Methodological Document

AFOLU SECTOR

BCR0005 Quantification of GHG Emissions Reduction

ACTIVITIES PREVENTING CONVERSION OF NATURAL SAVANNAS

BIOCARBON CERT®

PUBLIC CONSULTATION VERSION 2.0 | December 31, 2025

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Acronyms and abbreviations

AFOLU	Agriculture, Silviculture and Other Land Uses
AB	Aboveground biomass
BB	Belowground biomass
CH_4	Methane
CNVC	Change in the area with natural vegetation cover
CO_2	Carbon dioxide
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse Gases
GIS	Geographical Information System
HCV	High Conservation Value
IPCC	Intergovernmental Panel on Climate Change
N_2O	Nitrous oxide
SOC	Soil Organic Carbon
TB	Total biomass
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VCC	Verified Carbon Credits

1 Introduction

Natural savannas are one of the most characteristic biomes of the terrestrial intertropical zone, dominating large regions of South America, Africa, Southeast Asia and Australia. It is one of the great structural and functional units in which the biota of the earth's land surface has been differentiated, at the same level as forests, montane forests, moorlands or deserts. They are characterized by associations of herbaceous vegetation with or without the presence of scattered trees and shrubs and with seasonal patterns of water availability determined by a marked dry climatic season.

In savannas and other grasslands the belowground carbon is predominant, accumulated mainly in roots and soil organic matter. Savannas in general have developed adaptations to cope with grazing and the common perturbation of fire and consequently both the vegetation and soil carbon are relatively resistant to moderate disturbances from grazing and fire regimes IPCC (2006)[1].

Although natural savannas are known to play a key role in carbon storage, provide habitat for wildlife and play an important role in water regulation, they have rarely been considered in conservation strategies to prevent the conversion of natural savannas. At the same time, according to WWF (2021)[2], "*natural savannas currently face one of the highest and fastest rates of conversion and degradation, which means a significant loss of biodiversity and increased greenhouse gas emissions. Consequently, actions to reduce conversion are necessary and depend on finding a balance between production and conservation*".

This methodology document focuses on activities that prevent conversion of natural savannas and/or anthropogenic degradation resulting in the loss, suppression, or long-term decline of natural vegetation cover in natural savannas.

Project holders implementing activities located within savanna biomes shall apply the provisions of this methodology document.

This methodology is designed to quantify anthropogenic greenhouse gas emission reductions and removals resulting from deliberate management, conservation, and restoration activities in natural savannas that alter the baseline trajectory of conversion of natural savannas or degradation.

[1] https://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/pdf/4_Volume4/V4_06_Ch6_Grassland.pdf

[2] https://www.wwf.org.co/?367073/Los-pastizales-naturales-son-esenciales-para-enfrentar-el-cambio-climatico-y-revertir-la-perdida-de-biodiversidad

The methodology include aspects related to activities that prevent the conversion in natural savannas, comprising GHG removals by ecosystem restoration, and the use of landscape management tools, identification of GHG reservoirs and sources, spatial and temporal boundaries, drivers of conversion or anthropogenic degradation, baseline scenario, additionality, uncertainty and risk management, leakage management and monitoring activities.

2 Objectives

The objectives of this methodological document (hereinafter referred to as this Methodology) are to:

(a) quantify and credit anthropogenic greenhouse gas (GHG) emission reductions and removals resulting from activities that prevent conversion of natural savannas and/or anthropogenic degradation in natural savannas;

(b) establish a conservative and dynamic baseline based on historical trends in land cover change, degradation patterns, and associated anthropogenic drivers, including recurrent fire regimes and grazing pressures where relevant;

(c) ensure that credited mitigation outcomes are additional to what would have occurred in the absence of the project activity, through the mandatory application of the BioCarbon Standard Baseline and Additionality Tool;

(d) account for GHG emission reductions and removals associated with the maintenance, recovery, or enhancement of aboveground biomass, belowground biomass, and soil organic carbon stocks in natural savannas;

(e) conservatively address non-CO_2 emissions from fire events by quantifying such emissions only when they occur within the project area during the monitoring period, in accordance with applicable IPCC Guidelines;

(f) identify, monitor, and manage risks related to non-permanence and leakage, including those associated with land-use displacement and changes in land management practices; and

(g) provide a transparent, verifiable, and replicable methodological framework under the BioCarbon Standard.

3 Version and validity

This document constitutes the public consultation version 2.0. December 31, 2025, and shall remain valid until replaced, revised, or withdrawn by BioCarbon Cert in accordance with the BioCarbon Standard governance procedures.

BioCarbon Cert may update this methodology from time to time to reflect improvements in scientific knowledge, methodological robustness, and programmatic requirements. Project holders and validation and verification bodies shall ensure that the most recent version of the methodology is applied, as applicable.

Projects registered under previous versions of this methodology may continue to operate and remain eligible for verification. However, all subsequent verification and credit issuance events shall apply the most recent version of the methodology in force at the time of verification, including all applicable updates, tools, and requirements of the BioCarbon Standard.

This requirement shall apply prospectively and shall not affect the validity of emission reductions or removals already verified and credited under previous methodology versions.

4 Scope

This methodology applies to project activities implemented within natural savanna biomes that result in measurable and verifiable greenhouse gas (GHG) emission reductions and/or removals through the prevention of conversion of natural savannas and/or anthropogenic degradation.

For the purposes of this methodology, conversion of natural savannas includes both the transformation of natural savannas to anthropogenic land uses and anthropogenic processes that lead to the sustained loss, suppression, or long-term decline of natural savanna vegetation cover, even where the land remains classified as savanna. Such processes may include, inter alia, recurrent fire regimes, unsustainable grazing practices, and other land management activities that prevent natural regeneration and ecosystem recovery.

The scope of this methodology covers GHG emission reductions and removals associated with:

(a) the prevention of conversion of natural savannas to anthropogenic land uses;

(b) the reduction of anthropogenic degradation resulting in the loss of aboveground biomass, belowground biomass, and/or soil organic carbon; and

(c) restoration and landscape management actions that maintain, recover, or enhance carbon stocks in natural savannas relative to the baseline scenario.

This methodology accounts for changes in carbon stocks in aboveground biomass, belowground biomass, and soil organic carbon pools, as well as for non-CO_2 emissions associated with fire events when such events occur within the project area during the monitoring period, in accordance with applicable IPCC Guidelines.

Project activities shall be designed and implemented as deliberate management interventions that alter the baseline trajectory of conversion of natural savannas or degradation. Activities that do not demonstrably affect the baseline scenario shall not be eligible under this methodology.

5 Applicability conditions

This methodology is applicable to project activities implemented within natural savanna biomes that meet all of the following conditions:

(a) The project activities are designed to prevent conversion of natural savannas and/or anthropogenic degradation resulting in the loss, suppression, or long-term decline of natural savanna vegetation cover, including but not limited to recurrent burning, unsustainable grazing practices, and other land management activities that prevent natural regeneration;

(b) The project activities constitute deliberate and identifiable management interventions that alter the baseline trajectory of conversion of natural savannas or degradation and lead to measurable and verifiable greenhouse gas (GHG) emission reductions and/or removals;

(c) The baseline scenario is established using a dynamic approach based on historical land cover trends, degradation patterns, and documented anthropogenic drivers, supported by geospatial evidence and time series analysis;

(d) The project boundary, reference region, and monitoring framework allow for the identification, quantification, and monitoring of changes in aboveground biomass, belowground biomass, and soil organic carbon stocks attributable to the project activity;

(e) Non-CO_2 emissions associated with fire events are quantified only when such events occur within the project area during the monitoring period, using applicable IPCC methodologies;

(f) The project activities do not result in the displacement of conversion of natural savannas or degradation outside the project boundary without appropriate identification, assessment, and conservative treatment of leakage;

(g) Project activities comply with all applicable legal, land tenure, and environmental requirements in the host jurisdiction.

6 Normative references

The following normative references are relevant for the application of this methodology. For dated references, only the edition cited applies. For undated references, the latest version shall apply.

(a) BioCarbon Standard, including all applicable rules, procedures, and methodological tools governing the quantification, monitoring, reporting, and verification of greenhouse gas (GHG) emission reductions and removals;

(b) IPCC. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use (AFOLU);

(c) IPCC. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use (AFOLU);

(d) Applicable national legal and regulatory frameworks relevant to land use, land tenure, environmental protection, and land management in the host jurisdiction;

BioCarbon Standard Baseline and Additionality Tool;

BioCarbon Standard tools related to leakage assessment, permanence and reversal risk management, uncertainty assessment, and monitoring and reporting, as applicable.

7 Terms and definitions

For the purposes of this methodology, the following terms and definitions apply. Where terms are not defined herein, the definitions provided in the BioCarbon Standard and the applicable IPCC Guidelines shall apply.

Additionality

The condition whereby the greenhouse gas emission reductions and removals achieved by the project activity would not have occurred in the absence of the project activity, as demonstrated through the application of the BioCarbon Standard Baseline and Additionality Tool.

Agents causing conversion of natural savannas and/or anthropogenic degradation

Individuals, social groups, or institutions (public or private) that, influenced by underlying drivers or enabling conditions, take decisions or undertake actions that lead to the conversion of natural savannas to anthropogenic land uses and/or to anthropogenic degradation, and whose influence is manifested spatially through one or more direct drivers operating within the landscape.

Agriculture, Forestry and other land use (AFOLU)

Sector encompassing greenhouse gas emissions and removals from managed lands and associated land-use categories, including agriculture, forestry, and other land uses, as addressed in the IPCC Guidelines for National Greenhouse Gas Inventories.

Anthropogenic degradation

Human-induced processes that reduce or suppress natural vegetation cover, biomass stocks, or soil organic carbon in natural savannas, including recurrent fire regimes, unsustainable grazing practices, and other land management activities that prevent natural regeneration and ecosystem recovery.

Baseline scenario

A dynamic representation of the most plausible evolution of land cover, vegetation structure, and carbon stocks within the project area in the absence of the project activity, derived from historical land cover trends, degradation patterns, and documented anthropogenic drivers.

Carbon fraction

According to IPCC (2006), the default carbon fraction of dry biomass is 0.47, unless more specific values are justified and documented.

Conversion of natural savannas

Conversion of natural savannas refers to the transformation of natural savanna ecosystems to anthropogenic land uses, as well as to anthropogenic processes that result in the sustained loss, suppression, or long-term decline of natural savanna vegetation cover, even where the land remains classified as savanna.

For the purposes of this methodology, the term land-use change may be used solely as an operational term in the context of historical land-cover datasets, matrices, rates, equations, or geospatial analyses, where such terminology is embedded in source data or analytical methods. In all such cases, land-use change shall be interpreted as referring exclusively to the conversion of natural savannas, as defined above, and shall not be construed as a broader or independent methodological concept.

Direct causes of conversion of natural savannas

Direct causes refer to human activities that operate at the local scale and have an immediate and observable effect on natural savanna vegetation cover. These causes include actions that directly result in the conversion of natural savannas to anthropogenic land uses or in anthropogenic degradation, through processes such as vegetation clearing, recurrent burning, unsustainable grazing, infrastructure development, or other land management practices that suppress natural regeneration and ecosystem recovery.

Ecological integrity

Combination of ecosystem processes (functions) and biodiversity that characterize an area in a specific period. Maintaining the ecological integrity of an area implies the continuous provision of ecosystem goods and services[3].

Ecological Restoration

According to the Society for Ecological Restoration (SER), ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed.[4]

Eligible areas

Areas within the geographical limits of the project that correspond to the category of natural savannas at the beginning of the project activities and at least five years prior to the project start date.

Fire event

A discrete occurrence of biomass combustion within the project area during the monitoring period, identified through geospatial evidence and/or field verification.

[3] Bridgewater, P., Kim, R. & Bosselmann, K. (2015). Ecological Integrity: A Relevant Concept for International Environmental Law in the Anthropocene? Yearbook of International Environmental Law. 25. 61-78. 10.1093/yiel/yvv059.
[4] https://www.ser.org/

GHG Project (Greenhouse gas project)

activity or activities that alter the conditions of a GHG baseline and cause GHG emissions reductions or GHG removals.

[SOURCE: ISO 14064-3:2019(en), 3.4.1.]

GHG Project holder (greenhouse gas project proponent)

individual or organization that has overall control and responsibility for a GHG project.

Note 1 to entry: The term "project proponent" is also used synonymously in the text.

[SOURCE: ISO 14064-2:2019(en), 3.3.2]

Greenhouse gas reservoir (GHG reservoir)

component, other than the atmosphere, that has the capability to accumulate GHGs, and to store and release them.

Note 1 to entry: The total mass of carbon contained in a GHG reservoir at a specified point in time could be referred to as the carbon stock of the reservoir.

Note 2 to entry: A GHG reservoir can transfer GHGs to another GHG reservoir.

Note 3 to entry: The collection of a GHG from a GHG source before it enters the atmosphere and storage of the collected GHG in a GHG reservoir could be referred to as GHG capture and GHG storage.

[SOURCE: ISO 14064-3:2019(en), 3.3.5]

Herbaceous vegetation

Cover constituted by a plant community dominated by typically herbaceous elements developed naturally in different densities and strata, which form a dense cover (>70% occupancy) or an open cover (30% - 70% occupancy). An herbaceous plant is a non-lignified or barely lignified plant, so that it has a soft consistency in all its organs, both subway and epigeous (Font Queur, 1982) [5].

High conservation value - HCV

Exceptionally significant or critical Biological, ecological, social, or cultural value.

[5] FON QUER, P. (1982). En: Leyenda CORINE LAND COVER

Leakage

Any measurable and attributable increase in greenhouse gas emissions or decrease in removals occurring outside the project boundary that results from the implementation of the project activity.

Leakage Area

Areas of natural savanna vegetation located outside the project boundary to which activities causing conversion of natural savannas and/or anthropogenic degradation may be displaced as a result of the implementation of project activities, and that are beyond the control of the project holder. These areas correspond to locations that may become accessible or attractive to the agents responsible for such activities due to project-induced constraints or changes within the project area.

Mineral soil

Any soil that does not meet the definition of organic soil, as set out in Annex 3A.5, Chapter 3, Volume 4 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Natural Forest (Forest)

“Forest” is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 meters at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest[6].

The GHG project holder must demonstrate the consistency of the eligibility analysis, in accordance with national forest definitions, following the criteria defined by the UNFCCC in its decision 11/COP.7.

Natural savanna

A natural ecosystem characterized by a continuous or semi-continuous herbaceous layer, with a variable presence of woody and/or shrubby vegetation, whose structure, composition, and ecological functioning are determined by climate, soils, and disturbance regimes, including fire and grazing, and which has not been converted to anthropogenic land uses.

[6] UNFCCC. The Marrakesh Accords. Available in https://unfccc.int/sites/default/files/resource/docs/cop7/13a01.pdf

Non-CO2 fire emissions

Methane (CH_4) and nitrous oxide (N_2O) emissions resulting from the combustion of woody and/or shrubby biomass during a fire event, quantified only when such events occur within the project area, using applicable IPCC methodologies.

Permanence

The condition whereby greenhouse gas (GHG) emission reductions and/or removals achieved through project activities are maintained over time, such that the underlying carbon stocks or avoided emissions are sustained and not reversed within the project boundary during the crediting and monitoring periods.

Project activity

A set of deliberate and identifiable management, conservation, restoration, or landscape management actions implemented within natural savannas that alter the baseline trajectory of conversion of natural savannas or anthropogenic degradation and result in measurable and verifiable greenhouse gas emission reductions and/or removals.

Project Area

The geographically defined area within which project activities that generate demonstrable net climate benefits are implemented. Where a programmatic or scalable approach is applied, the Project Area also includes all potential areas in which additional project activities may be implemented after initial validation, subject to the applicable eligibility, monitoring, and verification requirements of this methodology and the BioCarbon Standard.

Project Start date

Date on which activities that will result in emission reductions or effective GHG removals begin. For GHG projects that apply this methodology, the start date corresponds to the date on which the implementation of the project activities begins to generate the reduction of emissions by avoiding land use changes in the eligible areas, within the limits of the project. These may be, for example, agreements with the actors who have the right to use the land and/or the initiation of management actions of the areas within the limits of the project.

Reference region

A geographically defined area outside the project boundary that is representative of the biophysical conditions, accessibility, and anthropogenic drivers affecting the project area, used for the establishment of the baseline scenario.

Shrubland

It includes the areas covered by shrub vegetation naturally developed in different densities and substrates. A shrub is a perennial plant, with a woody stem structure, with a height between 0.5 and 5 m, strongly branched at the base and without a defined crown FAO (2001) [7].

Soil carbon[8]

Organic carbon contained in mineral soils to a given depth chosen by the country and applied consistently throughout the time series. Live fine roots of less than 2 mm (or another diameter chosen by the country for underground biomass) are included with soil organic matter when they cannot be distinguished from the latter empirically.

Underlying causes of conversion of natural savannas and/or anthropogenic degradation

Underlying causes are structural or systemic factors that shape and reinforce direct causes of conversion of natural savannas and/or anthropogenic degradation. These include social, political, economic, technological, institutional, and cultural variables that define the broader context within which land-use decisions are made. Underlying causes influence the behavior and incentives of agents and help explain why processes leading to the conversion or degradation of natural savannas occur and persist over time.

8 Project boundaries

The project boundary defines the spatial and temporal limits within which project activities are implemented, baseline conditions are established, greenhouse gas (GHG) emission reductions and removals are quantified, and potential leakage is identified and assessed.

[7] ORGANIZACIÓN DE LAS NACIONES UNIDAS PARA LA AGRICULTURA Y LA ALIMENTACION. 2001. Situación de los bosques del mundo 2001. FAO, Roma, 131 p. En: Leyenda CORINE LAND COVER
[8] IPCC Guidelines for national greenhouse gas inventories (2006)

8.1 Temporal and spatial limits

8.1.1 Eligible areas

The GHG project holder shall demonstrate that the areas within the geographical boundaries of the Project correspond to the natural savanna biome, specifically to herbaceous vegetation and shrubland categories, at the beginning of the project activities and for at least five (5) years prior to the project start date.

Areas that do not correspond to the natural savanna biome, including wetlands, peatlands, or other ecosystems with distinct greenhouse gas dynamics, shall not be included within the project boundary under this methodology.

For this purpose, the project holder shall:

(a) ensure that the project boundaries are located within the natural savanna biome and identify the corresponding ecoregion using an internationally recognized ecoregional classification system (e.g., WWF ecoregions), as applicable;

(b) identify, delineate, and classify the natural savanna areas present within the project boundary based on a cartographic analysis of land cover, using an official or widely accepted land cover classification system (e.g., CORINE Land Cover or an equivalent national classification), at a level of detail sufficient to distinguish herbaceous vegetation and shrubland categories; and

(c) compile and retain adequate geospatial data and mapping information to assess land cover and land use within the project boundary during the historical reference period, supported by remote sensing data and, where applicable, field verification, in accordance with the requirements of this methodology.

The project holder shall compile adequate geospatial data and mapping information to assess land cover and land use during the historical reference period, using digital image processing from remote sensing data.

The minimum spatial resolution required is 30 m (e.g., as available from Landsat products). A spatial resolution of 10 m or higher (e.g., as available from Sentinel-2 products) is recommended.

For all satellite imagery used, established and recognized approaches to data preprocessing shall be applied.

8.1.2 Adding areas to the project after validation

Areas may be added to the project after validation, provided that all of the following conditions are met:

(a) The project holder shall identify, during the validation process, the potential project expansion areas and define the criteria under which new areas may be incorporated into the project;

(b) Any new area proposed for inclusion in the project shall meet, at a minimum, the following criteria:

   (i) comply with the BioCarbon Standard and all applicable rules, tools, and requirements in force at the time of verification;

   (ii) generate greenhouse gas (GHG) emission reductions and/or removals exclusively from project activities that have been validated under this methodology;

   (iii) implement the same types of activities to prevent conversion of natural savannas and/or anthropogenic degradation as those described in the validated project document;

   (iv) present causes and agents of conversion of natural savannas, baseline conditions, and additionality characteristics that are consistent with those validated for the initial project areas; and;

   (v) have a project start date that is subsequent to the start date of the areas included at validation.

8.1.3 Reference region for baseline estimation

The GHG project holder shall delineate a reference region for estimating changes in natural vegetation cover (herbaceous and shrublands) in savanna areas, that could occur in the project area in the baseline scenario.

The reference region shall be a geographically defined area outside the project boundary that is representative of the project area in terms of biophysical conditions, accessibility, land-use categories, landscape configuration, and anthropogenic drivers of conversion of natural savannas and degradation.

The geographic boundaries of the reference region shall meet all the following criteria:

(a) the reference region and the project area shall be located within the same ecoregion[9] or within ecoregions that are demonstrably comparable in terms of climate, vegetation structure, and land-use dynamics;

(b) the agents and drivers identified as causing conversion of natural savannas and/or anthropogenic degradation in the reference region shall have the capacity to access and affect the project area;

(c) the project area shall be subject to similar land-use pressures and be of comparable interest to the agents identified in paragraph (b); and;

(d) land tenure arrangements, land-use rights, and relevant legal or customary frameworks in the reference region shall be comparable to those in the project area.

The reference region shall be used exclusively for the establishment of the baseline scenario and shall not overlap with the project boundary or with areas included in the project after validation.

8.1.4 Leakage area

The leakage area corresponds to areas of natural savanna vegetation (herbaceous vegetation and shrublands) outside the project boundary to which conversion of natural savannas, or anthropogenic degradation activities may be displaced as a result of the implementation of the project activities and that are beyond the control of the GHG project holder.

The leakage area shall be delineated based on the identification of agents and drivers of conversion of natural savannas and/or anthropogenic degradation associated with the baseline scenario and the project activities.

In particular, the delineation of the leakage area shall consider the following criteria:

(a) all areas of herbaceous vegetation and shrublands within the savanna biome that are located within the plausible mobility range and area of influence of the agents identified as causing conversion of natural savannas or degradation shall be included;

(b) areas where access by such agents is legally, physically, or institutionally restricted, and where displacement of activities is demonstrably not plausible, may be excluded; and

[9] Geographical region with specific characteristics in terms of climate, geology, hydrology, flora, and fauna. https://www.worldwildlife.org/biomes

(c) the leakage area shall not overlap with the project boundary or with areas included in the project after validation.

The leakage area shall be used to identify, quantify, and conservatively account for potential displacement of conversion of natural savannas or degradation attributable to the project activities, in accordance with the provisions of this methodology.

8.1.5 Temporal limits and analysis period

The temporal limits of the Project correspond to the period during which project activities are implemented, and greenhouse gas (GHG) emission reductions and/or removals are quantified in accordance with this methodology.

The temporal boundaries of the Project shall be defined with reference to:

(a) the project start date, defined as the date on which the implementation of project activities begins to effectively alter the baseline trajectory of conversion of natural savannas and/or anthropogenic degradation;

(b) the period of quantification of GHG emission reductions and/or removals, during which the project holder is eligible to quantify mitigation outcomes relative to the baseline scenario; and

(c) the monitoring periods, corresponding to the intervals for which data are collected, verified, and reported for credit issuance.

The analysis of historical conversion of natural savannas, and degradation used to establish the baseline scenario shall cover a period of at least ten (10) years prior to the project start date, unless a shorter period is duly justified based on data availability and demonstrated representativeness.

GHG emission reductions and/or removals shall be quantified ex post for each monitoring period, based on observed changes within the project boundary and, where applicable, the leakage area, and shall not be extrapolated beyond the defined monitoring periods.

8.1.6 Historical period of land use change

The analysis of historical land-use change and anthropogenic degradation for the reference region and, where applicable, the leakage area shall be conducted over a historical reference period covering at least ten (10) years prior to the project start date.

The historical period shall be selected to adequately capture prevailing trends, patterns, and variability in land-use change and degradation affecting natural savanna vegetation, and shall be representative of the baseline scenario conditions in the absence of the project activity.

The analysis shall be based on consistent and comparable land cover data across the historical reference period and shall rely on geospatial information derived from remote sensing, supported by ancillary data and, where applicable, field verification.

Where limitations in data availability prevent the use of a ten (10) year historical period, a shorter period may be applied only if the project holder provides a clear technical justification demonstrating that the selected period is representative of longer-term land-use change dynamics and does not lead to an overestimation of baseline emissions.

The same historical reference period and analytical approach shall be applied consistently to the project area, the reference region, and the leakage area, unless deviations are explicitly justified and documented.

8.1.7 Estimation of GHG emissions reduction/removal

The estimation of greenhouse gas (GHG) emission reductions and/or removals shall be conducted for each monitoring period within the defined project boundary and, where applicable, the leakage area, by comparing observed project scenario outcomes against the baseline scenario established in accordance with this methodology.

GHG emission reductions and/or removals shall be quantified ex post, based exclusively on observed and verifiable changes in land cover, vegetation structure, and carbon stocks attributable to the project activities, and shall not be projected or extrapolated beyond the monitoring period under assessment.

The estimation shall account for changes in carbon stocks in the selected greenhouse gas reservoirs, including aboveground biomass, belowground biomass, and soil organic carbon, in accordance with the applicable provisions of this methodology and the selected emission factors.

Where applicable, GHG emissions associated with leakage and non-CO_2 emissions from fire events occurring within the project boundary during the monitoring period shall be identified, quantified, and conservatively deducted from the gross emission reductions and/or removals.

Net GHG emission reductions and/or removals eligible for crediting shall be determined as the difference between baseline emissions and removals and project scenario emissions and removals, after accounting for leakage, non-CO_2 emissions, and any applicable conservative adjustments.

The estimation procedures, assumptions, data sources, and calculations used to quantify GHG emission reductions and/or removals shall be transparently documented and made available for validation and verification.

8.2 Greenhouse gas reservoirs and sources

This section defines the greenhouse gas (GHG) reservoirs and emission sources considered within the project boundary for the quantification of emission reductions and/or removals under this methodology. The selection of reservoirs and sources shall be conservative and shall not result in an overestimation of credited mitigation outcomes.

8.2.1 Greenhouse gas reservoirs

In accordance with applicable IPCC Guidelines, changes in carbon stocks may be estimated for the following greenhouse gas reservoirs: aboveground biomass, belowground biomass, deadwood, litter, and soil organic carbon.

Project holders may select one or more of these reservoirs for quantification, provided that they:

(a) transparently justify the selection or exclusion of each reservoir; and

(b) demonstrate that the exclusion of any reservoir does not lead to an increase in estimated greenhouse gas emission reductions or removals.

The default selection of reservoirs under this methodology is shown in Table 1. Reservoirs identified as "Optional" may be included where project activities are expected to result in measurable changes and where sufficient data are available to ensure conservative estimation.

Table 1. Greenhouse gas reservoirs

Carbon pool	Selected (Mandatory/ Optional/Non selected)	Justification
Aboveground biomass	Mandatory	The change in carbon content in this pool is significant, according to the IPCC.
Belowground biomass	Mandatory	The change in carbon content in this pool is significant, according to the IPCC.

Carbon pool	Selected (Mandatory/ Optional/Non selected)	Justification
Deadwood	Optional	The change in carbon stocks in this reservoir may increase due to project activities; inclusion is optional and shall be justified where selected.
Litter	Optional	The change in carbon stocks in this reservoir may increase due to project activities; inclusion is optional and shall be justified where selected.
Soil organic carbon	Optional	The change in carbon stocks in this reservoir may increase due to project activities; inclusion is optional and shall be justified where selected.

8.2.2 Greenhouse gas emission sources

The greenhouse gas emission sources considered under this methodology are limited to those that are directly attributable to conversion of natural savannas, anthropogenic degradation, and project activities within the project boundary, as well as to potential leakage effects outside the project boundary.

The emission sources and associated greenhouse gases selected for accounting are presented in Table 2.

Carbon dioxide (CO_2) emissions resulting from the combustion of woody biomass are not explicitly quantified, as such emissions are reflected through changes in carbon stocks.

Non-CO_2 emissions from fire events, specifically methane (CH_4) and nitrous oxide (N_2O), shall be quantified only when fire events are detected within the project boundary during the monitoring period, using applicable IPCC methodologies. Such emissions shall not be assumed or modeled in the baseline scenario.

Where fire events occur, the resulting non-CO_2 emissions shall be treated as project emissions and conservatively deducted from gross greenhouse gas emission reductions and/or removals for the corresponding monitoring period.

Table 2. Emission sources and greenhouse gases

Emission source	GHG	Selection status	Justification
Burning of woody biomass[10]	CO_2	Non selected	CO_2 emissions resulting from the combustion of woody biomass are not explicitly quantified, as such emissions are reflected through changes in carbon stocks.
	CH_4	Selected (conditional)	CH_4 emissions shall be included only if fire events affecting woody biomass are detected within the project boundary during the monitoring period, in accordance with applicable IPCC methodologies.
	N_2O	Selected (conditional)	N_2O emissions shall be included only if fire events affecting woody biomass are detected within the project boundary during the monitoring period, in accordance with applicable IPCC methodologies.

9 Stratification and sampling requirements

Stratification and sampling requirements under this methodology are intended to ensure that greenhouse gas (GHG) emission reductions and/or removals are quantified accurately, conservatively, and transparently, reflecting the spatial heterogeneity of natural savanna ecosystems.

Stratification and sampling shall be applied where variability in vegetation cover, biomass distribution, land-use dynamics, or degradation status is expected to materially affect the estimation of carbon stock changes or conversion of natural savannas rates.

The project holder shall stratify the project area where relevant differences exist in:

(a) vegetation type (e.g. herbaceous vegetation, shrublands, mixed formations);

(b) degradation status or disturbance history (e.g. recurrent fire, grazing pressure);

(c) conversion of natural savannas dynamics or conversion risk; and

[10] The quantification of CH_4 and N_2O emissions caused by burning woody biomass is estimated based on the guidelines presented in the 2006 IPCC guidelines for national greenhouse gas inventories. Volume 4. Agriculture, forestry and other land uses. Non-CO_2 greenhouse gas emissions from biomass burning

(d) management or restoration interventions implemented under the project.

Stratification shall be based on geospatial analysis using land cover maps, remote sensing data, and other verifiable spatial information, and shall be applied consistently to the baseline scenario and the project scenario.

The same stratification approach shall be applied, where relevant, to the reference region and the leakage area, unless deviations are technically justified and documented.

9.1 Sampling requirements

Where direct field measurements are used to estimate changes in carbon stocks, the project holder shall apply a sampling approach that is statistically valid and appropriate to the spatial heterogeneity of the project area and the selected greenhouse gas reservoirs.

Sampling design may include systematic, random, stratified random, or transect-based approaches, as appropriate to site conditions and project objectives. The chosen sampling approach shall be justified and documented.

Sampling intensity, plot size, and measurement frequency shall be sufficient to support conservative estimation of carbon stock changes and to enable quantification of uncertainty in accordance with the BioCarbon Uncertainty Management Tool.

9.2 Conservancy and conservativeness

Stratification and sampling shall be applied consistently across monitoring periods. Any changes to stratification or sampling design shall be justified, documented, and transparently reported.

Where sampling results indicate high variability or uncertainty, conservative assumptions shall be applied in accordance with the BioCarbon Standard and its applicable tools.

Stratification and sampling approaches shall not be designed or adjusted in a manner that would lead to an overestimation of GHG emission reductions or removals.

9.3 Documentation and verification

All stratification criteria, sampling designs, and supporting data shall be documented in the Project Document and made available for validation and verification.

Detailed procedures for field measurement protocols, data quality control, uncertainty treatment, and sampling error management shall follow the requirements established in the BioCarbon Monitoring, Reporting and Verification (MRV) Tool and the BioCarbon Uncertainty Management Tool.

10 Baseline scenario and additionality

This section establishes the procedures for defining the baseline scenario and demonstrating the additionality of project activities implemented under this methodology. The baseline scenario represents the most plausible evolution of land use, vegetation cover, and associated greenhouse gas (GHG) emissions and removals in the absence of the project activity.

10.1 Baseline scenario

The baseline scenario shall be established using a dynamic approach, based on the analysis of historical trends in land-use change and anthropogenic degradation affecting natural savanna vegetation within the reference region.

The baseline scenario shall reflect the continuation of observed patterns of loss, suppression, or long-term decline of natural savanna vegetation cover resulting from anthropogenic drivers, including but not limited to recurrent fire regimes, grazing pressures, and other land management practices, as identified in accordance with Section 9 (Drivers of conversion of natural savannas and anthropogenic degradation).

The baseline scenario shall be derived from:

(a) historical land cover change and degradation rates observed over the historical reference period defined in Section 7.1.6;

(b) geospatial analysis of changes in herbaceous vegetation and shrubland cover within the reference region; and

(c) documented evidence of the agents and drivers responsible for such changes.

The same methodological approach, data sources, and analytical assumptions shall be applied consistently to the project area, the reference region, and, where applicable, the leakage area.

Non-CO_2 emissions associated with fire events shall not be assumed or modeled in the baseline scenario. Such emissions shall be considered only when fire events occur within the project boundary during the monitoring period, in accordance with this methodology.

The baseline scenario shall be conservatively defined so as not to overestimate baseline emissions or removals and shall be transparently documented in the Project Document.

10.2 Additionality

Project activities implemented under this methodology shall demonstrate additionality by applying the BioCarbon Standard Baseline and Additionality Tool in its entirety, in accordance with the rules and procedures of the BioCarbon Standard.

The application of this methodology does not imply automatic additionality. The project holder shall demonstrate, at a minimum, that:

(a) the project activities are not legally required under the applicable legal framework in the country where the project is implemented;

(b) the proposed activities are not common practice within the relevant geographic and sectoral context; and

(c) the project activities face identifiable barriers (financial, institutional, technical, or related), that are overcome through the implementation of the project and the generation of Verified Carbon Credits.

The additionality assessment shall be consistent with the baseline scenario defined under Section 9.1 and with the identified drivers and agents of conversion of natural savannas and anthropogenic degradation described in Section 10.

Where project activities involve restoration, landscape management, or reductions in anthropogenic degradation (including reductions in recurrent fire), the project holder shall demonstrate that such activities would not have been implemented, or would not have been sustained at the same scale or effectiveness, in the absence of the project activity.

Additionality shall be assessed at validation and shall be re-confirmed, as applicable, during subsequent verifications in accordance with the BioCarbon Standard.

11 Drivers of conversion and anthropogenic degradation

This section establishes the identification and analysis of the drivers and agents of conversion of natural savannas and anthropogenic degradation affecting natural savanna ecosystems within the project area, the reference region, and, where applicable, the leakage area.

The analysis of drivers of conversion of natural savannas constitutes a mandatory input for:

(a) the establishment of a realistic and conservative baseline scenario;

(b) the delineation and justification of the reference region and the leakage area;

(c) the design and targeting of project activities; and

(d) the demonstration of additionality in accordance with this methodology.

The characterization of drivers and agents of conversion of natural savannas and anthropogenic degradation shall be conducted in a systematic and transparent manner, based on observed land-use dynamics, documented evidence, and contextual analysis.

The key elements for developing such characterization are described below.

11.1 Spatial and temporal dimensions

Conversion of natural savannas and anthropogenic degradation affecting natural savannas shall be characterized in both spatial and temporal dimensions.

The spatial dimension shall describe the location, extent, and configuration of conversion of natural savannas and degradation processes within the project area, the reference region, and, where applicable, the leakage area.

The temporal dimension shall describe historical trends, current dynamics, and plausible future trajectories of conversion of natural savannas and degradation, based on the historical period of conversion of natural savannas defined in Section 7.1.6.

11.2 Context

The characterization of drivers and agents of conversion of natural savannas shall consider the broader biophysical, socio-economic, institutional, and legal context within which land-use decisions are made.

This contextual analysis shall support the understanding of how different factors interact to influence conversion of natural savannas and anthropogenic degradation dynamics in natural savannas.

Contextual elements to be considered include, inter alia:

Territorial context

The biophysical environment and the ways in which societies occupy, use, and manage the territory, including land tenure, land-use practices, and applicable legal and regulatory frameworks.

Sociocultural context

The social organization, cultural practices, and relationships among different human groups that influence land-use decisions and production systems.

Economic context

The economic activities, production systems, and market drivers that motivate conversion of natural savannas and contribute to regional economic dynamics.

Historical context

Historical patterns of occupation, land use, and production that shape current land-use dynamics and influence future trajectories.

11.3 Key actors, interests, and motivations

The project holder shall identify and characterize the key actors involved in conversion of natural savannas and anthropogenic degradation processes, including public and private entities, social groups, and other relevant stakeholders.

The analysis shall describe the interests, motivations, decision-making processes, and relative influence of such actors, as well as their geographic area of operation and role in driving changes in natural savanna vegetation cover.

11.4 Economic activities and their importance

Economic activities that directly or indirectly contribute to conversion of natural savannas and anthropogenic degradation shall be identified and characterized.

The analysis shall assess the spatial patterns associated with such activities and their economic and socio-cultural importance for the identified actors, in order to inform the design of appropriate and targeted project activities.

11.5 Direct and indirect impacts

The project holder shall assess the direct and indirect impacts of identified drivers, agents, and activities on natural savanna vegetation cover, biomass stocks, and soil organic carbon.

Impacts may be assessed qualitatively and, where data permit, quantitatively, including through spatial analysis that links specific drivers to observed conversion of natural savannas and degradation patterns.

11.6 Relations and synergies

The project holder shall identify and analyze interactions and synergies among different drivers, agents, and activities that jointly contribute to conversion of natural savannas and anthropogenic degradation.

This analysis shall support the identification of leverage points and integrated measures to effectively reduce conversion of natural savannas and degradation within the project area.

11.7 Conversion and degradation chain of events

The project holder shall identify and document causal chains linking underlying causes, direct drivers, and observed conversion of natural savannas or anthropogenic degradation outcomes in natural savannas.

For each major pathway leading to the loss, suppression, or long-term decline of natural vegetation cover, a causal chain comprising at least three (3) linked elements shall be identified, including:

(a) the underlying causes influencing land-use decisions;

(b) the agents responsible for implementing conversion of natural savannas or degradation activities; and

(c) the direct actions resulting in changes to natural savanna vegetation cover.

12 Project activities

Project activities under this methodology shall be designed and implemented to directly address the drivers and agents of conversion of natural savannas and anthropogenic degradation identified in Section 10.

Project activities shall constitute deliberate, identifiable, and verifiable interventions that are expected to alter the baseline trajectory of conversion of natural savannas or degradation in natural savannas and result in measurable greenhouse gas (GHG) emission reductions and/or removals.

12.1 Alignment with drivers of conversion of natural savannas

For each project activity, the project holder shall demonstrate a clear and documented link between:

(a) the specific driver(s) and agent(s) of conversion of natural savannas or anthropogenic degradation identified in Section 10;

(b) the design and implementation of the project activity; and

(c) the expected effect of the activity on reducing, preventing, or reversing conversion of natural savannas or degradation processes.

Project activities that cannot be directly linked to identified drivers and agents shall not be eligible for crediting under this methodology.

12.2 Types of eligible project activities

Eligible project activities may include, inter alia, the following categories, provided that they meet all applicability conditions of this methodology and are demonstrated to be additional:

(a) Activities to prevent conversion of natural savannas

Activities aimed at preventing the conversion of natural savannas to anthropogenic land uses, including measures addressing agricultural expansion, infrastructure development, or other conversion pressures.

(b) Activities to reduce anthropogenic degradation

Activities aimed at reducing or eliminating degradation processes that lead to the loss, suppression, or long-term decline of natural savanna vegetation cover, including recurrent burning, unsustainable grazing practices, and other damaging land management activities.

(c) Restoration and landscape management activities

Activities aimed at restoring degraded savanna areas or improving landscape-level management practices to enable natural regeneration, recovery of vegetation structure, and enhancement of carbon stocks in biomass and soils.

12.3 Activity definition and documentation

Each project activity shall be clearly defined and documented in the Project Document and shall include, at a minimum:

(a) a unique activity identifier;

(b) a description of the activity and its implementation approach;

(c) the driver(s) and agent(s) of conversion of natural savannas or degradation addressed by the activity;

(d) the geographic area where the activity is implemented;

(e) the implementation schedule; and

(f) indicators to monitor activity implementation and performance.

The level of detail provided shall be sufficient to enable validation and verification of the activity's implementation and its contribution to observed changes in land-use dynamics.

12.4 Implementation and monitoring of project activities

The project holder shall implement project activities in accordance with the validated Project Document and shall monitor their implementation throughout the project's monitoring periods.

Monitoring of project activities shall be designed to verify that activities are implemented as planned and to support the interpretation of observed changes in conversion of natural savannas and degradation patterns within the project boundary.

12.5 Relationship between project activities and GHG accounting

Project activities shall not be credited directly. Greenhouse gas emission reductions and/or removals shall be quantified exclusively based on observed and verifiable changes in land use, vegetation cover, and carbon stocks within the project boundary, as defined in Section 9.

The role of project activities is to explain and support the causal link between implementation actions and observed mitigation outcomes, including the prevention of conversion of natural savannas, reduction of anthropogenic degradation, and restoration of natural savanna vegetation.

13 GHG emission reduction from project activities

Greenhouse gas (GHG) emission reductions and/or removals under this methodology shall be quantified based on observed and verifiable changes in land use, vegetation cover, and carbon stocks within the project boundary, relative to the baseline scenario defined in Section 9.

Project activities implemented under this methodology do not generate credits directly. Emission reductions and/or removals are credited solely on the basis of quantified mitigation outcomes resulting from changes in land-use dynamics and associated carbon stocks.

13.1 Stratification

In order to improve the accuracy and conservativeness of carbon stock change estimates, the project holder shall stratify the project area where biomass distribution, vegetation structure, or land-use dynamics are not homogeneous.

Stratification shall be applied consistently to both the baseline scenario and the project scenario and shall reflect relevant differences in vegetation cover, degradation status, and land-use change patterns.

Stratification methodologies shall be based on official land cover classification systems or recognized remote sensing approaches, supported by field data where applicable.

13.2 Activity data

Activity data for the estimation of GHG emission reductions and/or removals shall consist primarily of observed changes in the area of natural savanna vegetation cover, including herbaceous vegetation and shrublands, within the project boundary and, where applicable, the leakage area.

Activity data shall be derived from geospatial analysis of land cover change, using consistent data sources, classification methods, and spatial resolution across the baseline and monitoring periods.

13.2.1 Estimation of the land use change

The project holder shall estimate land-use change by comparing land cover classifications between at least two points in time: the project start date and one or more historical reference dates defined in accordance with Section 7.1.6.

Only areas where natural savanna vegetation cover is detected at the initial date and anthropogenic land uses are detected at the subsequent date shall be considered as land-use change, in order to ensure temporal attribution of the change event. When persistent anthropogenic degradation is reflected in a transition to non-natural or degraded land-cover categories according to the classification applied, such transitions shall also be considered as land-cover change for the purposes of this methodology.

Areas for which land cover information is unavailable or unreliable for one or more dates shall be excluded from the analysis to avoid overestimation of land-use change rates.

To calculate the area with loss of natural vegetation cover between the two dates, only the areas for which natural vegetation cover is detected on the first date and anthropic land use on the second date shall be accounted so that there is the certainty that the event occurred in the period analyzed (land use change).

Natural cover losses detected after one or several dates without information[11] shall not be included in the calculation to avoid overestimated rates in periods when areas without information increase due to different factors, for example, in climatic periods of high cloudiness or failures in the satellite programs' sensors that take the images.

This process shall be supported by cartographic inputs for the period of analysis, based on the following recommendations:

(a) Collect data that will be used to analyze land use changes on natural savanna vegetation cover, during the historical reference period within the project boundaries. It is a good practice to perform this for at least three time points, (3) to (5) years apart.

(b) Select spatial data of medium resolution (from 10 meters to a maximum of 30 meters spatial resolution) from optical and radar sensor systems, such as (but not limited to) Landsat, SPOT, ALOS, AVNIR2, ASTER, Sentinel 1 and 2, among others, covering the last 5 -10 years.

(c) Collect high-resolution remotely sensed data (< 5 x 5 meters per pixel) and/or direct field observations for validation of maps on the terrain. Describe the type of data, coordinates and sampling design used to collect them.

(d) In tabular format (Table 3), provide information on the data collected.

Table 3. Characterization of the cartographic inputs

Vector (Satellite o airplane)	Sensor	Resolution		Covering	Date of acquisition	Scene or identification point	
		Spatial	Spectral	(Km²)	(DD/MM/YYYY)	Path/Latitude	Row/Longitude

[11] Complementary information may be used to reduce the area without information. Detailed information about the methodology, the relevance of the use of the selected information source and the evaluation of the accuracy of the image classification shall be presented.

When interpreted data with adequate spatial and temporal resolution are available, they can also be considered for further analysis[12]. To complete the land cover analysis, it is recommended to classify the natural land cover with the strata defined in numeral 11.1.

Validation processes for the treatment of satellite images and geographic data shall be supported by international standards such as ISO[13], OGC or the American Society for Photogrammetry and Remote Sensing.

The detailed methodological procedures used in the pre-treatment, classification, post-classification processing and accuracy assessment of the remote sensing data shall be carefully documented in a technical annex. In particular, the following information shall be documented:

(i) Data sources and pre-processing[14]

(ii) Data classification and further processing[15]

The assessment of classification accuracy that ensures the quality of land cover and land use maps shall be above 90%.

As a result of this analysis, a matrix of land cover change is obtained, which combines all defined land cover classes in which land use changes are evident. A table shall list the resulting categories of change between the initial and final period. Additionally, it shall contain the area data for each of the periods and their totals.

Table 4. Matrix of land cover change and use [16]

IDcl		Initial Classes Coverage/Use			
		I1	I2	I3	I4
	F1				
	F2				

[12]Existing maps shall be used by performing a full quality validation of these. As they often do not report on documentation, error estimates, whether they were obtained by change detection techniques rather than by comparison of static maps, etc. If historical land cover and land use change data are already available, information on the minimum mapping unit, the methods used to produce these data, and descriptions of cover and use classes, category changes shall be compiled, including how these classes can be matched to cover classes and categories.

[13] Such as ISO 19131 – Data product technical specifications; ISO 19115-1 Geographic Metadata and ISO 19157 – Data quality

[14] Specify type, resolution, source and date of acquisition of remote sensing data (and other data) used; geometric, radiometric and other corrections made; spectral bands and indices used (such as NDVI); projection and parameters used to geo reference images; error estimate of geometric correction; software version and software used to perform pre-processing tasks; etc.

[15] Definition of land cover and land use classes and categories of change; classification approach and classification algorithms; coordinates and description of ground-truthing data collected for training purposes; ancillary data used in classification, if any; software and software version used to perform the classification; additional spatial data and analysis used for post-classification analysis, including class subdivisions using spectral criteria, if any; etc.

[16] Each class will have a unique identifier (IDcl). The methodology sometimes uses the notation icl (= 1, 2, 3, … Icl) to indicate the initial coverage classes; and fcl (= 1, 2, 3, Fcl) to indicate the final classes. All initial and final classes are listed in this table.

IDcl		Initial Classes Coverage/Use			
		I1	I2	I3	I4
Final Classes Coverage	F3				
	F4				

13.2.2 Historical land use change in the reference area

Historical land-use change rates in the reference region shall be estimated using the same analytical approach applied to the project area, based on the historical reference period.

The resulting historical average change in natural savanna vegetation cover shall be used to represent the expected land-use change trajectory in the baseline scenario.

The annual historical land-use change under the baseline (without-project) scenario is estimated using Equation 1, as follows[17]:

$$SCNC_{yr} = \left(\frac{1}{t_2 - t_1} \ln\frac{A_2}{A_1}\right) x\ A_p \qquad \text{Equation 1}$$

Where:

$SCNC_{yr}$	Average annual change in the area covered by natural savanna (herbaceous vegetation and shrublands) under the without-project scenario, including the loss, suppression, or persistent decline of such cover attributable to the conversion of natural savannas and/or to anthropogenic degradation processes, in accordance with the land-cover classification applied.; ha yr^{-1}
t_2	Final year of the reference period, year
t_1	Initial year of the reference period, year
A_1	Area covered by natural savanna (herbaceous vegetation and shrublands) within the reference region in year t_1, as determined using the land-cover classification applied; ha
A_2	Area covered by natural savanna (herbaceous vegetation and shrublands) within the reference region in year t_2, as determined using the land-cover classification applied, t2; ha

[17] Puyravaud, Jean-Philippe. "Standardizing the calculation of the annual rate of deforestation." Forest ecology and management 177.1-3 (2003): 593-596.

A_p Eligible area; ha

The CSCN represents the average annual historical change in the area covered by natural savanna within the reference region and shall be the value used, under the baseline scenario, to represent changes associated with the conversion of natural savannas and with the persistent anthropogenic degradation of natural savanna cover, in accordance with the land-cover classes defined for this methodology.

13.2.3 Projected land use change in the project scenario

The projected land-use change in the project scenario shall be derived by adjusting the baseline land-use change trajectory based on the observed effectiveness of project activities in reducing or preventing land-use change and anthropogenic degradation.

Projections shall be conservative and shall not exceed observed reductions in land-use change during the monitoring period.

The estimation of the annual changes, in the scenario with Project, is carried out using Equation 2, as follows:

$$SCNC_p = SCNC_{lb}\ x\ (1 - \%PDp) \quad \text{Equation 2}$$

Where:

$SCNC_p$ Average annual change in the area covered by natural savanna (herbaceous vegetation and shrublands) under the with-project scenario, including the loss, suppression, or persistent decline of such cover attributable to the conversion of natural savannas and/or to anthropogenic degradation processes, in accordance with the land-cover classification applied; ha yr^{-1}

$SCNC_{lb}$ Average annual change in the area covered by natural savanna (herbaceous vegetation and shrublands) under the without-project (baseline) scenario, including the loss, suppression, or persistent decline of such cover attributable to the conversion of natural savannas and/or to anthropogenic degradation processes, in accordance with the land-cover classification applied; ha yr^{-1}

%PDp Percentage reduction in changes in the area covered by natural savanna attributable to the implementation of the project activities, relative to the without-project scenario.

Within the project area, different rates of change in the area covered by natural savanna (herbaceous vegetation and shrublands) are estimated for each defined stratum, in accordance with the stratification applied and the land-cover classes used in the methodology[18].

The land covers shall be presented using the following table:

Table 5. Land use/coverage units in the project area

Coverage		Description	Area per year			
			1	2	...	t
ID$_i$	Name		ha	ha	ha	ha
1						
2						
...						
n						

13.2.4 Historical and projected land use change in the leakage area

Historical and projected land-use change in the leakage area shall be estimated using the same methods and assumptions applied to the project area and reference region.

Any increase in land-use change attributable to displacement effects shall be conservatively quantified and deducted from gross GHG emission reductions and/or removals.

The annual historical land use change in the leakage area is estimated using Equation 3, as follows:

$$SCNC_{lk,yr} = \left(\frac{1}{t_2 - t_1} \ln\frac{A_2}{A_1}\right) x\, A_{lk} \qquad \text{Equation 3}$$

Where:

$SCNC_{lk,yr}$ Average annual change in the area covered by natural savanna (herbaceous vegetation and shrublands) within the leakage area under the without-project scenario, including the loss, suppression, or persistent decline of such cover attributable to the conversion of natural savannas and/or to anthropogenic degradation processes, in accordance with the land-cover classification applied; ha

t_2 Final year of the reference period; year

[18] Coverages or strata can be static (with fixed limits) or dynamic (with limits that change over time).

t_1 Initial year of the reference period; year

A_1 Area covered by natural savanna (herbaceous vegetation and shrublands) within the leakage area in year t_1, as determined using the land-cover classification applied; ha

A_2 Area covered by natural savanna (herbaceous vegetation and shrublands) within the leakage area in year t_2, as determined using the land-cover classification applied; ha

A_{lk} Leakage area; ha

This assessment yields a land-cover change matrix that combines natural savanna land-cover classes with the transition categories defined for the methodology, enabling the identification and quantification of changes associated with the conversion of natural savannas and with persistent anthropogenic degradation within the leakage area. The resulting change categories shall be presented in the corresponding table.

Table 6. Matrix of changes in vegetation cover in the leakage area

IDcl		Initial Classes Coverage/Use			
		I1	I2	I3	I4
Final Classes Coverage	F1				
	F2				
	F3				
	F4				

13.2.5 Projected land use change in the leakage area in the project scenario

The projected annual land use change in the leakage area in the project scenario is estimated using Equation 4:

$$SCNC_{project,lk,yr} = CSNC_{lk,bl}\ x\ (1 + \%E_{lk}) \qquad \text{Equation 4}$$

Where:

$SCNC_{project,lk,yr}$ Average annual change in the area covered by natural savanna (herbaceous vegetation and shrublands) within the leakage area under the with-project scenario, including the loss, suppression, or persistent decline of such cover attributable to the conversion of natural savannas and/or to anthropogenic degradation processes, in accordance with the land-cover classification applied; ha

$SCNC_{lk,bl}$ Average annual change in the area covered by natural savanna (herbaceous vegetation and shrublands) within the leakage area under the without-project (baseline) scenario, including the loss, suppression, or persistent decline of such cover attributable to the conversion of natural savannas and/or to anthropogenic degradation processes, in accordance with the land-cover classification applied; ha

$\%E_{lk}$ Percentage increase in the rate of change of the area covered by natural savanna within the leakage area attributable to displacement effects resulting from the implementation of the project activities.

The use of a default value of 10% is accepted under this methodology when it is not possible to estimate a project-specific value based on observable and verifiable evidence.

Within the leakage area, different rates of change in the area covered by natural savanna (herbaceous vegetation and shrublands) may be estimated by stratum where stratification has been applied[19].. The corresponding table shall summarize the land-cover units and their areas by year, in accordance with the land-cover classification applied.

Use of default values for leakage estimation

The default value of 10% for the parameter $\%E_f$ may be used only when the project holder demonstrates that it is not possible to estimate a project-specific value based on observable and verifiable data.

The use of the default value shall be justified and documented in the Project Document and shall be subject to validation and verification.

Table 7. Land use/coverage units in the leakage area

Coverage		Description	Area per year			
			1	2	...	t
ID_i	Name		ha	ha	ha	ha
1						
2						
...						
n						

13.3 Emissions factors

The emission factors correspond to the carbon stocks in the reservoirs considered. The project holder shall submit a detailed description of the estimate of changes in carbon

[19] Coverages or strata can be static (with fixed boundaries) or dynamic (with boundaries that change over time)

stocks in these reservoirs, in accordance with IPCC guidelines, and demonstrate that their use does not lead to overestimation of emissions at baseline.

Emission factors are determined based on IPCC good practices, under the following assumptions:

- Belowground biomass is included differentially to soil organic carbon content.
- It is assumed that all carbon in the above-ground and below-ground biomass pool is emitted in the same year as the deforestation event.
- A gross emission is assumed in which the soil carbon content (SOC) at 30 cm[20] is emitted in equal proportions for 20 years after the land use change event occurs.

13.3.1 Conversion of carbon contained in total biomass to carbon dioxide equivalent

Total biomass (BT) is estimated as the sum of aboveground biomass (AB) and belowground biomass (BB).

The carbon content of total biomass is obtained by multiplying total biomass by the carbon fraction of dry matter (CF).

The carbon dioxide equivalent contained in total biomass (FCBeq) is obtained by applying the stoichiometric relationship between carbon (C) and carbon dioxide (CO_2), expressed by the constant 44/12..

CFBeq is calculated using Equation 5, as follows:

$$CFBeq = BT\ x\ CF\ x\ \frac{44}{12} \quad \text{Equation 5}$$

Where:

$CFBeq$	Carbon dioxide equivalent, content in the total biomass; tCO2e ha^{-1}
TB	Total biomass, defined as the sum of aboveground biomass (AB) and belowground biomass (BB); t ha^{-1}
CF	Carbon fraction of biomass dry matter; default value 0.47, in accordance with IPCC Guidelines, unless a project-specific value is justified; dimensionless

[20] The project holder may include the estimation of SOC at a depth greater than 30 cm. In this case, the SOC estimation shall be performed in areas with and without natural cover and the difference in SOC between both covers shall be used in the equation presented in section 11.3.2.

$\frac{44}{12}$ The molecular ratio constant between carbon (C) and carbon dioxide (CO_2)

Total biomass (BT) used under this methodology may be determined through:

(a) default values derived from recognized sources consistent with IPCC Guidelines, where available and applicable to the project context;

(b) direct field measurements using appropriate sampling and stratification methods; or

(c) a combination of both approaches, provided that methodological consistency and conservativeness are ensured.

The method selected to determine total biomass shall be justified and documented in the Project Document, in accordance with the BioCarbon Monitoring, Reporting and Verification (MRV) Tool.

13.3.2 Emission factor of soil organic carbon (SOC)

Annual rates of soil organic carbon emissions can be determined by the following options: (a) using default values, (b) project own estimates. These are described below.

(a) Using default values

The IPCC acknowledges that "*it is good practice to use the default reference value for carbon stocks (SOC_{REF}) indicated in Table 3.3.3*" of the IPCC Good Practice Guidance for LULUCF (Tier 1).

<u>*Mineral soils*</u>

The default values for SOC (in mineral soils) are found in *Table 8*.

Table 8. Default reference (under native vegetation) soil organic C stocks (SOCREF) in tonnes C per ha for 0 - 30 cm depth

<table>
<tr><th>Region</th><th>HAC soils (1)</th><th>LAC soils (2)</th><th>Sandy soils (3)</th><th>Spodic soils (4)</th><th>Volcanic soils (5)</th><th>Wetland soils (6)</th></tr>
<tr><td>Boreal</td><td>68</td><td>NA</td><td>10#</td><td>117</td><td>20#</td><td>146</td></tr>
<tr><td>Cold temperate, dry</td><td>50</td><td>33</td><td>34</td><td>NA</td><td>20#</td><td rowspan="2">87</td></tr>
<tr><td>Cold temperate, moist</td><td>95</td><td>85</td><td>71</td><td>115</td><td>130</td></tr>
<tr><td>Warm temperate, dry</td><td>38</td><td>24</td><td>19</td><td>NA</td><td>70#</td><td rowspan="2">88</td></tr>
<tr><td>Warm temperate, moist</td><td>88</td><td>63</td><td>34</td><td>NA</td><td>80</td></tr>
</table>

Tropical, dry	38	35	31	NA	50#	NA
Tropical, moist	65	47	39	NA	70#	
Tropical, wet	44	60	66	NA	130#	

Note: Data are derived from soil databases described by Jobbagy and Jackson (2000) and Bernoux et al. (2002). Mean stocks are shown. A default error estimate of 95% (expressed as 2X standard deviations as percent of the mean are assumed for soil-climate types. NA denotes 'not applicable' because these soils do not normally occur in some climate zones.

# indicates where no data were available and default values from IPCC Guidelines were retained.

[1] Soils with high activity clay (HAC) minerals are lightly to moderately weathered soils, which are dominated by 2:1 silicate clay minerals (in the World Reference Base for Soil Resources (WRB) classification these include Leptosols, Vertisols, Kastanozems, Chernozems, Phaeozems, Luvisols, Alisols, Albeluvisols, Solonetz, Calcisols, Gypsisols, Umbrisols, Cambisols, Regosols; in USDA classification includes Mollisols, Vertisols, high-base status Alfisols, Aridisols, Inceptisols).

[2] Soils with low activity clay (LAC) minerals are highly weathered soils, dominated by 1:1 clay minerals and amorphous iron and aluminium oxides (in WRB classification includes Acrisols, Lixisols, Nitisols, Ferralsols, Durisols; in USDA classification includes Ultisols, Oxisols, acidic Alfisols).

[3] Includes all soils (regardless of taxonomic classification) having > 70% sand and < 8% clay, based on standard textural analyses (in WRB classification includes Arenosols,; in USDA classification includes Psamments).

[4] Soils exhibiting strong podzolization (in WRB classification includes Podzols; in USDA classification Spodosols). Non applicable under this methodology

[5] Soils derived from volcanic ash with allophanic mineralogy (in WRB classification Andosols; in USDA classification Andisols)

[6] Soils with restricted drainage leading to periodic flooding and anaerobic conditions (in WRB classification Gleysols; in USDA classification Aquic suborders). Non applicable under this methodology.

Source: Good Practice Guidance for Land Use, Land-Use Change and Forestry [21]

(b) project-specific estimation data

Project holders which develop their own emission factors shall provide scientifically based evidence of their reliability and representativeness, document the experimental procedures used to derive them, and provide uncertainty estimates.

Soil carbon stocks shall be determined from measurements. These shall be carried out separately for each soil mapping unit identified within the project boundaries. For estimating SOC from project data, a methodology that meets the technical and statistical rigor appropriate for this type of estimation shall be used.

For the estimation of greenhouse gas (GHG) emissions associated with land-use changes that involve the conversion of natural savannas and/or persistent anthropogenic degradation processes resulting in a measurable loss of soil organic carbon in mineral soils, a gross emission of soil carbon is assumed.

[21] https://www.ipcc.ch/site/assets/uploads/2018/03/GPG_LULUCF_FULLEN.pdf

In accordance with IPCC Guidelines, the soil organic carbon (SOC) content is assumed to be emitted linearly over a period of 20 years from the time the conversion or persistent degradation event occurs.

For this purpose, the annual rate of soil carbon emitted over 20 years (SOC_20years) is calculated by dividing the total SOC by 20, using Equation 6.

$$SOCeq = \frac{SOC}{20} \, x \, \frac{44}{12} \qquad \text{Equation 6}$$

Where:

$SOCeq$	Carbon dioxide equivalent corresponding to the annual emission of soil organic carbon derived from the conversion of natural savannas and/or from persistent anthropogenic degradation processes that result in a loss of SOC in mineral soils; $tCO_2e \cdot ha^{-1} \cdot year^{-1}$
SOC	Soil organic carbon content in mineral soils, expressed as carbon stocks prior to the conversion or persistent degradation event; $tC \cdot ha^{-1}$
$\frac{44}{12}$	The molecular ratio constant between carbon (C) and carbon dioxide (CO_2)

13.4 GHG emissions in the analysis period

GHG emissions in the analysis period shall be estimated separately for the baseline scenario, the project scenario, and, where applicable, the leakage area.

Emissions associated with non-CO_2 gases from fire events shall be included only when such events are detected within the project boundary during the monitoring period, in accordance with Section 7.2.

The annual greenhouse gas emissions associated with the conversion of natural savannas and/or persistent anthropogenic degradation processes that result in the loss of biomass and/or soil organic carbon, under the without-project (baseline) scenario, are calculated using Equation 7.

$$AE_{bl} = SCNC_{bl} \, x \left(CFB_{eq} \; + \; SOC_{eq} \right) \qquad \text{Equation 7}$$

Where:

AE_{bl} Annual greenhouse gas emissions under the without-project (baseline) scenario, associated with the conversion of natural savannas and/or with persistent anthropogenic degradation of natural savanna cover; $tCO2\ ha^{-1}\ yr^{-1}$

$SCNC_{bl}$ Average annual change in the area covered by natural savanna (herbaceous vegetation and shrublands) under the without-project (baseline) scenario, including the loss, suppression, or persistent decline of such cover attributable to the conversion of natural savannas and/or to anthropogenic degradation processes, in accordance with the land-cover classification applied; $ha\ yr^{-1}$

CFB_{eq} Carbon dioxide equivalent contained in total biomass per unit area, determined in accordance with the biomass-to-CO_2e conversion equation; $tCO2e\ ha^{-1}$

SOC_{eq} Carbon dioxide equivalent corresponding to the annual emission of soil organic carbon in mineral soils, derived from the conversion of natural savannas and/or from persistent anthropogenic degradation processes, calculated under the assumption of linear emission over a 20-year period; $tCO_2e{\cdot}ha^{-1}{\cdot}year^{-1}$

The annual greenhouse gas emissions associated with the conversion of natural savannas and/or persistent anthropogenic degradation processes that result in the loss of biomass and/or soil organic carbon, under the with-project scenario, are calculated using Equation 8.

$$AE_{project,y} = SCNC_{project}\ x\ (CBF_{eq} + SOC_{eq}) \qquad \text{Equation 8}$$

Where:

$AE_{project,y}$ Annual greenhouse gas emissions under the with-project scenario, associated with the conversion of natural savannas and/or with persistent anthropogenic degradation of natural savanna cover; $tCO_2e{\cdot}ha^{-1}{\cdot}year^{-1}$

$SCNC_{project}$ Average annual change in the area covered by natural savanna (herbaceous vegetation and shrublands) under the with-project scenario, including the loss, suppression, or persistent decline of such cover attributable to the conversion of natural savannas and/or to anthropogenic degradation processes, in accordance with the land-cover classification applied; $ha\ yr^{-1}$

CBF_{eq} Carbon dioxide equivalent contained in total biomass per unit area, determined in accordance with the biomass-to-CO_2e conversion equation; $tCO2e\ ha^{-1}$

SOC_{eq} Carbon dioxide equivalent corresponding to the annual emission of soil organic carbon in mineral soils, derived from the conversion of natural savannas and/or from persistent anthropogenic degradation processes, calculated under the assumption of linear emission over a 20-year period; $tCO_2e{\cdot}ha^{-1}{\cdot}year^{-1}$

The annual greenhouse gas emissions associated with the conversion of natural savannas and/or persistent anthropogenic degradation processes that result in the loss of biomass and/or soil organic carbon within the leakage area are calculated using Equation 9:

$$AE_{lk,yr} = SCNC_{lk} \, x \left(CBF_{eq} + SOC_{eq} \right)$$ Equation 9

Where:

$AE_{lk,yr}$	Annual greenhouse gas emissions within the leakage area, associated with the conversion of natural savannas and/or with persistent anthropogenic degradation of natural savanna cover; $tCO2 \; ha^{-1} yr^{-1}$
$SCNC_{lk}$	Average annual change in the area covered by natural savanna (herbaceous vegetation and shrublands) within the leakage area, including the loss, suppression, or persistent decline of such cover attributable to the conversion of natural savannas and/or to anthropogenic degradation processes, in accordance with the land-cover classification applied; $ha \; yr^{-1}$
CBF_{eq}	Carbon dioxide equivalent contained in total biomass per unit area, determined in accordance with the biomass-to-CO_2e conversion equation; $tCO2e \; ha^{-1}$
SOC_{eq}	Carbon dioxide equivalent corresponding to the annual emission of soil organic carbon in mineral soils, derived from the conversion of natural savannas and/or from persistent anthropogenic degradation processes, calculated under the assumption of linear emission over a 20-year period; $tCO_2e \cdot ha^{-1} \cdot year^{-1}$

13.4.1 Emissions of other GHG

If fire events affecting woody and/or shrubby biomass are detected within the project boundary during the monitoring period, the project holder shall quantify the associated CH_4 and N_2O emissions resulting from biomass combustion, in accordance with the applicable IPCC (2006) Guidelines for National Greenhouse Gas Inventories.

The quantification of CH_4 and N_2O emissions resulting from the combustion of woody and/or shrubby biomass shall be conducted in accordance with the applicable IPCC (2006) Guidelines for National Greenhouse Gas Inventories. CH_4 and N_2O emissions shall be calculated using the following equations:

$$Emissions\ of\ CH_4 = Carbon\ released\ x\ 0{,}016\ x\ CO_2EFM$$ Equation 10

Where:

CO2EFM= Carbon dioxide equivalent factor of 21

$$Emissions\ of\ N_2O = Carbon\ \text{released} * 0{,}00011 * CO_2EFN \qquad \text{Equation 11}$$

Where:

CO2EFN= Carbon dioxide equivalent factor of 310

13.5 Expected GHG emission reductions

Net GHG emission reductions and/or removals shall be calculated as the difference between baseline emissions and removals and project scenario emissions and removals, after deducting emissions attributable to leakage and non-CO_2 fire events.

All calculations, assumptions, and data sources used in the estimation of GHG emission reductions and/or removals shall be transparently documented and made available for validation and verification.

The net greenhouse gas (GHG) emission reductions and/or removals resulting from the prevention of the conversion of natural savannas and/or from the reduction of persistent anthropogenic degradation processes, under the with-project scenario, are estimated in accordance using Equation 12, as follows:

$$ER_{project} = (t_2 - t_1)\ x\ (AE_{bl} - AE_{project} - AE_{lk}) \qquad \text{Equation 12}$$

Where:

$ER_{project}$	Net greenhouse gas emission reductions attributable to the prevention of the conversion of natural savannas and/or to the reduction of persistent anthropogenic degradation processes under the with-project scenario; tCO_2e
t_2	Final year of the reference period; year
t_1	Initial year of the reference period; year
AE_{bl}	Annual greenhouse gas emissions associated with the conversion of natural savannas and/or with persistent anthropogenic degradation processes under the without-project (baseline) scenario, calculated in accordance with this methodology; $tCO_2e\ yr^{-1}$
$AE_{project}$	Annual greenhouse gas emissions associated with the conversion of natural savannas and/or with persistent anthropogenic degradation processes within

the project area under the with-project scenario, calculated in accordance with this methodology; $tCO_2e\ yr^{-1}$

AE_{lk} Annual greenhouse gas emissions associated with the conversion of natural savannas and/or with persistent anthropogenic degradation processes within the leakage area, calculated in accordance with this methodology; $tCO_2e\ yr^{-1}$

Note: Emissions from non-CO_2 fire events and emissions attributable to leakage are included in the terms AE_{proy} and AE_f, respectively, in accordance with the relevant sections of this methodology.

Treatment of non-CO_2 emissions from fires

Methane (CH_4) and nitrous oxide (N_2O) emissions arising from fire events occurring within the project boundary during the monitoring period shall be quantified in accordance with IPCC Guidelines and deducted from gross greenhouse gas emission reductions prior to the application of any uncertainty adjustment.

14 Uncertainty management and conservative adjustment

Uncertainty associated with the estimation of greenhouse gas (GHG) emission reductions and/or removals under this methodology shall be identified, assessed, quantified, and treated in a conservative and transparent manner.

All projects applying this methodology shall apply the BioCarbon Uncertainty Management Tool, which establishes the mandatory procedures for the identification of uncertainty sources, the quantification of combined uncertainty, the application of conservative adjustments where required, and the documentation of uncertainty treatment.

Uncertainty shall be assessed for all relevant components of the quantification, including, inter alia, activity data, emission factors, stratification and sampling approaches, monitoring data, and any assumptions used in the estimation of changes in carbon stocks and non-CO_2 emissions from fire events.

The uncertainty assessment and any resulting conservative adjustment shall be applied after the quantification of baseline emissions, project emissions, and leakage, and prior to the determination of net GHG emission reductions eligible for credit issuance.

The application of uncertainty management and conservative adjustment shall be consistent across the project area, the reference region, and the leakage area, and shall be transparently documented in the Project Document and in the relevant monitoring and verification reports, in accordance with the BioCarbon Standard.

15 Leakage management

Leakage management under this methodology establishes the procedures for identifying, assessing, monitoring, and conservatively accounting for any displacement of conversion of natural savannas or anthropogenic degradation attributable to the implementation of project activities.

Leakage refers to any measurable and attributable increase in greenhouse gas (GHG) emissions or decrease in removals occurring outside the project boundary that results from the project activities and that would not have occurred in the absence of the project.

Leakage shall be identified, assessed, and managed in a conservative and transparent manner, consistent with the drivers and agents of conversion of natural savannas identified under Section 9 and the spatial delineation of the leakage area defined under Section 7.1.4.

15.1 Identification of leakage risk

The project holder shall identify potential leakage risks by analyzing the agents, activities, and drivers of conversion of natural savannas and anthropogenic degradation that may be displaced outside the project boundary as a result of the project activities.

Leakage risk identification shall consider, inter alia:

(a) the mobility and decision-making flexibility of identified agents;

(b) the availability of similar land-use opportunities outside the project boundary;

(c) access conditions, land tenure arrangements, and regulatory constraints in surrounding areas; and

(d) the scale and intensity of project activities relative to baseline land-use dynamics.

15.2 Assessment and quantification of leakage

Where leakage risk is identified as material, the project holder shall assess and, where applicable, quantify leakage in accordance with this methodology.

Leakage shall be assessed based on observed changes in land use, vegetation cover, or degradation patterns within the defined leakage area, using the same methodological approach, data sources, and analytical assumptions applied to the project area and the reference region.

Leakage shall be quantified ex post, based exclusively on observed and verifiable data collected during the monitoring period. No ex-ante assumptions or fixed default leakage factors shall be applied unless explicitly allowed under this methodology.

Any quantified leakage shall be conservatively deducted from gross greenhouse gas emission reductions and/or removals prior to the determination of net results eligible for credit issuance.

15.3 Leakage prevention and mitigation measures

Project activities shall be designed, where feasible, to minimize the risk of leakage by addressing the underlying drivers and agents of conversion of natural savannas and anthropogenic degradation at an appropriate spatial scale.

Leakage prevention or mitigation measures may include, inter alia, landscape-level planning, engagement with relevant stakeholders, or complementary management actions that reduce incentives for displacement.

The effectiveness of such measures shall be assessed through monitoring of land-use dynamics within the leakage area.

15.4 Monitoring of leakage

Monitoring of leakage shall be conducted in accordance with the monitoring requirements defined under Section 13 and shall focus on detecting changes in land use, vegetation cover, or degradation patterns within the leakage area that may be attributable to project activities.

Monitoring data used for leakage assessment shall meet the same quality, consistency, and documentation requirements applied to project area monitoring.

15.5 Conservativeness and documentation

Where uncertainty exists regarding the attribution or magnitude of leakage, conservative assumptions shall be applied in accordance with the BioCarbon Standard and its applicable tools.

All assumptions, data sources, analytical methods, and results related to leakage identification, assessment, and deduction shall be transparently documented in the Project Document and monitoring and verification reports.

Leakage management shall be reassessed during each verification cycle to reflect changes in project activities, land-use dynamics, or external conditions that may affect leakage risk.

16 Permanence and reversal risk management

Permanence under this methodology refers to the durability over time of greenhouse gas (GHG) emission reductions and/or removals achieved through the prevention of conversion of natural savannas and the reduction of anthropogenic degradation in natural savannas.

Project activities implemented under this methodology may be subject to risks of reversal, including but not limited to renewed conversion of natural savannas, degradation pressures, fire events, or changes in management conditions that could lead to the loss of previously achieved mitigation outcomes.

The identification, assessment, and management of reversal risk shall be conducted in accordance with the BioCarbon Permanence and Reversal Risk Management Tool, which establishes the mandatory procedures for evaluating risk factors, applying risk mitigation measures, and implementing any required conservative adjustments or buffer mechanisms.

Permanence and reversal risk management shall be applied consistently throughout the project lifecycle and shall be reassessed, as applicable, during subsequent verification cycles to reflect changes in project conditions, land-use dynamics related to conversion of natural savannas, or external risk factors.

All assumptions, risk assessments, and mitigation measures related to permanence and reversal risk shall be documented in the Project Document and relevant monitoring and verification reports, in accordance with the BioCarbon Standard.

17 Monitoring requirements

Monitoring requirements under this methodology establish the parameters, scope, and minimum frequency of data collection necessary to quantify greenhouse gas (GHG) emission reductions and/or removals resulting from project activities.

Monitoring shall be conducted in a manner that ensures transparency, consistency, completeness, and verifiability of all data used in the quantification of baseline emissions, project emissions, leakage, and net GHG emission reductions.

This methodology defines what parameters shall be monitored and at what minimum frequency. The procedures for data quality management, uncertainty treatment, aggregation, reporting formats, and verification shall follow the requirements established in the BioCarbon Monitoring, Reporting and Verification (MRV) Tool and the BioCarbon Uncertainty Management Tool.

17.1 Scope of monitoring

Monitoring shall apply to all areas and components relevant to the quantification of GHG emission reductions and/or removals, including:

(a) the project area;

(b) the reference region, where required to support baseline reassessment; and

(c) the leakage area, where applicable.

Monitoring data shall be collected ex post and shall reflect observed and verifiable conditions during each monitoring period. No extrapolation beyond the monitoring period shall be permitted.

17.2 Parameters to be monitored

At a minimum, the project holder shall monitor the following parameters, as applicable to the project design and site conditions:

(a) land cover and land-use changes within the project boundary, including herbaceous vegetation and shrublands;

(b) changes in aboveground and belowground biomass carbon stocks in selected strata;

(c) soil organic carbon, where this pool is included under the methodology;

(d) occurrence, extent, and spatial location of fire events affecting woody biomass within the project boundary;

(e) activity data required to quantify leakage, where applicable; and

(f) any additional parameters required to apply the equations defined in this methodology.

17.3 Monitoring of fire events

Fire events affecting woody biomass within the project boundary shall be monitored using remote sensing data and, where applicable, field verification.

Only fire events that are detected and verified during the monitoring period shall be considered for the quantification of non-CO_2 emissions under this methodology. Fire events shall not be assumed or modeled in the absence of observed evidence.

17.4 Monitoring frequency

Monitoring shall be conducted at least once per monitoring period, in accordance with the verification and crediting cycle defined under the BioCarbon Standard.

Where land-use dynamics, degradation processes, or fire risk exhibit high temporal variability, more frequent monitoring (e.g. annual land-cover assessment) shall be applied to ensure accurate detection of changes relevant to GHG quantification.

17.5 Data sources and documentation

Monitoring data may be derived from a combination of field measurements, remote sensing, and other verifiable data sources, as appropriate to the monitored parameter.

Where direct field measurements are used to estimate changes in carbon stocks, project holders shall apply measurement, sampling, and laboratory analysis methods that are scientifically robust, transparent, and appropriate to the project context, in accordance with the BioCarbon Monitoring, Reporting and Verification (MRV) Tool and applicable IPCC Guidelines.

Equivalent methods may be applied, provided that their appropriateness, accuracy, and conservativeness are justified and documented for validation and verification.

All monitoring data shall be documented, archived, and made available for validation and verification in accordance with the BioCarbon MRV Tool. Any data gaps, deviations from the approved monitoring approach, or exceptional circumstances affecting data collection shall be transparently documented and treated conservatively.

17.6 Link to uncertainty management

Uncertainty associated with monitored data shall be identified, quantified, and treated in accordance with the BioCarbon Uncertainty Management Tool.

Any conservative adjustment resulting from uncertainty assessment shall be applied after the quantification of baseline emissions, project emissions, and leakage, and prior to the determination of net GHG emission reductions eligible for credit issuance.

17.7 Quality control and quality (QA/QC) assurance procedures

Quality Assurance and Quality Control (QA/QC) procedures shall be applied to ensure the accuracy, completeness, consistency, and reliability of all data and information used for the quantification of greenhouse gas (GHG) emission reductions and/or removals under this methodology.

QA/QC requirements shall apply to all stages of data collection, processing, analysis, documentation, and reporting, including baseline data, project monitoring data, leakage-related information, and any supporting evidence used in GHG quantification.

Project holders shall implement QA/QC procedures in accordance with the BioCarbon Monitoring, Reporting and Verification (MRV) Tool, which establishes mandatory requirements for data quality management, internal checks, documentation, traceability, and readiness for validation and verification.

QA/QC procedures shall include, at a minimum:

(a) verification of the completeness and consistency of monitoring data across monitoring periods;

(b) checks for transcription errors, outliers, and internal consistency in datasets and calculations;

(c) confirmation that monitoring methods and data sources are applied consistently with the validated Project Document; and

(d) documentation of any data gaps, deviations, corrections, or methodological adjustments.

Any errors, inconsistencies, or missing data identified through QA/QC procedures shall be corrected promptly. Where correction is not possible, conservative assumptions shall be applied in accordance with the BioCarbon Standard and its applicable tools.

All QA/QC procedures, corrective actions, and supporting records shall be documented and retained for validation, verification, and audit purposes, in accordance with the requirements of the BioCarbon Standard.

17.7.1 Review of the information processing

The processing of data collected through field measurements, remote sensing, and digital recording systems shall be subject to review as part of the project's Quality Assurance and Quality Control (QA/QC) procedures.

Data review shall be conducted to identify inconsistencies, transcription errors, gaps, or deviations from the approved monitoring approach. The scope, sampling approach, and level of detail of such reviews shall be determined in accordance with the BioCarbon Monitoring, Reporting and Verification (MRV) Tool, which establishes the applicable QA/QC requirements.

Where errors or inconsistencies are identified, the project holder shall assess their materiality, implement corrective actions, and document all corrections and assumptions applied. Where correction is not possible, conservative assumptions shall be applied in accordance with the BioCarbon Standard and its applicable tools.

17.7.2 Data recording and archiving system

All data generated under this methodology shall be recorded, stored, and archived in an organized, secure, and traceable manner, using digital and, where applicable, physical formats.

Archived information shall include, as applicable:

(a) field data and monitoring records;

(b) geospatial data and geographic information system (GIS) files;

(c) calculations and supporting documentation related to greenhouse gas (GHG) quantification; and

(d) monitoring, verification, and corrective action reports.

Data archiving, retention periods, access controls, and documentation requirements shall follow the provisions of the BioCarbon MRV Tool and other applicable BioCarbon tools in force.

All records shall be retained for the minimum period required by the BioCarbon Standard to ensure traceability, verification, and auditability of issued credits.

18 Document status and publication format

This methodological document has been developed, reviewed, and approved in accordance with the governance procedures of the BioCarbon Standard.

This version constitutes a Public Consultation Version, issued for the purpose of receiving technical and stakeholder feedback. Comments received during the public consultation process shall be reviewed and addressed in accordance with the BioCarbon Standard procedures for methodology development and revision.

Upon completion of the public consultation process, BioCarbon Cert may revise and publish a subsequent version of this methodology reflecting accepted comments, technical updates, or clarifications.

The official and valid version of this methodology shall be the version published on the official website of the BioCarbon Standard. In the event of discrepancies between different copies or formats of this document, the version available on the official website shall prevail.

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18.1 Transition period

This methodology may introduce revisions or updates that affect applicability conditions, monitoring requirements, or procedural aspects over time. To ensure an orderly and transparent implementation of such updates, a transition period may be established by BioCarbon Cert where appropriate.

During a defined transition period, projects registered under a previous version of this methodology may continue to operate in accordance with the version applicable at the time of registration, subject to any mandatory requirements explicitly defined by the BioCarbon Standard.

Unless otherwise specified by BioCarbon Cert, all verification and credit issuance events initiated after the end of the transition period shall apply the most recent version of the methodology and all applicable BioCarbon tools in force at that time.

The duration, scope, and conditions of any transition period shall be specified by BioCarbon Cert and publicly communicated through official channels. In the absence of an explicitly defined transition period, the provisions set out in Section 2 (Version and validity) shall apply.

Document History

Version	Date	Description
Document for public consultation	September 23, 2022	Initial version Document submitted to public consultation
Version 1.0	October 21, 2022	Updated version – After public consultation
Version 1.1	August 29, 2024	Additionality Minor editorial changes
Draft for public consultation Version 2.0	December 31, 2025	Public consultation version incorporating a comprehensive methodological update, including revised scope and applicability, strengthened baseline and additionality requirements, integration of BioCarbon tools (MRV, Uncertainty, Leakage and Permanence), refined treatment of fire, leakage and reversal risk, and extensive structural and editorial