PEATLAND CARBON METHODOLOGY

BCR0013
Conservation and Restoration of Peatland Ecosystems

BIOCARBON CERT®

PUBLIC CONSULTATION VERSION | December 3, 2025

BIOCARBON CERT

www.biocarbonstandard.com

BioCarbon Cert. 2025. BCR0013. Conservation and Restoration of Peatland Ecosystems. Public Consultation Version 1.0. December 3, 2025. 84 p. http://www.biocarbonstandard.com

Table of contents

19.2 Scientific and Technical Literature 82

List of tables

Acronyms and abbreviations

AB	Aboveground biomass
AE	Annual emission
A	Area
BB	Belowground biomass
BCR	BioCarbon
BE	Baseline emissions
BT	Total biomass
BCC	Biomass carbon content
CDM	Clean Development Mechanism
CF	Combustion Factor
CH_4	Methane
CO_2	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent
EF	Emission Factor
ETF	Enhanced Transparency Framework
ER	Emission reductions
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse Gases
GIS	Geographic Information System
IPCC	Intergovernmental Panel on Climate Change
MB	Mass of Biomass / Mass of Fuel Burned
MRV	Monitoring, Reporting and Verification
N_2O	Nitrous oxide
PE	Project emissions
SOC	Soil organic carbon
QA/QC	Quality Control/Assurance Control
RS	Remote Sensing
UF	Uncertainty Factor
UNFCCC	United Nations Framework Convention on Climate Change
VCC	Verified Carbon Credits
WTD	Water Table Depth

1 Introduction

Peatland ecosystems are among the most carbon-rich natural systems on the planet, storing exceptionally large quantities of carbon in deep layers of waterlogged organic soils that accumulate over thousands of years (Joosten et al., 2016). Although they cover less than four percent of the global land surface, peatlands hold approximately one-third of the world's soil carbon, functioning as long-term, highly stable carbon reservoirs when kept intact and saturated. Beyond their carbon-storage role, peatlands regulate hydrological cycles, support unique biodiversity, and provide essential ecosystem services for local communities and downstream water users.

When peatlands are drained, converted, burned, or otherwise disturbed, their ecological function collapses and they become significant sources of greenhouse gas emissions. Oxidation of exposed peat releases large amounts of CO_2, altered hydrology drives substantial changes in CH_4 fluxes, and degraded peatlands become increasingly vulnerable to recurring fires. Protecting and restoring peatlands is therefore a critical global priority for climate mitigation, biodiversity conservation, and long-term ecosystem resilience.

The BCR0013 – Conservation and Restoration of Peatland Ecosystems establish the requirements for quantifying greenhouse gas (GHG) emission reductions and removals achieved through the conservation, hydrological restoration, and ecological recovery of peatland ecosystems. This methodology provides project holders with a comprehensive, science-based framework to assess baseline conditions, demonstrate additionality, implement eligible activities, quantify GHG impacts, manage leakage, and monitor long-term ecosystem performance in peat-dominated landscapes.

This methodology applies to peatland ecosystems in tropical, subtropical, temperate, and high-mountain regions, including ombrotrophic and minerotrophic peatlands, forested peat swamps, shrub- and herb-dominated peatlands, páramo peatlands, and other organic-soil ecosystems. It is designed to accommodate both conservation of intact peatlands and restoration of degraded sites through rewetting, hydrological interventions, and measures that promote the recovery and stabilization of native vegetation and ecological functions.

The methodology complements, but does not replace, other methodologies under the BioCarbon Standard. In areas where peatlands overlap with the scope of BCR0003 (high-mountain ecosystems) (BioCarbon Cert, 2025b) or BCR0007 (inland wetlands) (BioCarbon Cert, 2025c), this methodology shall take precedence for all aspects related to carbon accounting, baseline development, monitoring, and reporting in peat soils. While those methodologies provide valuable ecosystem-level context, the unique hydrological, ecological, and carbon-storage characteristics of peatlands require a dedicated accounting approach.

This methodology is not a REDD+ methodology. Peatlands differ fundamentally from forest ecosystems, and their degradation and restoration do not align with REDD+ categories. Most peatland carbon is stored in organic soils rather than biomass; degradation is driven primarily by hydrological alteration rather than loss of tree cover; and restoration involves rewetting and hydrological stabilization, which are not recognized REDD+ interventions. Many peatlands, particularly high-altitude, shrubland, or herbaceous peatlands, do not meet standard forest definitions, making REDD+ frameworks conceptually and technically unsuitable. A dedicated peatland methodology ensures ecosystem-specific accounting consistent with the IPCC Wetlands Supplement (2013) and the 2019 Refinements (IPCC, 2014); (IPCC, 2019).

This methodology shall be applied in conjunction with the BIOCARBON STANDARD and its normative tools, including the Baseline & Additionality Tool (BioCarbon Cert, 2025f), MRV Tool (BioCarbon Cert, 2025g), Permanence and Reversal Risk Tool (BioCarbon Cert, 2025h), Uncertainty Assessment Tool (BioCarbon Cert, 2025e), and Avoiding Double Counting (ADC) Tool (BioCarbon Cert, 2025d). Together, these ensure scientific robustness, environmental integrity, transparency, and alignment with the best practices.

2 Objectives

The objective of this methodology is to establish a robust, transparent, and scientifically grounded framework for quantifying greenhouse gas (GHG) emission reductions and removals resulting from the conservation and restoration of peatland.

This methodology provides project holders with the requirements needed to determine baseline conditions, demonstrate additionality, implement eligible conservation and restoration measures, quantify GHG benefits, manage leakage, address permanence risks, and monitor long-term ecosystem outcomes.

Specifically, the methodology aims to:

(a) Define the eligible conservation and restoration activities that maintain or improve hydrological conditions, reduce peat oxidation, avoid degradation, and enhance the ecological integrity of peatland;

(b) Establish procedures to identify the baseline scenario, including hydrological and ecological conditions in the absence of the project activity;

(c) Provide methodological requirements to demonstrate additionality, ensuring that credited emission reductions and removals would not occur without carbon finance;

(d) Provide equations, parameters, and procedures to quantify baseline emissions, project emissions, and net GHG emission reductions or removals, in full alignment with the 2013 IPCC Wetlands Supplement and the 2019 Refinement (IPCC, 2014); (IPCC, 2019);

(e) Define monitoring requirements, including hydrological, ecological, and fire-related parameters necessary to assess project performance during implementation;

(f) Identify and quantify leakage risks, including hydrological, activity-shifting, market, and transport-related leakage;

(g) Address permanence and reversal risks, including hydrological re-drying, fire, and governance or management failures, by applying the BioCarbon Permanence and Reversal Risk Tool (BioCarbon Cert, 2025h);

(h) Ensure the transparent treatment of uncertainty, requiring conservative adjustments consistent with the BioCarbon Uncertainty Assessment Tool (BioCarbon Cert, 2025e);

(i) Ensure consistency with the BioCarbon Standard, its normative tools, and its environmental and social safeguards, and align with broader policy frameworks that promote scientific rigor, transparency, and environmental integrity.

3 Version and validity

This document constitutes Version 1.0 of the BCR0013 – Conservation and Restoration of Peatland. This version is released for public consultation on December 3, 2025.

Updated versions of this methodology may be issued from time to time by BioCarbon Cert as new scientific evidence, international guidance, or program requirements evolve. Project holders shall ensure that they apply the latest valid version at the time of validation. Once a project has been validated under a specific version, subsequent verifications shall follow the versioning rules established in the BioCarbon Standard unless otherwise specified.

All version updates shall be made publicly available and clearly distinguished from previous versions.

4 Scope

This methodology applies to project activities that conserve or restore peatland through hydrological and ecological interventions that reduce or prevent greenhouse gas emissions or enhance carbon storage in peat soils. The methodology provides the requirements for establishing the baseline scenario, demonstrating additionality, quantifying emission reductions and removals, addressing leakage, and monitoring project performance.

The scope includes:

(a) Conservation of intact peatland, avoiding degradation, drainage, conversion, or fire, and maintaining hydrological conditions that prevent peat oxidation;

(b) Hydrological restoration of degraded peatland, including rewetting, blocking drainage canals, and reinstating natural hydrological regimes to reduce peat oxidation and fire risk;

(c) Ecological restoration, including recovery of native vegetation that contributes to long-term stabilization of hydrological and biogeochemical processes;

(d) Long-term carbon storage resulting from reduced CO_2 emissions from peat oxidation, changes in CH_4 and N_2O fluxes, and reduced fire-related emissions.

The methodology covers peatland in tropical, subtropical, temperate, boreal, and high-mountain regions.

Excluded from this scope are activities involving drainage, peat extraction, conversion to agriculture or forestry, establishment of non-native plantations, or interventions that compromise the hydrological integrity of peatland.

This methodology does not apply to projects that seek crediting under REDD+ categories, as peatland conservation and restoration fall outside the scope of forest-based REDD+ activities.

5 Normative references

This methodology shall be applied in conjunction with the latest version of the BioCarbon Standard and all relevant program documents, including:

(a) BCR Standard v4.0 (BioCarbon Cert, 2025a).

(b) Baseline & Additionality Tool (BioCarbon Cert, 2025f).

(c) Monitoring, Reporting and Verification (MRV) Tool (BioCarbon Cert, 2025g).

(d) Permanence and Reversal Risk Tool (BioCarbon Cert, 2025h).

(e) Uncertainty Assessment Tool (BioCarbon Cert, 2025e).

(f) Avoiding Double Counting (ADC) Tool (BioCarbon Cert, 2025d).

(g) Sustainable Development Safeguards (SDS) Tool (BioCarbon Cert, 2025i).

(h) Sustainable Development Goals (SDG) Tool (BioCarbon Cert, 2023).

This methodology also draws on the following international references:

(a) 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006).

(b) 2013 IPCC Wetlands Supplement (IPCC, 2014).

(c) 2019 Refinement to the 2006 Guidelines (IPCC, 2019).

(d) Guidelines for Global Action on Peatlands. Ramsar Convention Secretariat. (Ramsar, 2018).

(e) FAO Peatlands – guidance for climate change mitigation through conservation, rehabilitation and sustainable use (FAO, 2012).

(f) CORSIA Emissions Unit Eligibility Framework (ICAO, 2019).

(g) ICVCM Core Carbon Principles and Assessment Framework (ICVCM, 2024).

All references listed above form part of the normative requirements of this methodology.

6 Applicability conditions

This methodology applies to project activities that conserve or restore peatland through hydrological and ecological interventions that reduce greenhouse gas (GHG) emissions or enhance long-term carbon storage in peat soils. The following conditions shall apply.

6.1 Eligible peatland types

The project area shall consist of land that meets the definition of peatland, meaning land with a naturally accumulated layer of peat formed under water-saturated conditions. The methodology is applicable to the following peatland types:

(a) Ombrotrophic peatlands (rain-fed peatlands and bogs);

(b) Minerotrophic peatlands (groundwater-fed peatlands and fens);

(c) Tropical peat swamp forests (whether forested or non-forested at the time of the project);

(d) Shrub- and herb-dominated peatlands;

(e) High-mountain peatlands, including páramo and other alpine organic-soil systems;

(f) Any other ecosystem classified as peatland based on peat depth, organic soil characteristics, and hydrological regime, in accordance with internationally recognized definitions;

(g) Peatland shall contain an organic soil layer consistent with the IPCC definition of organic soils, characterized by sustained saturation and accumulation of partially decomposed organic material;

(h) Eligible peatland shall contain a minimum peat depth of 30 cm, or shall otherwise demonstrate peat-forming conditions consistent with long-term carbon accumulation;

(i) The project shall provide evidence of the historical hydrological regime, including past water table depth (WTD), drainage history or indicators of long-term saturation, to confirm that the area meets peatland formation criteria.

6.2 Eligible project activities

Eligible project activities shall include measures that improve peatland hydrology, restore ecological functions or prevent further degradation. The methodology is applicable to project activities that fall within one or more of the following categories.

6.2.1 Hydrological restoration activities

Activities that restore or maintain saturated or near-saturated conditions through hydrological interventions, including:

(a) blocking or disabling drainage ditches, canals or channels;

(b) constructing or reinforcing dams, bunds, palisades or water-retention structures;

(c) re-establishing natural surface water flow paths;

(d) raising or stabilizing the water table to reduce peat oxidation;

(e) reconnecting hydrological units that have been fragmented by past drainage;

(f) filling or reshaping ditches to recover natural hydrological gradients.

These activities target the primary driver of emissions in degraded peatlands: water table lowering.

6.2.2 Rewetting and water management activities

Activities aimed at reinstating sustained saturation regimes, including:

(a) controlled rewetting to achieve hydrological stability;

(b) temporary or permanent water diversion to support saturation;

(c) micro-topography restoration to retain water in degraded peat areas;

(d) measures to reduce runoff, erosion or localized desiccation.

These interventions reduce aerobic decomposition, lower fire risk and re-establish peat-forming conditions.

6.2.3 Ecological restoration activities

Activities that recover ecological functions and promote peat-forming vegetation, including:

(a) restoration or recovery of hydrophilic and peat-forming plant species;

(b) removal or control of invasive species that reduce soil moisture or hinder peat formation;

(c) revegetation with native species adapted to saturated conditions;

(d) shading or surface-cover measures to reduce evapotranspiration in vulnerable areas;

(e) protection of natural regeneration processes.

These activities support long-term carbon accumulation, water retention and ecosystem resilience.

6.2.4 Fire prevention and risk reduction activities

Activities that reduce the susceptibility of peatlands to fire, including:

(a) creation or maintenance of firebreaks in strategic locations;

(b) monitoring and management of fuel loads;

(c) community-based fire prevention programs;

(d) rapid-response firefighting capacity within peatland areas;

(e) measures that reduce ignition sources in degraded peatlands.

Fire is a major source of emissions in drained peatlands; these activities directly reduce reversal risk.

6.2.5 Measures to prevent renewed drainage or degradation

Activities that maintain restored conditions and avoid future emissions, including:

(a) control or removal of illegal drainage attempts;

(b) protection of hydrological structures from damage or interference;

(c) land-use agreements or management plans that prevent conversion or new drainage;

(d) community engagement to reduce pressures that could cause re-degradation.

These activities safeguard permanence and ensure long-term project integrity.

6.2.6 Supportive activities necessary for hydrological or ecological restoration

Temporary or permanent actions that enable, facilitate or safeguard the implementation of eligible hydrological or ecological interventions. Supportive activities may include:

(a) temporary access infrastructure required for restoration works;

(b) installation of monitoring devices (e.g., piezometers, benchmarks);

(c) field surveys, mapping and modelling essential for restoration design;

(d) activities that enable the implementation and maintenance of eligible measures.

Supportive actions shall not introduce drainage, degradation or land-use change inconsistent with restoration objectives.

The applicability of eligible activities to specific peatland areas shall follow the peatland condition classes defined in Section 6.3.

6.3 Activity applicability by peatland condition

Eligible project activities shall be applied according to the hydrological and ecological condition of each peatland stratum identified under Section 10.1. The suitability of each activity type depends on the current state of degradation and hydrological disruption. At minimum, the following guidance shall apply:

6.3.1 Conservation of intact peatland

Activities that avoid degradation or disturbance of hydrological regimes, including:

(a) Prevention of drainage or deepening of existing drainage canals;

(b) Avoidance of land conversion or infrastructure that would alter water levels;

(c) Prevention of fires through improved management and early-response systems;

(d) Control of invasive species and maintenance of peat-forming vegetation;

(e) Low-impact ecological management aimed at preserving natural peatland function.

Restoration in intact peatland is minimal; the focus is on protection and prevention.

6.3.2 Hydrological restoration of degraded peatland

Activities that restore the natural or near-natural water table and hydrological connectivity (applicable to moderately and severely degraded peatlands), including:

(a) Rewetting through blocking, filling or disabling drainage canals or ditches;

(b) Construction of bunds, dams, palisades or other hydrological structures;

(c) Reinstatement of natural surface-water flow and retention areas;

(d) Removal or modification of drainage infrastructure;

(e) Microtopographic interventions to retain water and slow desiccation.

6.3.3 Ecological restoration

Activities that support the recovery of natural vegetation and ecological processes, including:

(a) Promotion of native hydrophilic vegetation;

(b) Removal of invasive species that alter hydrology or accelerate peat degradation;

(c) Revegetation aimed at stabilizing hydrology and reducing fire susceptibility;

(d) Rehabilitation of fire scars or degraded vegetation patches.

6.3.4 Fire prevention and fire risk reduction

Measures that reduce the probability, extent or severity of fires in peatland, including:

(a) Hydrological restoration that increases moisture and reduces fuel dryness;

(b) Fuel-load management in high-risk areas;

(c) Early warning, surveillance and rapid-response systems;

(d) Community-based fire monitoring and prevention;

(e) Establishment or reinforcement of natural wet buffers.

6.4 Non-eligible activities

The following activities shall not be eligible under this methodology:

(a) Drainage, deepening, expansion, or construction of canals, ditches, or other drainage infrastructure;

(b) Conversion of peatland for agriculture, forestry, aquaculture, infrastructure, or extractive activities;

(c) Establishment of non-native or monoculture plantations on peatland;

(d) (j) Introduction, establishment or promotion of plant species classified as invasive, alien or harmful under national regulations, official species lists or environmental authorities;

(e) Mechanical peat extraction, peat mining, or removal of peat for any purpose;

(f) Activities that result directly or indirectly in long-term drying, oxidation, or destabilization of peat soils;

(g) Activities whose primary objective is biomass production or land-use change rather than peatland conservation or restoration;

(h) Activities incompatible with national regulations for wetlands or organic soils;

(i) Activities that increase fire risk, including practices that promote surface drying, uncontrolled burning, or removal of protective vegetation in vulnerable peat areas;

(j) Activities involving intensive use of heavy machinery that cause soil compaction, disturbance, or hydrological disruption, unless their use is clearly justified and demonstrated to support hydrological or ecological restoration.

6.5 Conditions for long-term carbon storage

Eligible activities shall not reduce the long-term stability or carbon-storage capacity of peat soils. To be eligible, all project activities shall meet the following conditions:

(a) The project shall maintain or restore a hydrological regime that prevents peat oxidation over the long term.

(b) Activities shall demonstrate that peat soils will remain saturated or with water table levels consistent with reduced CO_2 emissions.

(c) The minimum expected duration of carbon benefits shall be at least 100 years, consistent with long-term carbon storage requirements under the BioCarbon Standard.

(d) Any installed hydrological structures shall be designed for long-term functionality and shall include maintenance plans and provisions for monitoring.

(e) Project activities shall not create new drivers of peatland degradation in adjacent or hydrologically connected areas.

7 Terms and definitions

Additionality

It is the characteristic that allows demonstrating that the reductions of GHG emissions or removals derived from implementing a GHG project activity generate a net benefit to the atmosphere in terms of reduced or removed GHG emissions.

Those GHG emission reductions project holders demonstrates that would not occur in the absence of the project are considered additional, as described in section 9 of this document.

Source: Adapted from the Glossary CDM terms. Version 10.0.

Baseline scenario or reference scenario

The baseline scenario is the scenario that reasonably represents the sum of the variations in carbon stocks, included in the project boundaries, that would occur in the absence of the project's activities.

Source: Adapted from the Glossary CDM terms. Version 10.0

Degraded peatland

A peatland in which natural hydrological conditions, ecological integrity, or carbon storage capacity have been diminished due to anthropogenic or natural disturbances. Such disturbances include drainage, sustained lowering of the water table, peat oxidation, fire, vegetation loss, compaction, or erosion. According to the IPCC (2014), peatland degradation occurs when the water table remains sufficiently below the surface to permit aerobic decomposition of peat, resulting in increased CO_2 emissions and altered ecosystem functioning.

Ecological Restoration

According to the Society for Ecological Restoration SER (2025) "ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed."

Fire-prone peatland

A peatland in which hydrological degradation, such as drainage, sustained lowering of the water table, or surface drying, combined with vegetation changes or climatic stressors, creates conditions that permit ignition and smoldering combustion of peat or surface biomass. According to the IPCC (2014), peat fires occur primarily when the water table drops sufficiently below the peat surface to enable aerobic drying of upper peat layers, allowing smoldering combustion to be initiated and sustained under low-moisture conditions.

GHG emission reductions

The quantified decrease in greenhouse gas emissions relative to the baseline scenario resulting from project activities. In peatland contexts, emission reductions arise primarily from the suppression of aerobic peat oxidation following rewetting, decreases in CO_2 emissions due to higher water tables, reductions in CH_4 and N_2O fluxes where applicable, and the elimination or substantial reduction of fire-related emissions.

According to the IPCC (2014), re-establishing saturated conditions reduces peat decomposition and fire occurrence, leading to measurable declines in GHG emissions compared to drained or degraded peatlands.

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

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

[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]

GHG removals

The long-term uptake, accumulation, or retention of carbon resulting from project activities that restore or maintain the ecological and hydrological conditions of peatland. In accordance with the IPCC (2014), removals in peatlands arise from processes that enhance carbon sequestration, such as the recovery of hydrophilic vegetation and organic matter accumulation, and from the maintenance of saturated peat conditions that prevent aerobic decomposition. GHG removals represent the net increase in stored carbon or the avoided loss of carbon that would otherwise be released under drained or degraded conditions.

Hydrological connectivity

The natural or restored movement and exchange of water within a peatland and between hydrologically linked peatland units, including surface water flow, subsurface flow and vertical water exchanges. According to the IPCC (2014), maintaining hydrological connectivity is essential for sustaining high water table levels, minimizing peat oxidation and preserving peatland ecological functions. Loss or disruption of hydrological connectivity caused by drainage, barriers, channelization or upstream abstraction can lower the water table, increase aerobic peat decomposition and lead to degradation.

Hydrological infrastructure

Physical structures installed, rehabilitated or modified through project activities to manage or restore water movement within peatland, including dams, bunds, palisades, canal blocks, ditch filling structures and other water retention or flow control features. These structures are intended to raise or stabilize the water table, restore hydrological connectivity and prevent the drainage or drying that leads to peat oxidation. According to the IPCC (2014), hydrological interventions that maintain saturated conditions are essential for reducing aerobic decomposition of peat and limiting fire risk.

Hydrological restoration

Interventions implemented to re-establish or improve natural water regimes in peatland so that saturated or near-saturated conditions are maintained throughout the year. Hydrological restoration includes actions such as blocking or disabling drainage channels, constructing dams, bunds and water retention structures, re-instating surface water flow and eliminating sources of artificial drainage. According to the IPCC (2014), restoring high water table levels is essential for reducing aerobic peat decomposition, limiting fire risk, stabilizing carbon stores and recovering the ecological functions of peatland.

Hydrological unit

A contiguous area of peatland that operates as a single and coherent hydrological system in which water inputs, storage and flows are functionally connected. A hydrological unit may include surface water, subsurface flow paths and shared groundwater influences. According to the IPCC (2014), hydrological units in peatlands are defined by the natural water regime that maintains saturated conditions and regulates peat accumulation and decomposition. Disturbance or fragmentation of a hydrological unit, such as through drainage or water diversion, can alter water table levels, disrupt hydrological connectivity and accelerate peat degradation.

Intact peatland

A peatland that retains its natural hydrological regime, exhibits minimal human or natural disturbance and maintains saturated or near-saturated conditions that limit aerobic peat decomposition. According to the IPCC (2014), an intact peatland is characterized by a consistently high-water table, stable peat-forming vegetation, and ecological processes that support long-term carbon accumulation. Intact peatlands show little or no evidence of drainage, peat oxidation, fire, vegetation loss or structural alteration and function as effective carbon stores under undisturbed conditions.

Leakages

Leakages are the measurable and attributable changes in anthropogenic GHG emissions that occur outside the project boundary as a direct or indirect result of project activities. According to the IPCC (2006); IPCC (2014), leakage represents the net increase in emissions from sources not included within the project area but influenced by the intervention. In peatland projects, leakage may arise from unintended hydrological impacts, displacement of land-use activities, shifts in market-driven production or additional transport emissions. Only leakage that is quantifiable, attributable to the project and not already included in baseline or project emissions shall be considered.

Monitoring period

The period of time during which GHG emission reductions or removals generated by the project are measured, recorded and reported for verification. The monitoring period shall be defined in the Project Document and shall follow the requirements of the BioCarbon Standard for frequency, duration and data completeness. Consistent with IPCC inventory principles, the monitoring period represents the interval for which activity data, emission factors and all relevant parameters are collected and documented to quantify GHG impacts.

Organic soil / Peat soil

Soil composed predominantly of organic material that has accumulated from the partial decomposition of plant remains under water saturated or anaerobic conditions. According to the IPCC (2006); IPCC (2014) organic soils are characterized by high organic matter content and low bulk density and form when waterlogging limits aerobic decomposition. For the purpose of this methodology, organic soil is considered equivalent to peat soil when it meets IPCC criteria for organic soil formation, including sustained saturation, organic material accumulation and characteristics consistent with peat deposits.

Peat

Partially decomposed organic material that has accumulated under water saturated and anaerobic conditions. Peat forms when limited oxygen availability slows decomposition, allowing organic matter to build up over long periods of time. In the IPCC Guidelines, peat is identified as the characteristic material of peatlands and a major long-term carbon reservoir IPCC (2014).

Peat oxidation

The aerobic decomposition of peat that occurs when the water table drops sufficiently below the peat surface, allowing oxygen to penetrate upper peat layers and enabling microbial activity. According to the IPCC (2014), peat oxidation is the primary source of CO_2 emissions from drained or degraded peatlands, and its rate increases when peat becomes unsaturated, warmer or more exposed to air. Sustained peat oxidation leads to loss of peat volume, subsidence and long-term carbon depletion.

Peatlands

Land areas where a naturally accumulated layer of peat is present as the main substrate. Peatlands form under water saturated and anaerobic conditions that slow the decomposition of organic material and allow peat to accumulate over long periods of time. In the IPCC (2014), peatlands are defined through the presence of peat rather than vegetation type, land cover or ecosystem category. Peatlands may be forested or non-forested and occur in tropical, temperate, boreal and high mountain regions.

Peatland condition indicators

Biophysical parameters used to assess the ecological and hydrological state of a peatland, including vegetation composition, soil moisture, water table depth, hydrological connectivity, surface stability, evidence of peat oxidation, fire scars and signs of physical disturbance. Peatland condition is evaluated through variables that reflect water saturation, vegetation typical of peat-forming environments and the absence of drainage or degradation processes. These indicators help determine whether a peatland is intact, degraded or in recovery following restoration activities (IPCC 2014).

Permanence

The condition resulting from the project activities whereby the system implemented within its limits extends continuously and over time, removing GHG from the atmosphere.

Project area

The delineated area of peatland where conservation or restoration activities are implemented and where GHG emission reductions or removals are generated and claimed. The project area shall contain all land units in which hydrological, ecological or management interventions directly influence water table depth, peat condition or GHG emissions. The project area shall be clearly mapped, georeferenced and justified in the Project Document, consistent with principles of boundary definition applied in the IPCC Guidelines (2019).

Reversal

A measurable and verified increase in GHG emissions within the project boundary that negates, in whole or in part, previously credited emission reductions or removals. A reversal may occur when hydrological or ecological conditions deteriorate after credit issuance, resulting in renewed peat oxidation, fire events or other disturbances that re-release stored or avoided emissions. Only increases in emissions attributable to conditions within the project boundary and corresponding to credited pools or sources shall be considered reversals, and the event must be documented and verified during a monitoring or verification cycle.

Rewetting

A form of hydrological restoration in which the water table in previously drained or degraded peatland is raised to saturated or near-saturated conditions in order to reduce or prevent aerobic peat decomposition. Rewetting restores the natural water regime that limits oxygen penetration into peat layers, suppresses peat oxidation, reduces fire susceptibility and supports ecological processes that maintain long-term carbon storage (IPCC, 2014).

Soil organic matter

According to (SER, 2025) soil organic matter comprises all organic materials of plant or animal origin, decomposed, partially decomposed and undecomposed. It is generally synonymous with humus, although the latter is more commonly used to refer to well-decomposed organic matter, referred to as humic substances. Soil organic matter is a primary indicator of soil quality.

Subsidence

The lowering of the peat surface caused by peat oxidation, compaction or loss of water content. Subsidence reflects the reduction of peat volume that occurs when drainage or drying increases aerobic decomposition and structural collapse of peat layers. Persistent subsidence is a measurable indicator of hydrological and ecological degradation in drained peatlands (IPCC, 2014).

Water table depth (WTD)

The vertical distance between the peat surface and the saturated zone within the peat profile. WTD is the primary hydrological parameter controlling peat oxidation, CH_4 dynamics, hydrological stability and fire susceptibility. Changes in WTD determine whether peat layers remain anaerobic or become aerated, which directly influences greenhouse gas emissions and peatland condition (IPCC, 2014).

8 Eligibility criteria

This section defines the eligibility criteria that project areas shall meet to qualify under this methodology, along with additional requirements that apply to project activities. Eligibility of project activities is defined in Section 6.2. All eligibility requirements shall be demonstrated at validation and maintained throughout the crediting period.

8.1 Eligibility of project areas

A project area shall be eligible when it meets the definition of peatland in Section 6.1 and demonstrates hydrological and ecological conditions consistent with peat formation or degradation. In addition to meeting the peatland-type requirements, the project shall demonstrate:

(a) Risk of degradation or continued emissions, documented through evidence such as historical drainage, recurrent seasonal drying, subsidence measurements, fire occurrence, or land-use pressures that threaten hydrological integrity;

(b) Hydrological relevance, demonstrated by field observations, water table data, hydrological mapping, peat-depth surveys, or documented evidence of connectivity between the project area and surrounding hydrological units;

(c) Membership in a hydrological unit, supported by topographic or hydrological analysis (e.g., flow direction, catchment delineation, drainage networks) to confirm that project activities can influence the water table or hydrological regime of the peatland;

(d) Documentation showing that project interventions will not cause adverse hydrological effects outside the project boundary;

(e) Clearly mapped and georeferenced project boundaries that reflect the hydrological logic of the peatland system.

(f) The project area shall also demonstrate one of the following conditions:

  (i) face a credible risk of hydrological or ecological degradation in the absence of the project, or
  (ii) present evidence of existing degradation, including drainage, subsidence, peat oxidation, fire impacts, or vegetation loss.

(g) The land within the project boundary shall not be subject to legally authorized or planned activities that require drainage, conversion, extraction, or other interventions incompatible with peatland conservation or restoration.

(h) The project holders have legal rights to implement all project activities and to prevent activities that would compromise the peatland's hydrological integrity.

(i) Exclusion of areas already under protection (conditional)

Protected areas may be eligible only if:

  (i) the project activities generate measurable and additional GHG benefits beyond existing legal protections, and
  (ii) the project holders can demonstrate active management responsibilities.

8.2 Eligibility of project activities

8.2.1 Conditions of eligibility

Project activities shall meet the eligibility requirements defined in Section 6.2 and shall be consistent with hydrological, ecological and regulatory conditions relevant to peatland management. In addition to the requirements established in Section 6.2, eligible project activities shall demonstrate:

(a) Consistency with national wetland or peatland management plans, strategies or policies, where such plans exist, ensuring alignment with national priorities for wetland conservation, restoration or climate adaptation;

(b) Consistency with sustainable land-use and peatland management practices, including avoidance of actions that would compromise ecological integrity, hydrological stability or biodiversity values;

(c) Technical appropriateness for the peatland condition class defined in Section 6.3, supported by hydrological and ecological evidence that justifies each intervention;

(d) No potential to increase long-term hydrological degradation, soil compaction, vegetation loss or fire risk within or around the project area, and verified absence of any significant long-term deterioration of peatland hydrological conditions resulting from the proposed interventions;

(e) Feasibility and proportionality of interventions, ensuring that activities are appropriate in scale, necessary to achieve project outcomes and aligned with best practices for peatland restoration and conservation;

(f) Compatibility with national environmental regulations, including restrictions on drainage, land conversion, use of invasive species and disturbance of protected ecosystems.

8.2.2 Eligibles activities

Eligible interventions shall meet the following requirements; accordingly, activities shall:

(a) Conserve or restore peatland hydrology or ecology, including:

- (i) maintaining or raising the water table,
- (ii) blocking or disabling drainage infrastructure,
- (iii) reinstating surface water retention,
- (iv) restoring hydrological connectivity,
- (v) preventing fires,
- (vi) recovering natural wetland vegetation

(b) Not introduce new drivers of degradation, such as:

- i) new drainage infrastructure,
- ii) conversion of peatland for agriculture or forestry,
- iii) mechanical peat extraction,
- iv) establishment of plantations incompatible with natural hydrology.

(c) Contribute directly to reduced peat oxidation, reduced fire risk, or enhanced carbon storage;

(d) Demonstrate technical feasibility and based on sound hydrological and ecological principles;

(e) Include maintenance and monitoring provisions to ensure long-term functionality;

(f) Comply with national and local environmental legislation relevant to wetlands and peat soils;

(g) Minimize the use of heavy machinery to avoid peat disturbance and associated GHG emissions, except where the temporary use of such machinery is technically justified, strictly necessary for hydrological restoration, and implemented under controlled conditions that prevent long-term impacts.

8.3 Exclusions and restrictions

The following areas and activities shall be excluded:

(a) Areas where drainage infrastructure cannot be effectively disabled or reversed;

(b) Areas undergoing ongoing or planned peat extraction, land conversion, or activities requiring long-term drainage;

(c) Activities whose primary objective is biomass production, land-use change, or any intervention not aimed at peatland conservation or restoration;

(d) Activities that increase long-term GHG emissions or degrade peatland condition;

(e) Activities involving heavy machinery or construction that significantly disturbs peat, unless justified and demonstrated as necessary for hydrological restoration.

9 Project boundaries

The project boundaries define the physical, hydrological, temporal, and accounting limits within which greenhouse gas (GHG) emission reductions and removals are quantified. All boundaries described in this section shall be clearly documented and justified at validation.

9.1 Geographical boundaries

The geographical boundary shall include all land areas where project activities are implemented and where changes in hydrology, vegetation, fire risk, or soil conditions attributable to the project may influence GHG emissions or removals.

The geographical boundaries shall encompass all areas where project interventions occur and where direct biophysical effects are expected. These boundaries shall include:

(f) The project area where peatland restoration, conservation, or management interventions take place;

(g) Adjacent peat-forming ecosystems that are hydrologically connected and may influence or be influenced by project actions;

(h) Areas hosting project-related infrastructure, access routes, or staging areas;

(i) A defined buffer zone surrounding the project area, where indirect influences or spillover risks may occur, including potential edge effects, water redistribution, or increased fire vulnerability.

Project holders shall delineate the geographical boundary using GIS-based maps that include:

(j) the project area;

(k) peat depth information, where available;

(l) major hydrological features (streams, wetlands, depressions);

(m) existing drainage canals, ditches, or other infrastructure;

(n) fire scars or other indicators of degradation;

(o) any areas hydrologically or ecologically connected to the project area.

Geographical boundaries shall be represented with coordinates in a verifiable spatial reference system.

9.2 Hydrological boundaries

The hydrological boundary defines the extent of the hydrological unit(s) that influence or are influenced by water movement across the project area.

Hydrological boundaries shall be defined to reflect the water flows, storage dynamics, and drainage systems that determine peatland function. The hydrological boundary definition shall include:

(a) Identification of natural and artificial drainage basins, water catchments, and micro-topographic units relevant to peat formation and saturation;

(b) Description of surface water flow patterns, groundwater gradients, and seasonal water table fluctuations that influence peat stability;

(c) Clear distinction between hydrological information derived from:

   (i) hydrological modelling (e.g., groundwater models, surface flow models), and

   (ii) field-based measurements (e.g., piezometers, dipwells, flow meters), specifying the conditions under which each dataset is required and the acceptable levels of uncertainty;

(d) A hydrological study shall be mandatory when:

  i) the project area contains mixed drainage conditions or multiple drainage sources;
  ii) water table restoration may affect downstream users or adjacent ecosystems;
  iii) historical drainage patterns are complex or poorly documented;
  iv) the project involves construction, removal, or modification of water-control structures;

(e) Monitoring points and measurement locations used to verify hydrological responses during implementation.

The hydrological boundary shall include:

(a) the full extent of peatland hydrological units connected to or impacted by project activities;

(b) areas within the project where water table depth (WTD) is expected to change due to rewetting or conservation measures;

(c) areas where hydrological connectivity is restored or maintained;

(d) any upstream or downstream peatland sections that may affect or be affected by hydrological changes.

Where hydrological units extend beyond the project area, impacts shall be evaluated to ensure that no unintended degradation or hydrological leakage occurs outside the project boundary.

9.3 Project infrastructure and hydrological structures

The project boundary shall include all physical infrastructure and hydrological structures that influence peatland condition or contribute to the implementation of restoration measures. These include:

(a) Permanent hydrological structures such as dams, weirs, ditch blocks, bunds, and water control gates;

(b) Modified or decommissioned drainage systems (ditches, canals, culverts, pumps);

(c) Temporary structures used during implementation, including temporary access tracks, staging areas, earthworks, and temporary water retention devices;

(d) Permanently installed monitoring and measurement devices, such as piezometers, groundwater wells, staff gauges, water level loggers, meteorological sensors, and soil moisture probes;

(e) Infrastructure required for fire prevention or early warning systems;

(f) Equipment or platforms associated with ecological monitoring, hydrological monitoring, or safety controls.

9.4 Temporal boundaries

The temporal boundary covers the full period during which:

(a) baseline conditions are assessed;

(b) project activities are implemented;

(c) GHG emissions and removals are monitored;

(d) GHG benefits are credited.

Project activities shall have a defined start date, and quantification periods shall follow the requirements of the BioCarbon Standard. The project holders shall document the timeline of interventions, including restoration measures requiring multi-year implementation.

9.5 Carbon pools and GHG sources

The carbon pools and GHG sources applicable under this methodology, including their classification as mandatory or optional and their behavior under baseline and project conditions, are presented in Table 1.

Table 1. Carbon pools considered under this methodology

Carbon Pool	**Mandatory/Optional**	**Scenario**	**Justification / Explanation**
Peat soil carbon	Mandatory	Baseline	Largest and most important carbon pool in peatlands[1]. Under degraded conditions (e.g., drainage, lowered WTD, oxidation), peat carbon decreases due to aerobic decomposition.

[1] The understanding of soil organic carbon distribution and dynamics is also consistent with international soil carbon assessment frameworks, including the GSOCseq technical specifications (FAO, 2020).

Carbon Pool	Mandatory/Optional	Scenario	Justification / Explanation
		Project	Project activities that maintain or restore saturated or near-saturated hydrological conditions (e.g., blocking drains, preventing degradation, conserving intact hydrology) substantially reduce peat oxidation and lead to sustained reduction of CO_2 emissions. Long-term stabilization of peat carbon may occur under both conservation and effective restoration.
Aboveground biomass (AGB)	Optional	Baseline	Small relative to peat soil, but may decline in degraded areas (e.g., fire, vegetation loss, drainage). Spatially variable depending on ecosystem type.
		Project	May increase under restoration activities that promote native vegetation recovery or prevent fire. In conservation areas, AGB remains stable or may gradually increase. This pool may be included only when robust monitoring data are available.
Belowground biomass (BGB)	Optional	Baseline	Typically minor compared to peat soil carbon. Often reduced in degraded peatlands due to vegetation stress or hydrological disruption.
		Project	May increase where hydrological or ecological restoration promotes root biomass recovery and peat-forming vegetation. Optional pool, include only when reliably measurable.
	Optional	Baseline	Not usually a major contributor. May decrease due to fires, oxidation, or

Carbon Pool	Mandatory/Optional	Scenario	Justification / Explanation
Dead organic matter (Litter)			vegetation loss in degraded peatlands.
		Project	DOM stabilizes under wetter or conserved conditions, and may accumulate gradually if vegetation recovers. Include only where sampling is feasible and uncertainty remains low.

The Table 2 presents the GHG emission sources included in the methodology, specifying whether they are mandatory or optional and summarizing their expected behavior under the baseline and project scenarios.

Table 2. Emission sources and GHGs selected for accounting

GHG Source	Mandatory/Optional	Scenario	Justification / Explanation
CO_2 from peat oxidation	Mandatory	Baseline	Main baseline emission. High aerobic peat oxidation when WTD is lowered; CO_2 release increases with deeper drainage.
		Project	CO_2 emissions decrease under project conditions that restore or maintain higher water table levels (e.g., hydrological restoration, effective conservation), which suppress aerobic peat oxidation.
CH_4 emissions	Mandatory	Baseline	Hydrology-dependent. Typically low in drained peatlands due to inhibited anaerobic processes.
		Project	CH_4 emissions may increase in areas where water table levels rise under project activities that restore saturation; however, this increase is generally outweighed by large CO_2 reductions. CH_4 may remain low in conservation areas with stable hydrology.

GHG Source	Mandatory/Optional	Scenario	Justification / Explanation
N_2O emissions	Optional	Baseline	Include only if justified. Usually negligible unless nitrogen inputs or agricultural uses exist.
		Project	Rarely significant in peatlands. Expected to remain very low or unchanged under both conservation and restoration conditions unless nutrient inputs are introduced.
Fire emissions	Mandatory when applicable	Baseline	Highly variable. Fire events in drained or degraded peatlands may produce significant CO_2, CH_4, and N_2O emissions; deep peat fires are possible.
		Project	Project activities that maintain or restore high moisture levels, improve fire prevention, or reduce ignition risk lead to negligible or zero fire emissions in most years.
Leakage emissions	Mandatory when applicable	Baseline	Occur only if leakage drivers (e.g., displaced activities, hydrological effects) are present outside the boundary. Depends on surrounding land uses.
		Project	Only residual leakage is deducted. Expected to be low or zero with effective management, monitoring, and stakeholder engagement.
Transport emissions	Optional	Baseline	Include only if project-induced transport exists; typically minor in peatland landscapes.
		Project	Rare in peatland projects; include only if eligible activities cause additional fuel use compared to baseline.
Drainage-related emissions	Mandatory when applicable	Baseline	Part of baseline deterioration. Continued or deepened drainage increases CO_2 emissions due to enhanced oxidation.

GHG Source	Mandatory/Optional	Scenario	Justification / Explanation
		Project	Project activities that prevent or stop drainage (e.g., disabling drains, maintaining intact hydrology) eliminate or reduce drainage-driven CO_2 emissions.

10 Stratification and sampling requirements

10.1 Stratification and peatland zonation

The project area shall be stratified to improve accuracy, reduce uncertainty and ensure that differences in peatland condition are properly represented in greenhouse gas quantification. Stratification allows the separation of areas with distinct hydrological, ecological or physical characteristics that influence emissions and removals.

At minimum, stratification shall consider hydrological conditions, peat depth, dominant vegetation classes and degradation status, as these variables determine water table dynamics, peat oxidation rates, methane production, fire susceptibility and restoration outcomes.

10.1.1 Hydrological strata

Hydrological strata represent distinct water table regimes within the project area that influence peat oxidation, methane fluxes, fire susceptibility and overall peatland condition. Stratifying the project area by hydrological status improves the accuracy of emission factors and reflects the ecological responses of peatland to drainage or rewetting.

Hydrological strata shall, at minimum, distinguish the following categories:

(a) Saturated or near-saturated peatland

Peatland where the water table is at or very close to the peat surface for most of the year. These conditions maintain anaerobic environments within the peat layer, suppress aerobic peat oxidation and limit the occurrence of deep peat fires. Methane fluxes are driven by water table position, vegetation type and temperature.

(Reference: IPCC (2014), Chapter 2 and rewetting guidance.)

(b) Seasonally lowered water table

Peatland where the water table remains high during wet months but drops below the peat surface during part of the year. These fluctuations create alternating anaerobic and aerobic periods within the peat layer, leading to moderate peat oxidation, increased subsidence and variable methane dynamics. Seasonally lowered conditions often occur in peatlands with shallow legacy drainage or climatic seasonality.

(Reference: IPCC (2014), water table position as determinant of CO_2 and CH_4 fluxes.)

(c) Persistently lowered water table

Peatland where the water table remains substantially below the peat surface for extended periods, typically due to drainage, channelization or hydrological disruption. These conditions enable continuous aerobic peat decomposition, elevated CO_2 emissions, increased fire susceptibility and pronounced subsidence. Persistently lowered water table strata represent degraded hydrological conditions and are associated with the highest baseline CO_2 emissions.

(Reference: IPCC (2014), drained organic soils and associated CO_2 emission factors.)

Hydrological stratification shall be supported by measurements of water table depth (WTD), evidence of drainage infrastructure, field observations of peat condition and any remote sensing or hydrological data used to document water movement and saturation regimes.

10.1.2 Peat depth strata

Peat depth strata represent categories of peat thickness that affect peatland hydrology, carbon storage and GHG emission dynamics. Stratifying the project area by peat depth improves the accuracy of emission estimates and reflects the biophysical characteristics that influence peat oxidation, subsidence, fire behavior and restoration outcomes. At minimum, the following peat depth classes shall be distinguished:

(a) Shallow peat (peat depth < 30 cm)

Peat layers that are thin, discontinuous or recently developed. Shallow peat areas are more sensitive to drainage and may lose saturated conditions rapidly. Carbon stocks are lower than in deeper deposits, and peat oxidation may progress quickly once the water table drops.

(Reference: IPCC (2006); IPCC (2014), definitions of organic soils and minimum peat depth thresholds.)

(b) Moderate peat depth (30–100 cm)

Peat deposits of intermediate thickness that support significant carbon storage and moderate hydrological buffering. These areas show measurable subsidence and oxidation under drainage and respond well to rewetting interventions. They also represent transitional zones between shallow and deep peat systems.

(Reference: IPCC (2014) categories for organic soils under forestry, cropland and grassland with medium peat depth.)

(c) Deep peat (> 100 cm)

Peat deposits exceeding one meter in depth, characteristic of long-term peat accumulation under persistent saturation. Deep peat holds the largest proportion of carbon stocks, exhibits strong hydrological buffering capacity and is highly sensitive to drainage. Once degraded, deep peat deposits may experience accelerated oxidation, pronounced subsidence, and increased fire vulnerability. Rewetting of deep peat is essential for restoring long-term carbon stability.

(Reference: IPCC (2014), deep peat profiles and hydrological characteristics affecting CO_2 and CH_4 fluxes.)

Peat depth stratification shall rely on field measurements, soil coring, peat probes or verified soil maps. Stratification shall reflect actual peat thickness relevant to GHG accounting and restoration planning.

10.1.3 Vegetation classes

Vegetation classes represent dominant plant functional groups that influence hydrology, surface moisture, peat formation processes and GHG dynamics. Stratification by vegetation type improves the accuracy of emission factors and reflects ecological conditions relevant to peatland restoration. At minimum, the following vegetation classes shall be distinguished:

(a) Forested peatland

Peatland dominated by tree species adapted to saturated or seasonally saturated conditions. This class includes forested peat swamps in tropical regions such as the Congo Basin, Amazonia and Southeast Asia, as well as tree-dominated peat-forming systems in temperate and boreal regions. Forested peatlands typically exhibit canopy cover, peat-forming root systems and water tables that fluctuate seasonally within the peat layer.

(Reference: IPCC (2014), Chapters 2 and 3.)

(b) Shrub peatland

Peatland dominated by woody shrubs or small ericaceous vegetation characteristic of nutrient-poor, waterlogged environments. Shrub peatlands may develop where hydrological conditions support peat accumulation, but canopy development is limited by climate, water chemistry or disturbance history.

(Reference: IPCC (2014), classifications of shrub- and heath-dominated organic soils in peat-forming environments.)

(c) Herbaceous peatland

Peatland dominated by herbaceous plant communities, including sedges, grasses, mosses and other peat-forming ground vegetation. These systems are typical of minerotrophic and ombrotrophic peatlands, valley bogs, fens and open peat surfaces where herbaceous vegetation drives peat accumulation.

(Reference: IPCC (2014) descriptions of bogs, fens and graminoid-dominated peat systems.)

(d) High-mountain peat soils

Peat-forming systems in high-altitude environments, including páramo peatlands and alpine organic soils. These peatlands are characterized by cold climates, high moisture availability, saturated soils and vegetation dominated by tussock grasses, cushion plants and hydrophilic species adapted to frost and cloud immersion.

(Reference: IPCC (2014) category “high-altitude organic soils” within the Wetlands Supplement and FAO mountain peatland typologies.)

10.1.4 Degradation strata

To improve accuracy and reflect the hydrological and ecological condition of peatland, the project area shall be stratified into degradation classes. Degradation strata represent distinct levels of peatland condition that influence water table depth, peat oxidation, GHG emissions and restoration potential. Stratification shall, at minimum, distinguish the following categories:

(a) Intact peatland

Peatland that maintains natural hydrological regimes, exhibits minimal disturbance and retains saturated or near-saturated conditions. Intact peatland typically shows:

(i) Consistently high-water table depth,
(ii) limited or no evidence of peat oxidation,
(iii) absence of drainage infrastructure,

(iv) minimal subsidence,
(v) vegetation communities characteristic of peat-forming environments.

Intact peatland is associated with low CO_2 emissions and hydrology-driven CH_4 fluxes consistent with saturated conditions.

(b) Moderately degraded peatland

Peatland in which hydrological or ecological functions have been partially altered but not fully disrupted. Moderately degraded peatland typically shows:

(i) seasonal or localized lowering of the water table,
(ii) partial drainage influence (e.g., shallow ditches or legacy drainage),
(iii) measurable but moderate peat oxidation and subsidence,
(iv) early signs of vegetation change or loss of hydrophilic species,
(v) patchy fire scars or disturbance indicators.

This stratum emits increased CO_2 through oxidation while maintaining some capacity for ecological recovery under restoration.

(c) Severely degraded peatland

Peatland in which natural hydrological conditions have been substantially disrupted, resulting in strong drainage effects, extended unsaturated periods and advanced ecological degradation. Severely degraded peatland typically shows:

(i) persistently low water table levels across most of the year,
(ii) extensive or deep drainage networks,
(iii) high peat oxidation rates and marked subsidence,
(iv) widespread vegetation loss or conversion to non-peatland species,
(v) frequent fire occurrence or deep burn scars.

This stratum represents the highest baseline emissions (CO_2, fire-related GHGs) and the highest restoration potential, but also the highest risk if left unmanaged.

Degradation strata shall be supported by hydrological measurements (WTD), field observations, historical imagery and any additional evidence required to document peatland condition. Stratification shall be consistent with the IPCC (2014), which identifies water table depth and drainage status as primary determinants of peatland degradation and GHG emissions.

Each stratum shall be monitored and calculated separately, the aggregated using area-weighted estimates.

10.2 Sampling requirements

Sampling activities shall be designed to ensure statistically robust quantification of GHG reductions, allowing accurate estimation of peat condition, hydrological status, vegetation attributes, and any other biophysical parameters required for GHG accounting. The sampling design shall meet the following requirements.

10.2.1 Minimum sampling density

The sampling plan shall ensure sufficient spatial coverage and representativeness. At minimum:

(a) Sampling density shall be adequate to capture spatial variability in peat depth, water-table conditions, vegetation structure or other parameters relevant to emissions;

(b) A minimum density of 1 sampling point per defined hydrological unit or restoration management zone shall be required, unless justification for a different intensity is provided;

(c) In areas exhibiting high heterogeneity (e.g., mixed drainage influence, variable peat depths, mosaic vegetation), increased sampling density shall be required to reduce uncertainty;

(d) Sampling density shall be sufficient to achieve the confidence level required by the BioCarbon Uncertainty Tool.

Projects shall document the rationale for the chosen sampling density and demonstrate its adequacy.

10.2.2 Sampling design

Sampling design shall be statistically valid and appropriate for detecting differences in hydrology, peat condition and vegetation across strata. The sampling design shall follow statistically valid approaches, including:

(a) use random sampling within each stratum;

(b) Stratified random sampling (recommended when project areas include hydrological strata, vegetation zones or degradation states);

(c) ensure that sampling density captures spatial heterogeneity;

(d) Systematic grid sampling where spatial structure is well defined;

(e) enable replication during subsequent monitoring periods.

10.2.3 Allowed alternative sampling methods

The following alternative sampling approaches may be used when they improve efficiency, accuracy or representativeness, provided they are justified and documented:

(a) Cluster sampling, suitable in areas where sampling points can be grouped to reduce accessibility constraints or improve cost-efficiency;

(b) Adaptive sampling, permitted when rare, spatially clustered or patch-dependent conditions (e.g., localized deeper drainage effects, bare peat exposure, fire scars) require dynamic allocation of sampling effort;

(c) Double-sampling or two-phase sampling, where remote sensing indicators are calibrated through field data to optimize efficiency;

(d) Methods combining field sampling with remote sensing or hydrological modelling outputs, provided field data are used to validate, calibrate, or confirm assumptions.

10.2.4 Sampling parameters

Sampling shall generate field measurements for parameters required in this methodology, including:

(a) water table depth (WTD), measured at permanent or semi-permanent piezometers;

(b) peat depth, measured using corers or peat probes;

(c) indicators of peat condition, including subsidence, surface moisture and oxidation evidence;

(d) vegetation composition, using transects or plots where applicable;

(e) hydrological infrastructure performance, where sampling is required to verify function;

(f) evidence of fire scars or combustion layers when relevant.

10.2.5 Sampling frequency

Sampling frequency shall be sufficient to detect seasonal and interannual variability. At minimum:

(a) WTD shall be measured at least quarterly;

(b) peat depth shall be measured at baseline and re-measured only where subsidence or disturbance is expected;

(c) vegetation and peat condition indicators shall be assessed at least annually;

(d) additional measurements shall be taken after extreme weather events, major disturbances or restoration interventions.

10.2.6 Data quality and QA/QC

Sampling shall follow standardized field procedures and QA/QC requirements, including:

(a) calibration of instruments before and during field campaigns;

(b) documentation of field conditions, measurement methods and personnel;

(c) validation of outliers and correction of evident measurement errors;

(d) storage of raw data, field notes, photographs and GPS files;

(e) traceability of samples across monitoring periods.

10.2.7 Use of remote sensing

Remote sensing may complement field sampling when appropriate, including:

(a) land-use and vegetation mapping;

(b) detection of drainage features;

(c) fire detection (hotspots, burn scars);

(d) hydrological surface patterns.

Remote sensing shall not replace required field measurements unless explicitly justified and validated.

10.3 Documentation and transparency

Sampling plans shall include:

(a) A map of all sampling locations with coordinates;

(b) A description of sampling intensity, allocation, timing and frequency;

(c) Justification for methodological choices, including use of alternative sampling designs;

(d) Demonstration that sampling meets uncertainty requirements and supports verifiable quantification.

11 Baseline scenario and additionality

The baseline scenario represents the most plausible greenhouse gas (GHG) emission pathway in the absence of the project. Additionality ensures that the emission reductions or removals credited under this methodology are not business-as-usual and would not occur without the project activity. Both baseline scenario determination and additionality demonstration shall follow the requirements set out in this section.

11.1 Baseline scenario identification

The baseline scenario shall represent the most plausible conditions of the peatland in the absence of the project, reflecting hydrological, ecological, climatic and land-use drivers that determine peatland degradation pathways.

The identification of the baseline scenario shall consider:

(a) Existing land-use practices, hydrological alterations and drainage conditions that contribute to peat oxidation, subsidence or fire vulnerability;

(b) Historical and current management regimes, including drainage maintenance, vegetation removal, fire use, or other activities that would continue under business-as-usual;

(c) Climatic drivers that may exacerbate degradation, such as changes in precipitation patterns, increased evapotranspiration, temperature anomalies, and drought frequencies affecting water table stability;

(d) Natural processes that accelerate degradation, including drying trends, peat subsidence, vegetation collapse, erosion, permafrost thaw (where applicable), or increased fire susceptibility due to climatic stress;

(e) Regulatory, institutional or socio-economic conditions that influence land-use decisions and determine whether drainage or other degrading activities are likely to persist;

(f) Hydrological and ecological evidence demonstrating how current conditions would likely evolve without intervention;

(g) Observable trends in peatland condition, including water table decline, vegetation change, soil exposure, or ongoing drainage effects.

The resulting baseline shall reflect a conservative and evidence-based projection of emissions and ecological trajectories in the absence of project activities.

11.2 Baseline parameters and evidence

The baseline scenario shall be supported by transparent, measurable and verifiable evidence. The following parameters and information sources shall be used, as applicable:

(a) Historical and current water table measurements, groundwater gradients and hydrological monitoring records;

(b) Vegetation composition, peat condition class, land-use history and disturbance records;

(c) Soil physical and chemical parameters relevant to peat decomposition risk;

(d) Mapping of drainage infrastructure and hydrological pathways affecting peat stability;

(e) Fire history, fire risk indicators and associated GHG emission trends;

(f) Documented land-use and management practices, including maintenance of drainage systems, burning, clearing, or agricultural use;

(g) Relevant climatic datasets, including rainfall, evapotranspiration, and drought indices.

To strengthen robustness, projects may also provide supplementary scientific evidence (non-mandatory, but highly recommended):

(a) (Validated hydrological modelling describing expected baseline water table trajectories or drainage influence zones;

(b) Satellite-based time-series analysis (e.g., Sentinel, Landsat, MODIS, radar-based moisture indices) showing vegetation stress, moisture dynamics, fire scars, or land-use change over time;

(c) Subsidence measurements, including peat surface elevation change, where draining has historically occurred or is ongoing;

(d) High-resolution remote sensing to validate land cover, ground moisture conditions, peat exposure or disturbance extent;

(e) Modelled projections of climate-related risk factors that may intensify peatland degradation under baseline conditions.

All evidence shall be consistent, spatially explicit when possible, and sufficient to justify the assumptions underpinning the baseline scenario and its projected GHG emissions.

11.3 Baseline emissions

Baseline emissions shall represent the GHG emissions expected under the identified baseline scenario, considering hydrological, ecological and climatic characteristics described in Section 10.1 and Section 10.2.

Baseline emissions shall include, as applicable:

(a) Emissions from peat oxidation resulting from persistent drainage, lowered water tables or degraded vegetation;

(b) Emissions associated with fire events, including CH_4 and N_2O from combustion of peat and vegetation, where fire recurrence is part of the baseline;

(c) Emissions from ongoing land-use activities, such as agriculture, forestry drainage, or peat extraction, where these are demonstrated to continue under business-as-usual;

(d) Emissions reflecting natural degradation processes, including climate-driven drying trends or erosion, when evidence supports their occurrence in the baseline scenario;

(e) Any additional sources of baseline emissions applicable to specific peatland types or conditions, consistent with IPCC methodologies.

All baseline emissions shall be estimated in accordance with the applicable IPCC guidelines and the specific equations and calculation procedures referenced in this methodology.

11.4 Demonstration of additionality

Project activities shall demonstrate additionality by applying the BioCarbon Baseline & Additionality Tool (BioCarbon Cert, 2025f). Project holders shall demonstrate that:

(a) The project activity is not legally required

There are no existing regulations that mandate the conservation or restoration measures implemented by the project.

(b) The project activity is not financially viable without carbon finance

Hydrological or ecological restoration interventions require financial inputs that would not be mobilized without revenue from carbon credits.

(c) The project activity is not common practice

Conservation or restoration of peatland is not widespread in the region and does not represent standard land management practice.

(d) The baseline scenario represents a credible alternative

The baseline scenario shall be a plausible and realistic representation of conditions in the absence of the project.

(a) The project activity generates real and measurable climate benefits beyond the baseline

(b) Any claimed emission reductions or removals shall exceed what would occur in the absence of the project, based on conservative quantification methods.

Additionality shall be demonstrated at validation and reassessed at each renewal of the crediting period, following the requirements of the BioCarbon Standard.

12 Quantification of GHG reductions and removals

12.1 Quantification of the Baseline Emissions

Baseline emissions from peatland include greenhouse gas emissions that arise from the hydrological and ecological conditions present in the absence of the project. These emissions consist of:

(a) CO_2 emissions from peat oxidation, resulting from water table depths that allow aerobic decomposition of peat layers;

(b) CH_4 emissions driven by hydrological conditions, representing methane fluxes determined by water table position and anaerobic processes in the peat profile (IPCC, 2014);

(c) N_2O emissions, only if nitrogen-rich inputs or land use justify their inclusion;

(d) Fire-related emissions, including CO2, CH4 and N2O released during combustion events;

(e) Emissions from continued drainage, representing increasing CO2 emissions associated with deeper or expanding drainage that lowers the water table and increases peat oxidation (ΔEF).

In this methodology, CH_4 emissions in the baseline refer specifically to fluxes generated by the hydrological state of the peatland, primarily controlled by water table depth and the extent of anaerobic conditions within the peat layer.

All CH_4 and N_2O emissions shall be converted to CO_2-equivalent units (CO_2e) using the 100-year global warming potentials (GWP_{100}) adopted by the BioCarbon Standard, which are based on the IPCC (2014) Fifth Assessment Report (AR5).

Total baseline emissions shall be calculated according to the Equation 1:

$$BE_y = BE_{CO_2,y} + BE_{CH_{4},y}^{CO_{2e}} + BE_{N_2O,y}^{CO_{2e}} + BE_{fire,y}^{CO_{2e}} + BE_{Drain,y} \quad \text{Equation 1}$$

Where:

BE_y	=	Emissions, in the baseline scenario, in year y; tCO_2e
$BE_{CO_2,y}$	=	CO_2 emissions, in the baseline scenario, from peat oxidation, in year y; tCO_2
$BE_{CH_4,y}$	=	CH_4 emissions, in the baseline scenario, from hydrological conditions, in year y; tCO_2e
$BE_{N_2O_y}$	=	N_2O emissions, in the baseline scenario, if nitrogen-rich inputs or land use, in year y; tCO_2e
BE_{fire_y}	=	Fire-related emissions, in the baseline scenario, in year y; tCO_2e
$BE_{Drain,y}$	=	Emissions, in the baseline scenario, from continued drainage, in year y; tCO_2

12.1.1 Baseline CO_2 Emissions from peat oxidation

According to the IPCC (2014) (Equation 2.1) CO_2 from peat oxidation is directly related to drainage and depth of the water table.

$$BE_{CO_2,y} = \sum_i A_i \times EF_{CO_{2,i}} \quad \text{Equation 2}$$

Where:

$BE_{CO_2,y}$	=	Emissions from peat oxidation, in the baseline scenario, in year y; tCO2
A_i	=	Area of peatland stratum I; ha
$EF_{CO_{2,i}}$	=	CO_2 emission factor for peat oxidation ($tCO_2\ ha^{-1}\ yr^{-1}$), from IPCC defaults or project-specific measurements.

IPCC Default EF *examples*:

- Drained tropical peatland: ~ 73 $tCO_2\ ha^{-1}\ yr^{-1}$
- Drained temperate peatland: ~ 20–40 $tCO_2\ ha^{-1}\ yr^{-1}$
- Intact peatland: near zero to < 2 $tCO_2\ ha^{-1}\ yr^{-1}$

Project should use IPCC regional defaults or country-specific data when available.

12.1.2 Baseline CH_4 Emissions

Methane emissions depend strongly on water table depth and vegetation type.

Equation (IPCC 2014, Eq. 3.1):

$$BE_{CH_{4},y}^{CO_{2e}} = \sum_{i} A_i \times EF_{CH_{4,i}} \times GPW_{CH_4} \qquad \text{Equation 3}$$

Where:

$BE_{CH_4,y}$	=	CH_4 emissions, in the baseline scenario, in year y; tCO_2e
A_i	=	Area of peatland stratum *i*; ha
$EF_{CH_{4,i}}$	=	CH_4 emission factor for stratum *i*; $tCH_4\ ha^{-1}\ yr^{-1}$
GPW_{CH_4}	=	100-year global warming potential of CH_4; dimensionless

IPCC Default EF *examples*:

- Intact tropical peat swamps: high CH_4 emissions
- Drained peatlands: near-zero CH_4

Where typically:

GWP_{CH_4} = 28 (100-year horizon, AR5) unless otherwise required by the BioCarbon Standard.

12.1.3 Baseline N_2O Emissions (if applicable)

Only applicable when drainage or land use introduces nitrogen inputs.

Equation (IPCC, 2014. Volume 4, Eq. 11.1):

$$BE_{N_2O,y}^{CO2} = \sum_i A_i \times EF_{N_2O.y} \times GPW_{N_2O} \quad \text{Equation 4}$$

Where:

$BE_{N_2O,y}^{CO2}$	=	N2O emissions, in the baseline scenario, for stratum i, in year y; tCO_2e
A_i	=	Area of peatland stratum; ha
$EF_{N_2O.y}$	=	N2O emission factor for stratum i, in year y; $tN_2O\ ha^{-1}\ yr^{-1}$
GPW_{N_2O}	=	100-year global warming potential of N_2O; dimensionless

Most peatlands have low baseline N_2O unless fertilized or drained.

12.1.4 Fire-related baseline emissions

As demonstrated by Turetsky et al. (2015), fire events in drained or degraded peatlands can lead to catastrophic carbon losses, as smoldering combustion penetrates deep into peat deposits. Such fires may emit extremely high quantities of CO_2, CH_4 and N_2O, far exceeding emissions from surface biomass burning and representing one of the most significant disturbance-related sources of GHG emissions in peatland ecosystems.

According to the IPCC (2014), Eq. 2.6, the fire-related baseline emissions shall be calculated as:

$$BE_{Fire_y} = \sum_i \sum_g A_{burned,i} \times MB_i \times CF_i \times GEF_{g,i} \times 10^{-3} \times GWP_g \quad \text{Equation 5}$$

Where:

BE_{Fire_y}	=	Fire-related baseline emissions in year y; $tCO_2\ ha^{-1}\ yr^{-1}$
$A_{burned,i}$	=	Burned area in stratum *i; ha*
MB_i	=	Mass of available fuel (peat + vegetation) in stratum *i* (t dry matter yr^{-1})
CF_i	=	Combustion factor for stratum *i* (fraction of fuel actually combusted)

$GEF_{g,i}$	=	Gas-specific emission factor for g (g gas kg^{-1} dry matter
g	=	CO_2, CH_4, N_2O
10^{-3}	=	Conversion factor from g gas kg^{-1} d.m. to t gas t^{-1} d.m.
GWP_g	=	100-year Global Warming Potential for gas g

Peat fires are highly carbon-intensive:

- 100–300 $tCO_2e\ ha^{-1}$ per fire event (IPCC literature values)

Fire baseline shall consider historical recurrence.

12.1.5 Emissions from continued drainage

If drainage deepens naturally or through maintenance, additional emissions from continued drainage shall be calculated using Equation 6.

$$BE_{Drain,y} = \sum_i A_i \times \Delta EF_{CO_2,i} \qquad \text{Equation 6}$$

Where:

$BE_{Drain,y}$	=	Incremental baseline CO2 emissions from continued or deeper drainage in year y; $tCO_2\ yr^{-1}$
A_i	=	Area of peatland stratum i affected by deeper drainage conditions; ha
$\Delta EF_{CO_2,i}$	=	Incremental CO_2 emission factor for stratum i due to deeper drainage; $tCO_2\ ha^{-1}\ yr^{-1}$

The incremental emission factor $\Delta EF_{CO_2,i}$ shall be determined as:

$$\Delta EF_{CO_2,i} = EF_{deep,i} - EF_{shallow,i} \qquad \text{Equation 7}$$

Where:

$EF_{deep,i}$ = CO_2 emission factor for peat oxidation under deeper drainage conditions in stratum i ($tCO_2\ ha^{-1}\ yr^{-1}$). This factor reflects greater exposure of peat to oxygen due to a larger vertical distance between the peat surface and the water table, resulting in higher CO_2 emissions.

$EF_{shallow,i}$ = CO_2 emission factor for peat oxidation under shallower drainage conditions in stratum i ($tCO_2\ ha^{-1}\ yr^{-1}$). This factor corresponds to conditions where the water table is closer to the peat surface and oxygen exposure is reduced, resulting in lower CO_2 emissions.

The difference between $EF_{deep}$and $EF_{shallow}$reflects the well-established relationship between water table depth and peat oxidation rates, as documented in the IPCC (2014) Wetlands Supplement. As drainage deepens, CO_2 emissions increase due to enhanced aerobic decomposition. As guidance, the IPCC (2014) indicates that lowering the water table depth by 10 cm may increase CO_2 emissions by approximately 9 $tCO_2\ ha^{-1}\ yr^{-1}$, depending on peat type and site conditions.

12.2 Quantification of the Project Emissions

12.2.1 Total project emissions

Under project conditions, greenhouse emissions change in characteristic ways, as detailed in the following list:

(a) CO_2 emissions decrease, due to reduced aerobic oxidation of peat;

(b) CH_4 emissions may increase in areas where project activities restore sustained saturation;

(c) Fire-related emissions decrease substantially where project activities maintain or restore saturated or moist conditions that reduce ignition risk;

(d) N_2O emissions generally remain low, unless land-use or nutrient inputs alter nitrogen cycling.

Project emissions shall be quantified by aggregating emissions from all relevant greenhouse gases. Accordingly, total project emissions in year y shall be determined as the sum of CO_2, CH_4, N_2O, and any fire-related emissions, as presented in Equation 8.

$$PE_y = PE_{CO_2,y} + PE_{CH_4,y} + PE_{N_2O,y} + PE_{Fire,y} \quad \text{Equation 8}$$

Where:

PE_y = Total project emissions, in year y; tCO2 yr⁻¹

$PE_{CO_2,y}$ = Project CO_2 emissions from peat oxidation in year y; $CO_2e\ yr^{-1}$.

$PE_{CH_4,y}$ = Project CH_4 emissions in year y; $tCO_2e\ yr^{-1}$.

$PE_{N_2O,y}$ = Project N_2O emissions in year y; $tCO_2e\ yr^{-1}$

$PE_{Fire,y}$ = Project fire-related emissions in year y; $tCO_2e\ yr^{-1}$

PE(CH4,y) and PE(N2O,y) shall be calculated using the corresponding 100-year Global Warming Potential (GWP) values adopted in the BioCarbon Standard, as specified in Equation 10 and Equation 11.

All gas-specific project emissions included in Equation 7 shall be reported only in tCO_2e, ensuring internal consistency and enabling aggregation without further conversion.

Emissions of individual greenhouse gases under project conditions shall be quantified using the relevant emission factors for each stratum. Project emissions for CO_2, CH_4, and N_2O shall be determined in accordance with Equation 9, Equation 10, and Equation 11, respectively.

12.2.2 Project CO_2 emissions from peat oxidation

$$PE_{CO_2,y} = \sum_i A_i \times EF_{CO_2,rewet,i} \quad \text{Equation 9}$$

Where:

$PE_{CO_2,y}$ = Project emissions form peat oxidation in year y; $tCO\ yr^{-1}$

A_i = Area of peatland stratum i under project conditions; ha

$EF_{CO_2,rewet,i}$ = CO_2 emission factor for peat oxidation in stratum i under project conditions; $tCO_2\ ha^{-1}\ yr^{-1}$

Project holders shall use emission factors consistent with improved or maintained hydrological conditions resulting from eligible project activities.

12.2.3 Project CH_4 emissions

$$PE_{CH_4,y} = \sum_i A_i \times EF_{CH_4,i} \times GWP_{CH_4} \qquad \text{Equation 10}$$

Where:

$PE_{CH_4,y}$	=	Project CH_4 emissions in year y, $tCH_4\ yr^{-1}$
A_i	=	Area of peatland stratum i under project conditions; ha
$EF_{CH_4,i}$	=	CH_4 emission factor for stratum i under restored or maintained saturated conditions; $tCH_4\ ha^{-1}\ yr^{-1}$
GWP_{CH_4}	=	100-year Global Warming Potential of CH_4; dimensionless

This equation ensures that CH_4 emissions are consistently converted to CO_2e before being aggregated in Equation 9.

12.2.4 Project N2O emissions

$$PE_{N_2O,y} = \sum_i A_i \times EF_{N_2O,i} \times GWP_{N_2O} \qquad \text{Equation 11}$$

Where:

$PE_{N_2O,y}$	=	Project N2O emissions in year y, tCO2 yr^{-1}
A_i	=	Area of peatland stratum i under project conditions; ha
$EF_{N_2O,i}$	=	N2O emission factor for stratum i under project conditions; tN2O $ha^{-1}\ yr^{-1}$
GWP_{N_2O}	=	100-year Global Warming Potential of N2O; dimensionless

Where credible evidence shows that N_2O emissions are negligible under project conditions, project holders may assume PE_{N2O}, y=0, provided that this assumption is justified and documented in accordance with this methodology.

12.2.5 Project fire-related emissions

The treatment of fire emissions under project conditions is based on the scientific guidance provided in the IPCC (2014). According to the IPCC (2014), deep peat fires occur only when the water table has been lowered sufficiently to expose dry peat layers to oxygen, allowing sustained smoldering combustion. Peatlands with restored or maintained saturated conditions exhibit greatly reduced ignition potential and are significantly less prone to smoldering combustion.

Therefore, under this methodology, project fire-related emissions shall be assumed to be negligible or zero in years where project activities maintain or restore moisture conditions that prevent ignition, and where no verified fire event occurs.

If a fire event is detected and verified during the monitoring period, project fire-related emissions shall be quantified using Equation 12 with project-specific activity data.

$$PE_{Fire,y} \approx 0 \qquad \text{Equation 12}$$

12.3 Quantification of leakage

Leakage refers to increases in greenhouse gas (GHG) emissions that occur outside the project boundary as a direct or indirect result of project activities. Leakage shall be quantified to ensure that net GHG emission reductions reflect the total climate benefit attributable to the project.

12.3.1 Hydrological leakage

Hydrological leakage refers to unintended drying, altered water distribution, or other negative hydrological impacts occurring outside the project boundary as a direct or indirect result of project interventions.

Hydrological leakage shall be assessed as follows:

(a) Project holders shall evaluate upstream and downstream hydrological units connected to the project area to determine whether rewetting or hydrological interventions could cause drying in adjacent areas.

(b) If monitoring data or hydrological modelling indicate that water table depth (WTD) decreases in adjacent peatlands as a result of project interventions, the associated increase in CO_2 emissions shall be quantified as hydrological leakage.

The hydrological leakage shall be calculated with the Equation 13.

$$LE_{hydro,y} = \sum_{i} A_{i,out} \times \Delta EF_{CO_2,i} \quad \text{Equation 13}$$

Where:

$LE_{hydro,y}$	=	Hydrological leakage emissions in year y, representing increases in CO_2 emissions occurring outside the project boundary due to project-induced hydrological changes; $tCO_2e\ yr^{-1}$
$A_{i,out}$	=	Area of adjacent peatland stratum i negatively affected by a decrease in WTD; ha
$\Delta EF_{CO_2,i}$	=	Increase in CO_2 emission factor for stratum i due to lowered WTD ($tCO_2\ ha^{-1}\ yr^{-1}$), calculated as the difference between the deeper-drained and shallower-drained emission factors.

If no hydrological alteration is detected outside the project boundary, hydrological leakage shall be set to zero.

12.3.2 Activity-shifting leakage

Activity-shifting leakage occurs when activities displaced by the project (e.g., agriculture, grazing, fuelwood collection, drainage maintenance) are relocated to peatland areas or other carbon-rich ecosystems outside the project boundary.

Leakage from displaced activities shall be quantified in accordance with Equation 14:

$$LE_{act,y} = \sum_{i} A_{shift,i} \times EF_{shift,i} \quad \text{Equation 14}$$

Where:

$LE_{act,y}$	=	Activity-shifting leakage in year y, representing increases in GHG emissions occurring outside the project boundary due to displaced activities; $tCO_2e\ yr^{-1}$
$A_{shift,i}$	=	Area where displaced activities occur in stratum i; ha
$EF_{shift,i}$	=	Applicable emission factor for the displaced activity in stratum i; $tCO_2e\ ha^{-1}\ yr^{-1}$

If project documentation demonstrates that displaced activities:

(a) are eliminated,

(b) move to non-peatland areas with negligible emissions, or

(c) are absorbed by alternative livelihoods without increasing emissions,

then $LE_{act,y} = 0$

12.3.3 Market leakage

Market leakage occurs when project activities reduce the supply of products or services (e.g., peat extraction, fuelwood, agricultural outputs), causing increased production elsewhere that results in additional GHG emissions outside the project boundary. Market leakage shall be quantified conservatively using Equation 15.

$$LE_{market,y} = \sum_{k} Q_{disp,k,y} \times EF_{market,k} \qquad \text{Equation 15}$$

Where:

$LE_{market,y}$	=	Market leakage in year y, representing increases in GHG emissions outside the project boundary caused by market-mediated responses to project activities; $tCO_2e\ yr^{-1}$.
$Q_{disp,k,y}$	=	Quantity of product or activity k displaced or reduced by the project in year y (e.g., tonnes of peat not extracted, m^3 of fuelwood supply reduced, hectares of cultivation avoided)

$EF_{market,k}$	=	Emission factor associated with the external production or supply of product/activity k, expressed in CO_2e (tCO_2e per unit of product or activity).

Where project documentation demonstrates that:

(a) displaced products or activities are replaced by low-emission or zero-emission alternatives,

(b) displaced demand is not met elsewhere, or

(c) the displacement does not trigger measurable emissions

then $LE_{market,y} = 0$

12.3.4 Transport leakage (if applicable)

Transport leakage occurs when project activities induce additional fuel consumption or transportation requirements outside the project boundary, resulting in incremental GHG emissions. Transport leakage shall be quantified in accordance with Equation 16.

$$LE_{trans,y} = \sum_{k} FC_y \times EF_{fuel} \qquad \text{Equation 16}$$

Where:

$LE_{trans,y}$	=	Transport leakage in year y, representing additional GHG emissions attributable to fuel use caused by project activities; $tCO_2e\ yr^{-1}$
FC_y	=	Total fuel consumption attributable to project-induced transport outside the project boundary during year y (liters, kg, or energy-equivalent units)
EF_{fuel}	=	Emission factor of the fuel used, expressed in CO_2e per unit of fuel (tCO_2e per liter, per kg, or per energy unit), consistent with IPCC or national inventory factors.

If no additional transportation requirements or fuel use are induced by the project, transport leakage shall be set to zero. $LE_{trans,y} = 0$

12.3.5 Total leakage

Total leakage in year y shall be calculated as the sum of all applicable leakage sources, as presented in Equation 17.

$$LE_y = LE_{hydro,y} + LE_{act,y} + LE_{market,y} + LE_{trans,y} \quad \text{Equation 17}$$

Where:

LE_y	=	Total leakage emissions in year y; $tCO_2e\ yr^{-1}$
$LE_{hydro,y}$	=	Hydrological leakage in year y (Equation 13)
$LE_{act,y}$	=	Activity-shifting leakage in year y (Equation 14)
$LE_{market,y}$	=	Market leakage in year y (Equation 15)
$LE_{trans,y}$	=	Transport leakage in year y (Equation 16)

All leakage components shall be quantified conservatively, based on verifiable data, and following the principles of transparency and completeness.

Project-level leakage shall be limited to emissions that are directly attributable to project activities. Jurisdictional or national-level leakage is outside the scope of project-level quantification and shall not be assessed or deducted under this methodology.

If none of the leakage sources described above occur in year y, total leakage shall be set to zero.

12.4 Treatment of optional pools

Optional carbon pools may be included in the quantification of GHG emission reductions and removals when reliable data and scientifically justified methods are available. Optional pools shall only be included if their quantification does not increase uncertainty or risk overestimating the project's climate benefits. The following requirements shall apply:

12.4.1 Eligible optional pools

The following pools may be included as optional, provided their quantification is supported by documented evidence and consistent methodologies:

(a) Aboveground biomass

Changes in carbon stocks associated with vegetation regrowth following ecological restoration measures.

(b) Belowground biomass

Changes in root biomass where restoration activities demonstrably enhance the development of hydrophilic native vegetation.

(c) Dead organic matter (litter)

Carbon stored in litter or coarse woody debris where scientifically appropriate and where sampling can be carried out with sufficient accuracy.

(d) N_2O emissions or removals

Applicable only when nitrogen inputs, soil amendments, or land-use interactions warrant inclusion. In most peatland contexts, N_2O is negligible unless external nitrogen inputs are introduced.

12.4.2 Conditions for inclusion

Optional pools shall be included only when the project holders demonstrates that:

(a) Sufficient field data, sampling, or remote sensing evidence exist to quantify the pool reliably;

(b) The methodologies used follow recognized scientific standards and are consistent with IPCC guidance;

(c) Inclusion of the pool does not lead to an overestimation of emission reductions or removals;

(d) Monitoring of the pool is feasible throughout the crediting period;

(e) Uncertainty associated with the pool is within acceptable levels according to the BioCarbon Uncertainty Assessment Tool.

12.4.3 Conditions for exclusion

Optional pools may be excluded when:

(a) The pool contributes negligibly to overall carbon dynamics in peatlands;

(b) Data are insufficient to quantify the pool accurately;

(c) Exclusion does not lead to an overestimation of GHG reductions;

(d) Monitoring is not technically or financially feasible;

(e) The pool has high uncertainty that would compromise the integrity of emission reduction estimates.

If optional pools are excluded, the exclusion shall be documented and justified transparently.

12.4.4 Quantification

When optional pools are included, their changes in carbon stocks or emissions shall be quantified using recognized equations from the IPCC(2006); IPCC (2014), or the IPCC (2019). Quantification shall follow the same methodological principles applied to mandatory pools, including stratification, conservative assumptions, and uncertainty deductions.

12.4.5 Documentation requirements

The project holders shall document:

(a) The pools included or excluded;

(b) The justification for inclusion/exclusion;

(c) Data sources, sampling protocols, and analytical methods;

(d) Equations and assumptions applied;

(e) Uncertainty values and deductions applied.

12.4.6 Aggregation

When optional pools are included, their contributions to emission reductions or removals shall be aggregated with mandatory pools as:

$$ER_y^{total} = ER_y^{mandatory} + ER_y^{optional} \quad \text{Equation 18}$$

Where:

ER_y^{total}	=	Total emission reductions or removals in year y, including optional pools; $tCO_2e\ yr^{-1}$
$ER_y^{mandatory}$	=	Emission reductions or removals from all mandatory pools and sources in year y; $tCO_2e\ yr^{-1}$
$ER_y^{optional}$	=	Emission reductions or removals from optional pools included pursuant to Section 12.4; $tCO_2e\ yr^{-1}$

Optional pools may be included only when their quantification is supported by reliable data, and their exclusion does not result in an overestimation of net GHG emission reductions.

12.5 Net GHG emission reductions

Net GHG emission reductions represent the net climate benefit generated by the project after accounting for all required deductions and adjustments. Net GHG emission reductions shall be calculated annually for each monitoring period and aggregated across all peatland strata.

The quantification shall use conservative values for emission factors, activity data, leakage, and uncertainty deductions, following the methodological requirements set out in Sections 12.1, 12.2, 12.3, and 12.4.

Net GHG emission reductions in year y shall be calculated as the difference between baseline emissions and project emissions, adjusted for leakage and uncertainty, as shown in Equation 19.

$$ER_y = BE_Y - PE_Y - LE_y - UD_y \qquad \text{Equation 19}$$

Where:

ER_y	=	Net GHG emission reductions in year y. Represents the total climate outcome after subtracting project emissions, leakage, and uncertainty deduction applied to the gross emission reductions; $tCO_2e\ yr^{-1}$

BE_y	=	Baseline emissions in year y, including CO_2, CH_4, N_2O, fire-related emissions, and emissions from continued drainage, as applicable; $tCO_2e\ yr^{-1}$
PE_y	=	Project emissions in year y, including CO_2, CH_4, N_2O, and any fire-related emissions occurring under project conditions; $tCO_2e\ yr^{-1}$
LE_y	=	Leakage emissions in year y, including hydrological leakage, activity-shifting leakage, market leakage, and transport-related leakage, as applicable; $tCO_2e\ yr^{-1}$
UD_y	=	Uncertainty deduction in year y, determined using the BioCarbon Uncertainty Assessment Tool and based on the combined relative uncertainty of emission reduction estimates; $tCO_2e\ yr^{-1}$

All parameters shall be estimated conservatively using the procedures describing in this section.

Net GHG emission reductions shall be positive for the project to be eligible for credit issuance. If net reductions are negative or zero, no credits shall be issued for that year.

13 Leakage management

Leakage management includes the identification, prevention, monitoring, and mitigation of all leakage risks associated with project activities. The purpose of this section is to ensure that the project does not inadvertently increase greenhouse gas (GHG) emissions outside the project boundary and that any quantified leakage deductions reflect only residual, unavoidable leakage.

All leakage types identified in Section 12.3 shall be assessed and managed throughout the project implementation period, following the leakage assessment, monitoring, and deduction procedures established in this methodology.

13.1 Identification of leakage risks

Project holders shall identify all potential sources of leakage that may occur outside the project boundary as a result of project implementation. At minimum, the assessment shall consider:

(a) Displacement of land-use activities previously occurring within the project area (e.g., grazing, fuelwood harvesting, drainage maintenance, peat extraction);

(b) Leakage resulting from diversion of agricultural, forestry, or livelihood activities to surrounding peatlands or wetlands;

(c) Market-driven leakage where project restrictions cause increased pressure on undisturbed peatlands or alternative land areas;

(d) Displacement of fire practices or fire management strategies, including unintentional shifting of fire risk to adjacent areas;

(e) Risk of climatic leakage, where drainage or peatland degradation avoided in the project area could shift to other peatlands due to climate-driven pressures (e.g., increased fire incidence, drought-related land conversion);

(f) Risk of livestock migration or grazing displacement into adjacent peatlands or sensitive areas after exclusion from the project area;

(g) Legal or regulatory leakage risk, where local or national policy frameworks may incentivize drainage, land conversion or peat extraction outside the project boundary as a consequence of project restrictions;

(h) Leakage associated with construction, access, or transportation activities that may induce indirect degradation (e.g., soil compaction, accidental drainage impacts);

(i) Community-level leakage resulting from loss or reduction of access to natural resources, livelihoods, or traditional practices, potentially causing pressure on nearby ecosystems.

All identified leakage risks shall be documented, analyzed and considered in leakage quantification or mitigation plans, as applicable.

13.2 Leakage prevention measures

Project holders shall implement measures to prevent or minimize leakage risks identified under Section 12.3. Preventive measures shall include, as applicable:

(a) Providing alternative livelihood options or support measures for communities affected by restrictions within the project area, reducing the likelihood of activity displacement;

(b) Establishing grazing or resource-use agreements with local stakeholders to prevent livestock migration into adjacent peatlands or protected areas;

(c) Implementing integrated fire management strategies that reduce displacement of fire practices and fire risk beyond project boundaries;

(d) Coordinating with landowners and relevant authorities to prevent drainage reactivation or establishment of new drainage infrastructure adjacent to the project area;

(e) Monitoring land-use changes in buffer zones and surrounding areas to detect early signs of leakage or displacement.

Additional institutional and governance measures:

(a) Formal engagement with local land-use planning bodies to ensure that project restrictions do not create pressures for peatland conversion elsewhere;

(b) Collaboration with regulatory agencies to align project activities with broader wetland protection frameworks and prevent policy-driven leakage;

(c) Establishment of local agreements, co-management arrangements or community protocols to prevent unmanaged shifts in access, grazing, or resource use to non-project peatlands.

All prevention, mitigation and monitoring actions shall be documented and evaluated periodically to ensure their effectiveness and alignment with the leakage management plan.

13.3 Leakage monitoring

During each monitoring period, the project holders shall assess whether leakage has occurred based on:

(a) hydrological monitoring data (e.g., water table depth, water flow behavior) in peatland areas adjacent to the project boundary;

(b) remote sensing and field surveys to detect land-use or land-cover changes;

(c) local stakeholder engagement to identify activity displacement;

(d) analysis of market conditions when market leakage is relevant;

(e) transport activity records if the project influences external transportation patterns.

If leakage is detected, it shall be quantified using the procedures defined in Section 12.3 and deducted from net emission reductions.

13.4 Leakage deductions

All quantified leakage shall be deducted from the annual emission reductions according to Equation 15. If no leakage is observed, leakage shall be conservatively set to zero.

The project holders shall maintain full documentation of all leakage assessments, including:

(a) methodologies used for detection and quantification;

(b) input data and underlying assumptions;

(c) boundaries and spatial analysis methods;

(d) results from hydrological monitoring, field measurements, modeling, or remote sensing;

(e) justification for any component deemed negligible or equal to zero.

13.5 Corrective actions

If leakage is detected, the project holders shall implement corrective measures to reduce or eliminate its recurrence. Corrective measures may include:

(a) restoring hydrological balance in affected areas;

(b) modifying or reinforcing project activities to reduce the likelihood of displacement;

(c) addressing socioeconomic drivers that contribute to leakage;

(d) updating monitoring procedures, stakeholder engagement strategies, or project design if necessary.

All corrective actions and their documented outcomes shall be reported in each verification cycle.

13.6 Residual leakage and conservative treatment

Only residual leakage, that is, leakage remaining after prevention and corrective measures, shall be deducted from annual emission reductions. All leakage deductions shall apply a conservative approach to avoid overestimation of net GHG benefits.

14 Permanence and reversal risk management

Permanence refers to the durability of greenhouse gas (GHG) benefits generated by the project. Reversal risk refers to the likelihood that stored or avoided emissions may be re-released to the atmosphere due to natural or anthropogenic disturbances. This section defines the requirements for identifying, assessing, mitigating, and managing risks of reversal in peatland conservation and restoration projects.

All projects shall apply the BioCarbon Permanence and Reversal Risk Tool to determine the required buffer contribution and to ensure that project benefits remain durable over the long term.

14.1 Definition and scope of reversal

A reversal is defined as any measurable and verified increase in GHG emissions within the project boundary that negates, in whole or in part, previously credited emission reductions or removals. Reversals may occur when hydrological or ecological conditions deteriorate after credit issuance, resulting in renewed peat oxidation, fire events, or other disturbances that re-release stored or avoided emissions.

Reversals may also result from broader climatic, social, governance, or economic factors that indirectly undermine restored peatland stability, provided these factors lead to quantifiable increases in credited GHG sources.

Reversals shall only be considered when:

(a) the emissions increase is attributable to conditions within the project boundary;

(b) the increase corresponds to carbon pools or GHG sources accounted for by the project;

(c) the disturbance results in a quantifiable loss of credited climate benefits; and

(d) the event is documented and verified during a monitoring or verification cycle.

Events outside the project boundary or unrelated to credited GHG benefits shall not be classified as reversals.

Reversals do not include temporary fluctuations that do not result in a net loss of credited climate benefits, nor external disturbances that do not affect the credited carbon pools.

14.2 Reversal risk factors

The project holders shall identify, analyze, and document all relevant risk factors that may threaten the permanence of GHG benefits. These include:

(a) Hydrological infrastructure risks

- (i) failure, erosion, or overtopping of dams, bunds, or canal blocks;
- (ii) bypassing or breaching of blockage structures due to water pressure;
- (iii) sediment buildup or clogging that alters water flow;
- (iv) collapse or malfunction of water retention features.
- (v) Re-drying and drainage risks
- (vi) reactivation of pre-existing drainage networks;
- (vii) illegal or accidental construction of new drains;
- (viii) upstream water abstraction that lowers the water table;
- (ix) subsidence altering drainage gradients.

(b) Fire risks linked to hydrology

(i) smoldering ignition during seasonal droughts;
(ii) ignition sources entering the rewetted area (e.g., agricultural fires);
(iii) increased fuel loads during early restoration stages.

(c) Climate-related risks

(i) extreme dry seasons;
(ii) prolonged rainfall deficits;
(iii) temperature anomalies that enhance evapotranspiration.

(d) Ecological risks

(i) invasive species reducing peat moisture;
(ii) vegetation loss decreasing surface shading and moisture retention.

(e) Social and governance-related risks

(i) land tenure disputes, unresolved access rights or community conflict;
(ii) weak enforcement of drainage, wetland or fire regulations;
(iii) limited institutional capacity to ensure long-term protection;
(iv) lack of stakeholder engagement leading to unauthorized drainage or burning.
(v) Economic and market-related risks
(vi) market pressures increasing incentives for land conversion (e.g., agriculture, forestry, peat extraction);
(vii) fluctuations in commodity prices altering opportunity costs of conservation;
(viii) insufficient resources for long-term monitoring and maintenance;
(ix) economic shocks influencing land-use decisions and project compliance.

All identified risks shall be incorporated into the project's risk profile and shall be evaluated in the initial assessment and reassessed at each verification cycle.

14.3 Permanence and risk management tool

The project shall apply the BioCarbon Permanence and Reversal Risk Tool (BioCarbon Cert, 2025h) to assess overall project risk and determine the required contribution to the permanence reserve.

Specifically, the tool shall be used to:

(a) identify and score hydrological, ecological, climatic, socioeconomic, and management-related risks;

(b) evaluate the robustness of restoration interventions and long-term maintenance capacity;

(c) determine the project's total reversal risk rating;

(d) calculate the mandatory buffer contribution, which represents a percentage of the project's verified GHG benefits;

(e) reassess risk ratings at each verification and at every renewal of the crediting period.

The buffer contribution shall be maintained for the duration required by the BioCarbon Standard and may be adjusted upward or downward following reassessment of project risk.

14.4 Corrective actions and reserve adjustments

When a reversal is detected and verified, the project holders shall implement corrective actions to restore hydrological and ecological stability and prevent recurrence. Corrective actions may include:

(a) repair, reinforcement, or redesign of hydrological restoration structures;

(b) emergency rewetting measures to restore the water table;

(c) fire suppression, fuel management, and future fire-prevention strategies;

(d) engagement with communities and authorities to prevent illegal drainage or burning;

(e) ecological recovery measures such as revegetation of hydrophilic species.

Following verification of a reversal:

(a) the quantity of reversed emissions shall be quantified using the procedures in Section 12;

(b) an equivalent number of credits shall be cancelled from the project's reserve allocation;

(c) the project shall document causes, responses, and outcomes in its monitoring report;

(d) the reversal risk category shall be reassessed during the next verification.

Corrective actions do not retroactively restore cancelled reserve credits but may reduce future buffer requirements if long-term risk is demonstrably reduced.

15 Uncertainty assessment and conservative adjustment

Uncertainty assessment is required to ensure that quantified GHG emission reductions and removals are conservative, transparent, and robust.

Uncertainty associated with estimated emission reductions shall be assessed and deducted in accordance with the BioCarbon Uncertainty Tool, which provides standardized methods for evaluating uncertainty associated with activity data, emission factors, sampling design, model parameters, and any assumptions applied in the quantification process.

The following requirements apply:

15.1 Determination of uncertainty sources

The project holders shall identify and assess all sources of uncertainty contributing to the estimation of baseline emissions, project emissions, leakage, and net GHG emission reductions. These may include, but are not limited to:

(a) measurement error in field data (e.g., peat depth, water table depth, area measurements);

(b) sampling error associated with stratification and sampling design;

(c) uncertainty in emission factors (including IPCC defaults or project-specific factors);

(d) model uncertainty arising from hydrological or ecological modeling;

(e) temporal variability not captured by monitoring frequency;

(f) uncertainty in activity-shifting or leakage calculations.

All identified uncertainties shall be quantified following the procedures of the BioCarbon Conservative Approach and Uncertainty Management (BioCarbon Cert, 2025e).

Uncertainty shall be assessed to ensure that estimated emission reductions are robust, conservative and statistically reliable. In accordance with the BioCarbon Standard, projects shall quantify combined uncertainty associated with baseline emissions, project emissions and leakage, and apply the corresponding deduction factor derived from the BioCarbon Uncertainty Assessment Tool (BioCarbon Cert, 2025e).

The combined relative uncertainty and the required deduction shall be determined as presented in Equation 20 and Equation 21.

15.2 Calculation of combined relative uncertainty

The combined relative uncertainty and the corresponding uncertainty deduction factor shall be applied to the gross emission reductions for each year of the crediting period.

Uncertainty shall be quantified applying:

$$U_y = \frac{h_{90,y}}{ER_y} \qquad \text{Equation 20}$$

Where:

U_y	=	Combined relative uncertainty for year y; dimensionless
$h_{90,y}$	=	Half-width of the 90% confidence interval for the estimated emission reductions in year y; tCO_2e
ER_y	=	Mean estimated emission reductions before uncertainty deduction in year y; $tCO_2e\ yr^{-1}$

This formulation follows the IPCC Good Practice principle for expressing combined relative uncertainty.

The half-width of the confidence interval shall be derived using the statistical procedures described in the BioCarbon Uncertainty Assessment Tool (BioCarbon Cert, 2025e).

15.3 Determination of the uncertainty deduction factor

The uncertainty deduction factor UFy for year y shall be determined based on the combined uncertainty value (U) and the corresponding deduction thresholds established in the BioCarbon Uncertainty Assessment Tool.

The factor UFy represents the proportion of emission reductions that shall be deducted to ensure conservative reporting of GHG benefits.

15.4 Application of conservative adjustment

Uncertainty deductions shall be applied as follows:

$$UD_y = ER_{Gross,y} \times UF_y \qquad \text{Equation 21}$$

Where:

UD_y	=	Uncertainty deduction applied in year y; $tCO_2e\ yr^{-1}$

$ER_{Gross,y}$	=	Gross emission reductions in year y; $tCO_2e\ yr^{-1}$
UF_y	=	Uncertainty deduction factor for year y, derived from the BioCarbon Uncertainty Assessment Tool; dimensionless

The gross emission reductions in year y, calculated as:

$$ER_{Gross,y} = BE_y - PE_y - LE_y \quad \text{Equation 22}$$

The uncertainty deduction UDy shall be subtracted from gross emission reductions to determine the net emission reductions, consistent with Equation 19 of this methodology.

15.5 Documentation and transparency requirements

The project holders shall include in each monitoring report:

(a) a description of all uncertainty sources identified;

(b) all calculations used to derive the combined uncertainty;

(c) raw data, models, and assumptions used in uncertainty estimation;

(d) the uncertainty deduction factor;

(e) the final uncertainty deduction;

(f) the adjusted net emission reductions;

All calculations shall be transparent and reproducible.

16 Monitoring requirements

Monitoring is essential to ensure that all project activities, hydrological conditions, vegetation dynamics, and associated GHG impacts are measured, documented, and verified throughout the crediting period. The project holders shall implement a monitoring plan that complies with the BioCarbon Standard, the requirements of this methodology, and the monitoring procedures described in the project's Monitoring Plan.

Monitoring shall be conducted at intervals sufficient to capture changes in hydrology, peat condition, vegetation cover, and GHG-related parameters.

16.1 General monitoring requirements

The monitoring system shall:

(a) provide consistent, accurate, and verifiable data on all parameters required for quantification of baseline and project emissions;

(b) ensure that hydrological and ecological conditions remain consistent with project design and restoration objectives;

(c) incorporate field measurements, remote sensing, and modeling as appropriate;

(d) be documented in a Monitoring Plan validated during project registration;

(e) include a Quality Assurance and Quality Control (QA/QC) system to ensure data integrity;

(f) record any disturbances or deviations that may affect GHG impacts.

All monitoring shall be conducted by qualified personnel following standardized procedures, and all monitoring instruments shall be calibrated at a frequency consistent with manufacturer guidelines or, where such guidance is absent, at least once per monitoring period. All calibration events and procedural updates shall be fully documented and traceable.

Monitoring activities shall follow standardized field protocols, including documented methods for hydrological measurements, vegetation assessments, soil sampling, and sensor deployment, ensuring consistency across monitoring periods and personnel.

16.2 Parameters to monitor

The project holders shall monitor, at minimum, the following parameters within each peatland stratum:

(a) Water table depth (WTD)

Measured at permanent monitoring points.

WTD is the primary determinant of CO_2 and CH_4 emissions and fire risk.

Measurement frequency: at least quarterly, or more frequently in regions with high seasonal variability.

(b) Peat subsidence

Changes in the surface elevation of peat, measured annually at fixed benchmarks.

Subsidence indicates ongoing peat oxidation or hydrological instability.

(c) Hydrological connectivity and flow conditions

Assessment of restored or maintained hydrological pathways, including canals blocked, bunds, dams, and natural flow reactivation.

Monitoring includes visual surveys, hydrological measurements, and remote sensing.

(d) Vegetation and peatland conditions

Monitoring of vegetation cover, recovery of hydrophilic species, presence of invasive species, and vegetation changes affecting hydrology or fire risk.

Methods may include field transects and remote sensing classifications.

(e) Fire occurrence and fire risk indicators

(i) burned areas,
(ii) hotspots,
(iii) fire scars,
(iv) ignition sources,
(v) dry surface layers during droughts.

Monitoring shall include remote sensing analysis and field verification when required.

(f) CH_4 and CO_2 proxy parameters, including:

(i) water table depth,
(ii) vegetation type,
(iii) surface moisture,
(iv) peat temperature.

Direct flux measurements are optional but permitted when feasible.

(g) Hydrological infrastructure performance

Inspection and condition assessment of:

(i) canal blocks,
(ii) dams,
(iii) bunds,
(iv) levees,
(v) ditch fills,
(vi) any water-retention structures.

Monitoring includes integrity, erosion, bypassing, or failure points.

(h) Land-use and land-cover changes

Annual assessment via remote sensing to detect disturbances, drainage attempts, or activity displacement.

(i) Leakage-related observations

Monitoring data relevant to hydrological leakage, activity-shifting, or market leakage shall be recorded as described in Section 12.

16.3 Monitoring frequency

Monitoring shall follow this minimum schedule:

(a) WTD: quarterly, or monthly where seasonal variability exceeds 20 cm.

(b) Subsidence: annually.

(c) Vegetation condition: annually, with additional assessments after disturbance events.

(d) Fire occurrence: continuous remote sensing + annual field verification.

(e) Hydrological infrastructure: at least biannually and after extreme weather events.

(f) Land-use change: annually.

(g) GHG-related proxies: frequency aligned with WTD measurements.

More frequent monitoring is required when project areas exhibit: high climatic variability, hydrological instability, or elevated fire risk.

In cases where monitoring activities cannot be conducted due to extreme events (e.g., severe floods, fires, storms, or access restrictions), project holders shall:

(a) document the cause and duration of the interruption;

(b) apply conservative estimation methods as defined in the monitoring plan; and

(c) resume field monitoring as soon as conditions permit.

Such interruptions shall not compromise data integrity or the conservative estimation of GHG benefits.

16.4 Data sources (field, RS, models)

The monitoring framework shall be supported by a structured data model that integrates field measurements, remote sensing products and model-derived indicators into a coherent system suitable for verification. The data model shall ensure consistency, traceability and transparency in how information is collected, processed and used for greenhouse gas quantification. Field data remain the primary reference for hydrological and ecological parameters, while remote sensing and analytical models may be incorporated to complement field observations, improve spatial and temporal resolution and support detection of changes across the project area. All data sources, including field measurements, satellite-based products and model outputs, shall be documented and subject to QA/QC procedures to ensure accuracy and conservative application.

16.4.1 Advanced remote sensing and emerging measurement technologies

Advanced remote sensing technologies, including satellite-borne sensors (e.g., multispectral, hyperspectral, Synthetic Aperture Radar), LiDAR data, machine-learning–derived peatland condition indicators, interferometric measurements of land surface motion and other emerging geospatial techniques, may be used to complement field data collection and monitoring under this methodology.

Such technologies may support the estimation of water table dynamics, surface moisture, vegetation composition, subsidence, fire occurrence and land-use change. However, remote sensing outputs shall not replace mandatory field measurements unless their performance has been validated through field calibration and ground-truthing within the project area.

Project holders shall demonstrate the reliability, accuracy and traceability of remote sensing products through QA/QC procedures, transparent documentation of data sources, algorithms and processing methods and cross-validation with field measurements.

New or emerging technologies may be incorporated as they become available, provided that:

(a) their use is transparently documented;

(b) they improve measurement accuracy or reduce uncertainty;

(c) they are validated with field data;

(d) they do not increase the risk of overestimating GHG benefits.

The methodology encourages innovation in measurement approaches while maintaining the requirement that field-based hydrological observations remain the primary reference for quantifying water table depth, peat condition and other critical parameters.

16.5 Data quality and management

The project holders shall:

(a) retain raw data, field notes, photographs, GIS files, and processed datasets;

(b) apply QA/QC procedures for all measurements;

(c) calibrate monitoring equipment as required;

(d) maintain metadata for all datasets;

(e) ensure data security and traceability for the entire crediting period and any renewal periods.

16.6 Record keeping requirements

All monitoring datasets shall include standardized metadata (e.g., time stamps, coordinate systems, instrument specifications, data collectors, calibration history, and quality control status) to ensure data transparency and reproducibility. Records shall include, at minimum:

(a) measurement locations and coordinates,

(b) monitoring dates,

(c) instruments used and calibration logs,

(d) raw and processed data,

(e) maps of hydrological structures and monitoring points,

(f) incident reports (e.g., fires, drainage attempts, infrastructure failures),

(g) documentation of corrective actions when applicable.

Projects may employ cryptographically secure or blockchain-based storage systems to ensure tamper-proof preservation of monitoring records, subject to compliance with national data regulations.

Records shall be retained for verification and for reviews conducted by BioCarbon.

17 Quality Assurance and Quality Control (QA/QC)

Quality Assurance and Quality Control (QA/QC) procedures shall be applied to ensure transparency, accuracy, completeness, consistency, and reliability of all data and information used in the quantification of GHG emission reductions and removals, as well as in the monitoring and reporting of project performance. QA/QC requirements apply to all stages of the project cycle, including data collection, processing, analysis, documentation, and archiving.

17.1 Quality Assurance (QA)

Quality Assurance refers to the system of planned and systematic activities implemented to ensure that all monitoring and quantification procedures meet the requirements of this methodology and the BioCarbon Standard.

The project holders shall:

(a) develop and implement a QA plan that includes documented protocols for field measurements, hydrological monitoring, vegetation surveys, fire monitoring, and GIS analyses;

(b) ensure that monitoring personnel are trained and qualified to apply all relevant methodologies and sampling procedures;

(c) perform internal technical reviews of all calculations, datasets, and monitoring reports prior to submission for verification;

(d) verify that all instruments used for field measurements (e.g., water level loggers, GPS units, subsidence rods) are tested and maintained according to manufacturer specifications;

(e) conduct periodic audits of monitoring procedures and data handling systems to identify and correct deviations;

(f) ensure that QA procedures are updated as technologies, standards, or project conditions evolve.

17.2 Quality Control (QC)

Quality Control refers to the operational techniques and procedures used to verify that data collection, processing, and reporting are accurate and free from error.

The project holders shall:

(a) apply QC procedures during every monitoring event, including cross-checking field measurements, duplicate measurements, and consistency checks across datasets;

(b) maintain calibration records for all monitoring equipment and document the results of calibration checks;

(c) implement data validation routines, including checks for completeness, outliers, and logical consistency;

(d) store all data in secure, backed-up systems using standardized naming conventions and version control;

(e) ensure that any data corrections are fully documented, justified, and traceable.

17.3 Corrective actions and traceability

When QA/QC checks reveal inconsistencies, missing data, or errors, the project holders shall:

(a) identify the source of the issue and correct it promptly;

(b) document the error, the corrective action taken, and the date of correction;

(c) reassess any affected parameters or calculations;

(d) ensure that corrected data are clearly distinguished from original entries to preserve traceability;

(e) apply additional QC checks as necessary to prevent recurrence.

Corrective actions shall be included in the monitoring report for each verification cycle.

17.4 Documentation and archiving

The project holders shall maintain complete records of all QA/QC procedures, including:

(a) field logs, calibration logs, QA/QC checklists, and data validation reports;

(b) final datasets used for emission quantification, including metadata and processing steps;

(c) maps, photographs, remote sensing datasets, and GIS analyses;

(d) monitoring reports, internal reviews, and documented corrective actions.

All records shall be stored securely for the duration of the crediting period and any renewal periods.

17.5 Continuous improvement

The project holders shall periodically evaluate the effectiveness of QA/QC procedures and implement improvements based on:

(a) lessons learned from previous monitoring cycles,

(b) technological advancements (e.g., improved sensors, remote sensing),

(c) verifier feedback,

(d) updates to the BioCarbon Standard or guidance documents.

Continuous improvement shall be documented in the monitoring report.

18 Document Status and Publication Format

18.1 Status

This methodological document constitutes Version 1.0 (Public Consultation Version) of the BCR0013 – Conservation and Restoration of Peatland.

It is released for public consultation on December 3, 2025.

This version is intended exclusively for consultation. A final version will be issued following the review of all received comments. Project holders shall apply the officially approved final version at the time of project validation.

18.2 Version

All versions of this methodology shall clearly indicate:

(a) version number;

(b) date of release;

(c) status (e.g., Public Consultation Version, Final Version);

(d) nature of the changes introduced;

(e) justification for updates or revisions.

Version updates may include clarifications, corrections, methodological improvements, or adjustments based on new scientific evidence. All updates shall maintain alignment with the BioCarbon Standard and ensure continuity with previously issued versions.

18.3 Publication format

BioCarbon Cert shall publish all versions of this methodological document in digital format on the official website (www.biocarbonstandard.com).

Each published version shall:

(a) be publicly accessible and downloadable;

(b) clearly indicate its version number and publication date;

(c) include a document history table summarizing all past revisions;

(d) be distinguishable from previous versions;

(e) include instructions for project holders regarding the applicability of the version to new and existing projects.

BioCarbon Cert may also provide supplemental guidance, templates, or clarifications related to the application of this methodology. Any supplemental materials shall be considered non-normative unless explicitly stated otherwise.

19 References

19.1 BioCarbon Cert Documents

BioCarbon Cert. (2023). BCR tool: Sustainable development goals (SDG) (Version 1.0, p. 15). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/BCR_SDG-tool.pdf

BioCarbon Cert. (2025a). BCR STANDARD: Empowering sustainability, redefining standards (Version 4.0, p. 105). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/BCR_Standard.pdf

BioCarbon Cert. (2025b). BCR0003 Methodological Document AFOLU Sector: Activities that prevent land use change and improve management practices for peatlands and other wetlands in high mountain ecosystems (Version 4.0, p. 71). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/BCR0003_Methodological-document-HME.pdf

BioCarbon Cert. (2025c). BCR0007 Conservation and restoration of natural continental wetlands (Version 1.1, p. 82). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/BCR0007_Continental_Natural_Wetlands.pdf

BioCarbon Cert. (2025d). BioCarbon tool: Avoidance of double counting (ADC) (Version 3.0, p. 32). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/BCR_avoiding-double-counting.pdf

BioCarbon Cert. (2025e). BioCarbon tool: Conservative approach and uncertainty management (Version 1.0, p. 44). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/Conservative_Approach_and_Uncertainty_Management_tool.pdf

BioCarbon Cert. (2025f). BioCarbon tool: Identification of a baseline scenario and demonstration of additionality (Version 1.0, p. 40). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/Baseline_additionality_tool.pdf

BioCarbon Cert. (2025g). BioCarbon tool: Monitoring, reporting and verification (MRV) (Version 2.0, p. 26). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/BCR_Monitoring-reporting-and-verification.pdf

BioCarbon Cert. (2025h). BioCarbon tool: Permanence and risk management (Version 2.0, p. 24). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/BCR_risk-and-permanence.pdf

BioCarbon Cert. (2025i). Sustainable development safeguards (SDSs) tool (Version 2.0, p. 93). BioCarbon Cert. Available at: https://biocarbonstandard.com/wp-content/uploads/BCR_Sustainable_development_safeguards.pdf

19.2 Scientific and Technical Literature

FAO. (2012). Peatlands – Guidance for Climate Change Mitigation through Conservation, Rehabilitation and Sustainable Use. FAO. Available at: https://www.fao.org/4/i3013e/i3013e.pdf

FAO. (2020). Technical specifications and country guidelines for Global Soil Organic Carbon Sequestration Potential Map (GSOCseq). Rome, FAO. Available at: https://www.fao.org/documents/card/en/c/CB0353EN

IPCC. (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 4 — Agriculture, Forestry and Other Land Use. Eggleston, H. S., Buendia, L., Miwa, K., Ngara, T., & Tanabe, K. (Eds.). Institute for Global Environmental Strategies (IGES), Japan. Available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

IPCC. (2014). 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M., & Troxler, T. G. (Eds.). IPCC, Switzerland. Available at: https://www.ipcc.ch/publication/2013-supplement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories-wetlands/

IPCC. (2019). 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Calvo Buendia, E., Tanabe, K., Kranjc, A., Baasansuren, J., Fukuda, M., Ngarize, S., Osako, A., Pyrozhenko, Y., Shermanau, P., & Federici, S. (Eds.). IPCC, Switzerland.

Available at: https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/

ISO. (2019). ISO 14064-2: Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements (ISO 14064-2:2019). Available at: https://www.iso.org/standard/66454.html

Joosten, H., Sirin, A., Couwenberg, J., Laine, J., & Smith, P. (2016). The role of peatlands in climate regulation. Peatland Restoration and Ecosystem Services, 63–76. https://doi.org/10.1017/cbo9781139177788.005

Ramsar Convention Secretariat. (2018). Guidelines for Global Action on Peatlands. Ramsar Convention Secretariat. Available at: https://www.ramsar.org/sites/default/files/documents/pdf/guide/guide-peatlands-e.pdf

SER. (2025). International Principles and Standards for the Practice of Ecological Restoration (3rd ed.). Society for Ecological Restoration.

Turetsky, M., Benscoter, B., Page, S., Rein, G., van der Werf, G. R., & Watts, A. (2015). Global vulnerability of peatlands to fire and carbon loss. Nature Geoscience, 8, 11–14.

UNFCCC. (2022). Glossary of CDM terms (Version 11.0). Clean Development Mechanism, UNFCCC. Available at: https://cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf

History of document

Type of document

BioCarbon Standard. Methodological Document

Version	**Date**	**Nature of the document**
Public Consultation Version	December 3, 2025	Initial version of the Methodological Document

Note: Any future revisions to this document will be listed here, including the date, nature, and justification for the changes. All updated versions shall be made publicly available by the BioCarbon Standard and clearly distinguished from earlier versions.