Methodological Document
AFOLU PROJECTS

BCR0016
Regenerative Agricultural Land Management (ALM)
Methodology for Soil Organic Carbon Stock Enhancement and Reduction of Non-CO_2 Emissions

BioCarbon Cert®

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Acronyms and abbreviations

AFOLU	Agriculture, Forestry and Other Land Use
CH_4	Methane
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
GHG	Greenhouse gas
GIS	Geographic Information System
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
MRV	Monitoring, reporting and verification
SOC	Soil organic carbon
tCO_2e	Metric tonne of carbon dioxide equivalent
QA/QC	Quality assurance and quality control

1 Introduction

This methodology establishes a comprehensive and scientifically robust framework for quantifying greenhouse gas (GHG) emission reductions and removals resulting from improved and regenerative agricultural land management (ALM) practices under the BioCarbon Standard.

Agricultural systems are a major contributor to global greenhouse gas emissions and represent a critical sector for climate change mitigation. Emissions from agricultural lands are primarily associated with nitrous oxide (N_2O) from nitrogen inputs, methane (CH_4) from specific land and livestock interactions, and changes in soil carbon stocks driven by land management practices. At the same time, agricultural soils represent one of the largest and most immediately accessible opportunities for carbon dioxide (CO_2) removals through increases in soil organic carbon (SOC), as recognized by the Intergovernmental Panel on Climate Change (IPCC).

In recent years, regenerative agriculture has emerged as a widely adopted approach to improve soil health, enhance ecosystem resilience, and support sustainable production systems. These practices aim to restore ecological processes, including nutrient cycling, soil structure, water retention, and biological activity, which under appropriate conditions may contribute to increased SOC stocks and reduced GHG emissions. However, outcomes are highly context-dependent and vary significantly based on climate, soil characteristics, historical land use, and management intensity.

This methodology is designed to translate regenerative and improved agricultural practices into a quantifiable and verifiable framework for climate mitigation. It applies conservative, evidence-based approaches to ensure that all claimed GHG emission reductions and removals are measurable, additional, and robustly supported by monitoring, reporting, and verification (MRV) procedures.

The designation of a system or practice as “regenerative” shall not, in itself, constitute evidence of GHG emission reductions, removals, or additionality. All mitigation outcomes shall be demonstrated through consistent, transparent, and conservative quantification approaches aligned with internationally recognized methodologies, including the IPCC Guidelines for National GHG Inventories (IPCC, 2006; IPCC, 2019) and ISO 14064-2:2019.

This methodology adopts a net GHG accounting approach, whereby all relevant emissions and removals are quantified in an integrated manner. Any increases in emissions attributable to project activities shall be fully accounted for, and only net GHG emission reductions and removals shall be eligible for crediting.

This methodology is part of the new generation of methodologies developed under the BioCarbon Standard, integrating climate mitigation, soil restoration, sustainable production, and environmental co-benefits within a single, coherent framework. It is designed to be scientifically rigorous while remaining applicable across diverse agricultural systems and real-world project conditions.

2 Objectives

The objective of this methodology is to define a robust and operational framework for quantifying net greenhouse gas (GHG) emission reductions and removals resulting from improved agricultural land management practices.

Specifically, this methodology establishes procedures to:

(a) Establish a credible and conservative baseline reflecting prevailing agricultural practices and conditions;
(b) Demonstrate additionality through the structured application of regulatory, common practice, and barrier and/or investment analyses;
(c) Quantify carbon dioxide (CO_2) removals through measurable changes in soil organic carbon (SOC) stocks;
(d) Quantify nitrous oxide (N_2O) emissions associated with nitrogen dynamics in agricultural soils, including fertilization, residue management, and biological processes;
(e) Quantify methane (CH_4) emissions where relevant, including emissions associated with soil processes and integrated agricultural systems;
(f) Capture the combined effect of multiple management interventions implemented within agricultural systems;
(g) Account for all relevant emission sources and sinks within the project boundary, including any emission increases induced by project activities;
(h) Identify, assess, and conservatively quantify leakage effects outside the project boundary;
(i) Ensure that removals are subject to permanence provisions, including risk identification, monitoring, and compensation mechanisms;
(j) Define monitoring requirements that are scientifically defensible while remaining applicable under real-world project conditions;
(k) Apply conservative assumptions and uncertainty management procedures to avoid overestimation of mitigation outcomes.

This methodology shall ensure that all credited mitigation outcomes are measurable, additional, conservative, and verifiable, and aligned with the integrity requirements of the BioCarbon Standard.

3 Scope

This methodology applies to project activities that implement improved agricultural land management practices resulting in quantifiable greenhouse gas (GHG) emission reductions and/or removals.

This methodology incorporates enhanced monitoring, verification, and quality assurance requirements tailored to agricultural systems, addressing key challenges associated with variability, measurement uncertainty, and system complexity.

The scope of the methodology includes agricultural systems in which management changes lead to measurable impacts on:

(a) soil organic carbon (SOC) stocks;
(b) nitrous oxide (N_2O) emissions associated with nitrogen inputs and soil processes;
(c) methane (CH_4) emissions, where relevant, including emissions from soils and integrated agricultural systems.

This methodology prioritizes system-based interventions and excludes isolated or marginal practices that do not result in measurable and sustained changes in GHG emissions or carbon stocks.

The methodology is applicable to agricultural lands, including:

(a) croplands;
(b) managed grasslands;
(c) integrated crop–livestock systems;
(d) agricultural systems undergoing transition toward improved or regenerative management conditions.

Eligible project activities under this methodology shall involve measurable changes in land management practices that influence GHG emissions and/or carbon stocks at the project level. These may include, but are not limited to:

(a) reduction or elimination of soil disturbance (e.g., reduced tillage or no-till systems);
(b) implementation of cover cropping and maintenance of permanent soil cover;
(c) diversification of cropping systems, including crop rotations and intercropping;
(d) application of organic amendments (e.g., compost, manure, crop residues);
(e) improved nutrient management, including optimization of fertilizer use;
(f) enhancement of soil biological activity and structure;
(g) integration of crops and livestock systems, where applicable;
(h) practices aimed at restoring degraded agricultural soils.

The methodology is designed to be applicable across a wide range of environmental and management conditions, including:

(a) different climatic zones;
(b) varying soil types and land-use histories;
(c) heterogeneous soils and management practices;
(d) systems with varying levels of management intensity and technical capacity.

The methodology focuses on management-driven mitigation, rather than reliance on specific technologies.

This methodology adopts a net GHG accounting approach, integrating both emission reductions and removals within a single framework. Only net GHG emission reductions and removals shall be eligible for crediting.

Only absolute net GHG emission reductions and/or removals shall be eligible for crediting. Improvements in emission intensity alone shall not be sufficient.

4 Version

This document constitutes Version 1.0 of BCR0016 – Regenerative Agricultural Land Management (ALM) for Soil Organic Carbon Stock Enhancement and Reduction of Non-CO_2 Emissions.

The methodology becomes effective upon formal approval and publication by BioCarbon Cert. Only the version published on the official BioCarbon Standard website shall be considered valid and applicable.

BioCarbon Cert may review, revise, update, suspend, or replace this methodology at any time to reflect scientific advances, methodological improvements, program requirements, market developments, or integrity considerations.

Project activities shall comply with the version of the methodology in force at the time of project registration, unless otherwise specified by BioCarbon Cert.

Where revisions result in material changes affecting quantification, monitoring, reporting, environmental integrity, or program requirements, BioCarbon Cert may establish transition provisions or require the application of updated requirements to registered projects, in accordance with the BioCarbon Standard and applicable program rules.

5 Applicability conditions

5.1 General applicability

This methodology applies to project activities implemented in agricultural land systems where verifiable changes in management practices result in measurable greenhouse gas (GHG) emission reductions and/or removals.

Project activities shall demonstrate a direct and causal relationship between implemented management changes and observed GHG outcomes.

This methodology is applicable to:

(a) cropland systems;

(b) managed grasslands;

(c) integrated crop–livestock systems;

(d) agricultural systems undergoing transition toward improved or regenerative management conditions.

Project activities shall be management-driven and shall not rely exclusively on the installation of a single technology.

Eligibility of project activities is subject to restrictions on recent land-use change, as defined in Section 5.8.

5.2 Eligible project activities

Project activities shall involve material and measurable changes in agricultural land management practices that influence GHG emissions and/or carbon stocks.

The methodology requires that project activities reflect a system-level transformation in land management practices, ensuring that observed GHG outcomes are attributable to sustained and coherent changes in agricultural systems.

Eligible activities may include, but are not limited to:

(a) reduction or elimination of soil disturbance (e.g., reduced tillage or no-till);

(b) implementation of cover crops and maintenance of permanent soil cover;

(c) diversification of cropping systems, including crop rotation and intercropping;

(d) optimization of nutrient management, including reduction or improved application of nitrogen inputs;

(e) application of organic amendments (e.g., compost, manure, crop residues);

(f) enhancement of soil biological activity and structure;

(g) integration of crop and livestock systems, where applicable;

(h) restoration of degraded agricultural soils.

Project activities may include combinations of practices and shall be assessed as an integrated system, rather than as isolated interventions.

5.3 Regenerative integrity criteria

This methodology incorporates a regenerative integrity requirement to ensure that project activities contribute to improved soil function and ecosystem processes, while maintaining a rigorous and outcome-based approach to crediting.

Project activities shall demonstrate alignment with regenerative land management principles. At a minimum, the project shall implement a combination of practices that reflect improvements in soil disturbance, soil cover, biological diversity, or soil biological activity. The selection and implementation of these practices shall be appropriate to the local context and shall be maintained throughout the crediting period.

Project activities shall be implemented as integrated management systems. The application of a single isolated practice shall not be sufficient to demonstrate meaningful changes in greenhouse gas (GHG) emissions or removals.

The designation of a system or practice as "regenerative" shall not, in itself, constitute evidence of greenhouse gas emission reductions, removals, or additionality. Project holders shall demonstrate that such practices result in quantifiable and verifiable changes in emissions and/or carbon stocks in accordance with this methodology.

5.4 System characteristics

This methodology is applicable to agricultural systems characterized by:

(a) variability in management intensity;

(b) heterogeneous soil and climatic conditions;

(c) varying levels of productivity and technical management;

(d) degraded or partially degraded soils;

(e) dynamic management conditions over time.

Project holders shall document system characteristics and demonstrate that:

(a) project activities are adapted to local conditions;

(b) observed GHG outcomes are attributable to management changes;

(c) results are not driven solely by external factors such as climatic variability.

5.5 Climate and environmental conditions

Project activities may be implemented under a wide range of climatic and environmental conditions, including tropical, temperate, and semi-arid systems. The methodology is designed to be applicable in contexts with seasonal or interannual variability, including drought-prone or water-limited environments.

Project holders shall demonstrate that observed changes in emissions and carbon stocks are attributable to project activities and not solely to climatic variability. Where such variability introduces uncertainty, conservative assumptions shall be applied.

5.6 Project scale and aggregation

This methodology may be applied to individual project activities or to grouped and aggregated project structures. In all cases, the project design shall ensure that results are representative of the project area and that variability across participating units is adequately captured.

For aggregated projects, project holders shall apply appropriate stratification and sampling approaches to ensure that estimates of GHG emission reductions and removals are representative and conservative at the project level.

5.7 Applicability constraints

Project activities shall result in absolute net greenhouse gas emission reductions and/or removals. Improvements in emission intensity alone shall not be sufficient for crediting.

Project activities shall not lead to net increases in GHG emissions, and all emission sources affected by the project shall be accounted for. Activities shall be implemented and maintained throughout the crediting period and shall be capable of being monitored and verified under real-world conditions.

Where carbon removals are claimed, such removals shall be subject to permanence provisions, including risk assessment, monitoring, and appropriate compensation mechanisms.

5.8 Excluded activities

Activities shall not be eligible under this methodology where they do not result in measurable changes in management practices or where the relationship between the activity and GHG outcomes cannot be demonstrated.

This includes activities that rely solely on a single technological intervention without associated changes in management practices, as well as activities that depend exclusively on modeled outcomes without field-based validation for carbon removals.

Project activities shall not involve the conversion of natural ecosystems within the ten (10) years prior to the project start date. This requirement ensures that credited GHG emission reductions and removals are not associated with recent land-use change and maintains the environmental integrity of the methodology.

Activities that result in unaccounted or unmanageable leakage, or that involve the conversion of natural ecosystems within the ten years prior to the project start date, shall also be excluded.

5.9 Integrity safeguards

All project activities shall comply with the integrity requirements of the BioCarbon Standard. Greenhouse gas emission reductions and removals shall be measurable, additional, conservative, and verifiable.

Project holders shall ensure that all relevant emission sources and sinks are consistently accounted for, that no double counting occurs, and that any increases in emissions attributable to project activities are fully included in the net GHG balance.

Where uncertainty exists, conservative assumptions shall be applied to ensure that mitigation outcomes are not overestimated.

6 Normative references

The following documents constitute normative references for the application of this methodology. For dated references, only the version cited shall apply. For undated references, the latest available version shall apply.

This methodology shall be applied in conjunction with the BioCarbon Standard and its associated tools. Where inconsistencies arise, the provisions of the BioCarbon Standard shall prevail.

The following references shall be considered normative:

The Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use (AFOLU), including all relevant chapters for soil carbon, cropland, and grassland management;

The IPCC 2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories, including updated methodologies, emission factors, and approaches applicable to agricultural systems;

ISO 14064-2:2019, Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements;

The BioCarbon Standard (latest version);

The BioCarbon Additionality Tool (latest version);

The BioCarbon Monitoring, Reporting and Verification (MRV) Tool (latest version);

The BioCarbon Leakage Management Tool (latest version);

The BioCarbon Uncertainty Assessment Tool (latest version);

The BioCarbon Permanence and Risk Management Tool (latest version);

The BioCarbon Avoiding Double Counting (ADC) Tool (latest version);

The BioCarbon Sustainable Development Safeguards (SDS) framework (latest version).

Where relevant, project proponents may also apply supplementary guidance derived from:

IPCC Good Practice Guidance and uncertainty management approaches;

National greenhouse gas inventories and country-specific emission factors, where consistent with IPCC methodologies.

All references shall be applied in a manner that ensures consistency, transparency, and conservativeness in the quantification of greenhouse gas emission reductions and removals.

7 Terms and definitions

For the purposes of this methodology, the following terms shall apply. Where definitions are not provided herein, the definitions contained in the BioCarbon Standard (latest version) shall apply.

Additionality

The condition whereby greenhouse gas (GHG) emission reductions or removals would not have occurred in the absence of the project activity, as demonstrated in accordance with the BioCarbon Additionality Tool.

Agricultural land management (ALM)

The set of practices applied to agricultural land, including cropland and grassland systems, that influence soil properties, biological processes, and greenhouse gas emissions and removals.

Baseline scenario

The most plausible scenario of land management practices and associated GHG emissions and removals that would occur in the absence of the project activity.

Carbon dioxide removals

The net transfer of carbon dioxide (CO_2) from the atmosphere into carbon pools, including soil organic carbon and, where applicable, biomass.

Emission intensity

Greenhouse gas emissions per unit of agricultural output (e.g., per unit of crop yield or livestock product). Improvements in emission intensity alone shall not be sufficient for crediting under this methodology.

Greenhouse gas (GHG)

Gases that contribute to the greenhouse effect, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Leakage

An increase in GHG emissions outside the project boundary that occurs as a result of project activities.

Monitoring

The systematic collection, recording, and management of data required to quantify GHG emissions and removals and to demonstrate compliance with this methodology.

Net GHG balance

The total balance of GHG emissions and removals, accounting for all relevant sources, sinks, leakage, and uncertainty deductions.

Net GHG emission reductions and removals

The net climate benefit calculated as the difference between GHG emissions and removals under the project scenario and the baseline scenario.

Nitrous oxide (N_2O) emissions

Emissions resulting from soil processes associated with nitrogen inputs, including synthetic fertilizers, organic amendments, crop residues, and biological nitrogen fixation.

Project boundary

The spatial and operational limits within which project activities and associated GHG emissions and removals are accounted.

Project scenario

The scenario that reflects actual conditions and management practices implemented under the project activity.

Regenerative agricultural practices

Agricultural land management practices that aim to improve soil function, enhance biological activity, and strengthen ecosystem processes. The designation of a practice as "regenerative" shall not, in itself, constitute evidence of GHG emission reductions, removals, or additionality.

Removal

A process by which greenhouse gases are removed from the atmosphere and stored in a carbon pool.

Reversal

The release of previously stored carbon back into the atmosphere, resulting in a reduction or loss of credited removals.

Soil organic carbon (SOC)

The carbon component of organic matter present in soil, representing a primary carbon pool affected by agricultural land management practices.

SOC stock change

The measurable difference in soil organic carbon stocks between two points in time, expressed as a net increase or decrease.

Stratification

The division of the project area into relatively homogeneous units based on factors influencing GHG emissions and removals, including soil, climate, and management practices.

Uncertainty

The degree of variability or lack of precision associated with the estimation of GHG emissions and removals.

8 Project boundaries

The project boundary shall encompass all relevant greenhouse gas (GHG) sources, sinks, and reservoirs affected by project activities and contributing to measurable emission reductions and/or removals.

Project holders shall define the project boundary in a manner that is transparent, consistent, and conservative. The selection of included and excluded elements shall be justified based on their relevance and expected contribution to the overall GHG balance.

Only those carbon pools and emission sources that are expected to change as a result of project activities and that may materially affect the quantification of GHG outcomes shall be included.

8.1 Carbon pools and emission sources

The project boundary shall include all carbon pools and emission sources that are expected to be materially affected by project activities.

8.1.1 Carbon pools

Soil organic carbon (SOC) shall be included in all cases, as it represents the primary carbon pool affected by agricultural land management practices;

Aboveground biomass may be included where project activities (e.g., agroforestry or crop diversification systems) result in measurable and sustained changes;

Belowground biomass may be included where relevant and where robust quantification approaches can be applied.

Carbon pools shall be excluded where changes are negligible, highly uncertain, or not attributable to project activities.

Table 1. Carbon pools included in the project boundary

Carbon pool	Baseline scenario	Project scenario	Included?	Justification
Soil organic carbon (SOC)	Yes	Yes	Yes	Primary carbon pool affected by agricultural land management practices. Changes in SOC represent the main source of carbon dioxide removals under this methodology.
Aboveground biomass	Optional	Optional	Optional	May be included where project activities (e.g., cover crops, agroforestry, or increased vegetative biomass) result in measurable and sustained changes in carbon stocks.
Belowground biomass	Optional	Optional	Optional	May be included where changes in root biomass are expected to be significant and can be quantified using robust and consistent approaches.
Dead organic matter (dead wood)	No	No	No	Not a significant carbon pool in most agricultural systems and subject to high variability and uncertainty.
Litter	No	No	No	High turnover rates and rapid decomposition; generally considered in equilibrium with carbon inputs and outputs and not suitable for reliable stock-change accounting.

Carbon pool	Baseline scenario	Project scenario	Included?	Justification
Harvested biomass products	No	No	No	Carbon stored in harvested products is typically short-lived or accounted for outside the project boundary and is not directly attributable to agricultural land management practices under this methodology.

8.1.2 GHG emission sources

The following emission sources shall be included where relevant:

Nitrous oxide (N_2O) emissions associated with synthetic and organic fertilizer application, crop residues and soil organic matter decomposition, biological nitrogen fixation.

Methane (CH_4) emissions, where applicable, including emissions from soil conditions, emissions associated with integrated agricultural systems

Carbon dioxide (CO_2) emissions from fossil fuel use, where such emissions are attributable to project activities and are material.

Emission sources may be excluded where their contribution is demonstrably negligible or reliable quantification is not feasible and exclusion results in a conservative outcome.

Emissions shall be considered material where their contribution is significant relative to the total GHG balance and where their exclusion may affect the accuracy or conservativeness of results.

Table 2. GHG sources included in the project boundary

Source category	Gas	Baseline scenario	Project scenario	Included?	Justification
Soil nitrogen processes (fertilization, residues, biological fixation)	N_2O	Yes	Yes	Yes	Major emission source in agricultural systems; directly affected by changes in nutrient management, soil conditions, and biological processes.
Soil organic carbon stock changes	CO_2	Yes	Yes	Yes	Represents carbon removals through increases in SOC; primary mitigation pathway under this methodology.
Soil methane emissions (aerobic/anaerobic conditions)	CH_4	Yes (if relevant)	Yes (if relevant)	Conditional	Included where soil conditions (e.g., water saturation, rice systems) lead to measurable CH_4 emissions; otherwise may be excluded with justification.
Organic amendments application (e.g., manure, compost)	N_2O/CH_4	Yes (if relevant)	Yes (if relevant)	Conditional	Included where application of organic inputs leads to material emissions; relevance depends on

Source category	Gas	Baseline scenario	Project scenario	Included?	Justification
					management practices and environmental conditions.
Crop residue management	N_2O/CH_4	Yes (if relevant)	Yes (if relevant)	Conditional	Included where residue incorporation, retention, or burning results in measurable emissions; otherwise may be conservatively excluded.
Fossil fuel use (agricultural operations)	CO_2	Yes (if relevant)	Yes (if relevant)	Conditional	Included where emissions from machinery or operations are material and attributable to project activities; otherwise may be excluded conservatively.
Biomass carbon stock changes	CO_2	Optional	Optional	Optional	Included only where measurable, sustained changes occur and where no double counting with SOC or other pools is introduced.

All included sources and sinks shall be quantified using approaches consistent with IPCC methodologies, applying Tier 2 or higher approaches where feasible.

Table 3. Sources excluded from the project boundary

Source category	Gas	Baseline scenario	Project scenario	Included?	Justification
Plant respiration	CO_2	Yes	Yes	No	Considered part of the short-term biogenic carbon cycle and does not result in net emissions; excluded in accordance with IPCC guidance.
Soil respiration (heterotrophic and autotrophic)	CO_2	Yes	Yes	No	Reflected indirectly through SOC stock changes; separate accounting would result in double counting.
Minor non-CO_2 emissions from crop residues	CH_4/N_2O	Yes	Yes	No	Considered negligible in most agricultural systems or highly uncertain; exclusion is conservative where contribution is minimal.
Indirect emissions from input production (e.g., fertilizers, seeds)	CO_2	Yes	Yes	No	Upstream emissions are not directly attributable to project boundary activities and are excluded to maintain consistency with IPCC project-level accounting.
Emissions from transportation of inputs and products	CO_2	Yes	Yes	No (unless material)	Generally minor and not directly influenced by land management practices; may be included if demonstrated to be material.
Emissions from irrigation infrastructure and equipment	CO_2	Yes	Yes	No (unless material)	Typically small and not a primary driver of emissions under this methodology; inclusion subject to materiality assessment.

Source category	Gas	Baseline scenario	Project scenario	Included?	Justification
Soil erosion-related carbon fluxes	CO_2	Yes	Yes	No	Not explicitly accounted due to high uncertainty and lack of standardized quantification approaches at project scale.
Non-CO_2 emissions from burning outside project control	CH_4/N_2O	Yes	Yes	No	Excluded where not attributable to project activities or where control cannot be demonstrated.

8.1.2.1 Treatment of insignificant sources

Sources and sinks may be excluded where they are expected to have a negligible impact on the total GHG balance.

Such exclusion shall be permitted only where:

(a) the contribution is demonstrably immaterial;

(b) exclusion does not lead to overestimation of GHG emission reductions or removals;

(c) justification is clearly documented.

Where uncertainty exists regarding the significance of a source or sink, project holders shall conservatively include the source or apply an appropriate uncertainty deduction.

Optional emission sources, carbon pools, or activities may be excluded where the project holder demonstrates that their contribution is not material to the overall GHG balance.

A source, sink, or pool shall be considered material where its inclusion or exclusion could reasonably influence the quantification of net GHG emission reductions and removals or affect the environmental integrity of the project results.

The justification for excluding any source, sink, or pool shall be documented and made available for validation and verification.

8.2 Spatial and temporal boundaries

8.2.1 Spatial boundary

The spatial boundary shall include all areas where project activities are implemented and where associated GHG emission reductions and removals occur.

The project area shall:

(a) be clearly defined and georeferenced prior to validation;

(b) include all land under the control of the project holder or participating entities;

(c) reflect actual land management units where practices are implemented;

(d) be consistent with stratification used for monitoring and quantification.

Areas shall be excluded from the project boundary where:

(a) project activities are not implemented;

(b) monitoring cannot be reliably conducted;

(c) land is not under the control of the project holder;

(d) GHG outcomes cannot be attributed to project activities.

The spatial boundary shall remain consistent throughout the crediting period unless justified modifications are made in accordance with the BioCarbon Standard.

8.2.1.1 Project area and excluded areas

The project area shall include all land units where:

(a) project activities are implemented; and

(b) measurable GHG emission reductions and/or removals are expected.

Project holders shall demonstrate that:

(a) all included areas are under their control or the control of participating entities;

(b) project activities are consistently applied across the project area;

(c) monitoring is feasible and representative.

Excluded areas shall be:

(a) clearly identified and mapped;

(b) justified based on the absence of project activities or lack of data reliability.

8.2.2 Temporal boundary

The temporal boundary defines the period over which project activities are implemented and GHG emission reductions and removals are quantified.

The temporal boundary shall include:

(a) a project start date, corresponding to the implementation of management changes;

(b) a baseline period, representing historical conditions prior to project implementation;

(c) a monitoring period, during which emissions and removals are quantified and verified.

Where carbon removals are credited, the temporal boundary shall account for:

(a) the dynamic nature of soil organic carbon;

(b) delayed responses to management changes;

(c) the potential for reversals over time.

Monitoring shall therefore be conducted over a period sufficient to capture meaningful and statistically detectable changes in SOC stocks.

9 Project activities

9.1 General description of project activities

Project activities shall consist of deliberate and verifiable changes in agricultural land management practices that result in measurable greenhouse gas (GHG) emission reductions and/or removals within the project boundary.

Such activities shall be implemented in a manner that ensures a clear causal relationship between management changes and observed GHG outcomes. Project holders shall demonstrate that implemented practices directly influence at least one of the following components:

(a) soil organic carbon (SOC) stocks;

(b) nitrous oxide (N_2O) emissions associated with soil and nitrogen inputs;

(c) methane (CH_4) emissions, where relevant.

Project activities shall be designed and implemented as part of an integrated land management system. The combined effect of multiple practices shall be considered, and isolated or marginal changes that do not produce measurable outcomes shall not be eligible.

9.2 Types of eligible project activities

Eligible project activities shall include management-based interventions that modify soil processes, carbon dynamics, or emission pathways within agricultural systems.

These activities may include, but are not limited to, the following categories:

9.2.1 Soil management

Soil management practices shall aim to improve soil structure, enhance biological activity, and increase carbon retention. These may include reduced or no-tillage systems, as well as practices that minimize physical disturbance and promote soil stability.

9.2.2 Crop and vegetation management

Crop management practices shall promote continuous soil cover, increased biomass inputs, and system diversification. These may include cover cropping, crop rotation, intercropping, and the introduction of diversified or perennial species.

9.2.3 Nutrient management

Nutrient management practices shall aim to optimize nitrogen inputs and reduce emissions associated with fertilization. This may include improved timing, placement, and quantity of fertilizer application, as well as the substitution or integration of organic amendments.

9.2.4 Organic matter management

Practices that increase organic matter inputs to soil shall be included, provided that such inputs result in measurable changes in SOC stocks. This may include the application of compost, manure, or retention of crop residues.

9.2.5 Integrity systems

Where applicable, the integration of crops and livestock may be included, provided that such integration results in measurable changes in emissions and/or carbon stocks and is consistent with the scope of this methodology.

9.3 Conditions for eligibility of activities

Project activities shall meet the following conditions:

(a) activities shall represent a measurable change relative to the baseline scenario;
(b) activities shall be implemented within the defined project boundary;
(c) activities shall be maintained throughout the crediting period;
(d) activities shall result in quantifiable GHG emission reductions and/or removals;
(e) activities shall be supported by sufficient data to enable monitoring and verification.

Project holders shall demonstrate that project activities are effectively implemented and maintained in practice within the project boundary.

9.4 Excluded activities

The following activities shall not be considered eligible under this methodology:

(a) activities that do not result in measurable changes in management practices;
(b) activities that rely solely on modeled outcomes without field-based validation for carbon removals;
(c) activities that result only in improvements in emission intensity without reducing absolute emissions;
(d) activities that cannot demonstrate a causal relationship between implementation and GHG outcomes;
(e) activities that result in net increases in GHG emissions.

9.5 Technology-based interventions

Technology-based interventions may be included where they form part of an integrated management approach and contribute to measurable GHG emission reductions.

However, the eligibility of a project under this methodology shall not depend on the implementation of any specific technology, and technological measures alone shall not be sufficient to demonstrate eligibility.

9.6 Documentation of project activities

Project holders shall document all implemented activities in a manner sufficient to demonstrate their nature, extent, and consistency over time.

Documentation shall include:

(a) description of practices implemented;
(b) spatial distribution of activities;
(c) implementation timeline;
(d) changes relative to baseline conditions.

Such documentation shall be sufficient to support monitoring, reporting, and verification and to demonstrate the link between project activities and GHG emission reductions and removals.

10 Additionality

10.1 General requirement

Project activities shall demonstrate additionality in accordance with the BioCarbon Additionality Tool (latest version).

Project holders shall demonstrate that greenhouse gas (GHG) emission reductions and removals would not have occurred in the absence of the project activity. Additionality shall be established at the level of the project activity and shall reflect actual decision-making conditions.

The demonstration of additionality shall be based on objective, verifiable, and transparent evidence. Assumptions that are not supported by evidence or that result in overestimation of mitigation outcomes shall not be accepted.

The classification of a practice or system as "regenerative" shall not, in itself, constitute evidence of additionality.

This methodology adopts a practice-based approach to additionality, recognizing that emission reductions and removals in agricultural systems are driven by changes in land management practices rather than solely by the adoption of specific technologies.

Where multiple practices are implemented, additionality shall be assessed based on their combined effect on the system, ensuring that the overall mitigation outcome is attributable to the project activity.

The demonstration of additionality shall be consistent with the baseline scenario and the quantification of GHG emission reductions and removals, ensuring internal coherence across all components of the methodology.

10.2 Application of the Additionality Tool

The BioCarbon Additionality Tool shall be applied in full. All applicable steps and requirements defined in the tool shall be followed.

The demonstration of additionality shall include, at a minimum:

(a) regulatory surplus, demonstrating that project activities are not mandated by applicable laws or regulations;
(b) common practice analysis, demonstrating that the implemented practices are not widely adopted under similar conditions;
(c) barrier and/or investment analysis, demonstrating that the project activity faces constraints that prevent its implementation in the absence of carbon finance or equivalent incentives.

Project holders shall ensure that all inputs used in the application of the tool are consistent with the project context, are supported by evidence, and reflect realistic conditions.

10.3 Practice-based additionality in agricultural systems

Project activities under this methodology are based on changes in agricultural land management practices. Additionality shall therefore be demonstrated at the level of practice change, rather than solely at the level of technology adoption.

Project holders shall demonstrate that:

(a) the implemented practices represent a deviation from baseline management conditions;
(b) such deviation is material and measurable, and not incremental or insignificant;
(c) the practices are not already standard practice within the relevant geographic and production context.

Where multiple practices are implemented, additionality shall be assessed based on the combined effect of the practice change.

10.4 Additionality for existing operations

Projects implemented in existing agricultural systems may be eligible, provided that additional GHG emission reductions and/or removals are demonstrated beyond baseline conditions.

Where project activities build upon pre-existing practices, project holders shall demonstrate that:

(a) additional improvements are implemented beyond the pre-project condition;
(b) such improvements are not business-as-usual developments;
(c) continued additionality is justified throughout the crediting period.

Only incremental mitigation outcomes attributable to the project activity shall be eligible for crediting.

10.5 Additionality safeguards

The following conditions shall apply:

(a) Improvements in emission intensity alone shall not be sufficient to demonstrate additionality;
(b) Project activities shall result in absolute net GHG emission reductions and/or removals;
(c) Project activities shall not be financially or operationally viable under baseline conditions without carbon revenue or equivalent incentives, unless justified through barrier analysis;
(d) All assumptions used in the demonstration of additionality shall be conservative and evidence-based.

Project holders shall ensure that the demonstration of additionality is consistent with the baseline scenario and with the quantification of GHG emission reductions and removals.

10.6 Consistency and integrity of additionality demonstration

The additionality demonstration shall be internally consistent and aligned with all other sections of this methodology, including:

(a) baseline scenario;
(b) project activities;
(c) quantification of emissions and removals;
(d) monitoring and verification requirements.

Any inconsistency between the additionality demonstration and other components of the project shall be considered a material issue and shall be addressed prior to validation.

11 Stratification, sampling and representativeness

11.1 General requirement

Project holders shall apply stratification and sampling approaches that ensure greenhouse gas (GHG) emission reductions and removals are estimated in a representative and conservative manner.

Stratification and sampling shall be designed to:

(a) capture spatial variability within the project boundary;
(b) reflect differences in management practices and environmental conditions;
(c) support statistically robust estimation of GHG outcomes;
(d) reduce uncertainty and avoid overestimation of emission reductions and removals.

The level of detail in stratification and sampling shall be proportional to the heterogeneity of the project area and the complexity of the project activities.

11.2 Stratification of the project area

The project area shall be divided into homogeneous strata based on factors that influence GHG emissions and removals.

Stratification shall consider, at a minimum:

(a) soil type and texture;
(b) climatic conditions;
(c) land-use history and baseline management;
(d) crop type and vegetation cover;
(e) management practices, including tillage, fertilization, and residue management.

Additional criteria may be applied where relevant to improve the accuracy and representativeness of estimates.

Stratification shall ensure that each stratum represents a relatively homogeneous unit in which responses to project activities are expected to be consistent.

11.3 Definition of strata

Each stratum shall be defined as a spatial unit characterized by similar:

(a) environmental conditions;
(b) management practices;
(c) expected GHG response to project activities.

Strata shall be clearly delineated, georeferenced, and documented.

Project holders shall justify the criteria used to define strata and demonstrate that stratification improves the representativeness of sampling and the accuracy of estimates.

11.4 Stratification under heterogeneous conditions

Where the project area exhibits high spatial variability, project holders shall apply enhanced stratification approaches to ensure representativeness.

In such cases, project holders shall:

(a) increase the number of strata;
(b) refine stratification criteria;
(c) or increase sampling intensity within strata.

Where heterogeneity cannot be fully addressed through stratification, conservative assumptions or uncertainty deductions shall be applied.

11.5 Sampling design

Sampling shall be conducted using statistically sound approaches consistent with IPCC guidance and the BioCarbon Uncertainty Assessment Tool.

Sampling design shall:

(a) be appropriate to the parameter being measured (e.g., SOC, activity data);
(b) ensure sufficient coverage of all strata;
(c) provide statistically valid estimates at the project level;
(d) allow comparison between baseline and project conditions over time.

Sampling approaches shall be documented and justified, including the selection of sample size, distribution, and frequency.

Sampling results shall be representative at a minimum confidence level of 90%, unless otherwise justified and approved.

11.6 Soil organic carbon sampling

Soil organic carbon (SOC) sampling shall be based on a stratified design and shall reflect the spatial variability of the project area.

SOC sampling shall comply with the following requirements:

(a) sampling shall be conducted within each defined stratum;
(b) sampling depth shall be at least 0–30 cm, unless a deeper depth is justified;
(c) sampling methods shall be consistent across monitoring periods;
(d) sampling locations shall be fixed or statistically equivalent over time;
(e) laboratory analysis shall be conducted using recognized and consistent methods.

At a minimum, the number of sampling points per stratum shall be justified based on variability and shall be consistent with achieving statistically valid estimates, typically at a minimum confidence level of 90%.

SOC shall be re-measured at intervals sufficient to detect statistically significant stock changes and, in no case, less frequently than once every five (5) years where removals are credited.

Project holders may apply more frequent monitoring where project conditions, management changes, or uncertainty levels warrant additional measurement.

Where significant changes in land management, land use, or environmental conditions occur, BioCarbon may require additional SOC measurements or reassessment of monitored carbon stocks.

Where variability is high, project holders shall increase sampling density or apply conservative adjustments.

11.7 Representativeness

Project holders shall demonstrate that sampling results are representative of the entire project area.

This shall be ensured through:

(a) adequate number of sampling points;
(b) appropriate distribution of samples across strata;
(c) consistency between sampled areas and total project area.

Sampling bias shall be avoided. Project holders shall ensure that:

(a) sampling locations are not selected based on expected outcomes;
(b) all relevant conditions within the project area are represented.

Where representativeness cannot be fully demonstrated, conservative assumptions shall be applied.

Sampling results shall be considered representative only where the sampling design adequately captures the spatial variability of soils, management practices, and environmental conditions within the project boundary.

Where representativeness cannot be demonstrated with sufficient confidence, additional sampling, revised stratification, or conservative adjustments shall be applied.

11.8 Aggregated and grouped projects

For grouped or aggregated projects, stratification and sampling approaches shall ensure that results are representative across all participating units.

Project holders shall ensure that:

(a) participating units are included within an appropriate stratification framework;
(b) sampling captures variability across different project participants;
(c) aggregation does not introduce bias or underestimation of uncertainty.

Sampling approaches shall remain consistent across monitoring periods and across project expansions.

11.9 Conservativeness

Stratification and sampling shall be applied in a manner that avoids overestimation of GHG emission reductions and removals.

Where uncertainty exists in:

(a) stratification criteria;
(b) sampling design;
(c) representativeness of results;

project holders shall:

(a) apply conservative assumptions;
(b) increase sampling intensity;
(c) or apply uncertainty deductions.

All methodological choices shall prioritize environmental integrity over potential crediting volume.

11.10 Documentation requirements

Project holders shall document all elements of stratification and sampling, including:

(a) criteria used for stratification;
(b) number and boundaries of strata;
(c) sampling design and methodology;
(d) number and location of sampling points;
(e) justification of representativeness.

Documentation shall be sufficient to allow independent validation and verification of the applied approaches.

12 Baseline scenario

12.1 Conceptual approach

The baseline scenario represents the continuation of the agricultural land management system under prevailing conditions, reflecting how soils, inputs, and biological processes would evolve in the absence of the project activity.

The baseline scenario shall be defined as a dynamic system rather than a static reference condition. It shall reflect the expected evolution of emissions and carbon stocks under prevailing management practices over time.

This methodology treats the baseline not as a static reference, but as a dynamic management system, in which greenhouse gas (GHG) emissions and soil carbon stocks are the result of ongoing interactions between:

(a) land management practices;
(b) soil properties and biological processes; and
(c) environmental conditions.

The baseline shall therefore reflect the expected trajectory of the system, including both emissions and carbon stock dynamics, rather than a single point estimate.

12.2 Baseline identification

The baseline shall be defined as the continuation of existing agricultural land management practices within the project boundary.

Project holders shall demonstrate that the baseline system reflects:

(a) prevailing management practices applied prior to project implementation;
(b) typical input use and operational conditions;
(c) existing constraints affecting land management decisions; and
(d) realistic continuation of current practices over time.

The baseline shall not assume improvements in management practices unless such improvements are supported by verifiable evidence and are demonstrably part of an established trend.

12.3 Baseline conditions

Baseline conditions shall be reconstructed using a historical reference period sufficient to capture variability in management practices and environmental conditions.

The reference period shall:

(a) cover at least three (3) consecutive years prior to the project start date;

(b) include at least one full cropping cycle or rotation, where applicable;
(c) be extended where necessary to capture interannual variability.

Baseline reconstruction shall focus on identifying the dominant drivers of emissions and carbon dynamics, including:

(a) soil disturbance intensity;
(b) crop composition and rotation patterns;
(c) nutrient input levels and application practices;
(d) residue and organic matter management.

The reference period shall include at least one complete crop cycle or rotation, ensuring that baseline conditions capture the temporal variability inherent to agricultural systems.

Where direct records are not available, project holders may use a combination of documented evidence, remote sensing, surveys, and representative data sources, provided that such use is justified and conservative.

12.4 Baseline emissions and removals

The baseline shall reflect the expected trajectory of greenhouse gas emissions and soil organic carbon stocks over time, rather than a single point estimate.

The baseline scenario shall include all relevant emission sources and carbon pools defined within the project boundary.

At a minimum, the baseline shall quantify:

(a) nitrous oxide (N_2O) emissions associated with nitrogen inputs and soil processes;
(b) methane (CH_4) emissions, where relevant;
(c) soil organic carbon (SOC) stock dynamics under baseline management conditions.

Baseline emissions and removals shall be estimated using approaches consistent with IPCC methodologies and shall reflect realistic and conservative assumptions.

12.5 Baseline treatment of soil organic carbon

Soil organic carbon (SOC) under baseline conditions shall be treated conservatively.

Where sufficient data are available, SOC trends may be estimated based on measured or documented conditions. Where such data are limited or uncertain, SOC shall be assumed to be:

(a) stable; or
(b) declining under continued baseline management.

Increases in SOC that cannot be directly attributed to project-independent drivers and supported by verifiable evidence shall not be credited.

This approach ensures that credited removals reflect only changes attributable to the project activity.

12.6 Use of proxy data and assumptions

Where direct field data are not available, project holders may use proxy data, regional datasets, or default values to characterize baseline conditions.

The use of such data shall comply with the following principles:

(a) data shall be representative of the project context;
(b) sources shall be transparent and verifiable;
(c) assumptions shall be conservative and shall not result in overestimation of mitigation outcomes.

Where multiple values are available, project holders shall select values that result in lower estimated emission reductions or removals.

Where uncertainty is significant, conservative adjustments or uncertainty deductions shall be applied.

12.7 Consistency and internal coherence

The baseline scenario shall be internally consistent and aligned with all other components of the methodology.

This includes consistency between:

(a) baseline management practices and project activities;
(b) baseline assumptions and quantification approaches;
(c) emission sources and carbon pools included in the project boundary.

Differences between baseline and project scenarios shall reflect actual changes in management practices and shall be consistently applied across all calculations.

12.8 Baseline integrity requirements

The baseline shall be constructed in a manner that ensures environmental integrity.

Project holders shall ensure that:

(a) baseline emissions are not overestimated relative to realistic conditions;
(b) baseline carbon stocks are not underestimated;
(c) assumptions are based on verifiable and relevant evidence;
(d) speculative or non-evidence-based projections are not used.

Where multiple plausible baseline scenarios exist, the most conservative credible scenario shall be selected.

12.9 Baseline validity and reassessment

The baseline scenario shall remain valid only as long as the underlying conditions on which it was established continue to apply.

Project holders shall reassess the baseline:

(a) at each renewal of the crediting period;
(b) at intervals not exceeding five (5) years;
(c) or when material changes occur in regulatory, technological, or market conditions.

Where reassessment results in changes to baseline assumptions or parameters, the updated baseline shall be applied prospectively and shall be subject to validation.

The dynamic definition of the baseline scenario shall be consistent with the demonstration of additionality and the quantification of GHG emission reductions and removals, ensuring internal coherence across the methodology.

13 Leakage

13.1 General requirement

Leakage emissions shall be identified, assessed, and, where material, quantified.

Leakage refers to any increase in greenhouse gas (GHG) emissions occurring outside the project boundary as a result of project activities.

Project holders shall apply conservative approaches to ensure that leakage is not underestimated. Leakage shall be reassessed where material changes occur in project conditions, management practices, or production systems.

Leakage assessment shall be conducted in accordance with the BioCarbon Leakage Management Tool (latest version).

Project holders shall assess leakage risk using a structured approach consistent with the Tool, including:

(a) classification of leakage risk levels (e.g., low, medium, high); and
(b) application of corresponding quantification or conservative treatment requirements.

The level of detail required for leakage quantification shall be proportional to the assessed risk level.

Leakage shall be considered material where its contribution is significant relative to the total GHG balance and where its omission may lead to overestimation of net GHG emission reductions and removals.

Where leakage is identified as material, it shall be quantified using conservative approaches or, where quantification is not feasible, accounted for through conservative deduction factors in accordance with the BioCarbon Leakage Management Tool.

The identification, classification, and treatment of leakage shall be applied consistently across all project components.

Where leakage is assessed as negligible, project holders may justify zero leakage, provided that such justification is consistent with the criteria established in the Leakage Management Tool and supported by verifiable evidence.

13.2 Sources of leakage

Potential leakage sources in agricultural land management systems shall include, but are not limited to:

(a) displacement of agricultural production to areas outside the project boundary;
(b) changes in land use or management practices outside the project boundary resulting from project activities;
(c) redistribution or substitution of agricultural inputs, including fertilizers, organic amendments, or crop residues;
(d) diversion of biomass or organic matter from alternative uses;
(e) expansion of agricultural activities outside the project boundary to compensate for changes in productivity within the project area.

13.3 Identification of leakage

Project holders shall assess whether project activities are likely to result in leakage.

Leakage shall be considered material where:

(a) agricultural production is reduced within the project boundary and displaced to other locations;
(b) changes in management practices lead to increased emissions outside the project boundary;
(c) inputs such as fertilizers or organic amendments are reallocated in a manner that increases emissions elsewhere;
(d) biomass or residues are diverted from previous uses, resulting in increased emissions outside the project boundary.

Leakage identification and classification shall be consistent with the criteria defined in the BioCarbon Leakage Management Tool.

13.4 Production displacement

Project holders shall assess the risk of leakage associated with the displacement of agricultural production.

Leakage shall be considered material where:

(a) reductions in crop yield or production within the project boundary result in compensatory production outside the project boundary;
(b) agricultural activities are relocated to other areas as a result of project implementation;
(c) market-driven responses lead to expansion of agricultural land use outside the project boundary.

Where such risks are identified, project holders shall:

(a) quantify leakage using conservative assumptions; or
(b) apply a conservative deduction factor where quantification is not feasible.

Where no evidence of production displacement exists, project holders may justify that leakage is negligible.

13.5 Input reallocation and organic matter flows

Project holders shall assess leakage associated with the redistribution of inputs and organic matter.

Leakage shall be considered material where:

(a) organic amendments (e.g., manure, compost) are diverted from other locations, reducing carbon inputs or increasing emissions elsewhere;
(b) fertilizer use is reduced within the project boundary but increased outside the boundary;
(c) crop residues are diverted from alternative uses, resulting in increased emissions outside the project boundary.

Where such risks are identified, project holders shall:

(a) quantify leakage where data are available; or
(b) apply conservative assumptions or deductions where quantification is not feasible.

Project holders shall demonstrate that the sourcing and use of inputs and biomass do not result in unintended increases in emissions outside the project boundary.

13.6 Leakage quantification and treatment

Where leakage is identified as material, leakage emissions shall be quantified using conservative approaches consistent with IPCC guidance.

Where quantification is not feasible, project holders shall apply conservative deduction factors in accordance with the BioCarbon Leakage Management Tool.

Leakage emissions shall be deducted from total GHG emission reductions and removals.

13.6.1 Sampling approach

Where project holders demonstrate that leakage is negligible, leakage emissions may be conservatively set to zero.

Justification shall be provided, demonstrating that:

(a) agricultural production is not displaced outside the project boundary;
(b) total production levels are not shifted to other areas as a result of project activities;
(c) management changes do not result in indirect emissions outside the project boundary, including through input redistribution or land-use change.

The justification of zero leakage shall be based on verifiable evidence and shall demonstrate that no material displacement of production, inputs, or biomass occurs.

13.6.2 Conservative assumptions

Where data are limited, project holders shall apply conservative assumptions, including:

(a) assuming partial displacement of agricultural production where uncertainty exists;
(b) applying conservative emission factors for affected activities;
(c) using conservative scenarios where potential indirect effects cannot be fully quantified.

13.7 Leakage mitigation

(a) maintaining agricultural production within the project boundary, where applicable;
(b) avoiding displacement of production to non-project areas;
(c) ensuring that changes in management practices do not result in increased emissions outside the project boundary;
(d) applying consistent management practices across participating units in aggregated projects.

Leakage shall not be ignored where there is a reasonable risk of displacement of emissions or activities.

14 Uncertainty

14.1 General requirement

Uncertainty associated with the estimation of greenhouse gas (GHG) emissions and removals shall be assessed and, where relevant, quantified.

Uncertainty management is a key component of this methodology and is designed to prevent overestimation of GHG emission reductions and removals, particularly in relation to soil organic carbon.

Project holders shall apply conservative approaches to ensure that uncertainty does not lead to overestimation of GHG emission reductions and removals.

Where uncertainty cannot be reduced through improved data collection, sampling design, or methodological refinement, conservative assumptions or deductions shall be applied.

14.2 Sources of uncertainty

Sources of uncertainty may include, but are not limited to:

(a) variability in soil organic carbon (SOC) measurements;
(b) variability in activity data related to agricultural management practices (e.g., fertilizer application, residue management, crop systems);
(c) uncertainty in emission factors for nitrous oxide (N_2O) and methane (CH_4);
(d) sampling error and spatial variability within the project area;
(e) limitations in data availability or data quality.

Project holders shall identify all relevant sources of uncertainty and assess their potential impact on estimated GHG emission reductions and removals.

14.3 Quantification of uncertainty

Where feasible, uncertainty shall be quantified using statistical methods consistent with IPCC guidance (IPCC, 2019).

Quantification of uncertainty shall be conducted in accordance with the BioCarbon Conservative Approach and Uncertainty Management Tool (latest version).

Project holders shall apply the appropriate methodological approach defined in the Tool, including Tier 1 (error propagation) or Tier 2 (Monte Carlo simulation), depending on data availability, project complexity, and required level of accuracy.

Uncertainty assessment shall consider:

(a) variability within strata;

(b) sampling error;

(c) measurement and laboratory error;

(d) model uncertainty, where models are used.

Where multiple sources of uncertainty are present, greater weight shall be given to uncertainties associated with soil organic carbon (SOC), as SOC represents the primary source of carbon removals under this methodology.

The selection of the approach shall be justified and documented.

14.3.1 Soil organic carbon uncertainty

Uncertainty associated with SOC measurements shall be treated as a critical component of the overall uncertainty assessment, and sampling and analytical approaches shall be designed to minimize uncertainty in SOC estimation.

SOC uncertainty shall consider:

(a) spatial variability within strata;

(b) sampling density and representativeness;

(c) laboratory measurement error;

(d) temporal variability between monitoring periods.

Sampling design shall aim to reduce uncertainty to acceptable levels through appropriate stratification, sample size, and consistent methodologies.

14.3.2 Application of uncertainty deductions

Uncertainty deductions shall be determined using the data quality and discounting approaches defined in the BioCarbon Conservative Approach and Uncertainty Management Tool.

Where uncertainty is quantified and exceeds the thresholds or conditions defined in the Tool, a conservative deduction shall be applied to greenhouse gas (GHG) emission reductions and removals.

Such deduction shall be applied prior to credit issuance and shall result in a reduction of the total net GHG emission reductions and removals eligible for crediting.

Uncertainty deductions shall be applied consistently across all relevant components of the GHG balance.

The application of uncertainty adjustments shall:

(a) reduce the total credited emission reductions and removals;

(b) reflect the level of confidence in the estimates;

(c) avoid double counting of uncertainty across different components.

In all cases, uncertainty shall be treated conservatively.

15 Quantification of GHG emission reduction from project activities

15.1 General approach

Greenhouse gas (GHG) emission reductions and removals shall be quantified as the difference between baseline and project conditions, accounting for all relevant emission sources and carbon pools within the project boundary.

This methodology applies a system-based quantification approach, in which agricultural land is treated as an integrated system where emissions and removals arise from the interaction between:

(a) management practices;
(b) soil processes;
(c) and environmental conditions.

Quantification shall therefore capture both:

(a) changes in emissions (primarily N_2O and CH_4); and
(b) changes in carbon stocks (primarily soil organic carbon, SOC).

All components shall be quantified separately and then integrated into a net GHG balance.

GHG emissions shall be calculated in their original units and converted to CO_2 equivalent (tCO_2e) at the aggregation stage using IPCC AR6 Global Warming Potentials (GWP100).

Global Warming Potentials (GWP100) shall be applied in accordance with IPCC AR6.

The following values shall be used:

$GWPN_2O$ = 273

$GWPCH_4$ = 27.0

The quantification framework consists of the following components:

(a) baseline emissions and removals;
(b) project emissions and removals;
(c) leakage emissions;
(d) uncertainty deductions.

15.2 Core quantification components

The quantification of net GHG emission reductions and removals under this methodology shall include the following components:

(a) soil organic carbon stock changes;
(b) nitrous oxide emissions;
(c) methane emissions, where relevant;
(d) biomass carbon stock changes, where included;
(e) baseline emissions and removals;
(f) project emissions and removals;
(g) leakage emissions;
(h) uncertainty deductions.

15.2.1 Soil organic carbon (SOC) stock change

SOC shall be quantified using a stock-change approach based on direct measurement.

SOC quantification shall comply with the following principles:

(a) measurements shall be field-based and stratified;
(b) sampling depth shall be consistent across monitoring periods;
(c) bulk density shall be measured or appropriately estimated;
(d) sampling intervals shall be sufficient to detect statistically significant changes.

Model outputs may be used to support interpretation but shall not replace measured SOC stock changes.

15.2.2 Nitrous oxide (N_2O) emissions

Nitrous oxide emissions shall be quantified based on nitrogen inputs to soil.

Emissions shall include:

(a) direct emissions from nitrogen inputs;
(b) indirect emissions from volatilization and leaching.

Emission factors shall be:

(a) country-specific where available;
(b) otherwise IPCC default values shall be used conservatively.

IPCC AR6 Global Warming Potentials (GWP100) shall be applied where conversion to CO_2e is required, in accordance with the latest IPCC guidance (IPCC, 2021).

15.2.3 Methane (CH_4) emissions

Methane (CH_4) emissions shall be quantified where relevant to the project system.

This may include emissions associated with water-saturated or anaerobic soil conditions, such as flooded agricultural systems.

Where CH_4 emissions are not material, they may be excluded, provided that such exclusion is justified.

CH_4 emissions shall not be assumed to be significant in non-flooded or well-drained agricultural systems unless evidence indicates otherwise.

Where CH_4 emissions are included, they shall be quantified using methods consistent with the IPCC Guidelines for National Greenhouse Gas Inventories, applying Tier 2 or higher approaches where feasible.

The selection of activity data and emission factors shall reflect actual project conditions and shall be consistent with IPCC methodologies. Where multiple emission factors are available, conservative values shall be selected.

15.2.4 Biomass carbon stock changes (optional)

Where included, biomass carbon stock changes shall be quantified using approaches consistent with IPCC guidance.

Biomass shall only be included where:

(a) changes are measurable and sustained;
(b) no double counting with SOC occurs;
(c) long-term carbon storage can be demonstrated.

15.3 Baseline emissions and removals

Baseline emissions and removals shall be quantified in accordance with the baseline scenario defined in Section 12.

Baseline emissions shall represent the greenhouse gas (GHG) emissions that would occur in the absence of the project activity.

Baseline removals shall reflect carbon stock changes under baseline management conditions.

All baseline components shall be estimated using methods consistent with the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (AFOLU) and the 2019 Refinement, applying Tier 2 or higher approaches, where applicable.

Baseline parameters shall reflect:

(a) baseline management practices;
(b) baseline input levels;
(c) baseline environmental conditions.

SOC in the baseline shall be treated conservatively, typically assuming stable or declining conditions unless evidence supports otherwise.

Baseline emissions shall include all relevant emission sources identified within the project boundary and shall be calculated using the same stratification framework applied in the project scenario.

15.3.1 Baseline Nitrous oxide (N_2O) emissions

Baseline nitrous oxide (N_2O) emissions shall be quantified based on nitrogen inputs and related soil nitrogen processes under baseline management conditions.

Baseline N_2O emissions shall include, where relevant, direct emissions associated with nitrogen applied to soil and indirect emissions associated with volatilization and leaching losses.

The baseline N_2O emissions shall be calculated as follows:

$$N_2O_{BL,i,y} = \left(N_{inputs,BL,i,y} \times EF_{direct,BL}\right) + \left(N_{loss,BL,i,y} \times EF_{indirect,BL}\right) \quad \text{Equation 1}$$

Where:

$N_2O_{BL,i,y}$	=	Baseline nitrous oxide emissions in stratum i during year y; t N_2O-N/ha/year
$N_{inputs,BL,i,y}$	=	Total nitrogen input to soil under baseline conditions in stratum i during year y; kg N/ha/year
$EF_{direct,BL}$	=	Direct emission factor for baseline nitrogen inputs; kg N_2O-N/kg N input
$N_{loss,BL,i,y}$	=	Nitrogen losses under baseline conditions in stratum i during year y, including volatilization and leaching, where relevant; kg N/ha/year
$EF_{indirect,BL}$	=	Indirect emission factor for baseline nitrogen losses; kg N_2O-N/kg N lost
i	=	Stratum or homogeneous unit within the project boundary
y	=	Year of the monitoring or reporting period

15.3.2 Baseline Methane (CH_4) emissions

Baseline methane (CH_4) emissions shall be quantified where relevant to the project system.

Methane emissions under baseline conditions may occur in agricultural systems characterized by water-saturated or anaerobic soil conditions, including flooded or partially flooded systems. Where such conditions are not present, CH_4 emissions may be considered negligible.

Where CH_4 emissions are not material, they may be conservatively excluded, provided that such exclusion is justified.

Where applicable, baseline methane emissions shall be calculated as follows:

$$CH_{4_{BL,i,y}} = Activity_{BL,i,y} \times EF_{CH_4,BL} \quad \text{Equation 2}$$

Where:

$CH_{4_{BL,i,y}}$	=	Baseline methane emissions in stratum i during year y; t CH_4/ha/year or t CH_4/year, as applicable
$Activity_{BL,i,y}$	=	Activity data associated with methane generation under baseline conditions in stratum i during year y (unit depends on the system, e.g., flooded area, duration of anaerobic conditions, or other relevant drivers)
$EF_{CH_4,BL}$	=	Methane emission factor under baseline conditions (t CH_4 per unit of activity), determined in accordance with the IPCC Guidelines for National Greenhouse Gas Inventories
i		Stratum or homogeneous unit within the project boundary
y		Year of the monitoring or reporting period

Where methane emissions are expressed in carbon dioxide equivalent, baseline methane emissions shall be converted as follows:

$$CO_2e_{CH_4,BL,i,y} = CH_{4_{BL,i,y}} \times GWP_{CH_4} \quad \text{Equation 3}$$

Where:

$CO_2e_{CH_4,BL,i,y}$	=	Baseline methane emissions in stratum i during year y, expressed in carbon dioxide equivalent; tCO_2e/year

$CH_{4_{BL,i,y}}$	=	Methane emissions in stratum i during year y; t CH_4/year or t CH_4/ha/year, as applicable
GWP_{CH_4}	=	Global warming potential of methane (dimensionless), in accordance with the applicable IPCC guidance adopted by the BioCarbon Standard
i	=	Stratum or homogeneous unit within the project boundary
y	=	Year of the monitoring or reporting period

15.3.3 Aggregation of baseline emissions

Baseline greenhouse gas (GHG) emissions shall be aggregated across all strata within the project boundary.

Baseline emissions shall be calculated as follows:

$$BE_y = \sum_i \left(CO_2e_{CH_4,BL,I,Y} + CO_2e_{N_2O,BL,i,y}\right) \qquad \text{Equation 4}$$

Where:

BE_y	=	total baseline greenhouse gas emissions in year y; tCO_2e/year
$CO_2e_{CH_4,BL,I,Y}$	=	baseline methane emissions in stratum i during year y expressed in CO_2e; CO2e/year
$CO_2e_{N_2O,BL,i,y}$	=	baseline nitrous oxide (N_2O) emissions in stratum i during year y, expressed in CO_2e; tCO_2e/year
i	=	Stratum or homogeneous unit within the project boundary
y	=	Year of the monitoring or reporting period

Baseline emissions shall include all relevant emission sources identified within the project boundary and shall be calculated using the same stratification framework applied in the project scenario.

Baseline removals, including changes in soil organic carbon (SOC), shall be quantified separately and shall not be included in the aggregation of baseline emissions.

Baseline parameters shall be periodically reviewed and updated where significant changes in underlying conditions occur, including changes in management practices, environmental conditions, or data availability.

15.3.4 Baseline soil organic carbon (SOC) stock change

Baseline soil organic carbon stock change shall be quantified as the sum of carbon stock changes attributable to soil organic carbon within all strata included in the project boundary.

$$SOC_{BL,y} = \sum_{i} \Delta CO_{2\,SOC,BL,i,y} \qquad \text{Equation 5}$$

Where:

$SOC_{BL,y}$	=	Total baseline soil organic carbon stock change in year y; tCO_2e/year
$\Delta CO_{2\,SOC,BL,i,y}$	=	Change in soil organic carbon stocks in the baseline scenario in stratum i during year y, expressed in CO_2e; tCO_2e/year
i	=	Stratum or homogeneous unit within the project boundary
y	=	Year of the monitoring or reporting period

15.4 Project emissions and removals

Project emissions and removals shall reflect actual conditions under project implementation.

All parameters shall:

(a) be based on monitored data where required;
(b) reflect actual management practices;
(c) be updated over time as conditions change.

Where project activities increase inputs or system intensity, resulting emissions shall be fully accounted for.

15.4.1 Project Nitrous oxide (N_2O) emissions

Project nitrous oxide (N_2O) emissions shall be quantified based on nitrogen inputs and associated soil processes under project conditions.

$$N_2O_{p,i,y} = \left(N_{input,p,i,y} \times EF_{direct,p}\right) + \left(N_{loss,p,i,y} \times EF_{indirect,p}\right) \qquad \text{Equation 6}$$

Where:

$N_2O_{p,i,y}$	=	Project nitrous oxide emissions in stratum i during year y; t N_2O-N/ha/year
$N_{inputs,p,,i,y}$	=	Total nitrogen input to soil under project conditions in stratum i during year y; kg N/ha/year
$EF_{direct,p}$	=	Direct emission factor for project nitrogen inputs; kg N_2O-N/kg N input
$N_{loss,p,,i,y}$	=	Nitrogen losses under project conditions in stratum i during year y, including volatilization and leaching, where relevant; kg N/ha/year
$EF_{indirect,p}$	=	Indirect emission factor for project nitrogen losses; kg N_2O-N/kg N lost
i	=	Stratum or homogeneous unit within the project boundary
y	=	Year of the monitoring or reporting period

Conversion to CO2 equivalent:

$$CO_2e_{N_2O,i,y} = N_2O_{p,i,y} \times \frac{44}{28} \times GWP_{N_2O} \quad \text{Equation 7}$$

Where:

$N_2O_{p,i,y}$	=	t N2O-N/ha/year
$\frac{44}{28}$	=	Conversion N2O-N to N2O
GWP_{N_2O}	=	IPCC AR6 value (GWP_{100} = 273)

15.4.2 Project Methane (CH_4) emissions

Project methane (CH_4) emissions shall be quantified where relevant to the project system.

$$CH_{4_{p,i,y}} = Activity_{p,i,y} \times EF_{CH_4,p} \quad \text{Equation 8}$$

Where:

$CH_{4_{p,i,y}}$	=	Project methane emissions in stratum i during year y; t CH_4/ha/year or t CH_4/year, as applicable
$Activity_{p,i,y}$	=	Activity data associated with methane generation under project conditions in stratum i during year y (unit depends on the system, e.g., flooded area, duration of anaerobic conditions, or other relevant drivers)
$EF_{CH_4,p}$	=	Methane emission factor under project conditions (t CH_4 per unit of activity), determined in accordance with the IPCC Guidelines for National Greenhouse Gas Inventories
i		Stratum or homogeneous unit within the project boundary
y		Year of the monitoring or reporting period

Conversion to CO_2 equivalent:

$$CO_2e_{CH_4,p,i,y} = CH_{4_{p,i,y}} \times GWP_{CH_4} \quad \text{Equation 9}$$

Where:

$CO_2e_{CH_4,i,y}$	=	Project methane emissions in stratum i during year y, expressed in carbon dioxide equivalent; tCO_2e/year
$CH_{4_{p,i,y}}$	=	Methane emissions in stratum i during year y; t CH_4/year or t CH_4/ha/year, as applicable
GWP_{CH_4}	=	Global warming potential of methane (dimensionless), in accordance with the applicable IPCC guidance adopted by the BioCarbon Standard
i	=	Stratum or homogeneous unit within the project boundary
y	=	Year of the monitoring or reporting period

15.4.3 Aggregation of project emissions

Project emissions shall be aggregated as follows:

$$PE_{p,y} = \sum_{i} \left(CO_2e_{CH_4,p,I,Y} + CO_2e_{N_2O,p,i,y} \right)$$ Equation 10

Where:

$PE_{p,y}$	=	total project emissions in year y; tCO_2e/year
$CO_2e_{CH_4,p,I,Y}$	=	project methane emissions in stratum i in year y; tCO_2e/year
$CO_2e_{N_2O,p,i,y}$	=	project nitrous oxide emissions in stratum i in year y; tCO_2e/year
i	=	Stratum or homogeneous unit within the project boundary
y	=	Year of the monitoring or reporting period

Project emissions shall include all relevant emission sources within the project boundary and shall be calculated consistently with the baseline scenario.

Project removals, including soil organic carbon (SOC) stock changes, shall be accounted for separately and integrated into the net GHG balance.

15.4.4 Project soil organic carbon (SOC)

Project soil organic carbon (SOC) stock changes shall be quantified using a stock-change approach based on direct measurement.

SOC stock changes shall be calculated as follows:

$$\Delta SOC_{P,i,y} = SOC_{p,i,t2} - SOC_{p,i,t1}$$ Equation 11

Where:

$\Delta SOC_{p,Y}$	=	change in SOC stock in the project scenario in stratum i during period y; t C/ha
$SOC_{p,t1}$	=	initial SOC stock; t C/ha
$SOC_{p,t2}$	=	SOC stock at monitoring time; t C/ha

SOC changes shall be converted to CO_2e as follows:

$$\Delta CO_{2,SOC_{p,i,y}} = \Delta C_{SOC_{p,i,y},} \times \frac{44}{12}$$ Equation 12

Where:

$\Delta CO_{2,SOC_{p,i,y}}$ = Change in SOC stock in the project scenario in stratum i during period y expressed in CO2e; t CO_2e /year

$\Delta C_{SOC_{p,i,y}},$ = Change in SOC stock in the project scenario in stratum i during period y; tC/ha

$\frac{44}{12}$ = Molecular weight ratio used to convert carbon to carbon dioxide equivalent

15.5 Leakage

Leakage emissions shall be identified and quantified where material.

Leakage may arise from:

(a) displacement of agricultural production;
(b) redistribution of inputs;
(c) changes in land use outside the project boundary.

Where quantification is not feasible, conservative deductions shall be applied.

Where leakage is identified as material, leakage emissions shall be quantified using conservative methods consistent with IPCC guidance.

Quantification may be based on:

- Changes in agricultural production outside the project boundary;
- Changes in input use outside the project boundary
- Changes in land management or land-use activities attributable to project implementation.

$$LE_y = \sum CO2e_{CH_4 le,y} + CO2e_{N_2O,le,y} \quad \text{Equation 13}$$

Where:

LE_y = total leakage emissions in year y; tCO_2e/year

$CO2e_{CH_4 le,y}$ = leakage methane emissions in year y expressed in CO_2e; tCO_2e/year

$CO2e_{N_2O,le,y}$ = leakage nitrous oxide emissions in year y expressed in CO_2e; tCO_2e/year

15.5.1 Application of uncertainty deductions

Where uncertainty is quantified and exceeds acceptable thresholds, a conservative deduction shall be applied to GHG emission reductions and removals.

The uncertainty deduction shall be calculated as:

$$U_y = \mathrm{f}\left(U_{SOC}, U_{CH_4}, U_{N_2O}\right) \qquad \text{Equation 14}$$

Where:

U_y	=	total uncertainty deduction in year y; tCO_2e/year
U_{SOC}	=	uncertainty associated with the estimation of SOC stock change estimation; tCO_2e/year or %
U_{CH_4}	=	uncertainty associated with methane emissions estimation, where applicable; tCO_2e/year or %
U_{N_2O}	=	uncertainty associated with nitrous oxide emission estimation; tCO_2e/year or %

The functional form of $f(U_{SOC}, U_{CH_4}, U_{N_2O})$ shall be applied in accordance with the BioCarbon Conservative Approach and Uncertainty Management Tool and shall ensure conservative aggregation of uncertainty across emission sources and removals.

The aggregation function shall ensure that higher uncertainty in SOC estimates results in proportionally conservative deductions in credited GHG emission reductions and removals.

Uncertainty deductions applied in the calculation of net GHG emission reductions and removals shall be determined in accordance with Section 14 and the BioCarbon Conservative Approach and Uncertainty Management Tool.

In all cases, uncertainty shall be treated conservatively.

Where uncertainty cannot be reliably quantified, assumptions shall favor lower crediting outcomes.

15.6 Net GHG emission reductions and removals

Net greenhouse gas (GHG) emission reductions and removals shall be calculated as the integrated balance between baseline and project emissions and removals, accounting for leakage and uncertainty deductions.

The net GHG balance represents the combined effect of emission reductions and removals after accounting for leakage and uncertainty deductions.

The calculation shall reflect the net climate benefit attributable to the project activity.

Only net positive GHG emission reductions and removals shall be eligible for crediting.

The following conditions shall apply:

(a) all emission sources shall be consistently included in both baseline and project scenarios;
(b) all carbon stock changes shall be accounted for using consistent methodologies;
(c) leakage and uncertainty deductions shall be applied after quantification of emissions and removals;
(d) no double counting of emission reductions or removals shall occur.

The net GHG emission reductions and removals shall be calculated as:

$$ER_{net,y} = (BE_y - PE_y) + (SOC_{p,y} - SOC_{BL,y}) - LE_y - U_y \quad \text{Equation 15}$$

Where:

$ER_{net,y}$	=	Net GHG emission reductions and removals in year y; tCO_2e/year
BE_y	=	Baseline emissions; tCO_2e/year
$PE_{,y}$	=	Project emissions; tCO_2e/year
$SOC_{p,y}$	=	Project SOC stock change; tCO_2e/year
$SOC_{BL,y}$	=	Baseline SOC stock change; tCO_2e/year
LE_y	=	Leakage; tCO_2e/year
U_y	=	Uncertainty deduction; tCO_2e/year

15.6.1 Eligibility for crediting

The following conditions shall apply:

$$ER_{net,y} > 0$$

Only positive values of net GHG emission reductions and removals shall be eligible for crediting.

Where:

$$ER_{net,y} \leq 0$$

no credits shall be issued.

15.6.2 Integrity requirements

The quantification of net GHG emission reductions and removals shall comply with the following principles:

(a) all relevant sources and sinks shall be included;
(b) all increases in emissions attributable to project activities shall be fully accounted for;
(c) assumptions and parameters shall be conservative;
(d) results shall be transparent, reproducible, and verifiable.

15.6.3 Conservativeness

Where uncertainty exists, assumptions shall result in lower estimated emission reductions and removals.

The application of conservative assumptions shall ensure that credited mitigation outcomes are not overestimated.

16 Monitoring, reporting and verification (MRV)

16.1 General framework

The monitoring, reporting and verification (MRV) system shall ensure that all greenhouse gas (GHG) emission reductions and removals attributed to the project are quantifiable, traceable, and verifiable over time.

The monitoring framework defined in this methodology is designed to reflect the specific characteristics of agricultural systems, including variability in management practices, crop systems, and soil conditions. The use of system-specific parameters ensures that monitoring results are representative, traceable, and suitable for robust quantification of GHG emission reductions and removals.

The MRV system shall be designed as an integral component of the project, directly linked to the quantification approach defined in Section 13. All monitored data shall correspond to the variables and parameters used in baseline and project scenario calculations.

Monitoring shall reflect actual project conditions and shall demonstrate that observed GHG outcomes are attributable to implemented management practices.

16.2 Monitoring plan and system design

A monitoring plan shall be established prior to validation and shall define the procedures for data collection, processing, storage, and reporting.

The monitoring plan shall:

(a) identify all parameters required for quantification;
(b) define measurement or estimation methods;
(c) specify data sources and collection frequency;
(d) ensure consistency across monitoring periods.

The monitoring system shall be designed to operate under real-world conditions. Where direct measurement is not feasible, proxy data or conservative default values may be used, provided that such approaches are justified and documented.

16.3 Monitoring of agricultural systems and activity data

Monitoring shall capture the dynamic nature of agricultural systems, including changes in management practices, input use, and production conditions.

Project holders shall monitor, as applicable:

(a) crop types and rotation patterns;
(b) soil management practices, including tillage and residue management;
(c) nutrient inputs, including type, quantity, and application practices;
(d) organic amendments applied to soils;
(e) relevant environmental conditions influencing emissions.

Data shall be recorded at a frequency sufficient to reflect actual management practices and to support quantification.

16.4 Monitoring of soil organic carbon (SOC)

Soil organic carbon (SOC) shall be analyzed using recognized laboratory methods. Accepted analytical methods include:

(a) dry combustion (elemental analysis);
(b) Walkley–Black method;
(c) loss-on-ignition (LOI), where appropriate.

Dry combustion shall be considered the preferred method due to its higher accuracy and completeness of oxidation.

Where alternative methods are used, project holders shall:

(a) demonstrate that the selected method is appropriate for the soil type and conditions;
(b) apply correction factors or calibration relationships, where relevant;
(c) ensure that the use of such methods does not result in overestimation of SOC stocks or stock changes.

The selected analytical method shall be applied consistently across all monitoring periods.

Where significant methodological uncertainty is associated with the selected analytical method, conservative adjustments shall be applied.

16.5 Monitoring of emissions

Monitoring of emissions shall be consistent with the quantification approach and shall include, where relevant:

(a) nitrogen inputs and related parameters for N_2O estimation;
(b) activity data influencing CH_4 emissions;
(c) any additional variables required to apply emission factors or models.

Where direct measurement is not feasible, emission factors shall be applied using conservative assumptions.

16.6 Data management, traceability and documentation

All monitored data shall be recorded and managed in a manner that ensures full traceability from raw data to reported results.

Project holders shall:

(a) maintain complete records of data sources and assumptions;
(b) ensure that calculations can be reproduced;
(c) retain data for validation and verification purposes.

Data management systems shall ensure transparency, consistency, and integrity.

16.7 Quality assurance and quality control (QA/QC)

Project holders shall implement QA/QC procedures consistent with IPCC good practice.

QA/QC procedures shall ensure that:

(a) data are complete, consistent, and accurate;
(b) errors are identified and corrected;
(c) monitoring procedures are periodically reviewed and improved.

Where inconsistencies are identified, corrective actions shall be documented.

16.8 Reporting

Monitoring results shall be documented in monitoring reports that include:

(a) description of project activities;
(b) monitored data and sources;
(c) calculation procedures and assumptions;
(d) results of GHG emission reductions and removals.

Reports shall be sufficiently detailed to allow independent replication and verification.

16.9 Verification

All reported GHG emission reductions and removals shall be subject to independent verification by an accredited validation and verification body.

Verification shall assess:

(a) implementation of the monitoring system;
(b) completeness and reliability of data;
(c) accuracy and conservativeness of calculations.

Verification teams shall possess demonstrated expertise in agricultural systems, soil organic carbon measurement, and greenhouse gas accounting. Such expertise shall be appropriate to the specific project context and shall ensure the accurate assessment of project implementation, monitoring data, and quantification results.

16.10 Representativeness and aggregation

For aggregated projects, the MRV system shall ensure that results are representative across all participating units.

Sampling and monitoring approaches shall capture variability across the project and shall not introduce bias.

16.11 Measurement hierarchy and conservativeness

A hierarchical approach shall be applied to data collection:

(a) direct measurement shall be prioritized;
(b) project-specific estimates shall be used where measurement is not feasible;
(c) conservative default values shall be used where data are limited.

All assumptions shall be conservative.

16.12 Dynamic conditions and recalculation

The monitoring system shall capture material changes in project conditions over time.

Where significant changes occur in management practices, environmental conditions, or system characteristics, project holders shall:

(a) reassess relevant parameters;
(b) update calculations where necessary;
(c) document all changes transparently.

16.13 Data and parameters monitored

Where data limitations exist, assumptions shall be selected to avoid overestimation of GHG emission reductions and removals. Conservative approaches shall be applied consistently across all components of the MRV system.

16.13.1 Data and parameters available at validation

The following table defines the data and parameters required at the validation stage to establish baseline conditions, characterize the project system, and support the initial application of this methodology.

These parameters shall be derived from verifiable and representative sources and shall be consistent with the baseline scenario, project boundary, and stratification framework. Where direct data are not available, conservative assumptions or proxy data may be used, provided that their application is justified and documented.

Table 4. Data and parameters available at validation

Data / Parameter	Description	Unit	Source of data	Measurement / Estimation method	Frequency	QA/QC and comments
A proj	Total project area included in the project boundary	ha	GIS, cadastral records, field verification	Measured and documented through geospatial analysis	At validation and updated if boundary changes	Shall be consistent with the project boundary and stratification records
A str,i	Area of stratum i	ha	GIS, remote sensing, field validation	Measured through stratification process	At validation and updated if strata are revised	Shall sum to total project area
LU BL	Baseline land use and management condition	n/a	Historical records, field surveys, remote sensing	Documented based on observed pre-project conditions	At validation and reassessed as required	Shall be evidence-based and consistent with baseline scenario
Crop sys	Baseline cropping system and rotation patterns	n/a	Farm records, surveys, remote sensing	Documented based on historical practices	At validation	Shall reflect actual baseline management conditions
Fert BL	Baseline fertilizer application (type and rate)	kg N/ha	Farm records, surveys, regional data	Estimated or measured	At validation	Shall be representative and conservative

Data / Parameter	Description	Unit	Source of data	Measurement / Estimation method	Frequency	QA/QC and comments
Residue BL	Baseline residue management practices	n/a	Field observation, records	Documented	At validation	Shall reflect actual baseline practices
SOC to,i	Initial soil organic carbon stock in stratum i	t C/ha	Field sampling and laboratory analysis	Measured using stratified sampling design	At validation	Shall be based on representative sampling
BD i	Bulk density in stratum i	g/cm^3 or t/m^3	Field sampling and laboratory analysis	Measured	At validation and when resampling SOC	Shall be consistent with SOC calculations
D SOC	Soil sampling depth	cm	Monitoring protocol	Fixed measurement depth	At validation	Shall remain consistent across monitoring periods unless justified
EF N2O	Baseline N_2O emission factor	kg N_2O-N/kg N	IPCC or national data	Selected based on applicable guidance	At validation	Shall be conservative where multiple sources exist
EF CH4	Baseline CH_4 emission factor (if applicable)	kg CH_4/unit	IPCC or approved factor	Selected based on system conditions	At validation	Only where CH_4 is relevant
EF fuel,n	Emission factor for fossil fuel type n	tCO_2e/unit	Official national data or approved default	Selected from recognized source	At validation	Shall be conservative
Dist route,k	Relevant transport distance for route k	km	GIS, transport logs	Measured or conservatively estimated	At validation	Shall reflect realistic transport pathways
Leak risk	Initial leakage risk characterization	n/a	Project assessment	Assessed qualitatively and/or quantitatively	At validation	Shall be consistent with leakage provisions
Rev risk	Initial reversal risk characterization	n/a	Project assessment	Assessed using BioCarbon risk tool	At validation	Relevant where removals are credited

16.13.2 Data and parameters monitored

The following table defines the data and parameters to be monitored during the implementation of project activities.

These parameters shall reflect actual management practices and system conditions over time and shall be sufficient to support the quantification of greenhouse gas (GHG) emissions and removals in accordance with this methodology. Monitoring shall be conducted at a frequency appropriate to the parameter and shall ensure consistency, traceability, and reproducibility of results.

Table 5. Data and parameters monitored

Data / Parameter	Description	Unit	Source of data	Measurement / Estimation method	Monitoring frequency	QA/QC and comments
Crop type,y	Crop type and rotation in year y	n/a	Farm records, field observation	Recorded	At least annually	Shall reflect actual cropping system
Area crop,y	Area under each crop or management practice	ha	GIS, farm records	Measured	At each monitoring period	Shall be consistent with project boundary
Fert PJ,y	Fertilizer application (type and rate)	kg N/ha	Farm records, invoices	Measured or estimated	At least annually	Shall be traceable and consistent
Org input,y	Organic amendments applied (e.g., compost, manure)	t/ha	Farm records, field logs	Measured or recorded	At least annually	Shall be documented and verifiable
Residue mgmt, y	Residue management practices	n/a	Field records, observation	Recorded	At least annually	Shall reflect actual practices
Tillage,y	Soil disturbance practices (e.g., tillage intensity)	n/a	Field records, observation	Recorded	At least annually	Shall reflect management changes
SOC t,y,i	Soil organic carbon stock in stratum i at time t	t C/ha	Field sampling and laboratory analysis	Measured	Periodically (≥ every 5 years)	Shall follow consistent sampling design
BD t,y,i	Bulk density at time t in stratum i	g/cm^3 or t/m^3	Field sampling	Measured	When SOC is re-measured	Required for SOC calculations
N input,y	Total nitrogen input to soil	kg N/ha	Farm records, estimates	Calculated	At each monitoring period	Shall include all relevant sources

Data / Parameter	Description	Unit	Source of data	Measurement / Estimation method	Monitoring frequency	QA/QC and comments
EF_N2O,PJ,y	N_2O emission factor under project conditions	kg N_2O-N/kg N	IPCC or approved factor	Estimated	At each monitoring period	Shall be conservatively selected
CH4_activity,y	Activity data relevant to CH_4 emissions (if applicable)	n/a	Field records, environmental data	Recorded or estimated	At each monitoring period	Only where CH_4 is relevant
EF_CH4,PJ,y	CH_4 emission factor under project conditions	kg CH_4/unit	IPCC or approved factor	Estimated	At each monitoring period	Shall reflect actual conditions
Act_impl,y	Implementation status of project activities	n/a	Field records, logs	Recorded	Continuous / each monitoring period	Shall document actual practices
Fuel_cons,n,y	Fossil fuel consumption	L, kg, or GJ	Invoices, logs	Measured	At each monitoring period	Shall be traceable
Elec_cons,y	Electricity consumption (if relevant)	MWh	Utility records	Measured	At each monitoring period	Only where applicable
Trans_mass,k,y	Mass transported	t	Transport records	Measured or recorded	At each monitoring period	Where relevant
Trans_dist,k,y	Transport distance	km	GIS, logs	Measured or estimated	At each monitoring period	Changes shall be documented
Leak_event,y	Evidence of leakage event	n/a	Field assessment, records	Recorded and assessed	At each monitoring period	Shall reflect production or input displacement
Rev_event,y	Evidence of reversal event	n/a	Field assessment, SOC monitoring	Recorded and assessed	At each monitoring period	Relevant for removals
U_param,y	Parameters for uncertainty assessment	n/a	Sampling and calculations	Calculated	At each monitoring period	Required for Uncertainty Tool

17 Permanence and reversal risk management

17.1 General principle

Project activities shall ensure that all greenhouse gas (GHG) emission reductions and removals are durable and not subject to material risk of reversal.

Emission reductions associated with avoided emissions shall be considered permanent, provided that they are not subject to subsequent displacement.

Carbon removals, particularly those associated with soil organic carbon (SOC), shall be subject to permanence risk assessment and management.

17.2 Nature of permanence in agricultural systems

Increases in soil organic carbon (SOC) stocks in agricultural systems are inherently dependent on the continued implementation of management practices. Changes in practices such as tillage, crop rotation, residue management, or land-use conversion may result in rapid reversal of previously accumulated carbon stocks.

Project holders shall therefore demonstrate that the management practices responsible for the increase and maintenance of soil organic carbon stocks are maintained over time.

SOC stock increases shall be understood as a dynamic and reversible process, influenced by:

(a) management practices;
(b) climatic variability;
(c) land-use changes.

Project holders shall demonstrate that implemented practices support the maintenance or increase of carbon stocks over time.

17.3 Identification of reversal risks

Project holders shall identify risks that may lead to a reversal of credited removals.

Reversal risks shall include, but are not limited to:

(a) discontinuation of improved management practices;
(b) reintroduction of intensive tillage;
(c) changes in crop rotation or residue management;
(d) land-use change within the project boundary;
(e) extreme climatic events affecting soil carbon stability.

Risk identification shall be context-specific and supported by evidence.

17.4 Risk assessment

Reversal risk shall be assessed using a structured approach consistent with the BioCarbon Permanence and Risk Management Tool.

The assessment shall consider:

(a) likelihood of occurrence;
(b) magnitude of potential impact;

(c) system-specific vulnerabilities.

17.5 Risk mitigation measures

Project holders shall implement measures to reduce reversal risk, including:

(a) maintaining consistent management practices;
(b) applying adaptive management strategies;
(c) ensuring long-term commitments to project activities.

Project holders shall demonstrate that mitigation measures are sufficient to ensure the continuity of management practices that underpin SOC stock increases.

Risk mitigation measures shall be documented and monitored.

17.6 Buffer and risk compensation

Where carbon removals are credited, a portion of the verified emission reductions and removals shall be allocated to a buffer or reserve.

The buffer contribution shall:

(a) be determined based on the assessed level of risk;
(b) provide compensation in the event of reversals;
(c) ensure the environmental integrity of issued credits.

17.7 Monitoring of permanence

Project holders shall monitor factors affecting permanence, including:

(a) continuity of management practices;
(b) stability of SOC stocks;
(c) occurrence of events that may lead to reversals.

17.8 Treatment of reversals

In the event of a reversal, the corresponding quantity of credited removals shall be:

(a) cancelled; or
(b) compensated through the buffer mechanism.

Reversals shall be quantified and reported transparently.

17.9 Long-term integrity

Project activities shall promote the long-term maintenance of carbon stocks beyond the crediting period.

Project holders shall demonstrate that:

(a) management practices are likely to continue over time;
(b) the project contributes to sustained improvements in land management systems.

18 Quality assurance and quality control (QA/QC)

18.1 General requirement

The QA/QC framework defined in this section complements the MRV system and is intended to ensure the integrity, consistency, and continuous improvement of data and calculations used in the quantification of GHG emission reductions and removals.

Project holders shall implement quality assurance and quality control (QA/QC) procedures to ensure the accuracy, consistency, and reliability of all data used for the quantification of greenhouse gas (GHG) emission reductions and removals.

QA/QC procedures shall be applied throughout all stages of the project, including data collection, processing, analysis, and reporting.

18.2 QA/QC procedures

QA/QC procedures shall ensure that:

(a) monitored data are complete, consistent, and internally coherent;
(b) data sources are verifiable and properly documented;
(c) calculations are reproducible and free from systematic errors;
(d) assumptions are applied consistently across monitoring periods.

Project holders shall implement procedures for data validation, cross-checking of key parameters, and verification of calculation steps.

18.3 Data quality management

Project holders shall ensure that data quality is maintained through:

(a) the use of standardized data collection protocols;
(b) consistent application of measurement and analytical methods;
(c) appropriate training of personnel involved in data collection and management.

Where errors or inconsistencies are identified, corrective actions shall be implemented and documented.

18.4 Continuous improvement

QA/QC procedures shall be periodically reviewed and updated to improve the reliability and robustness of the monitoring system.

Where improvements in data quality or methodological approaches are identified, project holders shall incorporate such improvements in subsequent monitoring periods.

19 Document status

This document is an approved methodological document under the BioCarbon Standard and shall be applied in accordance with the requirements established herein and in the applicable BioCarbon program documents.

20 Bibliographic references

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