I. IINTRODUCTION AND HOW TO USE THIS METHODOLOGY

1.1 Purpose

This document serves as a technical guide for Project Proponents participating in the Malaysia Forest Carbon Offset (FCO) program. It provides a structured framework for quantifying and implementing projects that aim to remove, reduce or avoid Greenhouse Gas (GHG) emissions.

This FCO Methodology supports a range of project types. It enables Project Proponents to:
a. Assess project eligibility
b. Define project boundary
c. Establish baseline scenarios
d. Quantify GHG reductions, and
e. Monitor project performances.

This FCO Methodology is designed to be adaptable and can be used in conjunction with other FCO methodologies depending on project-specific needs.

Project proponents may reference the Theory of Change framework, which maps how interventions are expected to deliver emission reductions and co-benefits by identifying causal pathways, assumptions, and risks[1] to inform project design. Proponents may refer to Theory of Change UNDAF Companion Guidance by United Nations Development Group or other relevant frameworks developed by intergovernmental organisations, NGOs and NPOs, or jurisdictional authorities to guide the development of a project-specific Theory of Change.

1.2 Core FCO Methodologies:

The FCO program currently supports four key FCO Methodologies which is as illustrated in Annex 1:

a. **Afforestation, Reforestation, and Restoration (ARR):** Focuses on forest establishment or restoration on degraded lands to boost carbon sequestration.
b. **Improved Forest Management (IFM):** Enhances carbon stocks in production forests through sustainable practices like reduced impact logging and longer rotation cycles.
c. **Reducing Emissions from Deforestation and Degradation (REDD):** Aims to prevent deforestation and degradation in all forest types
d. **Wetland Ecosystems (WE):** Activities on wetland ecosystems including restoration, vegetation establishment, deforestation and degradation prevention as well as rewetting.

Additional Methodologies may be incorporated in the future.

1.3 How to use this FCO Methodology

This FCO Methodology guides Project Proponents to assess and implement activities under the FCO framework. The process begins with a spatial and historical assessment of the land:

a. **Current Land Assessment:** Evaluate the present condition of the land using maps and satellite imagery.
b. **Historical Land Use:** Determine the land's previous state to establish a baseline.

[1] Theory of Change UNDAF Companion Guidance, United Nations Development Group, 2017

c. **Condition Classification:** Compare current and historical states to classify the land as either intact or disturbed.

Based on this classification, Project Proponents can identify suitable intervention types:

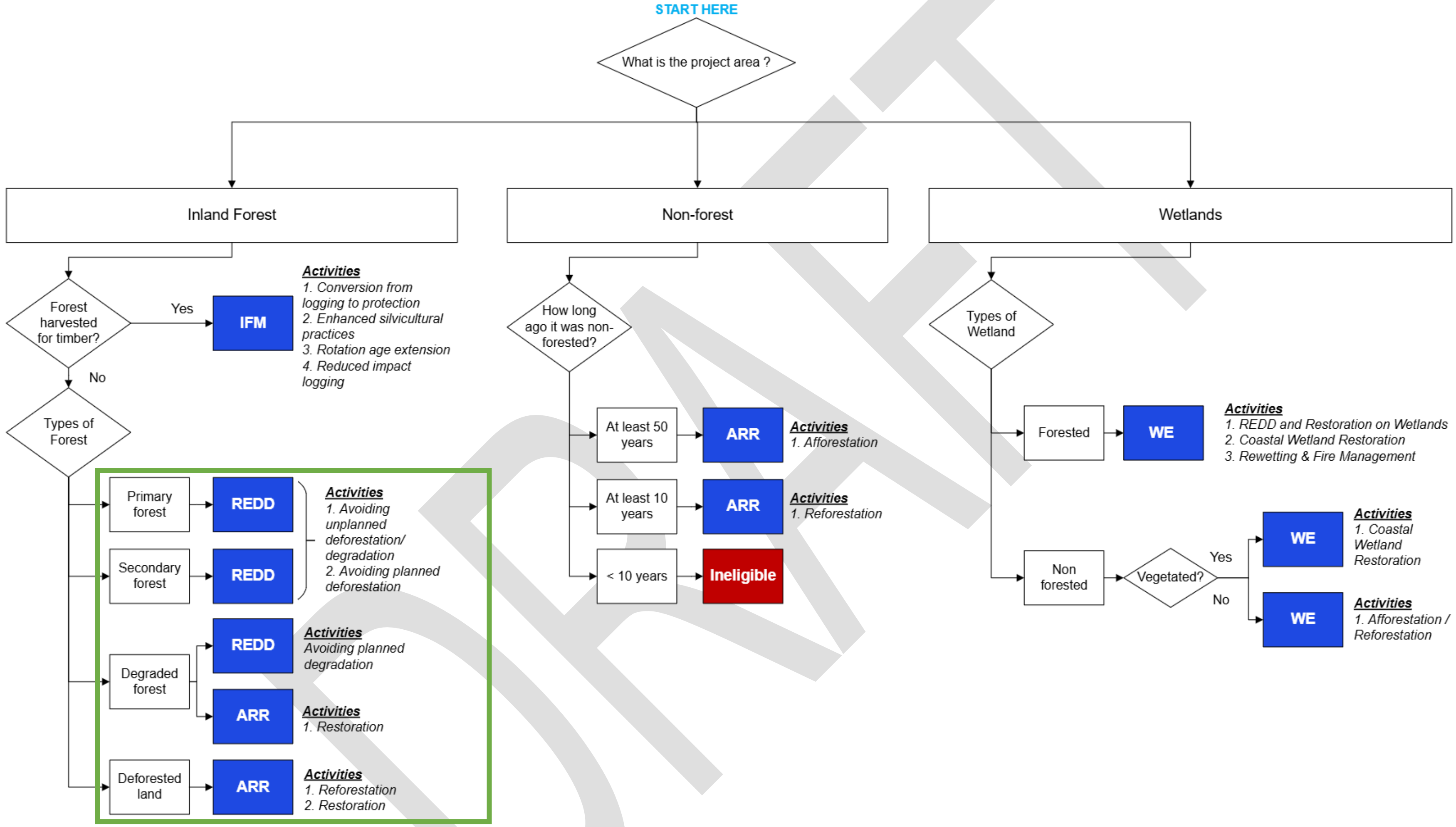
a. **GHG Avoidance Activities:** Actions that prevent emissions from occurring, such as avoiding planned or unplanned deforestation.
b. **GHG Reduction or Removal Activities:** Interventions that actively reduce or sequester emissions, tailored to forest lands, wetlands, or production forests.

1.4 <u>Focus of this FCO Methodology document:</u>

This document specifically focuses on the REDD Methodology. It should be used in conjunction with the overarching FCO Program Guidelines, Subsidiary Guidelines, and standardized FCO Tools. These resources collectively ensure that project design, monitoring, and reporting are accurate, consistent, and aligned with program requirements.

Project proponents may reference relevant sources such as national strategies, sectoral reports, or frameworks developed by international organisations, NGOs, or jurisdictional authorities, when identifying anticipated implementation challenges, including data limitations, technical constraints, and other contextual factors.

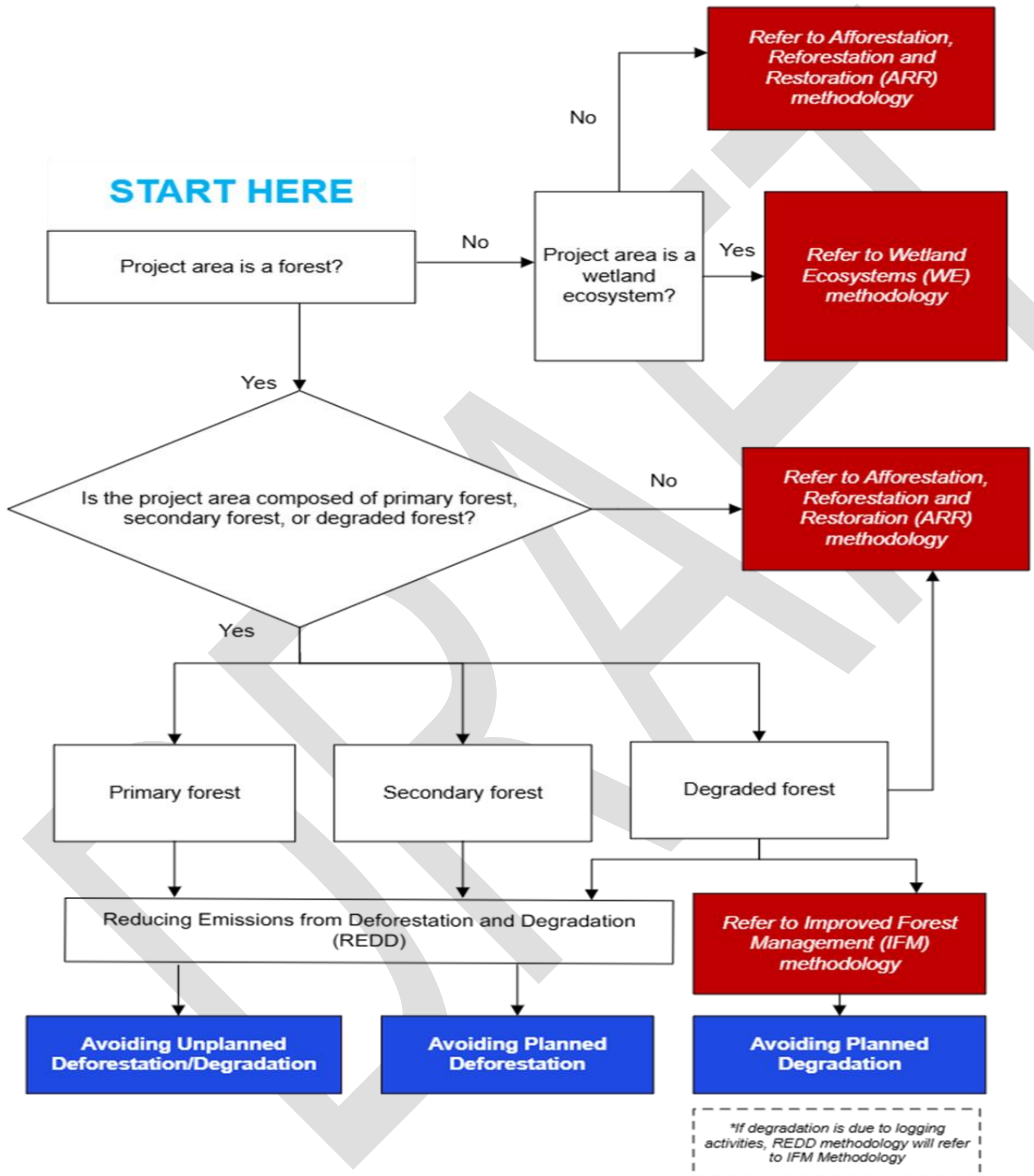
Figure 1. Overall Flowchart for Methodologies under FCO



II. ELIGIBILITY FLOWCHART

The eligibility flowchart is a visual decision-making tool designed to help Project Proponents determine whether a proposed project area qualifies for REDD activities under the FCO program.

Figure 2. REDD Eligibility Flowchart

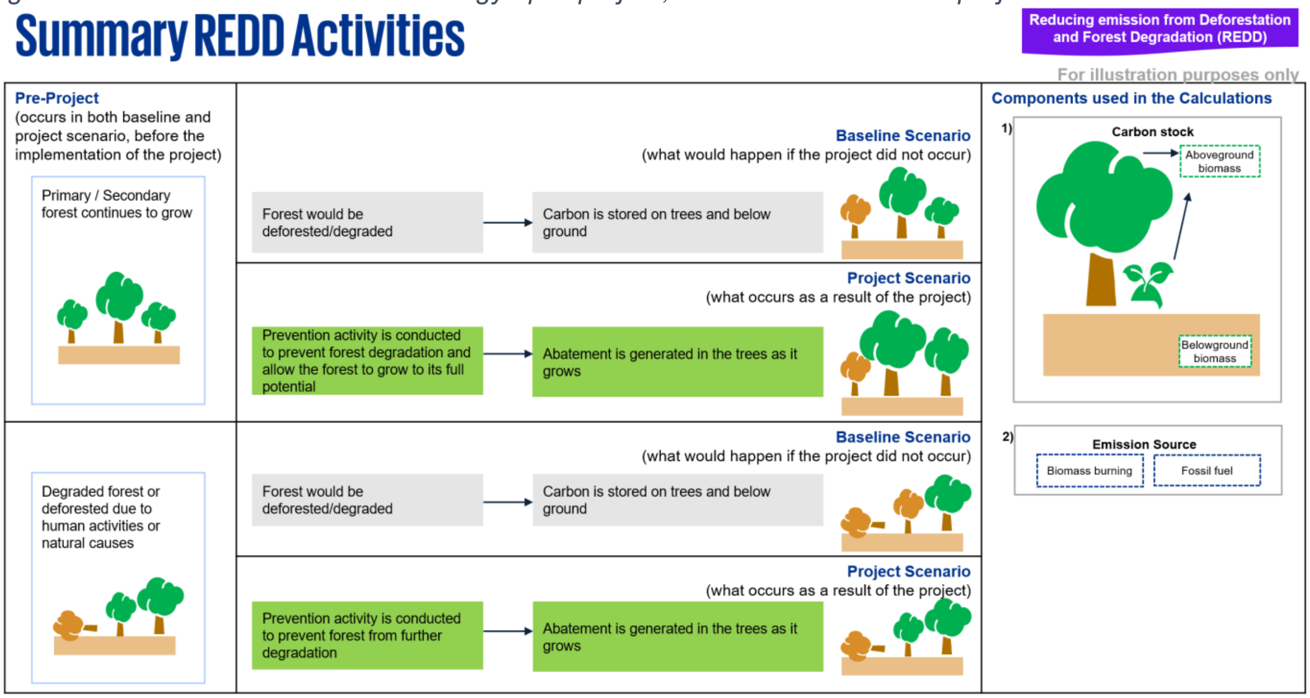


III. SUMMARY DESCRIPTION

This section provides an overview of the REDD Methodology - activity description, applicable ecosystem as well as the pre-project, baseline and project scenarios for an applicable project.

Type of GHG Emissions Mitigation Action *Refers to how the project reduces GHG emissions*	Project activities that prevent / reduces GHG emissions through: 1. **Avoiding Planned Deforestation :** Preventing deforestation on lands authorized for conversion from forest land to alternate uses. 2. **Avoiding Unplanned Deforestation/Degradation :** Preventing deforestation/degradation from activities like shifting agriculture, fuelwood collection, illegal logging, and unauthorized infrastructure developments Note : Avoiding planned degradation refers to activities that stops or reduces timber harvest in areas where harvesting is permitted - the IFM Methodology is referred for details.
Applicable Ecosystem *Identifies the type of environment where the project can be implemented*	**1. Primary forest :** Forest largely undisturbed by human activities Note: Forests affected by natural disturbances can still qualify as primary forests, provided there is no significant human intervention 2. **Secondary forest -** Forests that have been cleared and have recovered naturally 3. **Degraded forests -** Forest that show signs of disturbance due to human activities, such as reduced canopy cover or carbon stock.
Pre-Project Conditions *Refers to the state of the land and forest prior to the start of the FCO project*	Land must have been forest for at least 10 years prior to the project start date
Baseline Scenario *Represents the "business-as-usual" projection on what would happen to the forest and its carbon stocks in the absence of the project*	1. Forest clearing legally permitted for other land uses. 2. Forest land clearing by local communities (fuelwood collection, shifting agriculture) or illegal logging (unplanned deforestation/degradation)
Project Scenario *Describes the proposed interventions to-be implemented under the FCO project to prevent or reduce GHG emissions.*	1. **Avoiding Planned Deforestation :** Implements protection measures to prevent forest loss that is legally sanctioned or permitted. **2. Avoiding Unplanned Deforestation/Degradation :** Implements interventions to reduce or stop unauthorised or illegal forest loss, or small-scale agriculture, encroachment, or unsustainable logging practices

Figure 3. Overview of REDD Methodology : pre-project, baseline scenario and project scenario



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VII. MODULES & TOOLS

This FCO Methodology follows the following modules and tools:

a. FCO Tool: Baseline Determination and Additionality Assessment
b. FCO Tool: GHG Quantification Equations
c. FCO Tool: Buffer Risk Assessment
d. FCO Tool: Allometric Equations Guidance

VIII. LIST OF ABBREVIATIONS

No	Abbreviation	Definition
1	APDD	Avoiding Planned Deforestation and Degradation
2	ART	Architecture for REDD+ Transactions
3	AUD	Avoiding Unplanned Deforestation
4	HFLD	High Forest, Low Deforestation
5	PRF	Permanent Reserve Forest
6	TPA	Totally Protected Area
7	WE	Wetland Ecosystems

1 Definitions

Terms	Definition
Avoiding Planned Deforestation	Activities that reduce GHG emissions by preventing or minimising deforestation on forest lands that are legally authorised by the relevant authorities for conversion to non-forest uses
Avoiding Planned Degradation	Activities that reduce GHG emissions by stopping or reducing timber harvests in areas where harvesting is legally permitted under a Forest Management Plan.
Avoiding Unplanned Deforestation/Degradation	Activities that reduce GHG emissions by stopping deforestation and/or degradation of degraded to mature forests that would have occurred in any forest configuration. Activities that address subsistence farming or illegal logging.
Forested Wetland	Wetlands dominated by woody vegetation, such as trees, that grow on land saturated or flooded with water either permanently or seasonally[2,3] and meet the forest definition. *The applicable forested wetlands in this methodology are mangroves, nipa swamps, peat swamp forests and freshwater forested wetlands.*
Leakage Belt	Land surrounding or adjacent to the project area in which baseline activities could be displaced due to the project activities implemented in the project area[4].
Leakage Management Zone	Areas outside the project boundary and outside the leakage belt area in which the Project Proponent intends to implement activities that will reduce the risk of activity displacement leakage[5].
Permanent Reserve Forest	A collective term encompassing Protection Forests, Amenity Forests, and Research & Education Forests, as defined under the National Forestry Act. Specific references to PRF types will be indicated where relevant.
Permanent Reserved Forest (PRF) Protection Forest	Permanent Reserved Forest (PRF) Protection Forest serves to maintain climate and environmental stability, regulate water resources, conserve soil and biodiversity, and reduce flood and erosion impacts on rivers and agricultural land.

[2] *"Forested wetlands", Wisconsin Wetlands Association. https://www.wisconsinwetlands.org/learn/about-wetlands/wetland-types/forested-wetlands/*
[3] *"Forested wetlands", NSW Environment, Energy and Science, 2017. https://threatenedspecies.bionet.nsw.gov.au/*
[4] *Fundação Amazônia Sustentável (FAS), 2010, Methodology for Estimating Reductions of Greenhouse Gases Emissions from Frontier Deforestation REDD-NM-002*
[5] *Ibid*

Terms	Definition
Permanent Reserved Forest (PRF) Amenity Forest	Permanent Reserved Forest (PRF) Amenity Forest functions to maintain a sufficient area for recreational and eco-tourism activities and to increase public awareness on forests.
Permanent Reserved Forest (PRF) - Research and Education Forest	Permanent Reserved Forest (PRF) Research and Education Forest Functions to reserve some forests for the purpose of research, education and the preservation of biological diversity.
Non-Permanent Reserved Forest (PRF)	Non-Permanent Reserved Forest (PRF) are forested areas that have not been gazetted and are termed state land forests.
Totally Protected Area (TPA)	Totally Protected Area (TPA) is a legally designated land or marine zone protected under national and state laws to conserve biodiversity and ecosystems under the National Parks Act 1980, Wildlife Conservation Act 2010, where activities like logging, hunting, or resource extraction are prohibited or highly restricted.

2 Applicability Conditions

While the Eligibility Flowchart (Section II) provides a high-level visual guide to help Project Proponents quickly assess whether a proposed area may qualify for REDD activities under the FCO Program, this chapter on Applicability Conditions offers a more detailed technical criteria that must be met for a project to be formally considered eligible.
The Applicability Conditions outlined here, ensures that only those initiatives which align with the program's requirements proceed to quantification and crediting.

2.1 General Applicability Conditions

To ensure consistency and integrity of REDD implementation under the FCO Program, all proposed projects must first meet a set of overarching criteria. These General Applicability Conditions serve as the foundational screen before more detailed project specific eligibility assessment are applied.

1. **Forest classification**
   - The project area must meet the definition of a forest, as recognized under national definition and/or FCO program.

2. **Forest condition**
   - The land must have maintained forest canopy cover for at least 10 consecutive years prior to the project start date. Eligible forest types include
   - Primary (intact) forest – largely undisturbed by any activities
   - Secondary (disturbed) forest - forest that have been cleared and have recovered naturally
   - Degraded forest – forest that shows signs of disturbances, such as reduced canopy cover or carbon stock.

3. **Baseline alignment**
    - The proposed REDD activity must correspond to a baseline scenario involving either deforestation or forest degradation. Please refer to Figure 2 : REDD Eligibility Flowchart to identify the appropriate REDD activity pathway.

4. **Legal and customary land tenure**
    - The project must be grounded in a clear legal frameworks or policies that recognizes both statutory (legal) land tenure, and indigenous or customary land rights.
    - The project must also comply with all applicable national and international laws.

2.2 Project Level Applicability Conditions

While the general applicability conditions ensure that a project aligns with the overarching goals of the FCO REDD Methodology, project-level applicability conditions provide a more detailed and activity-specific framework. These conditions help determine whether the proposed REDD activity is technically feasible within the context of the project area.

Project level applicability conditions are essential for :
- Ensuring that REDD activities are grounded in credible baseline scenarios
- Aligning project activities (interventions) with drivers of deforestation or degradation
- Validating that the project can deliver measurable GHG emissions.

The table below outlines the applicability conditions for REDD activities by aligning the specific disturbances / key drivers of deforestation or degradation, to designated forest types in baseline scenario. It illustrates the conditions and required evidence necessary to implement REDD activities in project scenarios involving both planned and unplanned deforestation / degradation scenarios.

Table 1: Applicability Conditions for REDD Activities by Forest Type and Disturbance Drivers

			Baseline scenario	Project scenario
Forest Class	**Forest Condition**	**Examples**	**Key drivers of disturbances and required evidence**	**Potential REDD Activity**
PRF- Protection	• Primary • Secondary • Degraded	Water catchment forest, soil protection forest, virgin jungle forest	• Evidence of unauthorized logging or disturbance threats • Documentation of fire events from adjacent land	Avoided Unplanned Deforestation/Degradation
			• Official documentation of planned conversion applications (e.g. applications submitted to the relevant authority for conversion of forest land to other land uses)	Avoiding Planned Deforestation

			Baseline scenario	**Project scenario**
Forest Class	**Forest Condition**	**Examples**	**Key drivers of disturbances and required evidence**	**Potential REDD Activity**
PRF- Amenity Forest	• Secondary • Degraded	Forests designated for recreation, tourism and community engagement	• Official documentation of planned conversion applications (e.g. applications submitted to the relevant authority for conversion of forest land to other land uses)	Avoiding Planned Deforestation
			• Evidence of unauthorized logging or disturbance threats like encroachment or shifting agriculture	Avoided Unplanned Deforestation/Degradation
PRF- Research and Education Forest	• Primary • Secondary • Degraded	Forests for research, education and biodiversity conservation	• Evidence of illegal activity or unauthorized deforestation [6]	Avoiding Unplanned Deforestation/Degradation
State Land/Private Forests	• Primary • Secondary • Degraded	• State land forests • Private forests	• Official documentation of planned conversion applications (e.g. applications submitted to the relevant authority for conversion of forest land to other land uses)	Avoiding Planned Deforestation
			• Evidence of unauthorized logging or disturbance threats like encroachment or shifting agriculture	Avoiding Unplanned Deforestation/Degradation
Totally Protected Areas (TPA)	• Primary	Legally protected forests where no extractive activities are permitted, primarily for conservation	• Evidence of unauthorized logging or disturbance threats like encroachment or shifting agriculture	Avoiding Unplanned Deforestation/Degradation

[6] Illegal Occupation of Agricultural Research Land

2.2.1 Avoiding Unplanned Deforestation/Degradation

This condition applies to forest areas experiencing deforestation or degradation occurring without formal authorization, typically driven by subsistence activities or informal land use.
Baseline agents must meet all of the following criteria:

1. Activities include clearing land for purposes such as tree harvesting, settlements expansion, roads constructions, crop production, or ranching, where these activities are not part of large-scale industrial operations.
2. Agents lack the legal rights to deforest or degrade the land for these purposes.
3. Agents are either local residents or immigrants within the reference region for deforestation.

In this context, a 'baseline agent' refers to the individual, group, or entity responsible for activities that could lead to deforestation or forest degradation without the intervention of the REDD project.

2.2.2 Avoiding Planned Deforestation

This condition applies to forest area where the conversion of forest land to a non-forest condition is legally permitted. Key conditions include :

1. The forest land must be under legal threat of conversion (e.g., for agriculture, infrastructure, or development).
2. There must be documented evidence of intent to deforest, such as government approvals, land use plans, or applications for conversion.
3. The project must demonstrate that its intervention will prevent this legally sanctioned deforestation.
   This ensures that REDD activities are not only additional but also prevent emissions that would otherwise occur under lawful development.

2.2.3 Jurisdictional-Level Applicability Conditions

Jurisdictional-level applicability conditions apply to REDD projects that utilize jurisdictional baselines and are proposed by national or subnational governments. These conditions ensure that REDD activities are implemented within appropriate administrative boundaries and with the necessary legal authority.

To qualify under this category, the following criteria must be met :

1. **Eligible Project Proponent and/or Project Owner**
   - Either the Project Proponent or Project Owner must be a national or subnational governments,
   - Subnational Project Proponents and/or Project Owner must operate at no more than one administrative level below the national level.

   This flexibility ensures that jurisdictional REDD projects can be implemented by capable entities beyond national or subnational level, as long as they are formally authorized to act within the jurisdictional framework.

2. **Accounting area boundaries :**
   - The proposed subnational accounting area must align with the full extent of one or more administrative jurisdictions

- The accounting area must consist of forested land over which the Project Proponent and/or Project Owner have jurisdictional authority.

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3. **Safeguard compliance**
    - Project Proponent and/or Project Owner must demonstrate adherence to the Cancun Safeguards, which includes:
    - Respect for the rights of indigenous peoples and local communities
    - Promotion of biodiversity and ecosystem services
    - Transparent and effective governance structures

2.3 Ineligibility

While the above lists down the eligible project activities, certain scenarios are explicitly excluded to maintain the integrity, additionality and permanence of emission reductions. Projects are considered ineligible if they meet any of the following conditions :

1. **Baseline reforestation assumption**
    - Projects are ineligible if the baseline scenario assumes that the land will be reforested, afforested, or converted to agroforestry immediately after deforestation. Such assumptions undermine the permanence of emission reductions, as they imply that carbon stocks would naturally recover without project intervention.
    - For example, this includes clearing forests in areas legally designated for future reforestation or under existing land use plans (e.g., forest plantations or reforestation zones).
    - Exception: Projects may still be eligible only if they can clearly demonstrate that such clearing would result in net emissions and that REDD+ interventions would deliver additional and permanent climate mitigation benefits beyond what is legally or customarily expected..

2. **Commercial harvesting of trees**
    - Projects located in the PRF Production forest classes are not eligible.

3. Projects involving the harvest of trees for commercial wood products (e.g., timber, fuelwood, charcoal, fiber) are not eligible under the REDD Methodology. However, exceptions are made if the trees were planted as part of the REDD project itself, specifically for the purpose of mitigating leakage or supporting community development . In such cases, the harvest is permitted only if it aligns with the project's approved objectives and does not compromise the integrity of emission reductions.

4. Non-forest efficiency measures
    - Projects that reduce emissions solely through efficiency improvements in non-forest activities (e.g. industrial upgrades etc) are not eligible under this Methodology.

5. **Non-wetland classification**
    - Projects located in areas that are classified as wetlands under local laws and regulations are not eligible under this Methodology.

6. **Restrictions in TPA**

Projects located in TPA (e.g. National Parks, Wildlife Sanctuaries, Wildlife Reserves) are not eligible if state policies prohibit the monetization of carbon credits.

3 Project Boundary

This section defines the spatial and temporal boundaries within which the REDD project activities are implemented and monitored. Establishing a clear project boundary is essential for ensuring transparency, consistency and credibility in the quantification of GHG emission reductions. The project boundary encompasses four key dimensions.

1. **Geographical boundaries**
   These define the physical extent of the project area using spatial data such as satellite imagery, maps, and georeferenced coordinates. It includes delineation of exclusion zones, buffer areas, and leakage belts depending on the REDD activity type (e.g., planned vs. unplanned deforestation)

2. **Temporal boundaries**
   These refer to the timeframes over which project activities occur and emissions are measured. This includes the start and end dates of the crediting period, monitoring intervals, and any time-based limitations (e.g., the number of years for which Soil Organic Carbon [SOC] claims can be made).

3. **Carbon pools**
   The project proponents must identify which carbon pools are included or excluded in the accounting process. These typically include aboveground and belowground biomass, organic soil, carbon, litter, deadwood, and harvested wood products.

4. **GHG emission sources**
   All relevant sources of GHG emissions within the project boundary must be identified and assessed. These may include emissions from biomass burning, fossil fuel combustion, and other project-related activities.

3.1 Geographical Boundaries

In the implementation of REDD project activities, it is essential to clearly define and differentiate the spatial boundaries based on the specific REDD category such as, avoiding planned deforestation or avoiding unplanned deforestation/degradation. Accurate delineation of these boundaries is critical for establishing credible baselines, monitoring emissions reductions, and managing leakage risks.

1. **Avoiding Planned Deforestation**

   Planned deforestation refers to forest loss that is legally sanctioned or permitted, typically for land-use conversion such as agriculture, infrastructure development, or logging concessions.
   In REDD projects aimed at avoiding planned deforestation, the following spatial features must be delineated:

   a. **Project Area** (*Section 3.1.1*): The area under the control of the Project Proponent in which the REDD project activity will be implemented and GHG emission reductions accounted.
   b. **Proxy Area** (*Section 3.1.3*) : If a verifiable deforestation plan is unavailable, proxy area must be identified. This area is used to estimate the average annual rate of land clearing serve as the basis for establishing baseline deforestation rates.

2. **Avoiding Unplanned Deforestation/Degradation**

Unplanned deforestation and degradation refer to unauthorised or illegal forest loss, often driven by small-scale agriculture, encroachment, or unsustainable logging practices.
For REDD projects addressing unplanned deforestation or degradation, the following spatial features must be delineated:

a. **Project Area** (*Section 3.1.1*): The area under the control of the Project Proponent in which the REDD project activity will be implemented and GHG emission reductions will be accounted for.
b. **Reference Region/Area** (*Section 3.1.2*): The region from which historical deforestation data is extracted and projected forward to identify areas likely to be deforested in the absence of the project.
c. **Leakage Belt** (*Section 3.1.4*): The area surrounding or adjacent to the project site where baseline deforestation activities could be displaced due to the project implementation.
d. **Leakage Management Zone**: A designated area outside the project and leakage belt boundaries where interventions (e,g, improved land management, agroforestry, reforestation) are implemented to reduce the risk of activity displacement.

3. Jurisdictional Boundary

For jurisdictional-level REDD projects, it is essential to clearly define the accounting area within which emission reductions will be measured and reported. This includes both spatial and administrative clarity to ensure consistency with national or subnational frameworks.
Project Proponents must provide:

a. A clear description of the proposed accounting area, whether at the national or subnational level.
b. Georeferenced GIS shapefiles that delineate the boundaries of the accounting area.
c. The percentage of forest cover within the accounting area, supported by spatial data and analysis

3.1.1 Project Area

The project area refers to the specific land parcel(s) under the control of the Project Proponent where REDD activities will be implemented and emissions reductions will be accounted for. The area must consist exclusively of forest land as defined by national or FCO Program at the project start date.

To ensure transparency and verifiability, the project area must be clearly delineated and supported by appropriate documentation. This includes:

1. Legal proof of control
- Land titles issued by the public registry, or
- Other legally recognized documents confirming ownership or management rights, or
- Written consent from landowners authorizing the implementation of REDD activities

2. Spatial definition
- The physical boundaries of the project area must be precisely mapped to enable accurate measurement, monitoring, and verification of emissions reductions. If the project comprises multiple discrete land parcels, each must be individually identified and documented.

- For each discrete parcel, the following information must be provided :

No.	Information Type
1	Name of the project area (e.g., compartment number, allotment number, local name), giving a unique ID for each discrete parcel of land
2	Digital map(s) of the area
3	Geographic coordinates of each polygon vertex along with documentation of their accuracy (from a geo-referenced digital map)
4	Total land area
5	Details current land-tenure and ownership, including any legal arrangement related to land ownership

3.1.2 Reference Area/Region

The reference area (also referred to as reference region) is used to analyse historical land use and land cover changes; such as deforestation rates and spatial patterns, that inform the baseline scenario for REDD projects. It serves as the foundation for projecting future deforestation or degradation in the absence of project intervention.

To ensure the reference area is representative, it must meet the following conditions:

1. **Spatial requirements**
   - The reference area must be larger than the project area.
   - It must include either:
     - The project area, or
     - The leakage belt[7] surrounding the project area
   - If direct inclusion is not feasible, the reference area must be located in a geographically similar region that reflects comparable deforestation[8] pressures.

2. **Similarity criteria**[9] :
   The reference area must closely resemble the project area in the following dimensions:
   - Agents and drivers of deforestation
     - Similar types of actors (e.g., smallholder farmers, illegal loggers) and land-use pressure must be present.
   - Landscape configuration and ecological conditions
     - Comparable forest types or vegetation classes, soil types, slope gradients, and elevation ranges.
   - Socio-economic and policy context

[7] *FAS - Fundação Amazônia Sustentável, 2010, Methodology for Estimating Reductions of Greenhouse Gases Emissions from Frontier Deforestation REDD-NM-002*
[8] *Ibid*
[9] *Ibid*

- Similarities in land tenure systems, land-use practices, legal status (e.g., private, state, or conservation land), and enforcement of relevant policies and regulations.

3.1.3 Proxy Areas

In the absence of a verifiable general harvesting or tree planting plan that includes a projected deforestation rate, REDD projects must use proxy areas to estimate baseline deforestation rates. Proxy areas serve as representative analogs to the project area and provide empirical data on historical land clearing patterns under similar conditions.
To ensure the validity of proxy-based estimates, the selected proxy areas must meet the following criteria:

Proxy area must closely resemble the project area in the following aspects:

Land Conversion Practices	The methods and scale of land clearing must match those used by the baseline agent or class of agents in the project area.
Post-Deforestation Land Use	The land use following deforestation must be the same as what is expected in the project area under a business-as-usual scenario (e.g., conversion to agriculture, aquaculture, or infrastructure).
Land Rights and Management	Proxy areas must have the same type of land tenure (e.g. private, state, concession) and management arrangements as the project area.
Geographic Location	Proxy areas should be selected in the following order of preference: (a) near the project site, (b) elsewhere within the same country, (c) in neighboring countries (only if no suitable domestic proxies exist).
Legal and Suitability Status	The proxy area must meet the same legal and land suitability conditions as the project area, including zoning, land use permissions and development potentials
Timing of Deforestation	Deforestation in the proxy area must have occurred within the 10 years prior to the baseline period to ensure relevance.
Biophysical Conditions	The proxy area must fall within ±20% similarity to the project area in terms of: • Forest type or vegetation class, soil types, slope, and elevation class

3.1.4 Leakage Belt

Leakage belt refers to the area surrounding or adjacent the project boundary where deforestation or degradation activities may be displaced as a result of REDD project interventions[10]. This is critical for assessing and managing activity-shifting leakages, which occurs when baseline agents relocate their activities outside the project area due to restrictions imposed by the project.

[10] *Ibid*

To ensure the leakage belt is appropriately defined and defensible, the following conditions must be met:

Eligibility criteria

- The area must remain forested under the baseline scenario[11]
- There must be a credible risk that drivers of deforestation or degradation may be displaced from the project area into this area[12].

Delineation criteria

The boundary of the leakage belt must be defined based on the following three dimensions:

Mobility Constrains for the Agents	Use historical data, expert judgment, participatory rural appraisal (PRA), and/or other verifiable sources to assess how agents may shift their activities[13]. Consider[14]: • Availability and pricing of inputs and outputs related to land-use activities. • Proximity to roads, rivers, or other access routes. • Distance to markets or trading hubs where products are sold or traded. • Location of existing or planned settlements and infrastructure.
Regulation & Social Condition	The leakage belt must be situated in areas with similar • Land-use policies and enforcement mechanisms • Social and institutional conditions (e.g. community governance, customary rights). To maintain legal integrity and ensure emission reductions are verifiable, the leakage belt must not extend across state or jurisdictional boundaries unless: • There is explicit legal permission to include cross-boundary areas, or • The adjacent jurisdiction enforces comparable forest and land-use regulations
Landscape & Ecological Condition	The leakage belt must have similar ecological characteristics to the project area[15]. This includes[16]: • Forest or vegetation classes: The composition of forest or vegetation types in the leakage belt must be within ±20% similarity in composition. • Elevation range: The elevation range in the leakage belt must fall within ±20% of that in the project area. These parameters should be validated using GIS-based spatial analysis and remote sensing tools[17].

[11] Ibid
[12] Forest Carbon Partnership, FCPF Carbon Fund Methodological Framework Discussion Paper #5: Displacement (Leakage), October 2013
[13] FAS - Fundação Amazônia Sustentável, 2010, Methodology for Estimating Reductions of Greenhouse Gases Emissions from Frontier Deforestation REDD-NM-002
[14] Ibid
[15] Ibid
[16] Ibid
[17] Ibid

3.1.5 Drivers of Forest Change

To establish a credible and defensible baseline, the project must identify the key drivers of deforestation and forest degradation that are relevant to the project area. These drivers must be consistent with those observed in the reference area or proxy areas. Any discrepancies must be clearly explained and justified with supporting evidence.

Drivers of Forest Change refer to the underlying activities or pressures that lead to forest loss. These can be categorized based on whether the deforestation is planned (legally sanctioned) or unplanned (unauthorized or informal). Examples include Table 2 below.

Table 2.: Examples of Drivers of Forest Change

Forest Change	Drivers of Forest Change
Unplanned Deforestation/ Degradation	• Clearing land for settlements, crop production, ranching where such clearing for crop production does not amount to large scale industrial agricultural activities • Anthropogenic interventions without legal rights to deforest
Planned Deforestation	• Large scale agricultural or aquaculture operations • Land clearing on parcels larger than 500 ha • Activities conducted under formal land-use permits or legal frameworks

Understanding and documenting these drivers is essential for:

- Aligning the baseline scenario with actual land-use pressures.
- Designing targeted interventions that address the root causes of forest loss.
- Ensuring consistency across the project, reference, and proxy areas.

3.1.6 Stratification

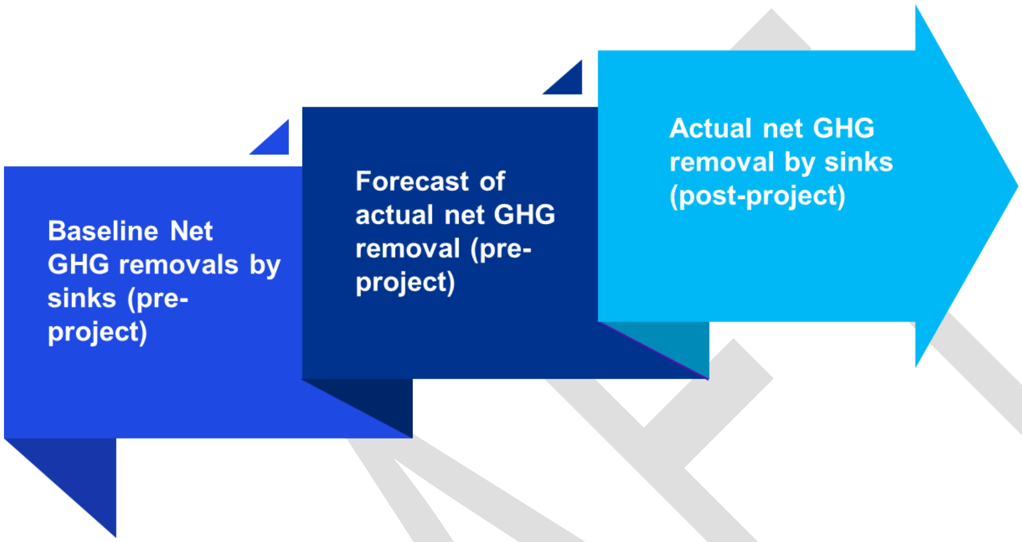
Stratification is the process of dividing the project and reference areas into relatively homogeneous units, or strata, to improve the accuracy and precision of carbon stock estimates and land-use change assessments. This is particularly important in ecologically diverse landscapes like Malaysia, where forest characteristics can vary significantly across regions.

Stratification should be based on variables that significantly influence carbon density, forest dynamics and land use dynamics. These may include:

- Forest type
    - e.g., lowland dipterocarp, peat swamp, montane forest
- Forest conditions
    - e.g., primary (intact), secondary (disturbed/logged), degraded
- Land use/land cover (LULC) category
    - e.g., forest, plantation, agriculture, settlements
- Soil type
    - e.g., mineral soils, peat soils
- Topography
    - e.g., elevation, slope
- Forest classification
    - e.g., protected areas, production forest, PRF, TPA

Each stratum should be internally consistent in terms of these characteristics and distinct from other strata. This allows for more accurate sampling, monitoring, and reporting of carbon stock changes and GHG emissions.

The stratification approach shall be adapted to the specific context of each project phase, as outlined below:



1. Baseline Net GHG removals by sinks (pre-project)

Stratification should be conducted based on the area's predominant vegetation types (e.g., grassland, bushland), crown cover, and historical land use. This approach reflects the expected carbon stock in the absence of project intervention. It is generally assumed that baseline removals on degraded or degrading lands are minimal compared to those achieved through project activities.

2. Forecast of actual net GHG removal (pre-project)

Stratification shall be based on:

• The area's major vegetation types, which influence initial biomass levels and growth potential; and

• The proposed planting and forest management plan, which outlines species selection, planting density, and silvicultural practices.

This stratification enables the application of appropriate growth models tailored to each stratum's characteristics, thereby improving the accuracy of projected carbon sequestration.

3. Actual net GHG removal by sinks (post-project)

Following project implementation, stratification must be updated to reflect the actual conditions on the ground. This includes:

- Ex-Ante Stratification: Initially based on the intended planting and forest management plan as submitted in the project design documentation.
- Ex-Post Stratification: Revised to align with the actual implementation of planting and management activities. This ensures that monitoring and reporting are based on real, rather than planned, interventions.

- Adjustment for Disturbances: In the event of natural (e.g., fire, storms, pest outbreaks) or anthropogenic (e.g., harvesting, replanting) disturbances that significantly alter biomass growth patterns, strata must be redefined or adjusted accordingly. This dynamic approach ensures that carbon accounting remains accurate and reflective of on-the-ground realities.

3.2 Temporal Boundaries

Temporal boundaries define the timeframe during which a project is implemented, and emissions reductions/ removals are measured, monitored and credited. These boundaries are important because it sets and document the period in which the activity will take place ensuring the accuracy and credibility of the project.

General Conditions

To qualify for the jurisdictional program, the project must adhere to the following conditions:

- The crediting period under FCO jurisdictional program is fixed at five calendar years.
- The initial crediting period may begin up to four calendar years prior to the year in which the Project Proponent submits an initial proposal. However, this period must not overlap with the historical reference period.
- For subnational entities, the crediting period must be concluded by December 31, 2030, regardless of the start date

Monitoring Requirements

- Monitoring reports are required in years 1, 3, and 5 of the crediting period.
- Optional monitoring reports may be submitted in years 2 and 4.
- These reports must document the emissions reductions or removals achieved during the respective periods.

Crediting Conditions

- The FCO Program does not permit the crediting of future emissions reductions.
- Credits can only be issued for emissions reductions or removals that have already occurred and been verified.
- Emission reductions or removals may be credited for up to four calendar years before the FCO Program initial proposal, if all other conditions are met. The conditions herein refer to the Jurisdictional-Level Applicability Conditions, Quantification, Monitoring, Reporting and Verification of GHG emissions.

3.3 Carbon Pools

Carbon pools are essential components of forest ecosystems where carbon is sequestered and stored, playing a crucial role in maintaining the balance of carbon stocks over time. These pools are integral for accurately measuring and monitoring changes in carbon levels, particularly in the context of assessing the effectiveness of emission reduction strategies. Each carbon pool within the ecosystem contributes uniquely to the carbon cycle, making it essential to understand how forest management practices, growth patterns, or disturbances can influence the overall carbon balance of a project.

In order to quantify emissions reductions or removals effectively, it is imperative to identify and differentiate specific carbon pools based on their significance and potential emissions impact.

	Carbon Pool	Description
Included	Aboveground tree biomass	Above-ground tree biomass plays a pivotal role in REDD initiatives as a major carbon pool central to carbon sequestration efforts. Significant decreases in above-ground biomass are observed in the baseline scenario following deforestation or forest degradation, highlighting the importance of monitoring and preserving this carbon pool.
	Aboveground non-tree biomass	While this pool must be included in the baseline assessment to account for post-deforestation carbon stocks, it may be conservatively excluded from forest carbon stocks calculations. The inclusion of aboveground non-tree biomass provides valuable insights into the impact of land-use changes on carbon dynamics, particularly in scenarios where forest degradation occurs.
	Belowground tree biomass	Belowground biomass, encompassing tree roots and other components, represents a substantial portion of carbon stored in forest ecosystems. Major reductions in belowground tree biomass are anticipated in the baseline scenario associated with deforestation or forest degradation, emphasizing its significance for carbon monitoring efforts.
	Belowground non-tree biomass	The potential emissions from belowground non-tree biomass are deemed negligible, underscoring its limited impact on overall carbon dynamics
	Soil Organic Carbon	In non-wetland soils, it is considered conservative to exclude soil organic carbon from carbon accounting due to its minor changes in response to forest management practices. However, in wetland soils, soil organic carbon represents a primary carbon pool that may experience substantial fluctuations in both baseline and project scenarios, necessitating careful monitoring and inclusion in carbon assessments.
Excluded	Deadwood	Carbon pools are conservatively excluded.
	Harvested wood products	Harvested wood products may be excluded from REDD initiatives, particularly in cases where timber harvest activities have a negligible impact on carbon stocks in the baseline scenario.
	Litter	The conservative exclusion of litter, including fine woody debris and organic matter on the forest floor, acknowledges its limited contribution to overall carbon storage and its tendency to reach equilibrium relatively quickly.

** Significance of the source of carbon pools is determined using an adaptation of CDM Tool for testing the significance of GHG emissions in Afforestation/Reforestation CDM project activities.*

3.4 GHG Emission Sources

This subsection outlines the relevant GHG emission sources that must be considered within the defined project boundaries.

To determine if an emission source is significant and whether it can be omitted within the project boundaries, a stepwise procedure must be carried out. Some emissions are conservative to exclude or are considered negligible if their relative contribution is less than 5% of the net carbon pool emissions.

	Sources	Gas	Included	Justification
Baseline Scenario	Burning of woody biomass	CO_2	✓	Major emissions source
		CH_4	Optional	Non-CO_2 gasses emitted from woody biomass burning – conservative to exclude
		N_2O	Optional	
	Combustion of fossil fuels	CO_2	Optional	May be excluded where determined negligible
		CH_4	✗	Potential emissions are negligible.
		N_2O	✗	
	Use of fertilizers	CO_2	✗	Potential emissions are negligible.
		CH_4	✗	
		N_2O	Optional	Potential emissions are negligible.
Project Scenario	Burning of woody biomass	CO_2	✓	Major emissions source
		CH_4	✓	Major emissions source
		N_2O	✓	Major emissions source
	Combustion of fossil fuels	CO2	Optional	Emissions associated with the combustion of fossil fuels due to leakage prevention activities are always considered insignificant. Emissions associated with other activities (e.g., monitoring, patrolling) must be demonstrated as negligible to be omitted.
		CH_4	✗	Potential emissions are negligible
		N_2O	✗	Potential emissions are negligible

	Sources	Gas	Included	Justification
Project Scenario	Use of fertilizers	CO2	✗	Potential emissions are negligible
		CH_4	✗	Potential emissions are negligible
		N_2O	Optional	Mandatory to be included where the usage of fertilizers increases due to the project (e.g., as a leakage avoidance mechanism). Otherwise, may be excluded if it is also excluded from the baseline.

4 Baseline and Additionality

This section outlines the procedures for establishing and reassessing the baseline scenario and demonstrating additionality for REDD projects under the FCO framework. A robust baseline scenario is essential to conservatively estimate GHG emissions or removals that would occur in the absence of project intervention. Additionality ensures that project activities result in real, measurable climate benefits beyond business-as-usual practices.

4.1 Baseline Determination and Additionality Assessment

The baseline scenario represents the most likely land use or management practices that would occur in the absence of the project. It serves as the reference point for estimating GHG emissions or removals.

To determine and justify this scenario, Project Proponents should refer to the **FCO Tool : Baseline Determination and Additionality Assessment.** This standardised tool guides Project Proponents through a series of steps to ensure that the selected baseline is realistic, evidence based and conservative.

4.2 Reassessment of Baseline

To maintain alignment with evolving land-use trends and ensure continued credibility, the baseline scenario must be reassessed periodically throughout the crediting period. The frequency and method for reassessment depend on the type of REDD activity and whether the baseline is derived from jurisdictional-level data.

The following outlines the reassessment requirements for Avoiding Planned and Unplanned Deforestation project types:

1. Avoiding Planned Deforestation:
   - The baseline must be reassessed every 10 years for the duration of the project, or earlier if there are any significant changes observed.

2. Avoiding Unplanned Deforestation and Degradation:
   - Using jurisdictional-level data:
     - The initial baseline validity may range from1 to 7 years
     - Subsequent validity periods must not exceed 6 years.
     - Reassessment is required at the end of each validity period, or earlier if there are any significant changes observed.
   - Not using jurisdictional-level data,
     - The baseline must be reassessed every 6 years throughout the project duration.

5 Quantification of Estimated GHG Reductions

This section outlines the methodology for calculating the GHG emission reductions achieved through REDD project activities. It provides a structured approach to quantify the difference between baseline emissions (what would have occurred without the project) and actual project emissions (with REDD interventions in place).

5.1 Baseline Emissions

Baseline emissions are established to represent the expected level of emissions in the absence of the project. The baseline net GHG emissions for planned/unplanned deforestation will be determined as follows:

$$\Delta C_{BSL,REDD} = \sum_{t=1}^{t*} \sum_{i=1}^{M} (\Delta C_{BSL,Def/Deg,i,t} + \Delta GHG_{BSL-E,i,t}) \qquad \textbf{(1)}$$

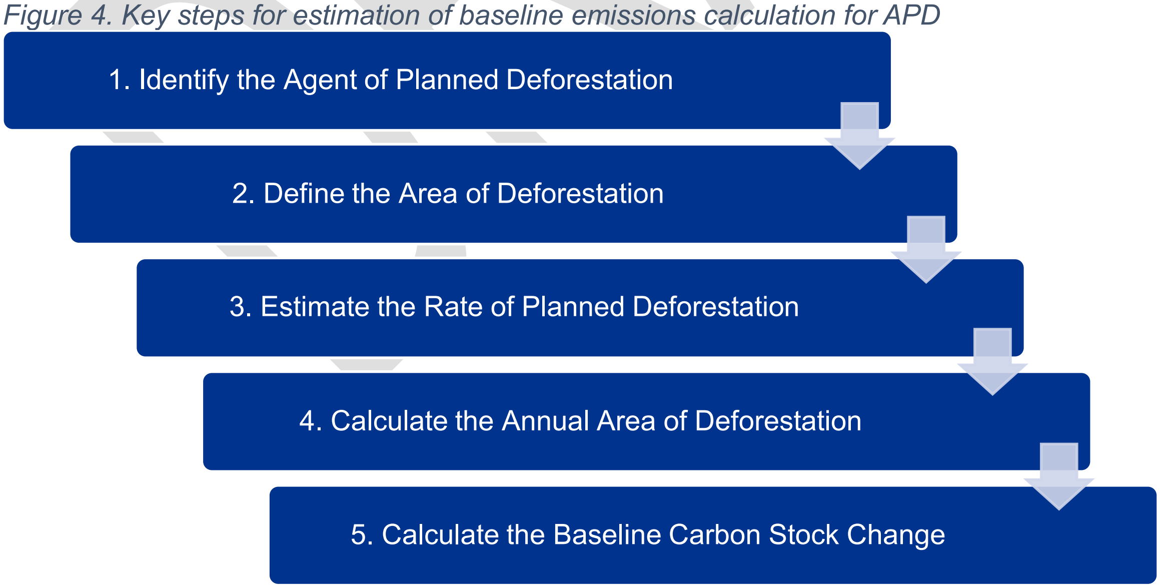
Where:

Variable	Description	Unit
$\Delta C_{BSL,REDD}$	Net greenhouse gas emissions in the baseline from planned/unplanned deforestation up to year *t**	tCO_2e
$\Delta C_{BSL,Def,i,t}$	Sum of the baseline carbon stock change under deforestation in stratum *i* in year *t* outlined in Equation 8 (Planned) or Equation 9 (Unplanned)	tCO_2e
$\Delta C_{BSL,Deg,i,t}$	Baseline carbon stock change from forest degradation in stratum i outlined in Equation 10	tCO_2e
$\Delta GHG_{BSL-E,i,t}$	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum *i* in year *t* as outlined in GHG Quantification Equations	tCO_2e/yr
i	1, 2, 3, … *M* strata	
t	1, 2, 3, … *t** years elapsed since the projected start of the project activity	

5.1.1 Avoiding Planned Deforestation (APD)

Below is a summary of the key steps to calculate baseline emissions for APD projects:

Figure 4. Key steps for estimation of baseline emissions calculation for APD



1. Identify the agent of planned deforestation in each baseline stratum

   Begin by determining the specific agent responsible for the planned deforestation within each baseline stratum. In straightforward cases, this agent may already be defined as an individual, organisation, or corporation.

   If the agent is not yet clearly defined such as when the government or another authority currently manages the land and future deforestation agents are unknown but expected to be officially approved, then identify the most probable class of deforestation agents. Please refer to *Section 3.1.5* for examples of deforestation agent and *Section 3.1.6* for stratification process.

2. Define the area of deforestation

   All Avoided Planned Deforestation (APD) projects must show a concrete, site-specific threat of deforestation that would occur within a defined timeframe. This threat must be supported by documentary evidence of the following:

Legal Permissibility	Proof that deforestation is legally allowed on the project site
Land Suitability	Evidence that the area is suitable for conversion to non-forest land use considering factors like soils, topography, climate and market access
Ownership Transfer (if applicable)	If relevant, show likely transfer of land to the baseline agent or class of agent through one of the following, before REDD consideration: • Bidding process for the project area indicating intent to deforest • Purchase offer from a development-focused entity • Other documentation showing the area would have been transferred to the agent/class of agent without the project
Government approval (if required)	If deforestation needs official approval, the intention to deforest must be provided: • Recent approval from a relevant government authority for land conversion, or • A filed request for deforestation approval
Intent to Deforest	The intent to deforest must be shown through evidence dated prior to any REDD activity: • Deforestation identified by class of agent (i.e., generalised group of actors typically engaged in deforestation activities) - A documented history (e.g., maps, government data) of similar planned deforestation within the past five years. • Deforestation identified by a specific baseline agent (i.e., a known entity like a particular company) - Either a verifiable land use plan for deforestation or a documented history of similar activities within the past five years.

3. Estimate the Rate of Deforestation

The REDD Methodology requires an estimate of the annual deforestation rate defined as the area expected to be cleared each year for each planned stratum over the duration of the project.

- If a valid and verifiable plan exists that outlines the projected rate of deforestation, that rate must be used.
- If no such plan is available, the rate must be estimated using proxy areas.

The applicability of proxy areas as detailed in *Section 3.1.3 Proxy Areas* must be considered for determination of deforestation rate. The proxy area is used to estimate the average annual proportion of land cleared, so it must include a sufficient number of land parcels to accurately reflect common deforestation practices both in the proxy area and the project area.

Assessment of proxy areas can be done through original data collection (such as field surveys or remote sensing) or, where appropriate, by using reliable existing data from credible sources.

This equation calculates the annual rate of planned deforestation for a particular forest type (stratum) using data from multiple proxy parcels (land parcels that were previously deforested under similar legal/land-use conditions).

$$D\%planned,i,t = \left(\frac{\sum_{n=1}^{N}(D\%_n / Yrs_n)}{N}\right) \qquad \textbf{(2)}$$

Where:

Variable	Description	Unit
$\boldsymbol{D\%planned,i,t}$	Projected annual deforestation rate in stratum i during year t	%
$\boldsymbol{D\%_n}$	Percent of land deforested in land parcel *n* of a proxy area	%
$\boldsymbol{Yrs_n}$	Number of years over which deforestation occurred in land parcel *n*	
$\boldsymbol{N}$	Total number of land parcels examined	
$\boldsymbol{n}$	1, 2, 3, …*N* land parcels examined in proxy area	
i	1, 2, 3, … *M* strata	

Step-by-step Explanation

a. Define the stratum of a specific forest class (e.g., lowland dipterocarp forest, hill dipterocarp forest).
b. Select the n land parcels that belong to the same stratum i with similar legal, ecological and land-use which have undergone planned deforestation.
c. For each land parcel (n):
d. Determine the total percentage of the parcel area that was cleared ($D\%_n$). Divide the total percentage of forest land deforested by the number of years it took to clear that land (Yrs_n).
e. Sum the annual deforestation rates for all land parcels calculated in Step 3, then divide the total by the number of proxy parcels (N) to get the average annual deforestation rate for that stratum and year.

4. Calculate Annual Area of Deforestation

The annual area of deforestation in the baseline can be determined using the following equation:

$$AAplanned, i, t = A_{planned,i} \times D\%_{planned,i,t} \quad \textbf{(3)}$$

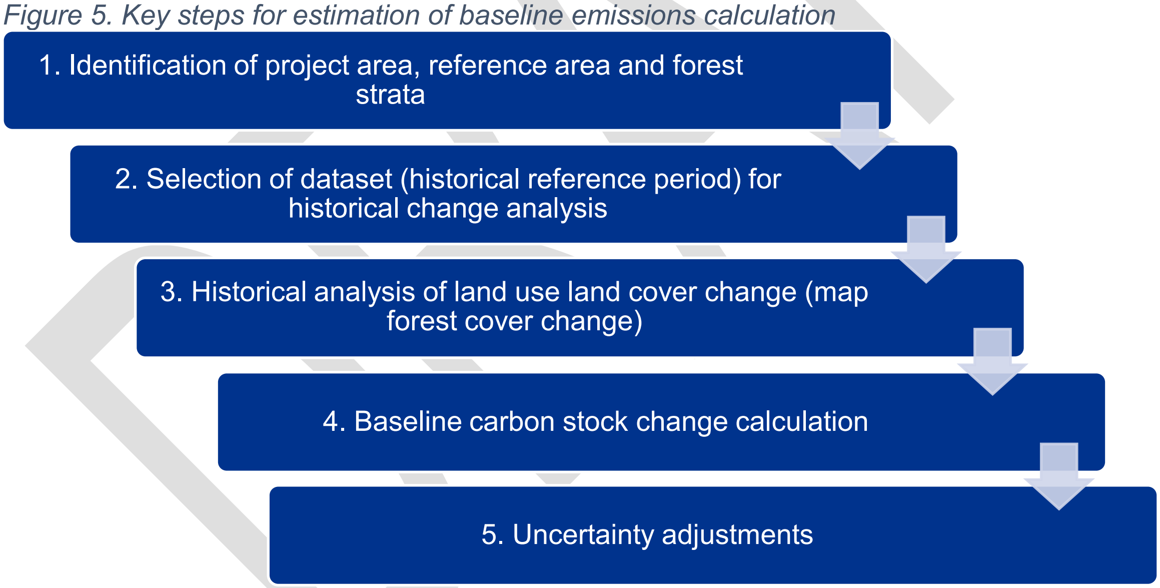
Where:

Variable	Description	Unit
$AAplanned, i, t$	Annual area of planned deforestation in stratum i during year t	ha
$D\%_{planned,i,t}$	Percent of land deforested in land parcel *n* of a proxy area or Projected rate of deforestation from verifiable plan	%
$A_{planned,i}$	Number of years over which deforestation occurred in land parcel *n*	

5.1.2 Avoiding Unplanned Deforestation and Forest Degradation

Below is a summary of the key steps to calculate baseline emissions:

Figure 5. Key steps for estimation of baseline emissions calculation



1. Identification of Project Area and Reference Area

The project area must be clearly delineated by the Project Proponent. The project area matches geographical, administrative or jurisdictional boundaries based on Section 3.1. This helps ensure operational clarity and minimises overlapping with adjacent projects.

The reference area must comply with the criteria set out in Section 3.1.2. It is used to assess land-use changes over time to inform the baseline scenario for the project. The project must demonstrate that the drivers of forest cover change in the reference area are comparable to those in the project area. The same reference boundaries must be applied consistently across REDD activity within a project to ensure baseline integrity.

2. Dataset Selection for Historical Change Analysis

To assess historical land-use changes in the reference area, the Project Proponent must choose a suitable and consistent data set where it covers the same season over different years. Ideally, the datasets must meet these requirements:

a. The analysis must cover 10 to 30 years prior to the project start date, using data no earlier than the year 2000, consistent with updated remote sensing standards and land use classification practices used in Malaysia.
b. The analysis must include at least three temporal data points (e.g., 2001, 2010, 2020) to capture meaningful forest cover trends.
c. Time intervals between these points must be at least 3 years to ensure detectable changes.
d. At least one satellite image or land-use dataset must be dated within 2 years before the project start date, ensuring current land dynamics are reflected.

3. Land Use Classification

At the start of the project, the proponent must identify and describe the existing land use within the reference area. The classification and sampling methods used should follow national or regional procedures that align with Intergovernmental Panel on Climate Change (IPCC) guidelines and other international standards. Land classification must be based on IPCC's six categories[18]:

a. Forests
b. Farmland
c. Grasslands
d. Wetlands
e. Settlements
f. Other lands

For forested areas, further classification is required by forest type and density. These strata may be further divided using appropriate classification methods chosen by the Project Proponent. Similarly, non-forest lands such as plantations can also be subdivided, especially when linked to cropland or arable land systems.

These sub-stratifications help identify land use types associated with potential deforestation and degradation drivers, which can result in forest carbon stock losses during land cover transitions. However, such detailed sub-classification is optional.

Land use descriptions should be supported by clear reference criteria, which could include:

a. Elevation, slope
b. Soil type
c. Proximity to roads and villages
d. Forest classifications

4. Spatial analysis and Techniques

[18] *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry, IPCC, 2003*

I. Types of Remote Sensing (RS) Data

The final spatial classification map must include at least six IPCC-defined land-use categories to quantify deforestation. If the reference area contains varied forest types, the map should also depict the dominant forest types across the landscape. Project Proponents may utilise existing forest/non-forest classifications from relevant administrative divisions or analyse land use dynamics within or around the landscape to enhance the accuracy of land-use classification. No additional classification by the Project Proponent is required in such cases.

Examples of such remote sensing instruments are:

- Aerial photographs (e.g., from drone surveys or national mapping agencies),
- Satellite imagery in the visible and near-infrared spectrum (such as Landsat, Sentinel-2, or SPOT), and
- Radar data from satellite or airborne platforms (e.g., ALOS PALSAR, Sentinel-1), which is especially useful in Malaysia's often cloud-covered tropical environment.

A combination of these data types at various spatial resolutions is often used to effectively assess land use, especially across forest types such as PRF categories (Protection, Amenity, and Research & Education Forests) TPAs, and state lands. These combinations allow for detailed tracking of land cover change and forest disturbance patterns.

II. Land Use Change Analysis

Remote sensing is essential for assessing historical land-use changes in reference areas to determine baseline conditions and rates of deforestation and degradation. In Malaysia, this may involve analysing transitions from natural forest (primary forest) to secondary (disturbed) forest, degraded forest, plantations, agriculture, or infrastructure.

III. Accuracy Assessment of Land Use Change Maps

Ensuring map accuracy is critical for MRV (Measurement, Reporting, and Verification) systems used in Malaysia's REDD+ projects. Accuracy assessments should align with best practices outlined in:

- Section 5 of the IPCC Good Practice Guidance (2003)
- Chapter 3A.2.4 of the 2006 IPCC Guidelines for AFOLU

Field verification, high-resolution satellite imagery, and national forest inventory data (e.g., from the Forest Department Peninsular Malaysia or state forestry agencies) can enhance the credibility of accuracy assessments in the Malaysian forest context.

5. Historical Analysis of Land Use Land Cover Change

Projects must estimate the average annual forest cover change between different strata over a defined historical reference period. This period can be split into multiple sub-periods if necessary. To determine the annual forest area change, refer to the datasets requirements as outline in Section 6.1.3.

The change of forest from one stratum to another is assessed by mapping both forested and non-forested areas within the project boundary. The annual rate of change is determined using the following equation:

$$AA_{unplanned,i,t} = \left(\frac{\mathrm{A}_{t2} - \mathrm{A}_{t1}}{t_2 - t_1}\right) \qquad \textbf{(4)}$$

Where:

Variable	Description	Unit
$AA_{unplanned,i,t}$	Annual Area of Forest Change for stratum *i* at year *t*	hectares
A_{t1}	Forest area in stratum *i* at reference time point t_1	hectares
A_{t2}	Forest area in stratum *i* at reference time point t_2	hectares
t_1	Start of reference period	
t_2	End of reference period	
i	1, 2, 3, … *M* strata	

The mean annual change in forest area from stratum 1 to stratum 2 is used to calculate the annual rate of forest area change, based on the equation provided below.

$$ARC_{i,} = \left(\frac{AA_{unplanned,i,t}}{A_{t1}}\right) \times 100 \quad \textbf{(5)}$$

Where:

Variable	Description	Unit
$ARC_{i,}$	Annual Rate of Change in Forest Area from stratum 1 to stratum 2 at interval t_1 *to* t_2	%
$AA_{unplanned,i,t}$	Annual Area of Forest Change for stratum *i* at year *t*	hectares
A_{t1}	Forest area in stratum *i* at reference time point t_1	hectares
t_1	Start of reference period	
t_2	End of reference period	

Changes in carbon stocks from forest degradation are influenced by land use land cover change, which is assessed using remote sensing technologies such as Synthetic Aperture Radar (SAR) or Light Detection and Ranging (LiDAR). To quantify these changes, data on carbon stock change in forest areas due to forest degradation must be provided. Hence, a greenhouse gas (GHG) emissions factor matrix related to deforestation is used to model the transition from forest to non-forest areas as the equation below.

$$\Delta C_{(1\rightarrow 2)t2-\,t1} = C_{1,t1} - C_{2,t2} \quad \textbf{(6)}$$

Where:

Variable	Description	Unit
$\Delta \boldsymbol{C}_{(1\rightarrow 2)t2-\,t1}$	Net carbon stock changes in all pools from stratum 1 to stratum 2 in the t_2-t_1 period	tCO_2e ha-1
$\boldsymbol{C}_{1,t1}$	Carbon stocks in stratum 1 at time t_1	tCO_2e ha-1
$\boldsymbol{C}_{2,t2}$	Carbon stocks in stratum 2 at time t_2	tCO_2e ha-1

5.1.3 Baseline Carbon Stock Change

This section applies to both planned and unplanned deforestation activities

Deforestation refers to the conversion of forest land into other land uses. Carbon stock changes in forest areas are determined using geographic information systems (GIS). To evaluate the carbon stock across the entire area, field assessments are conducted by collecting data from sampling plots in each stratum. Please refer to *Draft_FCO Tool GHG Quantification Equation* under Sample Sizes in Stratified

Simple Random Sampling for guideline on sample size in each stratum

The net carbon stock changes in the baseline is equal to the baseline pre-deforestation stock minus the long-term carbon stock after deforestation. Carbon pools excluded from the project can be accounted as zero.

The post-deforestation carbon stock must represent the long-term average carbon stock on the land after deforestation. These values may be determined from reference area or sourced from reliable literature, such as peer-reviewed studies, or reports from the IPCC or FAO.

For terrestrial carbon pools, stock changes in each pool are calculated by subtracting post-deforestation carbon stocks from forest carbon stocks as per *GHG quantification equations.*

$$\Delta \boldsymbol{C}_{\boldsymbol{BSL\_i,t}} = \Delta C_{AGB,i} + \Delta C_{BGB,i} + \Delta C_{DW,i} + \Delta C_{LI,i} + \Delta C_{SOC,i} \quad \textbf{(7)}$$

Where:

Variable	Description	Unit
$\Delta \boldsymbol{C}_{\boldsymbol{BSL\_i,t}}$	Net carbon stock changes in all pools in the baseline stratum *i* in year *t*	tCO_2e
$\Delta \boldsymbol{C}_{\boldsymbol{AGB,i}}$	Baseline carbon stock change in aboveground tree biomass in stratum *i* as outlined in *GHG Quantification Equation*s	tCO2e ha-1

Variable	Description	Unit
$\Delta\boldsymbol{C}_{\boldsymbol{BGB},\boldsymbol{i}}$	Baseline carbon stock change in belowground tree biomass in stratum *i* as outlined in *GHG Quantification Equation*s	tCO2e ha-1
$\Delta\boldsymbol{C}_{\boldsymbol{DW},\boldsymbol{i}}$	Baseline carbon stock change in dead wood in stratum *i* as outlined in GHG Quantification Equations	tCO2e ha-1
$\Delta\boldsymbol{C}_{\boldsymbol{LI},\boldsymbol{i}}$	Baseline carbon stock change in litter in stratum *i* as outlined in GHG Quantification Equations	tCO2e ha-1
$\Delta\boldsymbol{C}_{\boldsymbol{SOC},\boldsymbol{i}}$	Baseline carbon stock change in soil organic carbon in stratum *i* as outlined in GHG Quantification Equations	tCO2e ha-1

For REDD project activities: Avoiding Planned Deforestation

$$\Delta C_{BSL\,Def,i,t} = AA_{planned,i,t} \times \Delta C_{BSL\_i,t} \quad \textbf{(8)}$$

Where:

Variable	Description	Unit
$\Delta\boldsymbol{C}_{\boldsymbol{BSL\,Def},\boldsymbol{i},\boldsymbol{t}}$	Sum of the baseline carbon stock change in all terrestrial pools in stratum *i* in year *t*	tCO_2e
$\boldsymbol{AA}_{\boldsymbol{i},\boldsymbol{t}}$	Annual area of planned deforestation for stratum *i* at year *t*	ha
$\Delta\boldsymbol{C}_{\boldsymbol{BSL\_i},\boldsymbol{t}}$	Net carbon stock changes in all pools in the baseline stratum *i* in year *t*	tCO_2e

Avoiding Unplanned Deforestation

$$\Delta C_{BSL\,Def,i,t} = AA_{unplanned,i,t} \times \Delta C_{BSL\_i,t} \quad \textbf{(9)}$$

Where:

Variable	Description	Unit
$\Delta\boldsymbol{C}_{\boldsymbol{BSL\,Def},\boldsymbol{i},\boldsymbol{t}}$	Sum of the baseline carbon stock change in all terrestrial pools in stratum *i* in year *t,* t CO2-e (Determined independently for project area and leakage belt)	tCO_2e
$\boldsymbol{AA}_{\boldsymbol{unplanned},\boldsymbol{i},\boldsymbol{t}}$	Annual area of unplanned deforestation for stratum *i* at year *t*	ha
$\Delta\boldsymbol{C}_{\boldsymbol{BSL\_i},\boldsymbol{t}}$	Net carbon stock changes in all pools in the baseline stratum *i* in year *t*	tCO_2e

Avoiding Unplanned Degradation

$$\Delta C_{BSL\,Deg,i,t} = \Delta C_{(1\rightarrow 2)t2-\,t1} \times ARC_{i,} \times A_i \quad \textbf{(10)}$$

Where:

Variable	Description	Unit
$\Delta C_{BSL\ Deg,i,t}$	Baseline carbon stock change from forest degradation in stratum i,	tCO_2e
$\Delta C_{(1\rightarrow 2)t2-\ t1}$	Net carbon stock changes in all pools from stratum 1 to stratum 2 in the t_2-t_1 period	tCO_2e ha-1
$ARC_{i,}$	Annual Rate of Change in Forest Area from stratum 1 to stratum 2 at interval t_1 *to* t_2	%
A_i	Area of stratum in i	ha

5.1.4 Greenhouse Gas Emissions

This section applies to both planned and unplanned deforestation activities

The detailed calculation methods for GHG emission source can be found in **FCO Tool: GHG Quantification Equations**. The GHG emissions in the baseline within the project boundary must be estimated as:

$$\Delta GHG_{BSL-E,i,t} = E_{FC,i,t} + E_{BiomassBurn,i,t,} + N2O\ directN,i,t \quad \textbf{(11)}$$

Where:

Variable	Description	Unit
$\Delta GHG_{BSL-E,i,t}$	Greenhouse gas emissions as a result deforestation activities within the project boundary in the stratum *i* in year *t*	tCO_2e
$E_{FC,i,t}$	Net CO2e emission from fossil fuel combustion in stratum *i* in year *t*	tCO_2e
$E_{BiomassBurn,i,t,_{i,}}$	Non-CO2 emissions due to biomass burning in stratum *i* in year *t*	tCO_2e
$N2O\ directN,i,t$	Non-CO2 emissions due to biomass burning in stratum *i* in year *t (if applicable)*	tCO2e
i	1, 2, 3, …*M* strata	
t	1, 2, 3, …*t** years elapsed since the start of the REDD project activity	

5.1.5 Leakage Emissions

For avoiding planned deforestation, if the specific deforestation agent is known, leakage does not need to be accounted for, provided it can be clearly demonstrated that the agent's management plans or

land-use designations on their other lands have not significantly changed as a result of the project. Refer to *Section 5.3.2.1* for further details.
For avoiding unplanned deforestation or degradation, use Equation 1 to quantify baseline carbon stock changes and GHG emissions in the leakage belt ($\Delta C_{BSL,LB}$). Baseline carbon stock changes are calculated using Equation 9, while GHG emissions are quantified using Equation 11.

5.2 Project Emissions

Net GHG emissions in project case is equal to the sum of stock changes due to deforestation and forest degradation plus the total GHG emissions:

$$\Delta C_{WPS-REDD} = \sum_{t=1}^{t*}\sum_{i=1}^{M}(\Delta C_{P_{DefPA},i,t} + \Delta C_{P_{Deg},i,t} + \Delta C_{P,DistPA,i,t} + GHG_{P,E,i,t}) \tag{12}$$

Where:

Variable	Description	Unit
$\Delta CWPS - REDD$	Net GHG emissions in the REDD project scenario up to year t*	tCO2e
$\Delta CP, Def\ PA, i, t$	Net carbon stock change as a result of deforestation in the project area in the project case in stratum i in year t	tCO2e
$\Delta CP, Deg, i, t$	Net carbon stock change as a result of degradation in the project area in the project case in stratum i in year t	tCO2e
$\Delta CP, DistPA, i, t$	Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum *i* in year *t*	tCO2e
$GHGP - E, i, t$	Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum *i* in year *t*	tCO2e
i	1, 2, 3,…*M* strata	
t	1, 2, 3,…*t** years elapsed since the start of the project activity	

Leakage Belt

Leakage belt is an area where leakage occurs around an individual project area parcel. Adjacent project parcels will share a leakage belt which when summed up will become the leakage area.

$$\Delta C_{WPS-REDD,LB} = \sum_{t=1}^{t*}\sum_{i=1}^{M}(\Delta C_{P_{DefLB},i,t}) \tag{13}$$

Where:

Variable	Description	Unit
$\Delta CWPS - REDD, LB$	Net GHG emissions in the leakage belt in the REDD project scenario up to year t*	tCO2e

Variable	Description	Unit
$\Delta CP, Def\ LB, i, t$	Net carbon stock change as a result of deforestation in the leakage belt in the project case in stratum i in year t	tCO2e
i	1, 2, 3,…*M* strata	
t	1, 2, 3,…*t** years elapsed since the start of the project activity	

5.2.1 Project Carbon Stock Change

5.2.1.1 Carbon Stock Change for Deforestation

To detect and map deforestation, various remote sensing methods can be used. The chosen method must follow established best practices, depend on available resources and image processing software, and be applied consistently throughout the baseline period. The method must reliably estimate deforestation in both the project and leakage areas. For further guidance, refer to IPCC 2006 GL AFOLU, Chapter 3A.2.4.

The variable that accounts for the net carbon stock change as a result of deforestation in the project area and leakage belt is equal to the area deforested multiplied by the emission per unit area is shown below:

$$\Delta CP, Def\ PA, i, t = \sum_{u=1}^{U} (A\ Def\ PA, u, i, t * \Delta Cpools, P, Def, u, i, t) \quad \textbf{(14)}$$

$$\Delta C_{P-Def,LB,i,t} = \sum_{u=1}^{U} (A_{DefLB,u,i,t} * \Delta C_{pools,P,Def,u,i,t}) \quad \textbf{(15)}$$

Where:

Variable	Description	Unit
$\Delta CP, Def\ PA, i, t$	Net carbon stock change as a result of deforestation in the project case in the project area in stratum *i* in year *t*	tCO2e
$A\ Def\ PA, u, i, t$	Area of recorded deforestation in the project area stratum *i* converted to land use *u* in year *t*	tCO2e
$\Delta Cpools, P, Def, u, i, t$	Net carbon stock changes in all pools in the project case in land use *u* in stratum *i* in year *t*	tCO2e/ha
$\mathbf{u}$	1, 2, 3, …*U* post-deforestation land uses	
i	1, 2, 3,…*M* strata	
t	1, 2, 3,…*t** years elapsed since the start of the project activity	

From equation 9 and 10, the net carbon stock changes in all pools as a result of deforestation in project case is calculated as follows:

$$\Delta Cpools, P, Def, u, i, t = CBSL, i - CP, post, u, i - CWP, i \quad (16)$$

Where:

Variable	Description	Unit
$\Delta Cpools, P, Def, u, i, t$	Net carbon stock changes in all pools in the project case in land use *u* in stratum *i* in year *t*	tCO2e
$CBSL, i$	Carbon stock in all pools in the baseline case in stratum *i*	tCO2e
$CP, post, u, i$	Net carbon stock changes in all pools in the project case in land use *u* in stratum *i* in year *t*	tCO2e/ha
CWP, i	Carbon stock sequestered in wood products from harvests in stratum *i*	tCO2e/ha
u	1, 2, 3, …*U* post-deforestation land uses	
i	1, 2, 3,…*M* strata	
t	1, 2, 3,…*t** years elapsed since the start of the project activity	

**to note that all carbon stocks are emitted in the year deforested and that no stocks are permanently sequestered. This assumption applies regardless of whether burning is part of the conversion process.*
**to note that it is conservative in the project case to assume no wood products are produced*

Expanding from equation 11, for each post-deforestation land (u), estimation of long-term carbon stock is done using the following:

$$Cpost, u = CAB_{tree}, i + CBB_{tree}, i + CAB, non-tree, i + CBB, non-tree, i + CDW, i + CLI, i + CSOC, PD-BSL, i \quad (17)$$

Where:

Variable	Description	Unit
$Cpost, u$	Carbon stock in all pools in post-deforestation land use *u* in stratum *i*	tCO2e/ha
CAB_{tree}, i	Carbon stock in aboveground tree biomass in stratum *i*;	tCO2e/ha
CBB_{tree}, i	Carbon stock in belowground tree biomass in stratum *i*;	tCO2e/ha
$CAB, non-tree, i$	Carbon stock in aboveground non-tree vegetation in stratum *i*	tCO2e/ha
$CBB, non-tree, i$	Carbon stock in belowground non-tree vegetation in stratum *i*	tCO2e/ha
CDW, i	Carbon stock in dead wood in stratum *i*	tCO2e/ha

Variable	Description	Unit
CLI, i	Carbon stock in litter in stratum *i*	tCO2e/ha
$CSOC, PD - BSL, i$	Mean post-deforestation stock in soil organic carbon in the post deforestation stratum *i*	tCO2e/ha
u	1, 2, 3, …*U* post-deforestation land uses	
i	1, 2, 3, …*M* strata	

5.2.1.2 Carbon Stock Change for Forest Degradation

Monitoring degradation is only necessary if logging (whether legal or illegal), fuelwood collection, or charcoal production is anticipated under the project scenario.

$$\Delta CP, Deg, i, t = \Delta CP, DegW, i, t + \Delta CP, SelLog, i, t \quad (18)$$

Where:

Variable	Description	Unit
$\Delta CP, Deg, i, t$	Net carbon stock change as a result of degradation in the project area in the project case in stratum *i*;	tCO2e
$CP, DegW, i, t$	Net carbon stock change as a result of degradation through extraction of trees for illegal fuelwood and charcoal in the project area in the project case in stratum *i* in year *t*	tCO2e
$CP, SelLog, i, t$	Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case in stratum *i* in year *t*;	tCO2e/ha
i	1, 2, 3, …*M* strata	
t	1, 2, 3,…*t** years elapsed since the start of the project activity	

$\Delta CP, SelLog, i, t$ is considered to be zero in this case as this variable refers to selective logging which is not accounted for in this REDD Methodology.

Important to note that to address forest degradation, it is necessary to complete a participatory rural appraisal (PRA) of the communities within and surrounding the project area to determine if there is potential for illegal extraction of trees to occur.

If the PRA concludes that no illegal extraction of trees will occur, then $CP, DegW, i, t$ can be assumed to be zero and no monitoring of this would be needed. However, the PRA process must be repeated every 2 years to ensure that the potential of illegal extraction of trees will not occur.

However, if the PRA assessment indicates the potential of degradation, limited field sampling must be done. Where the PRA and the limited sampling show that degradation is occurring:

$$\Delta CP, DegW, i, t = ADegW, i * \frac{CDegW, i, t}{APi} \quad (19)$$

Where:

Variable	Description	Unit
$\Delta CP, DegW, i, t$	Net carbon stock changes as a result of degradation in stratum *i* in the project area in year *t*;	tCO2e
$ADegW, i$	Net carbon stock change as a result of degradation through extraction of trees for illegal fuelwood and charcoal in the project area in the project case in stratum *i* in year *t*	ha
$CDegW, i, t$	Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case in stratum *i* in year *t*;	tCO2e
APi	Total area of degradation sample plots in stratum *i*	ha
i	1, 2, 3, …*M* strata	
t	1, 2, 3,…*t** years elapsed since the start of the project activity	

5.2.1.3 Carbon Stock Change for Natural Disturbances

This sub section accounts for when natural disturbances occur ex-post within the project area such as natural disasters, pest, drought, or fire that caused degradation of forest carbon stocks. The areas affected by these disturbances shall be delineated, and the associated emissions shall be estimated. Emissions resulting from natural disasters may be omitted if the effects are deemed minimal.

The basis of net carbon stock change as a result of disturbance is equal to the area disturbed multiplied by the emission per unit area. For planned deforestation the sum of $ADistPA,q,i,t$ shall be equal to the area of overlap between the delineated area of the disturbance and the summed area of planned deforestation in the project area ($D\%planned,i,t * Aplanned,i$), summed to the year in which the disturbance occurred.

For unplanned deforestation the sum of $ADistPA,q,i,t$ shall be equal to the area of overlap between the delineated area of the disturbance and the summed area of unplanned deforestation in the project area ($ABSL,PA,unplanned,t$), summed to the year in which the disturbance occurred.

$$\Delta CP, DistPA, i, t = \sum_{q=1}^{Q} ADisPA, q, i, t * \Delta CP, Dist, q, i, t \qquad \textbf{(20)}$$

Where:

Variable	Description	Unit
$\Delta CP, DistPA, i, t$	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum *i* in year *t*	tCO2e
$ADisPA, q, i, t$	Net carbon stock change as a result of degradation through extraction of trees for illegal fuelwood and charcoal in the project area in the project case in stratum *i* in year *t*	ha
$\Delta CP, Dist, q, i, t$	Net carbon stock change as a result of degradation through selective logging of FSC certified forest management areas in the project area in the project case in stratum *i* in year *t*;	tCO2e/ha
q	1, 2, 3, …*Q* post-natural disturbance strata	

Variable	Description	Unit
i	1, 2, 3, …*M* strata	
t	1, 2, 3,…*t** years elapsed since the start of the project activity	

If the post-natural disturbance stratum q included fire, the area affected is assumed to be equal to the area impacted by natural disturbance in post natural disturbance stratum q.

$$Aburn,i,t = \sum_{q=1}^{Q} Aburn,q,i,t \quad (21)$$

'or the stratum where natural disturbance included fire:

$$Aburn,q,i,t = ADistPA,q,i,t \quad (22)$$

Where:

Variable	Description	Unit
$ADistPA,q,i,t$	Area impacted by natural disturbance in post-natural disturbance stratum *q* in stratum *i*, in year *t*	ha
$Aburn,q,i,t$	Net carbon stock change as a result of degradation through extraction of trees for illegal fuelwood and charcoal in the project area in the project case in stratum *i* in year *t*	ha
q	1, 2, 3, …Q post-natural disturbance strata where natural disturbance included fire	
i	1, 2, 3, …*M* strata	
t	1, 2, 3,…*t** years elapsed since the start of the project activity	

*to note that any emissions from fire should be accounted for using equation N for GHG emissions under project emissions

$$\Delta CP,Dist,q,i,t = CBSL,i + CP,Dist,q,i + CWP,q,i \quad (23)$$

Where:

Variable	Description	Unit
$\Delta CP,Dist,q,i,t$	Net carbon stock changes in pools as a result of natural disturbance in the project case in post-natural disturbance stratum q in stratum i in year t	tCO2e/ha
$CBSL,i$	Carbon stock in all pools in the baseline case in stratum i	tCO2e/ha
$CP,Dist,q,i$	Carbon stock in pools in post-natural disturbance strata *q* in stratum *i*	tCO2e/ha
CWP,q,i	Carbon stock sequestered in wood products from harvests following natural disturbance in post-natural disturbance stratum *q*, in stratum *i*;	tCO2e/ha

Variable	Description	Unit
q	1, 2, 3, …*Q* post-natural disturbance strata where natural disturbance included fire	
i	1, 2, 3, …*M* strata	
t	1, 2, 3,…t* years elapsed since the start of the project activity	

For each post-natural disturbance stratum (*q*) estimate the carbon stock following the natural disturbance. The carbon stocks must be measured.

$$\mathrm{C}, Dist, q, i, t = \mathrm{C}AB_{tree}, i + \mathrm{C}BB_{tree}, i + \mathrm{C}AB\_nontree, i + \mathrm{C}BB\_nontree, i + \mathrm{C}DW, i + \mathrm{C}LI, + \mathrm{C}SOC, i \quad \textbf{(24)}$$

Where

Variable	Description	Unit
$\Delta \mathrm{C}P, Dist, q, i, t$	Carbon stock in all pools in post-natural disturbance *q* in baseline stratum *i*	tCO2e/ha
$\mathrm{C}AB_{tree}, i$	Carbon stock in aboveground tree biomass in stratum *i*;	tCO2e/ha
$\mathrm{C}BB_{tree}, i$	Carbon stock in belowground tree biomass in stratum *i*;	tCO2e/ha
$\mathrm{C}AB\_nontree, i$	Carbon stock in aboveground non-tree vegetation in stratum *i*	tCO2e/ha
$\mathrm{C}BB\_nontree, i$	Carbon stock in belowground non-tree vegetation in stratum *i*	tCO2e/ha
$\mathrm{C}DW, i$	Carbon stock in dead wood in stratum *i*	tCO2e/ha
$\mathrm{C}LI, i$	Carbon stock in litter in stratum *i*	tCO2e/ha
$\mathrm{C}SOC, i$	Mean stock in soil organic carbon in stratum *i*	tCO2e/ha
q	1, 2, 3, …*Q* post-natural disturbance strata where natural disturbance included fire	
i	1, 2, 3, …*M* strata	
t	1, 2, 3,…t* years elapsed since the start of the project activity	

5.2.2 Greenhouse Gas Emissions

Throughout the project period, non-CO2 gas greenhouse emissions could be released within the project boundary, and where significant, this must be evaluated. These emissions are calculated with the following:

$$GHGP,E,i,t = \mathrm{E}FC,i,t + \mathrm{E}BiomassBurn,i,t + N2O\ directN,i,t \quad \textbf{(25)}$$

$$GHGLK,E = \mathrm{E}BiomassBurn,i,t + N2O\ directN,i,t \quad \textbf{(26)}$$

Where:

Variable	Description	Unit
$GHGP,E,i,t$	Greenhouse gas emissions as a result of deforestation activities within the project area in the project case in stratum i in year t	tCO2e
$GHGLK,E$	Greenhouse gas emissions as a result of leakage prevention activities up to year t*	tCO2e
$\mathrm{E}FC,i,t$	Emission from fossil fuel combustion in stratum *i* within the project area in year *t*	tCO2e
$\mathrm{E}BiomassBurn,i,t$	Net carbon stock change as a result of degradation in the project area in the project case in stratum i in year t	tCO2e
$N2O\ directN,i,t$	Non-CO2 emissions due to biomass burning in stratum *i* in year *t (if applicable)*	tCO2e
i	1, 2, 3,…*M* strata	
t	1, 2, 3,…*t** years elapsed since the start of the project activity	

5.2.3 Leakage Emissions

For quantification of carbon stock changes and GHG emissions in the leakage belt for project scenario ($\Delta C_{WPS-REDD,LB}$), apply Equation 13. Accordingly, carbon stock changes and greenhouse gas emissions in the leakage belt are calculated using Equation 15 in combination with GHG emissions calculated using Equation 26.

5.3 Leakage Emissions

5.3.1 Market Leakage

Market leakage occurs when reducing planned harvesting of timber, fuelwood, or charcoal in the project area causes increased harvesting in other areas to meet ongoing demand. This can result in indirect GHG emissions outside the project boundary.

Market effects can be further divided into three main sources of market leakage:

- Displaced timber harvest
- Displaced fuelwood or charcoal harvest
- Peatland drainage due to displaced harvesting

If the displaced harvesting takes place outside the country, these emissions are not included in leakage accounting, as they fall outside the national accounting boundary.

To reduce market leakage, Project Proponents may set up leakage management zones—areas where sustainable activities (e.g., afforestation, reforestation, sustainable forest management) are promoted to reduce the pressure to shift deforestation.

5.3.2 Activity Leakage

In REDD project implementation, deforestation that would have occurred within the project area may be displaced to areas outside its boundaries, resulting in leakage. If this displacement leads to increased deforestation, the associated carbon stock changes and GHG emissions must be accounted for as leakage.

5.3.2.1 Avoiding Planned Deforestation

If the specific deforestation agent is known, leakage does not need to be accounted for if it can be clearly shown that the agent's management plans or land-use designations on their other lands (which must be geographically identified) have not significantly changed due to the project.

Examples of such changes by the deforestation agent include:
- Assigning new areas as timber concessions
- Increasing timber harvest rates
- Clearing intact forests for agriculture
- Increasing use of fertilizer to enhance agricultural yield

In cases where the specific individual deforestation agent is not known, but the type or class of agent (e.g., smallholder farmers, logging companies) is identified, leakage does not need to be accounted for given if there is verifiable evidence showing that the management plans or land-use designations of all lands managed by that class of agents have not significantly changed as a result of the REDD project.

Additionally, leakage does not need to be considered if it can be shown that it is unrelated to the project and instead driven by external factors (e.g., market trends, policy changes). In such cases, Project Proponents must provide verifiable documentation—such as official records, market analyses, or peer-reviewed studies—along with an assessment explaining how these external factors influenced leakage accounting.

5.3.2.2 Avoiding Unplanned Deforestation

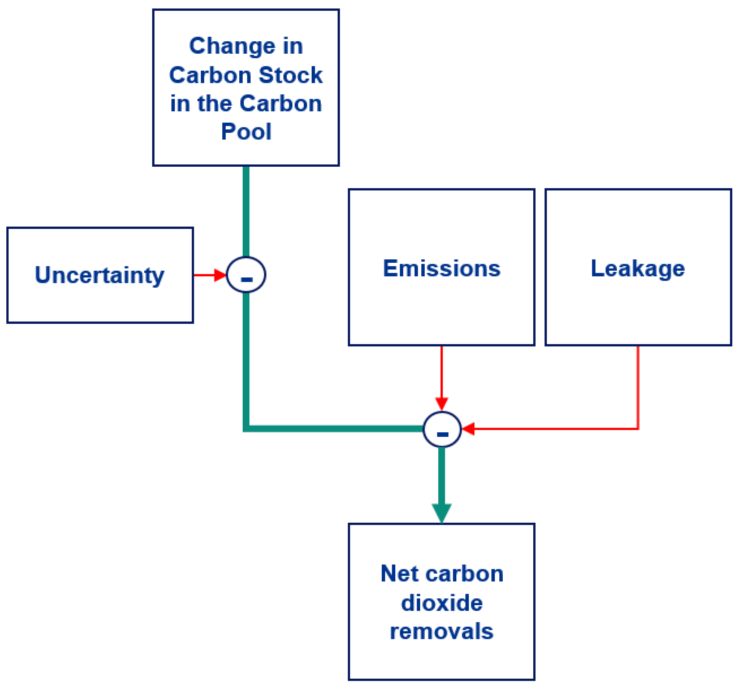
To quantify leakage from displaced unplanned deforestation, carbon stock changes and GHG emissions in the leakage belt must be estimated for both the baseline and the project implementation scenarios.

$$\Delta C_{LK-AS-LB} = \Delta C_{P,LB} - \Delta C_{BSL,LK,unplanned} \quad \textbf{(27)}$$

Where:

Variable	Description	Unit
$\Delta C_{LK-AS-LB}$	Net CO_2 emissions from unplanned deforestation displaced from the project area into the leakage belt, accumulated up to year t*	tCO2e
$\Delta C_{P,LB}$	Net GHG emissions in the leakage belt under the project scenario, up to year t*	tCO2e
$\Delta C_{BSL,LK,unplanned}$	Baseline net CO_2 emissions from unplanned deforestation occurring in the leakage belt, also measured cumulatively up to year t	tCO2e

5.4 Net GHG Emission Reductions



$$\Delta NER_{REDD} = \Delta C_{BSL-REDD} - \Delta C_{WPS-REDD} - \Delta C_{LK-REDD} \quad (28)$$

Where:

Variable	Description	Unit
ΔNER_{REDD}	Total net GHG emission reductions of the REDD+ project activity up to year *t**	tCO2e
$\Delta C_{BSL-REDD}$	Net GHG emissions in the REDD baseline scenario up to year t*	tCO2e

Variable	Description	Unit
$\Delta C_{WPS-REDD}$	Net GHG emissions in the REDD project scenario up to year t* – from GHG Quantification Equations	tCO2e
$\Delta C_{LK-REDD}$	Net GHG emissions due to leakage from the REDD project activity up to year t*	tCO2e

5.5 Uncertainty – Project Level Activities

Project Proponents may refer to the “Draft FCO Tool: “GHG Quantification Equations” under Section 3. Project-level uncertainty shall be assessed for each parameter using analytical or statistical approaches (e.g., 95% confidence intervals), with values propagated according to the equations provided. Uncertainty in the baseline rate of deforestation may use regression-based methods or proxy area measurements, and uncertainty across carbon pools is aggregated within project strata.

5.6 Calculation of Forest Carbon Units

The calculation of FCO units issued must account for the buffer credits deposited in the FCO Buffer Account. The percentage of buffer credits to be contributed is determined using FCO Tool: Buffer Risk Assessment,

The number of FCU units is calculated as follows:

$$FCU_{t2} = (adj\_NER_{t2} - adj\_NER_{t1}) * (1 - Buffer\_Factor_{t2}) \quad \textbf{(29)}$$

Where:

Variable	Description	Unit
FCU_t	Number of Forest Carbon Offset Units in year t	-
adj_NER_{t2}	Net CO_2 emissions reductions/removals from project activity up to year t2 adjusted to account for uncertainty	tCO_2e
adj_NER_{t1}	Net CO_2 emissions reductions/removals from project activity up to year t1 adjusted to account for uncertainty	tCO_2e
$Buffer\_Factor_{t2}$	Percentage of buffer credits to be contributed to the FCO Buffer Account in year t2	%

6 Monitoring

This section outlines the monitoring framework required to ensure the integrity, transparency, and accuracy of REDD project implementation and its associated GHG emission reductions. It provides guidance on the data and parameters to be validated and tracked throughout the project lifecycle.

Key components include:

- **Data and Parameters at Validation**: Specifies the baseline variables that must be confirmed before project initiation, including forest area change and deforestation rates.
- **Ongoing Monitoring Requirements**: Details the spatial, temporal, and carbon stock data that must be collected at regular intervals (typically every 3–5 years), using remote sensing, field measurements, and geolocation tools.

- **Monitoring Plan Development**: Describes the structure of a comprehensive monitoring plan, including procedures for data collection, quality assurance, uncertainty management, and documentation.
- **Baseline Renewal Protocols**: Establishes the criteria and frequency for reassessing baseline scenarios to reflect evolving land-use dynamics and maintain conservative estimates.

6.1 Monitoring Plan

Project Proponents must develop a Monitoring Plan, which outlines the procedures for measuring and verifying the project's carbon sequestration and emissions reductions, which contain at least the following:

a. Description of each monitoring task to be undertaken
b. Parameters to be measured
c. Data to be collected and data collection techniques
d. Frequency of monitoring
e. Quality assurance and quality control procedures
f. Data archiving procedures
g. Roles, responsibilities and capacity of monitoring team and management

Project Proponents must ensure continued compliance with the applicability conditions throughout the project crediting period.

<u>Managing Uncertainty</u>

Quality management procedures must be in place to ensure that data and information collected are managed accordingly. The procedures must include the assessment of uncertainty relevant to the project and baseline scenarios. Uncertainties related to quantification of GHG emissions reductions and removals by sinks should be reduced.

Project must identify key paraments that would influence the accuracy of estimates significantly. Local values that are specific to the project's circumstances must be obtained for these key parameters wherever possible. These values must be based on:

a. Data from well-referenced peer-reviewed literature
b. National inventory data or IPCC default factors
c. Expert opinion must be used in data selection in the absence of options 1) and 2). Rationale for selecting data value must be briefly noted.

If uncertainty is significant, project must select data that will indisputably lean towards underestimating rather than overestimating. Important to note that if opinions on best estimates and uncertainties were obtained from expert judgement, the Project Proponent must use guidance provided in IPCC (Approaches to Data Collection).

To ensure that fluctuations in GHG are estimated accurately and consistent across measurement periods, project must establish clear standard operating procedures to ensure data quality persists throughout the measuring periods. The procedures must at least include:

a. Documentation of field measurements carried out in project area. (Must be comprehensive enough that replication of sampling in the event of staff turnover between monitoring periods).

b. Training procedures, including the scope and date of training, for all persons involved in field measurement or data analysis must be present.
c. Protocol for assessing accuracy of plot measurements using quality control cruise and plan for correcting inventory if errors are found.
d. Protocols for assessing data for outliers, transcription errors, and consistency across measurement periods.
e. Data sheets must be safely archived for the life of the project. Data stored in electronic formats must be backed up.

6.2 Data and Parameters

6.2.1 Data and Parameters at Validation

1. Planned Deforestation Baseline Parameters

Data/Parameter	$AA_{planned,i,t}$
Data unit	ha
Description	Annual area of planned deforestation within stratum *i* during the defined baseline period
Equation number	3, 8
Source of Data	GPS coordinates and/or data from remote sensing and/or legal parcel records
Purpose of data	Calculation of baseline emissions

2. Unplanned Deforestation Baseline Parameters

Data/Parameter	$AA_{unplanned,i,t}$
Data unit	ha
Description	Annual area of unplanned deforestation within stratum *i* during the historical reference period
Equation number	4
Source of Data	GPS coordinates and/or Remote Sensing data
Purpose of data	Calculation of baseline emissions

3. Baseline Emissions Output Parameter

Data/Parameter	$\Delta C_{BSL,REDD}$
Data unit	t CO_2e
Description	Net greenhouse gas emissions in the baseline from planned/unplanned deforestation up to year *t**
Equation number	1
Purpose of data	Calculation of baseline emissions

6.2.2 Data and Parameters Monitored

This section lists the overall data and parameters that need to be monitored throughout the project period.

1. Geospatial Reference Parameter

Data/Parameter	Project location
Description	Coordinates of project boundary's location
Source of Data	Monitoring report
Description of measurement methods	Geographic coordinates from geolocation measuring tool or official (government) data from map of at least four points indicating the location.
Frequency of monitoring/recording	Must be monitored according to the monitoring cycle certification and monitoring must occur every 3-5 years.
Purpose of data	Baseline and project emissions

2. Project Area Definition Parameter

Data/Parameter	Project boundary
Description	Total project area
Source of Data	Monitoring report
Description of measurement methods	Satellite or aerial imagery as well as ground measurement of the boundary
Frequency of monitoring/recording	Must be monitored according to the monitoring cycle certification and monitoring must occur every 3-5 years.
Purpose of data	Baseline and project emissions

3. Project Area Deforestation Monitoring Parameter

From variable	$\Delta CP, Def\ PA, i, t$
Data/Parameter	$A\ Def\ PA, u, i, t$
Description	Area of recorded deforestation in the project area in stratum *i* converted to land use *u* in year *t*
Equation number	14
Source of Data	Remote sensing imagery
Description of measurement methods	-
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event.
Purpose of data	Baseline and project emissions

4. Leakage Belt Deforestation Monitoring Parameter

From variable	$\Delta CP, Def\ LB, i, t$
Data/Parameter	$A\ Def\ LB, u, i, t$
Description	Area of recorded deforestation in the leakage belt in stratum *i* converted to land use *u* in year *t*
Equation number	15
Source of Data	Remote sensing imagery
Description of measurement methods	-

Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event.
Purpose of data	Baseline and project emissions

5. Degradation Risk Area Monitoring Parameter

From variable	$\Delta CP, DegW, i, t$
Data/Parameter	$ADegW, i$
Description	Area potentially impacted by degradation processes in stratum *i*
Equation number	19
Source of Data	GIS delineation and ground truthing
Description of measurement methods	The area shall be composed of a buffer from all access points (access buffer), such as roads and rivers or previously cleared areas. The width of the buffer shall be determined by the depth of degradation penetration as defined as a PRA output.
Frequency of monitoring/recording	Must be repeated each time the PRA shows an indication of potential for degradation
Purpose of data	Baseline and project emissions

6. Degradation Sampling Design Parameter

From variable	$\Delta CP, DegW, i, t$
Data/Parameter	APi
Description	Total area of degradation sample plots in stratum *i*
Equation number	19
Source of Data	Ground measurement
Description of measurement methods	The sampling plan must be designed using plots so that the sample is at least 3% of the buffer zone.
Frequency of monitoring/recording	Must be repeated each time the PRA shows an indication of potential for degradation
Purpose of data	Baseline and project emissions

7. Degradation Biomass Loss Parameter

From variable	$\Delta CP, Deg, i, t$
Data/Parameter	$CDegW, i, t$
Description	Biomass carbon of trees cut and removed through illegal logging degradation process from plots measured in stratum *i* in year *t*
Equation number	19
Source of Data	Field measurement
Description of measurement methods	The diameter of all tree stumps within the designated plots will be measured and, for conservative estimates, treated as equal to the tree's original DBH. If the stump has a large buttress, nearby trees of the same species should be identified to calculate a ratio between their DBH and the diameter at the same height as the buttressed stump. This ratio will then be used to estimate the original DBH of the harvested tree.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event

Purpose of data	Baseline and project emissions

8. Natural Disturbance Monitoring Parameter

From variable	$\Delta CP, DistPA, i, t$
Data/Parameter	$ADisPA, q, i, t$
Description	Area impacted by natural disturbance in the project stratum *i* converted to natural disturbance stratum *q* in year *t*
Equation number	20
Source of Data	Remote sensing imagery in conjunction with ground truthing or GPS coordinates
Description of measurement methods	Minimum monitoring unit shall be equal to a minimum of one hectare.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Purpose of data	Baseline and project emissions

9. Baseline Carbon Stock Change Parameter

Data/Parameter	$\Delta C_{BSL\_i,t}$
Description	Net carbon stock changes in all pools in the baseline stratum *i* in year *t*
Equation number	7
Description of measurement methods	Refer to Draft_FCO Tool GHG Quantification Equations_Revision 1 for change in carbon stocks to be monitored

7 FCO Crediting Level

This chapter outlines the methodology for calculating FCO crediting levels, specifically applicable to jurisdictional-scale approaches only. The following formula and guidance are designed for use by Project Proponents operating at the jurisdictional level, where emissions reductions are assessed comprehensively across broader administrative areas rather than individual site-level projects. This approach enables the aggregation of emissions data, leakage, uncertainty, and buffer deductions to ensure environmental integrity and consistency across the FCO mechanism.

7.1 FCO Net Creditable Emission Reduction

To quantify the total number of FCO credits at jurisdictional level, Project Proponents to apply the following equation:

$$\text{FCO ERRt} = \text{GHG ERt} - \text{BUFt} - \text{LEAKt} - \text{UNCt} \quad \textbf{(30)}$$

Where:

Variable	Description	Unit
FCO ERR$_t$	FCO Credits issued in year t; measured in tonnes of CO_2 equivalent	tCO_2e

Variable	Description	Unit
GHG ER_t	GHG emission reductions in year t	tCO_2e
BUF_t	*Buffer withholding in year t; credited to a non-tradable buffer pool to manage reversal risk. Not cancelled, just held"*	tCO_2e
$LEAK_t$	Leakage deduction in year t	tCO_2e
UNC_t	Uncertainty deduction in year t	tCO_2e

At the end of each crediting period, the Project Proponent shall calculate the uncertainty deduction (UNC_t) based on the summed uncertainty of all emission reductions and removals during the entire period of FCO participation. This is derived from:

- Summed reference emissions
- Minus summed crediting period emissions

- If the total uncertainty contribution to date exceeds this calculated deduction value, then additional FCO credits will be issued into the Project Proponent's registry account.

7.1.1 GHG Emission Reduction

GHG ER_t shall be determined in accordance with Equation 23: FCO Net Creditable Emission Reductions

$$GHG\ ER_t = CL_t - GHG_t \quad \textbf{(31)}$$

Where:

Variable	Description	Unit
GHG ER_t	GHG ERs in year t	tCO_2e
CL_n	FCO Crediting Level for year t	tCO_2e/yr
GHG_t	GHG emissions in year t	tCO_2e

Calculating Crediting Level for Emissions

- The crediting level is determined based on the average annual emissions over a 5-year historical reference period. This value represents the baseline against which emission reductions are assessed.
- The reference period must be five consecutive calendar years, without overlap or gaps between the reference and crediting periods.
- The initial crediting period start date must be within 4 years prior to submission of the FCO Concept.
- The crediting level is updated every 5 years, and cannot increase unless:

- A new pool or activity is added; in this case, a new 5 year reference period must be used to recalculate the crediting level.

$$CLn = \frac{rEn}{5yr} \quad \textbf{(32)}$$

Where:

Variable	Description	Unit
CL_n	Crediting Level for crediting period n	*tCO_2e/yr*
rE_n	Summed emissions during period n in the historical reference period t	*tCO_2e*

Buffer Pool Contribution

The buffer contribution to address non-permanence risk shall be determined using the **FCO Tool: Buffer Risk Assessment**, which applies a risk-based calculation across defined risk categories. Where a local jurisdiction has established a recognized buffer or insurance mechanism that demonstrably addresses non-permanence, the project may follow the jurisdictional approach, subject to MFF's approval and alignment with the tool.

The buffer contribution is expressed as a percentage (%) of the project's net credited emission reductions and removals for a given year. This percentage is based on the project's risk profile, as shown in *Table 3: Buffer Contribution Assessment*.

The buffer withholding amount (BUF_t) shall be calculated using Equation 21: FCO Net Creditable Emission Reductions and is determined as follows:

Table 3: Buffer Contribution Assessment

Risk Rating	Buffer Contribution (%)
Fixed rate with no mitigating factors	25
Fixed rate with legal framework to support jurisdictional REDD	20
Fixed rate with legal framework to provide jurisdictional buffer for non-permanence risk*	5 - 10

*Note: This range is to be decided with the local jurisdictions.

The buffer withholding amount shall be applied to the emission reductions as calculated in Equation 23: FCO Net Creditable Emission Reductions

$$BUFt = GHGERt \times Buffer\ \% \quad \textbf{(33)}$$

Where:

Variable	Description	Unit
BUFt	FCO buffer withholding	tCO_2e
GHGERt	GHG ERs in year t	tCO_2e
Buffer %	Buffer contribution (from Table 3) potentially adjusted upwards as a result of prior reversals	%

7.1.2 Leakage

Projects using a subnational crediting level must account for the risk of emissions shifting outside the accounting area, known as leakage. To address this, a portion of the emission reductions must be deducted using a standardized leakage deduction.
Leakage is classified into four categories—High, Medium, Low, and No Leakage—based on the share of jurisdictional forest area included in the project boundary. The applicable leakage deduction percentage is determined using

4: Leakage Deduction Assessment.

The leakage deduction ($LEAK_t$) shall be determined in accordance with Equation 23: FCO Net Creditable Emission Reductions

LEAKt = (GHG ERt x Leakage%) **(34)**

Where:

Variable	Description	Unit
$LEAK_t$	leakage deduction	tCO_2e
GHGERt	GHG ERs in year t	tCO_2e
Leakage %	Percentage leakage deduction (from Table 4)	%

Table 4: Leakage Deduction Assessment

Leakage Category	Criteria	Deduction (Leakage %)
High	< 25% of jurisdictional forest area include	20%
Medium	25–60% of jurisdictional forest area included	10%
Low	60–90% of jurisdictional forest area included	5%

Leakage Category	Criteria	Deduction (Leakage %)
No Leakage	> 90% of jurisdictional forest area included	0%

7.1.3 Uncertainty – Jurisdictional Level Activities

Jurisdictional uncertainty shall be determined using an approach that accounts for broader spatial variability and increased data heterogeneity across administrative boundaries. It shall include:

- Use of **Monte Carlo simulations** (minimum 10,000 iterations) to quantify overall uncertainty in emissions reductions and removals.
- Application of a **90% confidence interval** to derive the **Uncertainty Adjustment Factor (UA_t)** and apply the **Uncertainty Deduction (UNC_t)**, in accordance with international standards such as ART TREES.
- To quantify the total number of **FCO credits** at the **jurisdictional level**, Project Proponents must apply the following formula to account for statistical uncertainty in emission reductions and removals:

UNCt = (GHG ERt+GHG REMVt) × UAt **(35)**

Uncertainty Adjustment Factor (UAt)

Uncertainty Adjustment Factor (UA_t) is applied when estimating carbon credits to ensure conservative and credible emission reduction This factor accounts for statistical uncertainty in measured or modeled emissions and removals data.

$$UA_t = 0.524417\ x \left(\frac{90\%\ \mathrm{CI}_t}{1.645006}\right) \quad \textbf{(36)}$$

Where:

Variable	Description	Unit
UNC_t	TREES uncertainty deduction in year t	tCO_2e
UA_t	TREES uncertainty adjustment factor in year t	*t*
GHG ER_t	GHG ERs in year t	tCO_2e
GHG $REMV_t$	GHG removals in year t	tCO_2e
0.524417	t value representing the program defined allowable level of uncertainty or risk	
90% CI_t	Half width of 90% confidence interval expressed as a percent of the mean emissions or removals in year t	%
1.645006	t value at 90% confidence level	

7.2 High Forest, Low Deforestation (HFLD)

To qualify as an HFLD Proponent under the FCO Program, national or subnational entities must demonstrate that they meet the HFLD threshold in each year of the historical reference period. This designation is applicable at the beginning of the Crediting Period and remains valid throughout, provided eligibility is maintained.

HFLD status is assessed by calculating an HFLD Score for each year (t) of the historical reference period using the formula:

$$\text{HFLDt} = \text{FCSt} + \text{DRSt} \quad \textbf{(37)}$$

Variable	Description	Unit
HFLD Score$_t$	HFLD Score in year *t*	*t*
FCS$_t$	Forest Cover Score in year *t*	*t*
DRS$_t$	Deforestation Rate Score in year *t*	*t*

To determine whether a project qualifies for the High Forest, Low Deforestation (HFLD) status, two key indicators are assessed:

1. **Forest Cover** – Entities must have more than 50% forest cover during each year of the historical reference period. A higher percentage of forest cover contributes positively to the overall HFLD score.
2. **Deforestation Rate** – The annual deforestation rate must remain below 0.5% in each reference year. The lower the deforestation rate, the higher the corresponding score awarded.

Each indicator is assigned a score based on its performance band. The HFLD Score for a given year is calculated by summing the Forest Cover Score and the Deforestation Rate Score. A combined score of 0.5 or higher qualifies the project for HFLD status in that year.

This simplified scoring approach encourages the preservation of high forest cover and consistently low deforestation rates. Projects maintaining HFLD eligibility across all years in the reference period may apply the HFLD Crediting Level, receiving distinct recognition within the FCO Registry.

8 General References

General Internet Research: Verified Carbon Standard, American Carbon Registry, Gold Standard, ART-TREES, T-VER
FAO (2023) Global Forest Resources assessment (FRA) Terms and Definitions.
IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 4 AFOLU
IPCC. (2019) Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
International Peatlands Society

International, W. (2021). THE REDD+ ENVIRONMENTAL EXCELLENCE STANDARD (TREES). International, Winrock.

IX. ANNEXES

Annex 1: General Principles of the four (4) FCO Activities under FCO Program