

   - Continuous monitoring of the risk factors (internal and external) identified in the NPR analysis (conducted as per the "Non-Permanence Risk Analysis and Guarantee Mechanism Tool (FR.CER.004)").
   - Procedures for the detection, recording, and immediate reporting to Tero Carbon of reversal events (e.g., abandonment of practices, severe erosion releasing SOC, loss of biomass in perennial crops). Reversal compensation mechanisms must be triggered as per FR.CER.004 and aligned with SBCE requirements for protection against reversal.
   - Monitoring of the maintenance of agricultural practices that support the SOC, AGB_perennial/BGB_perennial, and LTCS stocks, and of the integrity of the areas contributing to the Buffer Pool (for SOC and Perennial Biomass).

6. **Monitoring of Social and Environmental Safeguards and Co-benefits:**

   - KPIs for co-benefits (SDGs) and risk mitigation measures, as per "Social and Environmental Safeguards Analysis Tool (FR.CER.002)".

7. **Monitoring of Land Tenure Compliance:**
    - Maintenance of regularity as per “Land Tenure Compliance Manual (DC.CER.002)”.
8. **Monitoring of Stakeholder Engagement:**
    - As per “Stakeholder Consultation Procedure (DC.COM.003)” and “Grievance Management Procedure (DC.GOV.004)”.

For each parameter: variable, unit, collection/calculation methodology, frequency, responsible party, QA/QC.

Specific Frequency: The variation in soil carbon stock (SOC), in perennial/semi-perennial biomass, and the Long-Term Cyclical Stock (LTCS) must be monitored and reported at the end of each verification period. The implemented agricultural practices that support these stocks and the management emissions (EMIS) must be monitored and reported annually (or with the frequency defined for verification).

4.2. Monitoring Methodology and Quality

The Developer must establish a clear and replicable methodology for data collection, analysis, and reporting, ensuring auditable and consistent processes. Adopt QA/QC measures, including internal audits, control protocols, cross-checking of data, and documentary records. All monitored parameters must be reported presenting the estimated means and the associated uncertainty.

4.3. Period Between Verifications

The period between verifications must be defined in the Monitoring Plan, not exceeding three years. Annual verifications are recommended for ALM projects, especially in the first years, to capture changes and validate the effectiveness of the practices. In the event of the publication of a new major version of this methodology (e.g., v1.X to v2.0), the project must undergo re-validation before the next verification, as per the “Certification Program (DC.CER.001)”.

4.4. Monitoring Report

For each period, when requesting verification, the Developer must submit a comprehensive Monitoring Report, presenting the quantified results of net

removals and reductions and the requested VCUs. Use the “Acceptance Criteria Analysis Tool for Project Verification (FR.CER.007)”. The report must be aligned with the approved monitoring plan, addressing the quantification of carbon stocks, avoided emissions, the implementation of social and environmental safeguards, and the tracking of SDG indicators.

5. REVIEW OF THIS METHODOLOGY

This methodology (**TERO.007 – ALM**) will be periodically reviewed by Tero Carbon in collaboration with the author (Hdom Engenharia e Projetos Ambientais Ltda) or at the initiative of Tero Carbon, according to the procedures of the “Methodologies Program (DC.MET.001)”. Reviews may occur, at a minimum, every 5 years, or sooner, to:

1. Incorporate scientific and technical advances in ALM, especially in the quantification of SOC and agricultural emissions.
2. Reflect significant changes in national policies, regulations (such as the evolution of the SBCE regulation) or international ones, or in market requirements, including those of accreditation schemes like ICROA and CORSIA.
3. Accommodate stakeholder feedback.
4. Correct inconsistencies or errors.
5. Ensure alignment with the Tero Programs.

Substantial revisions will follow the full process of the “Methodologies Program (DC.MET.001)”. Tero Carbon may suspend or deactivate this methodology as detailed in the "Methodologies Program (DC.MET.001)”.

VERSION HISTORY

VERSION	DATE	NOTES
1.0	11/06/2025	Initial version developed and published, focused on VCU removals and reductions for ALM projects.