
# Technical Specifications Module: (C) AD-DtPF

## Technical Specifications Module (C) 2.1 (AD-DtPF): Avoided Deforestation – Deforestation to Protected Forest V1.0 for The Nakau Programme

An indigenous Forest Conservation Programme through Payments for Ecosystem Services

EUROPEAN UNION
ADB
LIVE&LEARN Environmental Education
carbonpartnership
ekos investing in nature

European Union

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Cover Photo: Weaver - view towards Drawa from the south coast of Vanua Levu, Fiji.

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# Table of Contents

# Introduction

## NAKAU PROGRAMME

The Nakau Programme is an indigenous forest conservation programme financed through payments for ecosystem services (PES). The Nakau Programme is a programme owned and operated by the Nakau Programme Pty Ltd (Programme Operator). Each project in the Nakau Programme is developed by means of applying two methodological components:

A. The Nakau Methodology Framework (covering all general methodology elements).
B. A Technical Specifications Module for each activity type and measured ecosystem service (ecosystem service accounting elements specific to that activity type).

Accordingly, each project in the Nakau Programme will produce a Project Description (PD) presented in two parts:

A. Part A: General Description (applying the Nakau Methodology Framework).
B. Part B: Technical Description (applying the relevant Technical Specification Module/s).

**Technical Specifications Module (C) 2.1 (AD-DtPF): Avoided Deforestation – Deforestation to Protected Forest** (this document) measures greenhouse gas ecosystem services derived from avoided deforestation activities in land use that avoids conversion of forest to non-forest land uses. The Avoided Deforestation sub-type for this module is: conversion of deforestation to protected forest (AD-DtPF). This Technical Specifications Module is applicable to the Pacific Islands, specifically the 22 countries and territories served by the Secretariat of the Pacific Community (SPC).[1]

### Technical Specifications

This Technical Specifications Module is based on, and follows the methodological requirements/guidance of the Plan Vivo Standard (2013), the ISO14064-2 standard, the Verified Carbon Standard (VCS), and the IPCC 2006 Guidelines for GHG Inventories. It is validated to the Plan Vivo Standard (2013).

The GHG elements of this Technical Specifications Module apply to anthropogenic carbon stock change factors in the baseline and project scenarios. Forest management laws and regulations in each of the Pacific Island countries where project activities may occur underpin the context for baseline activities. Project activities involve the avoidance of

[1] American Samoa, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn Islands, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, and Wallis and Futuna.

deforestation and the protection of forest that would be subject to deforestation in the absence of finance from payment for ecosystem services (PES).

This Technical Specifications Module has been designed to keep project development costs to a minimum by utilising conservative GHG accounting defaults where possible.

## STRUCTURE OF TECHNICAL SPECIFICATIONS MODULE

The remainder of this document is organised according to the following structure:

1. Eligibility and Guidance
2. Identifying GHG sources, sinks and Reservoirs
3. Determining the Baseline Scenario
4. Quantifying Baseline GHG Emissions and Removals
5. Quantifying Project GHG Emission Reductions and Removal Enhancements
6. Quantifying Project Habitat Hectare Enhancements
7. Assessment of Uncertainty
8. Monitoring the GHG Project

### Document Formatting

This document is formatted to enable the document components to be easily discerned by means of the following formatting convention:

*Text contained in a grey box in italics signifies verbatim methodological requirements and/or methodological guidance contained in a standard or methodological guidance document.* Where no italics are used then the methodological guidance has been paraphrased.

Evidence requirements are presented in tables with green headings:

| Evidence Requirement | | |
|---|---|---|
| # | Name/Description | Location |
| | | |
| | | |

This Technical Specifications Module functions as a template for the preparation of Part B of the Project Description (PD). Part B of the PD shall be formatted with the same headings and heading numbers in exactly the same order as presented in this Technical Specifications Module (from Section 1 onwards).

This Technical Specifications Module was developed as a variation to the Nakau Programme Technical Specifications Module (C) 1.1 IFM-LtPF validated to the Plan Vivo Standard, which was in turn based on the Rarakau Programme IFM-LtPF methodology (validated to the ISO14064-2 standard with elements validated to the VCS standard) (Weaver et al 2012).

# 1. Eligibility & Guidance

According to Section 5 of the Plan Vivo Standard (2013, p16):

*5.1. The project must develop technical specifications for each of the project interventions, describing:*

*5.1.1. The applicability conditions, i.e. under what baseline conditions the technical specification may be used*

*5.1.2. The activities and required inputs*

*5.1.3. What ecosystem service benefits will be generated and how they will be quantified. (NB Technical specification templates can be provided by the Plan Vivo Foundation)*

According to Section 5.1 of the ISO 14064-2 standard (2006):

*The project proponent shall ensure the GHG project conforms to relevant requirements of the GHG programme to which it subscribes (if any), including eligibility or approval criteria, relevant legislation or other requirements.*

*In fulfilling the detailed requirements of this clause, the project proponent shall identify, consider and use relevant current good practice guidance. The project proponent shall select and apply established criteria and procedures from a recognized origin, if available, as relevant current good practice guidance.*

*In cases where the project proponent uses criteria and procedures from relevant current good practice guidance that derive from a recognized origin, the project proponent shall justify any departure from those criteria and procedures.*

*In cases where good practice guidance from more than one recognized origin exists, the project proponent shall justify the reason for using the selected recognized origin.*

*Where there is no relevant current good practice guidance from a recognized origin, the project proponent shall establish, justify and apply criteria and procedures to fulfill the requirements in this part of ISO 14064.*

All projects shall describe the way the project meets the eligibility criteria of the Plan Vivo Standard and the specific eligibility requirements of this methodology, and how the project applies good practice guidance with specific reference to the latest IPCC Guidance on LULUCF.

All projects shall state the Technical Specifications Module/s applied.

## 1.1 ELIGIBILITY

According to section 5.2 (j) of the ISO 14064-2 standard (2006):

*This includes any information relevant for the eligibility of a GHG project under a GHG programme and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information.*

### 1.1.1 General Eligibility

According to Section 5 of the Plan Vivo Standard (2013, p17):

*5.14. To avoid 'double counting' of ecosystem services, project intervention areas must not be in use for any other projects or initiatives, including a national or regional level mandatory GHG emissions accounting programme, that will claim credits or funding in respect of the same ecosystem services, unless a formal agreement is in place with the other project or initiative that avoids double-counting or other conflicting claims, e.g. a formal nesting agreement with a national PES scheme.*

All projects applying this Technical Specifications Module must meet the following eligibility criteria:

a. Eligible forests will be indigenous forests that qualified as 'forest land' as of 31 December 2009 (excluding forests on peat lands).
b. Baseline activities in eligible forests comprise deforestation and associated GHG emissions.
c. Project activities in eligible forests comprise forest protection.
d. Projects will account for AFOLU GHG emissions and removals in the baseline and project scenarios.
e. Eligible forests are not subject to carbon credit or other carbon or PES unit claims by any other entity (including governments) as part of any other programme at the national, jurisdictional or project level.

| Table 1.1.1: Evidence Requirement: General Eligibility | |
|---|---|
| # | Location |
| 1.1.1a | Evidence that the forests in the project qualified as forests as of 31 December 2009. Such evidence to be provided in the form of dendrochronology, and/or aerial imagery and maps where available. The key is to provide defensible evidence that the forest existed as a forest as of this date. |
| | Provided in Part A, Section 2.3.5 of the PD. |
| 1.1.1b | Demonstration of accounting for AFOLU GHG emissions to be supplied in the carbon accounting sections of the PD. |

| | |
|---|---|
| | Presented in Part B, Section 3 - 6 of the PD. |
| 1.1.1c | Evidence that PES units generated from this project will not be subject to PES unit claims by other relevant entities shall be provided through applying both of the following:<br>a. A statement in the Programme Agreement whereby the Project Owner asserts that, for the duration of the Project Period, the eligible forest area will not be subject to any other project-scale crediting project or programme.<br>b. A statement by the relevant government or jurisdiction asserting that the eligible forest area for this project will not be used for carbon credit assertions of that government or jurisdiction, but may be used in national or jurisdictional carbon measurement / monitoring. |
| | Statements to be provided in an Appendix of the PD and updated in an Appendix of each monitoring report if there is any change to this situation. |

### 1.1.2 Eligible Baseline Activities

Baseline activities for projects applying this Technical Specifications Module are those implemented on forest land[2] that would be deforested in the baseline and converted to non-forest land use. Only areas that have been designated, sanctioned or approved for such activities (e.g. where there is legal sanction to deforest) by the national and/or local regulatory bodies are eligible for crediting under this activity type.

| Table 1.1.2: Evidence Requirement: Eligible Baseline Activity | |
|---|---|
| # | Description |
| 1.1.2a | Documentation demonstrating that the Eligible Forest Area for the carbon project is eligible for baseline activities of deforestation according to the laws and regulations of the host country. This documentation will include evidence that the government regulations (in principle) allow for the baseline activity to occur. |
| | Documentation to be provided in Appendix 1.1.2a of Part B of the PD. |
| 1.1.2b | Documentation demonstrating that the Eligible Forest Area for the carbon project contains soils suitable for non-forest land use following deforestation in the baseline. Documentation to be provided in Appendix 1.1.2b of the PD. |
| | Documentation to be provided in Appendix 1.1.2b of Part B of the PD. |

### 1.1.3 Eligible Project Activities

The project activity for each project applying this Technical Specifications Module will involve the legal protection of the eligible forests within the Project Area. This legal protection is required to legally prevent baseline activities and require the on-going implementation of project activities for the duration of the Project Period.

[2] See defintions in Appendix 1.

| Table 1.1.3: Evidence Requirement: Eligible Project Activity | |
|---|---|
| # | Description |
| 1.1.3a | The Project Owner and Project Coordinator shall provide, at verification of project implementation, evidence that the project has been protected by legally binding commitment to prevent baseline activities, and to assure continuation of management practices that protect the credited carbon stocks over the length of the project crediting period. |
| | To be provided in an Appendix of Part B of the PD. |

### 1.1.4 Eligible Forest Strata

Eligible forests will include unlogged forest or forest that has previously been logged and is currently regenerating. Eligible forests will include two forest management strata as follows:

a. Unlogged Forest: Where there is no evidence of prior logging or no record of prior logging. Unlogged Forest is not eligible to claim enhanced removal carbon benefits in this methodology. Project activities will protect this unlogged forest from timber harvesting, apart from *de minimis*[3] non-commercial wood harvesting for local house-building or other cultural purposes.
b. Logged Forest: With supporting evidence showing that the area has been previously logged between 1 January 1930 and 31 December 2009, or where the commercial wood harvesting operation currently occurring in these forests began prior to 31 December 2009, or where there is evidence that the forest is regenerating and not in an 'old growth' condition. Logged Forest is eligible to claim enhanced removal carbon benefits in this methodology. Project activities will prevent this previously logged forest from timber harvesting (apart from *de minimis* harvests mentioned in a. above).

| Table 1.1.4: Evidence Requirement: Eligible Forest Strata | |
|---|---|
| # | Description |
| 1.1.4a | Aerial imagery and maps that differentiate between unlogged and logged forest strata. |
| | To be presented in Part A, Section 2.3 of the PD. |
| 1.1.4b | Documentation demonstrating that any current commercial wood harvesting operation began prior to 31 December 2009 (where applicable). |
| | To be presented in Appendix 1.1.4b of the PD. |
| 1.1.4c | Documentation demonstrating the dates of past logging for logged forest areas and where such records exist (where applicable). |
| | To be presented in Appendix 1.1.4c of the PD. |

[3] I.e. Lower than 5% of the total allowable annual commercial timber harvest volume for the equivalent rotation.

Accordingly, there are two main variants to this AD-DtPF activity type depending on the original condition of the forest in question:

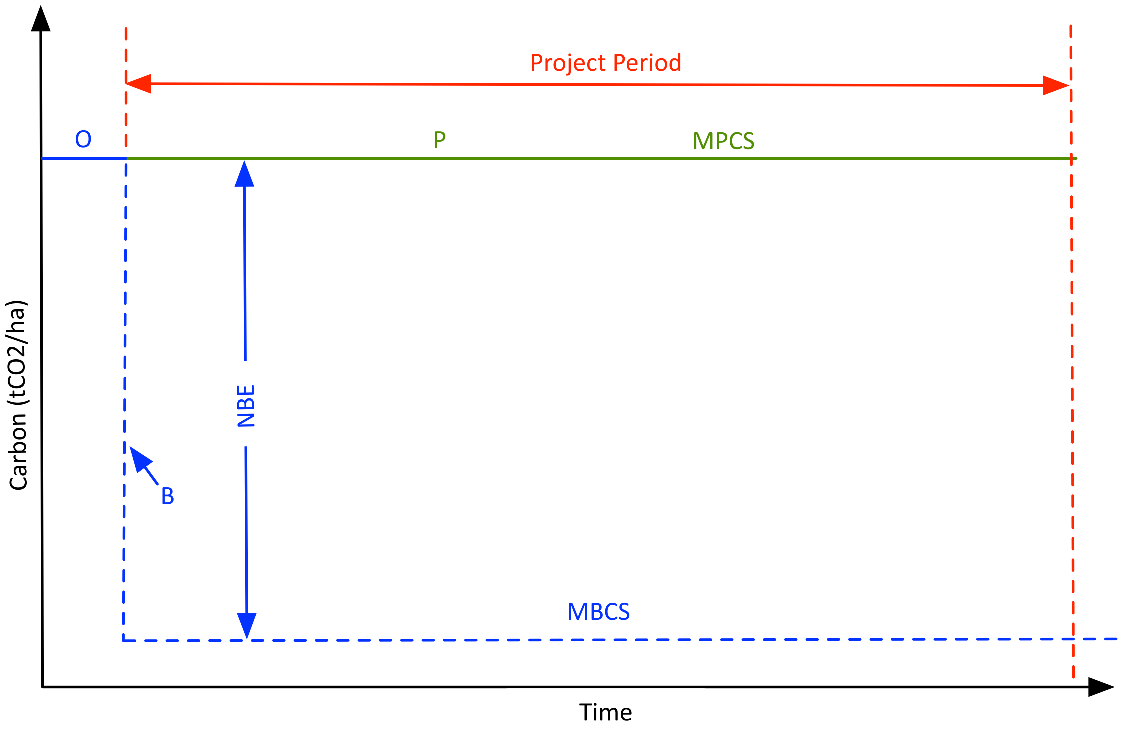
Variant 1: Avoided deforestation in an unlogged (old growth) forest (Fig 1.1.4a).

Variant 2: Avoided deforestation in a regenerating forest (Fig 1.1.4b).

Under Variant 1 (Figure 1.1.4a) the project scenario involves avoiding deforestation emissions arising from an unlogged old-growth forest deemed under this variant of this activity type to exist as carbon reservoir only. In other words, Unlogged Forest is deemed to not exist as a carbon sink because this methodology deems annual carbon removals to be balanced out by annual carbon emissions in old growth forest. Baseline emissions would occur as a result of wood harvesting and associated activities in such forest.

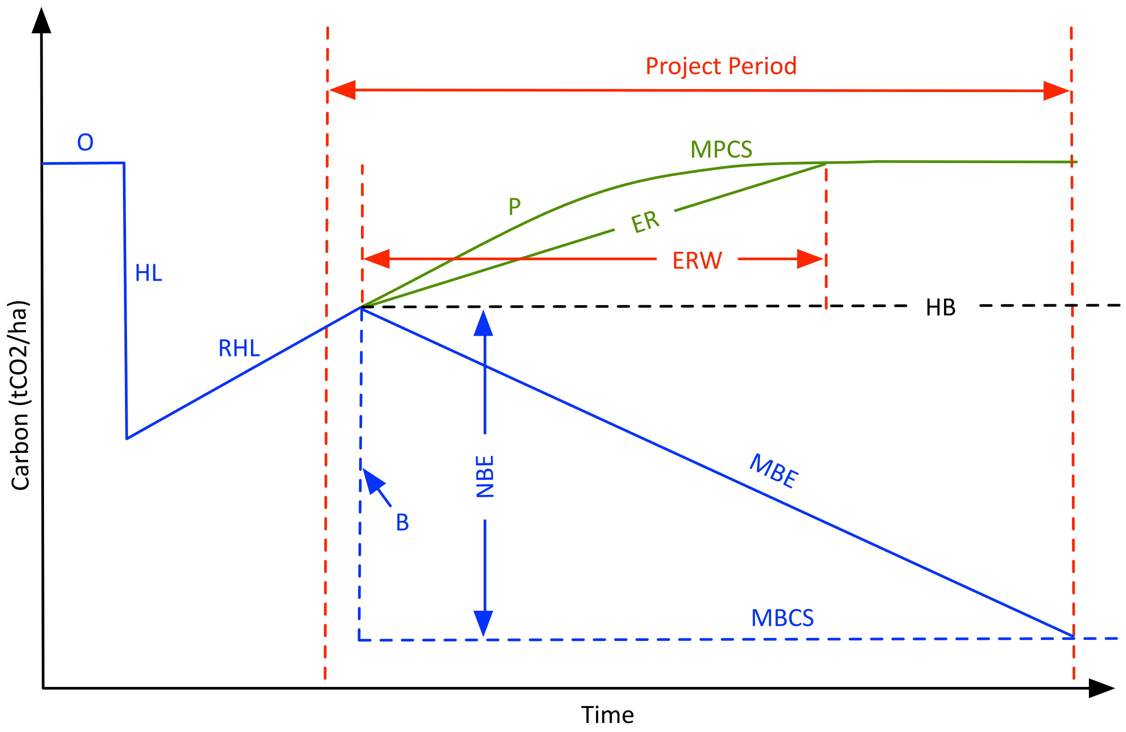
Variant 2a (Figure 1.1.4b) is slightly more complicated by the fact that in the original condition (i.e. pre-project) the forest in question is accumulating carbon biomass annually because it is a degraded forest system and therefore functions as a carbon reservoir <u>and</u> a carbon sink. This degraded forest system in Variant 2 can exist in one of three forms: Variant 2a - Regenerating (annual biomass accumulation); Variant 2b - actively degrading (annual biomass loss); or Variant 2c - Neither degrading nor regenerating (no annual biomass accumulation or annual biomass loss).

*Figure 1.1.4a. Variant 1 - Concept diagram: AD-DtPF$_{ULF}$ in Unlogged (old growth) Forest.*



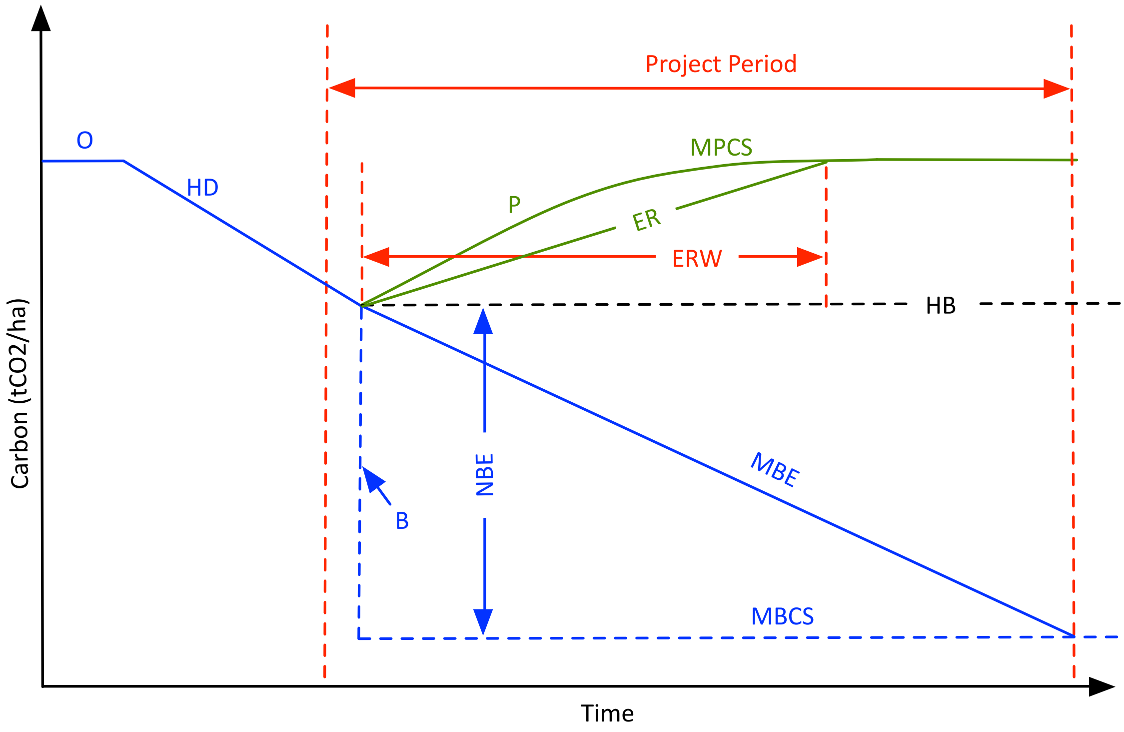

| | | |
|---|---|---|
| Key: | O = | Original mean carbon stocks in old growth undisturbed forest ($tCO_2e$) |
| | B = | Total change in carbon stocks under Baseline Scenario ($tCO_2e$) |
| | P = | Project Scenario carbon stocks under forest protection regime ($tCO_2e$) |
| | MPCS = | Mean Project carbon stocks ($tCO_2e$) |
| | MBCS = | Mean Baseline carbon stocks ($tCO_2e$) |
| | NBE = | Net Baseline Emissions ($tCO_2e$) |

*Figure 1.1.4b. Variant 2a - Concept diagram: AD-DtPF$_{LF}$ in Logged (regenerating) Forest.*




Key:
- O = Original mean carbon stocks in old growth undisturbed forest ($tCO_2e$)
- B = Total change in carbon stocks under Baseline Scenario ($tCO_2e$)
- HL = Change in carbon stocks resulting from historical logging ($tCO_2e$)
- RHL = Regeneration following historical logging ($tCO_2e$)
- P = Project Scenario carbon stocks under forest protection regime ($tCO_2e$)
- HB = Harvest baseline (mean carbon stocks at start of baseline timber harvesting) ($tCO_2e$)
- MPCS = Mean Project carbon stocks ($tCO_2e$)
- MBCS = Mean Baseline carbon stocks ($tCO_2e$)
- NBE = Net Baseline Emissions (Total) ($tCO_2e$)
- MBE = Modelled Baseline Emissions (annualised) ($tCO_2e$)
- ER = Enhanced Removals (Project Scenario) ($tCO_2e$)
- ERW = Enhanced Removals Window (Project Scenario) (60 years)

*Figure 1.1.4c. Variant 2b - Concept diagram: AD-LtPF$_{LF}$ in Logged (degrading) Forest.*




Key:

| | | |
|---|---|---|
| | O = | Original mean carbon stocks in old growth undisturbed forest ($tCO_2e$) |
| | B = | Total change in carbon stocks under Baseline Scenario ($tCO_2e$) |
| | HL = | Change in carbon stocks resulting from historical logging ($tCO_2e$) |
| | RHL = | Regeneration following historical logging ($tCO_2e$) |
| | P = | Project Scenario carbon stocks under forest protection regime ($tCO_2e$) |
| | HB = | Harvest baseline (mean carbon stocks at start of baseline timber harvesting) ($tCO_2e$) |
| | MPCS = | Mean Project carbon stocks ($tCO_2e$) |
| | MBCS = | Mean Baseline carbon stocks ($tCO_2e$) |
| | NBE = | Net Baseline Emissions (Total) ($tCO_2e$) |
| | MBE = | Modelled Baseline Emissions (annualised) ($tCO_2e$) |
| | ER = | Enhanced Removals (Project Scenario) ($tCO_2e$) |
| | ERW = | Enhanced Removals Window (Project Scenario) (60 years) |

If a degraded indigenous forest were subject to deforestation in the baseline scenario, the deforestation baseline activity would:

a. Generate emissions, and
b. Interrupt the process of natural regeneration (annual carbon stock accumulation).

The interruption of natural forest succession towards an old-growth condition is calculated on the basis of:

a. The mean sequestration rate for this forest type, and
b. The allowed duration of the Enhance Removals Window (i.e. 60 years based on a conservative estimate of the time it would take to regenerate to mature forest where the mean sequestration rate (annual increment) becomes zero ('old growth').

For this reason a project activity that protected Logged Forest land parcels and prevented deforestation would avoid emissions, and enhance GHG removals (sequestration) for those land parcels. Enhanced removals are caused by a change in management (forest protection) that allows the forest to continue to function as a net sink until it reaches an old growth condition. The eligible carbon credits generated from the enhanced removals component of Variant 2 land parcels are limited to the removals occurring above the Harvest Baseline (HB in Figures 1.1.4b and 1.1.4c. above). This is because carbon stock change occurring below the Harvest Baseline is accounted for in the avoided emissions component of carbon accounting in this activity type.

In each case, the eligible crediting volume of $CO_2e$ is restricted to the difference between the net mean projected Baseline Scenario carbon stocks and the net mean Project Scenario carbon stocks.

### 1.1.5 Specific Conditions

Specific conditions for projects applying this Technical Specifications Module:

a. The Project Period for all projects using this Technical Specifications Module shall be no less than 30 years, with perpetual right of renewal.
b. Project Owner exists as an entity capable of entering into binding project commitments with the Programme Operator and capable of owning carbon credit assets.
c. Project Owner owns the carbon rights and management rights over the forest lands in the project area.
d. Current and planned land use: land must be legally eligible for deforestation.
e. There may be no leakage through activity shifting to other lands owned or managed by project participants outside the bounds of the carbon project.

| Table 1.1.5: Evidence Requirement: Specific Conditions | |
|---|---|
| # | Description |
| 1.1.5a | Documentation to prove that Project Owner exists as a legal entity capable of acting as a counter party to a sale and purchase agreement and capable of owning carbon credit assets. This could be a certificate of incorporation, or similar legal document associated with the establishment of the legal entity sufficient to meet this eligibility criterion. |
| | To be provided in Appendix 1.2.5a of the PD. |
| 1.1.5b | Documentation to demonstrate that Project Owner owns the carbon rights and management rights over the forest lands in the project area. This would need to include documentation from the government that clarifies options for carbon rights ownership and the particular option selected in this case. It would also need to include evidence of said rights ownership by the Project Owner legal entity. |
| | To be provided in Appendix 1.1.5b of the PD. |

| | |
|---|---|
| 1.1.5c | Documentation to demonstrate that Project Owner is legally eligible to deforest the project area. This can be provided in the form of the relevant laws and/or regulations that permit forest removal and the eligibility of the land in question for such. |
| | To be provided in Appendix 1.1.5c of the PD. |
| 1.1.5d | Evidence of avoidance of activity shifting leakage to take the form of a leakage assessment using Section 5.2 of this Technical Specifications Module. |
| | To be provided in the leakage assessment undertaken in Part B, Section 5.2 of the PD. |

### 1.1.6 Rationale For 30-Year Project Period

According to Section 5 of the Plan Vivo Standard (2013, p16):

*5.5. Ecosystem services must be accounted for over a specified quantification period that is of sufficient length to provide a clear picture of the long-term impact of the activity.*

*5.6. The quantification period must not exceed the period over which participants can make a meaningful commitment to the project intervention, and must be justified in relation to the duration of payment and monitoring obligations.*

According to the IPCC (2000) (Chapter 5.3.4) there are a number of approaches to project duration for LULUCF projects: Perpetuity, 100 Years, Equivalence Based, and Variable. Two are relevant to this Technical Specifications Module:

> *"100 Years: Under this approach, the GHG benefits of a project must be maintained for a period of 100 years to be consistent with the Kyoto Protocol's adoption of the IPCC's GWPs (Article 5.3) and the Protocol's 100-year reference time frame (Addendum to the Protocol, Decision 2/CP.3, para. 3) for calculation of the AGWP for CO2. Although this concept has limitations (IPCC, 1996), it has been adopted for use in the Kyoto Protocol to account for total emissions of GHGs on a CO2-equivalent basis."*

> *"Equivalence Based: Under this approach, the GHG benefits of LULUCF mitigation projects must be maintained until they counteract the effect of an equivalent amount of GHGs emitted to the atmosphere, estimated on the basis of the cumulative radiative forcing effect of a pulse emission of $CO_2$e during its residence in the atmosphere (i.e., its AGWP) (IPCC, 1992). Variations of this concept have been developed that proposed minimum time frames of 55 years (Moura-Costa and Wilson, 2000) or 100 years (Fearnside et al., 2000)."*

The intention of the Nakau Programme is to provide for forest protection in perpetuity but in a manner that respects the rights of indigenous peoples and other private landowners in relation to the ability to make land use decisions in future generations. The Nakau

Programme is also required to abide by the laws relating to indigenous rights imposed by host governments. Such laws are designed to prevent land alienation. The Nakau Programme provides for the interests of permanence and the interests of preventing land alienation by adopting a minimum Project Period of 30 years with the option to roll over the project for subsequent 30-year periods indefinitely. This 30-year Project Period cycle is designed to provide a degree of intergenerational equity that would not be available to landowners under a permanent covenant. This 30-year cycle enables future generations of Project Owners to make informed decisions concerning the management of their forests in light of a re-evaluation of the realities of forest resource management every 30 years. The Nakau Programme has adopted this approach to demonstrate respect for future landowners (particularly indigenous peoples) under the premise:

A. That the governance rights (including strategic development decisions) over forest resources ought not to be permanently locked by past generations as a consequence of participation in carbon market activities, and
B. That there is a degree of uncertainty concerning the future existence of carbon markets beyond 30 years from the present and where an adaptive management approach would need the flexibility to change with changing circumstances.

This programme design feature is designed to enable a larger number of forest resource owners feel sufficiently empowered to participate in this programme compared with a programme that locked all future generations of landowners into a particular regime. This is of particular relevance to land owners who own land communally.

## 1.2 STANDARDS AND GUIDANCE

This Technical Specifications Module is validated to the Plan Vivo Standard. It is adapted from and closely follows the Nakau Programme Technical Specifications Module (C) 1.1 (IFM-LtPF) D2.1.1 validated to the Plan Vivo Standard and which also passed a technical review audit by an auditor[4] accredited to the Plan Vivo, CDM, VCS and ISO14064-2 standards.

[4] Dr Misheck Kapambwe, a contract auditor to Det Norske Veritas (DNV).

The following standards and guidance were used in the development of this Technical Specifications Module:

| **Table 1.2.1: Evidence Requirement: Good Practice Guidance** | |
|---|---|
| # | Good Practice Guidance Element |
| 1.2.1a | Plan Vivo Standard |
| | This methodology is validated to the Plan Vivo Standard, and follows the following Plan Vivo guidance documents:<br>• Plan Vivo Standard (2013)<br>• Plan Vivo PDD Template<br>• Plan Vivo PIN Template<br>• Plan Vivo Guidance Manual |
| 1.2.1b | IPCC 2006 Guidelines on National GHG Inventories |
| | This methodology is aligned to the IPCC 2006 Guidelines on National GHG Inventories in the following way:<br>• The carbon stock change calculations framework used in this methodology follows Section 2.2.1 of Volume 4 of the IPCC 2006 Guidelines. Specifically, this methodology elaborates on Equation 2.3 of Volume 4 of the IPCC 2006 Guidelines but varies by conservatively neglecting litter and soil carbon.<br>• Wood density and dry wood to carbon default values used in this methodology used the default values from the IPCC 2006 Guidelines on National GHG Inventories. |
| 1.2.1c | ISO 14064-2 Standard |
| | This methodology follows the ISO 14064-2 standard in every respect.<br>This methodology is modified from and closely aligned to the Rarakau Programme Methodology, validated to the ISO14064-2 standard. |
| 1.2.1d | The Verified Carbon Standard (VCS) |
| | This methodology followed the following VCS documents:<br>• VCS AFOLU Requirements V3.4<br>• VCS Guidance for Loss Events (8 March 2011)<br>• VCS Tool the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities (VT0001, V3.0).<br>• There was a close alignment of this methodology with the Green Collar IFM methodology Version 1.0 (18 March 2011) approved by the VCS in 2011. |
| 1.2.1e | The Clean Development Mechanism (CDM) |
| | • The CDM was used as the broad framework for the Programme of Activities/Grouped Project scope of this methodology.<br>• Exclusion of emissions derived from the removal of herbaceous vegetation was based on CDM EB decision reflected in paragraph 11 of the report of the 23rd session of the board: cdm.unfccc.int/Panels/ar/023/ar_023 _rep.pdf |

| | |
|---|---|
| | • The Additionality test in this methodology is from the VCS, which in turn is derived from the CDM Tool for Demonstration of Additionality. |

### 1.2.1 Alignment To Plan Vivo Standard (2013)

This Technical Specifications Module (when used in combination with the Nakau Methodology Framework) aligns to every element of the Plan Vivo Standard (2013) as depicted in the following table. Note that this alignment includes elements that are located in the Nakau Methodology Framework.

## Table 1.2.2 Plan Vivo Standard Alignment Table

| Plan Vivo Standard Element | Location in Nakau Methodology Framework | Location in Technical Specifications |
|---|---|---|
| 1 | | |
| 1.1 | 1.3.2 | |
| 1.2 | 1.3.2 | |
| 1.2.1 | 1.3.2 | |
| 1.2.2 | 1.3.2 | |
| 1.2.3 | 1.3.2 | |
| 1.2.4 | 1.3.2 | |
| 2 | | |
| 2.1 | 1.3.3 | |
| 2.1.1 | 1.3.3 | |
| 2.1.2 | 1.3.3 | |
| 2.1.3 | 1.3.3 | |
| 2.1.4 | 1.3.3 | |
| 2.2 | 2.8 | |
| 2.3 | 2.10 | |
| 2.4 | 2.5 | |
| 2.4.1 | 2.5 | |
| 2.4.2 | 2.5 | |
| 3 | | |
| 3.1 | 2.13.1 | |
| 3.2 | 2.13.3 | |
| 3.3 | 2.13.5 | |
| 3.4 | 2.13.4 | |
| 3.5 | 2.13.4 | |
| 3.6 | 2.13.9 | |
| 3.7 | 2.13.10 | |
| 3.8 | 2.13.11 | |
| 3.9 | 2.13.12, 4.2 | |
| 3.10 | 2.13.13, 4.2.2 | |
| 3.11 | 2.13.14 | |
| 3.12 | 2.13.15 | |
| 3.13 | 2.13.16 | |
| 3.14 | 2.13.17 | |
| 3.15 | 2.13.18 | |
| 3.16 | 2.13.19 | |
| 4 | | |
| 4.1 | 3.1.2 | |
| 4.1.1 | 3.1.2 | |
| 4.1.2 | 3.1.2 | |
| 4.1.3 | 3.1.2 | |
| 4.1.4 | 3.1.2 | |
| 4.1.5 | 3.1.2 | |
| 4.1.6 | 3.1.2 | |
| 4.1.7 | 3.1.2 | |
| 4.2 | 3.1.2.2 | |
| 4.3 | 3.1.2.2 | |
| 4.4 | 3.1.3 | |

| Plan Vivo Standard Element | Location in Nakau Methodology Framework | Location in Technical Specifications |
|---|---|---|
| 4.5 | 3.1.4 | |
| 4.6 | 3.1.5.1 | |
| 4.7 | 3.1.5.1 | |
| 4.8 | 3.1.5.1 | |
| 4.9 | 3.1.5.1 | |
| 4.10 | 3.1.5.1 | |
| 4.11 | 2.4 | |
| 4.12 | 3.1.6 | |
| 4.13 | 3.1.6 | |
| 4.14 | 3.2 | |
| 5 | | |
| 5.1 | 5.1 | |
| 5.1.1 | 5.1 | |
| 5.1.2 | 5.1 | |
| 5.1.3 | 5.1 | |
| 5.2 | | 4, 5 |
| 5.3 | | 3.1.6 |
| 5.4 | | 3.1.5 |
| 5.4.1 | | 3.1.5 |
| 5.4.2 | | 3.1.5 |
| 5.5 | | 1.1.6 |
| 5.6 | | 1.1.6 |
| 5.7 | 5.1 | |
| 5.8 | 1.3.3 | |
| 5.9 | | 8 |
| 5.9.1 | | 8 |
| 5.9.2 | | 8 |
| 5.9.3 | | 8 |
| 5.9.4 | | 8 |
| 5.9.5 | 6.2.2 | |
| 5.9.6 | | 8.1.8 |
| 5.9.7 | | 8.1.8 |
| 5.9.8 | | 8.1.8 |
| 5.10 | | 8.1.8 |
| 5.11 | | 7 |
| 5.12 | | 3.1.1 |
| 5.13 | 5.3 | |
| 5.14 | | 1.1.1 |
| 5.15 | | 2 |
| 5.16 | | 5.6 |
| 5.17 | | 4.1 |
| 5.18 | | 4.1 |
| 5.19 | | 5.2 |
| 5.20 | | 5.2 |
| 6 | | |
| 6.1 | | 5.4 |
| 6.2 | | 5.4 |

| Plan Vivo Standard Element | Location in Nakau Methodology Framework | Location in Technical Specifications |
|---|---|---|
| 6.3 | | 5.4.1 |
| 6.4 | | 5.4.1 |
| 7 | | |
| 7.1 | 5.2.2 | |
| 7.2 | 5.2.1, 5.2.2 | |
| 7.2.1 | 5.2.1 | |
| 7.2.2 | 5.2.1 | |
| 7.2.3 | 5.2.1 | |
| 7.2.4 | 5.2.1 | |
| 7.2.5 | 5.2.1 | |
| 7.2.6 | 5.2.1 | |
| 7.2.7 | 5.2.1 | |
| 7.2.8 | 5.2.1 | |
| 7.3 | 5.2.2 | |
| 7.4 | 5.2.3 | |
| 7.4.1 | 5.2.3.2 | |
| 7.4.2 | 5.2.3.5 | |
| 7.5 | 5.2.3.6 | |
| 8 | | |
| 8.1 | 4 | |
| 8.2 | 4.1.1 | |
| 8.2.1 | 4.1.1 | |
| 8.2.2 | 4.1.1 | |
| 8.2.3 | 4.1.1 | |
| 8.2.4 | 4.1.1 | |
| 8.2.5 | 4.1.1 | |
| 8.2.6 | 4.1.1 | |
| 8.2.7 | 4.1.1 | |
| 8.2.8 | 4.1.1 | |
| 8.2.9 | 4.1.1 | |
| 8.2.10 | 4.1.1 | |
| 8.3 | 4.1.2 | |
| 8.4 | 4.1.1 | |
| 8.5 | 4.1.3 | |
| 8.5.1 | 4.1.3 | |
| 8.5.2 | 4.1.3 | |
| 8.5.3 | 4.1.3 | |
| 8.6 | 4.1.3 | |
| 8.7 | 4.1.3 | |
| 8.8 | 4.3 | |
| 8.9 | 4.3 | |
| 8.10 | 4.3 | |
| 8.11 | 4.3 | |
| 8.12 | 4.3 | |
| 8.13 | 4.3 | |

# 2. Identifying GHG Sources, Sinks and Reservoirs

According to Section 5 of the Plan Vivo Standard (2013, p18):

*5.15. All carbon pools and emissions sources used to quantify climate services must be specified with justification for their inclusion. Carbon pools expected to decrease, and emissions sources expected to increase as a result of the project intervention must be included, unless decreases or emissions are likely to be insignificant, i.e. less than 5% of total climate benefits.*

Section 5.3 of the ISO 14064-2 Standard requires project proponents to:

*Select or establish criteria and procedures for identifying and assessing GHG sources, sinks and reservoirs controlled, related to, or affected by the project.*

*Based on selected or established criteria and procedures, the project proponent shall identify GHG sources, sinks and reservoirs as being:*

*a) Controlled by the project proponent,*
*b) Related to the GHG project, or*
c) *Affected by the GHG project.*

Section 5.5 of the ISO 14064-2 Standard requires project proponents to:

[Identify] *GHG sources, sinks and reservoirs relevant to the baseline scenario, and for each*

*a) Consider criteria and procedures used for identifying the GHG sources, sinks and reservoirs relevant for the project,*
b) *If necessary, explain and apply additional criteria for identifying relevant baseline GHG sources, sinks and reservoirs, and*
c) *Compare the project's identified GHG sources, sinks and reservoirs with those identified in the baseline.*

Section 5.6 of the ISO 14064-2 Standard requires project proponents to:

*Select or establish criteria and procedures for selecting relevant GHG sources, sinks and reservoirs for either regular monitoring or estimation.*

*Justify not selecting any relevant GHG source, sink and reservoir for regular monitoring.*

**Criteria For Selecting Relevant GHG Sources, Sinks and Reservoirs**

The GHG sources, sinks and reservoirs estimated in this Technical Specifications Module are restricted to LULUCF sector carbon emissions and removals as follows:

| Table 3a: GHG Sources, Sinks, and Reservoirs: Pacific REDD+ Program | |
|---|---|
| **Sources** | $CO_2$e emissions from above ground woody biomass removed from the forest. |
| | $CO_2$e emissions from above ground woody biomass entering the deadwood pool in the form of discarded crown and branches of harvested (target) trees. |
| | $CO_2$e emissions from additions to the above ground deadwood carbon pool resulting from collateral damage to non-target trees due to wood harvest activities. |
| | $CO_2$e emissions from the decomposition of below ground biomass resulting from above ground wood harvesting and collateral damage. |
| **Sinks** | $CO_2$e sequestered in the natural background rate of natural forest regeneration. |
| | $CO_2$e sequestered in harvest patches as a consequence of the opening the forest canopy. |
| **Reservoirs** | The GHG assessment in this project estimates the change in carbon stocks contained in carbon reservoirs (and associated emissions and/or removals), rather than the total content of carbon stored in the forest carbon reservoirs/pools. |

The total volume of carbon stored in the above ground carbon pools is measured in this methodology by means of a carbon stock inventory. Carbon stored below ground is derived from the application of a root-shoot ratio. Furthermore, the GHG sources and sinks estimated in this methodology are restricted to LULUCF carbon pools that are controlled by the Project Owners and lie within the Eligible Forest Area of the project.

The carbon pools used in this methodology are:

| Table 3b: Carbon Pools Used in this Methodology | | |
|---|---|---|
| Carbon Pool | Included/ Excluded | Justification |
| Above ground biomass (AGB) | Included | Deforestation causes a significant change in carbon stocks associated with the loss of above ground biomass. |
| Below ground biomass (BGB) | Included | When you kill a tree you also kill its roots (unless the tree is of a species that coppices). The 2006 IPCC Guidelines on GHG Inventories uses a BGB default value of 0.37 of AGB for tropical rainforest. The only exception to this default rule for this methodology applies to species that are known to be capable of regenerating from cut stumps. Project Coordinators shall identify the proportion of the above ground biomass emitted (AGBE) attributable to these species in the Baseline, and remove the below ground biomass emitted (BGBE) portion for these |

| | | |
|---|---|---|
| | | species in the baseline calculation. |
| Dead-wood (DW) | Included | Required under VCS Tool for AFOLU Methodological Issues. |
| Harvested Wood Products | Included | Required under VCS Tool for AFOLU Methodological Issues, even though harvested wood products are usually not considered when estimating the baseline or project scenarios under the Plan Vivo Standards for RED projects (Estrada (CIFOR) 2011, p49). Included in this methodology to maintain consistency with the VCS on this point. |
| Litter | Excluded | Insignificant and exclusion is conservative. |
| Soil organic carbon | Excluded | Exclusion is conservative. |

The inclusion/exclusion of greenhouse gases in this methodology are shown in Table 3c.

Table 3c: Emission sources other than resulting from changes in stocks in carbon pools

| Gas | Sources | Included / Excluded | Justification |
|---|---|---|---|
| Carbon dioxide ($CO_2$) | Removal of woody vegetation through commercial logging activity | Included | Such removal of vegetation causes $CO_2$ emissions to the atmosphere. |
| | Combustion of fossil fuels (in vehicles, machinery and equipment) | Excluded | Not required by Plan Vivo Standards. |
| | Removal of herbaceous vegetation | Excluded | Based on CDM EB decision reflected in paragraph 11 of the report of the 23rd session of the board: cdm.unfccc.int/Panels/ar/023/ar_023_rep.pdf |
| Methane ($CH_4$) | Combustion of fossil fuels (in vehicles, machinery and equipment) | Excluded | Not required by Plan Vivo Standards. |
| | Burning of biomass | Excluded | Exclusion is conservative. |
| Nitrous oxide ($N_2O$) | Combustion of fossil fuels (in vehicles, machinery and equipment) | Excluded | Not required by Plan Vivo Standards. |
| | Nitrogen based fertilizer | Excluded | Potential emissions are conservatively neglected. |
| | Burning of biomass | Excluded | Potential emissions are conservatively neglected. |

**Comparison Between Baseline & Project**

The sources, sinks and reservoirs defined in the baseline scenario will be the same for the project scenario.

# 3. Determining The Baseline Scenario

Section 5.4 of the ISO 14064-2 Standard requires project proponents to:

*1. Select or establish criteria and procedures for identifying and assessing potential baseline scenarios considering the following:*

- *a) The project description, including identified GHG sources, sinks and reservoirs ([see Section 3 above]);*
- *b) Existing and alternative project types, activities and technologies providing equivalent type and level of activity of products or services to the project;*
- *c) Data availability, reliability and limitations;*
- *d) Other relevant information concerning present or future conditions, such as legislative, technical, economic, socio-cultural, environmental, geographic, site-specific and temporal assumptions or projections.*

*2. Demonstrate equivalence in type and level of activity of products or services provided between the project and the baseline scenario and shall explain, as appropriate, any significant differences between the project and the baseline scenario.*

*3. Select or establish, explain and apply criteria and procedures for identifying and justifying the baseline scenario.*

*4. [Develop] the baseline scenario, the project proponent shall select the assumptions, values and procedures that help ensure that GHG emissions reductions or removal enhancements are not over-estimated.*

Baseline activities under this Technical Specifications Module are restricted to deforestation[5] implemented on forest lands[6] and are included in the IPCC category "forest land converted to non-forest land".

Only areas that have been designated, sanctioned or approved for such activities (e.g. where there is legal sanction to deforest) by the national and/or local regulatory bodies are eligible for crediting under this methodology.

[5] Using the FAO FRA 2010 definition (see Explanatory Notes in Appendix 1).

[6] Using the FAO FRA 2010 definition: Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. Source: http://www.fao.org/docrep/014/am665e/am665e00.pdf

# 3.1 BASELINE SELECTION, ADDITIONALITY AND BASELINE MODELLING

## 3.1.1 Selection of Baseline

According to the Plan Vivo Standard (2013, p17):

*5.12. A baseline scenario must be provided for each project intervention, describing current land uses and habitat types and existing major ecosystem services provided in the area, and how these are most likely to change over the quantification period in the absence of project interventions.*

Each land parcel in a project applying this Technical Specifications Module must determine the Baseline Scenario as deforestation.

In justifying the Baseline Activity, Project Coordinators must determine the most likely land use in the absence of the project, through the identification of possible land uses using the following criteria, and an assessment of land use options according to the following criteria:

a. Land suitability
b. Technical barriers
c. Economic barriers
d. Institutional constraints

## 3.1.2 Justification of Selected Baseline

All projects applying this Technical Specifications Module must justify the selected baseline in terms of the most likely baseline activity and scale of the baseline activity. The scale of baseline activity has a direct bearing on the volume of baseline emissions. The scale of the baseline activity is determined by:

a. Legal sanction of the baseline activity type,
b. Legal sanction of baseline activity scale, and
c. Commercial viability of the type and scale of baseline activity.

### 3.1.2.1 Commercially Viable Baseline

The baseline activity is defined as the maximum deforested area of land within the Project Area that is legally sanctioned for deforestation and a change from forest to non-forest land use.

A forest carbon inventory is required for all projects applying this Technical Specifications Module. Projects are also required to undertake an economic analysis for establishing the scale of baseline activity and demonstrating that the baseline activity is commercially viable.

This Technical Specifications Module establishes the baseline on historical activities in the project and/or reference area, so is similar to making the assumption that the baseline scenario will continue for the Project Period. Project Coordinators are required to update the baseline every ten years from the Project Start Date.

### 3.1.3 Justification for Excluding Alternative Baselines

All projects applying this Technical Specifications Module must justify the exclusion of alternative baselines by means of an assessment of the feasibility or likelihood of alternative baselines.

### 3.1.4 Stratification

All projects applying this Technical Specifications Module shall stratify the baseline scenario into the following strata:

a. Forest composition stratification.
b. Forest management stratification.

Forest composition strata include forest type, vegetation type and/or target timber species.

The two forest management strata for this methodology are:

a. Logged Forest –
   i. Areas of forest that have been subjected to timber harvesting between 1 January 1930 and 31 December 2009 (for forests that were not being actively logged immediately prior to the Project Start Date), or
   ii. Areas of forest that have been subject to timber harvesting between 1 January 1930 and the Project Start Date (for forests that were being actively logged since 31 December 2009 but where the logging activity started prior to 31 December 2009).
b. Unlogged Forest - areas of forest not subject to past timber harvesting. This includes old growth forest where:
   i. There is no evidence of the forest being logged since 1 January 1900 or
   ii. Forest that may have been logged since 1 January 1930 but which is (conservatively) deemed to have not been logged since 1 January 1930. (The conservatism in the latter relates to the fact that forests or land parcels deemed to be 'Unlogged Forest' in the Baseline Scenario are not eligible for claiming Enhanced Removals in the Project Scenario because they are deemed to be not accumulating biomass annually in their original condition.

### 3.1.5 Additionality

According to Section 5 of the Plan Vivo Standard (2013, p16):

*5.4. Ecosystem services forming the basis of Plan Vivo projects must be additional i.e. would not have been generated in the absence of the project, which involves as a minimum demonstrating that:*

- *5.4.1. Project interventions are not required by existing laws or regulations, unless it can be shown that those laws are not enforced or commonly met in practice and the support of the project is therefore justified;*
- *5.4.2. There are financial, social, cultural, technical, scientific or institutional barriers preventing project interventions from taking place.*

According to section 5.4 of the ISO 14064-2 standard (2006):

*The project proponent shall select or establish, justify and apply criteria and procedures for demonstrating that the project results in GHG emissions reductions or removal enhancements that are additional to what would occur in the baseline scenario.*

This Technical Specifications Module tests the additionality of the project using the most recent version of the VCS Additionality Tool.

### 3.1.6 Baseline Revision

According to Section 5.3 of the Plan Vivo Standard (2013):

*Technical specifications must be updated at least every 5 years where they are still being used to sign new PES Agreements, by reviewing both available data from project monitoring results, e.g. species growth data, and new available data from outside the project.*

All projects are required to undertake a baseline revision every 5 years. This baseline revision will include revision of the technical data used to create the Baseline and Project Scenarios from an ecosystem service accounting perspective.

# 4. Quantifying Baseline GHG Emissions and Removals

According to Section 5 of the Plan Vivo Standard (2013):

*5.2. Sources of data used to quantify ecosystem services, including all assumptions and default factors, must be specified and as up-to-date as possible, with a justification for why they are appropriate.*

*5.18. An approved approach must be used to quantify initial carbon stocks and emissions sources, and estimate how they are most likely to change over the project period, as part of the baseline scenario.*

According to Section 5.7 of the ISO 14064-2 Standard:

*The project proponent shall select or establish criteria, procedures and/or methodologies for quantifying GHG emissions and/or removals for selected GHG sources, sinks and/or reservoirs (see Section 6 above).*

*Based on selected or established criteria and procedures, the project proponent shall quantify GHG emissions and/or removals separately for*

*a) Each relevant GHG for each GHG source, sink and/or reservoir relevant for the project, and*
*b) Each GHG source, sink and/or reservoir relevant for the baseline scenario.*

*When highly uncertain data and information are relied upon, the project proponent shall select assumptions and values that ensure that the quantification does not lead to over-estimation of GHG emissions reductions or removal enhancements.*

*The project proponent shall estimate GHG emissions and/or removals by GHG sources, sinks and reservoirs relevant for the project and relevant for the baseline scenario, but not selected for regular monitoring.*

*The project proponent shall establish and apply criteria, procedures and/or methodologies to assess the risk of a reversal of a GHG emission reduction or removal enhancement (i.e. permanence of GHG emission reduction or removal enhancement).*

*If applicable, the project proponent shall select or develop GHG emissions or removal factors that:*

- *are derived from a recognized origin,*
- *are appropriate for the GHG source or sink concerned,*

- *are current at the time of quantification,*
- *take account of the quantification uncertainty and are calculated in a manner intended to yield accurate and reproducible results, and*
- *are consistent with the intended use of the GHG report.*

This Technical Specifications Module calculates the net anthropogenic GHG emissions and removals in the Baseline Scenario, and then calculates the net anthropogenic GHG emissions and removals in the Project Scenario.

## 4.1 CALCULATION OF GHG EMISSIONS AND REMOVALS

The highest-level equation for carbon stock change measurement in this Technical Specifications Module for baseline and project scenarios is equivalent to Equation 2.3 of Volume 4, Chapter 2 of the 2006 IPCC Guidelines for National GHG Inventories:

**EQUATION 2.3**
**ANNUAL CARBON STOCK CHANGES FOR A STRATUM OF A LAND-USE CATEGORY AS A SUM OF CHANGES IN ALL POOLS**

$$\Delta C_{LU_i} = \Delta C_{AB} + \Delta C_{BB} + \Delta C_{DW} + \Delta C_{LI} + \Delta C_{SO} + \Delta C_{HWP}$$

Where: $\Delta C_{LUi}$ = Carbon stock changes for a stratum of land-use category; and subscripts denote the following carbon pools: AB = Above Ground Live Biomass; BB = Below Ground Live Biomass; DW = Deadwood; LI = Litter; SO = Soils; HWP = Harvested Wood Products.

Annual carbon stock change calculations for baseline and project scenarios are based on Equation 2.7 (Chapter 2, Volume 4) of the IPCC 2006 Guidelines on National GHG Inventories.

**EQUATION 2.7**
**ANNUAL CHANGE IN CARBON STOCKS IN BIOMASS IN LAND REMAINING IN A PARTICULAR LAND-USE CATEGORY (GAIN-LOSS METHOD)**

$$\Delta C_B = \Delta C_G - \Delta C_L$$

Where: $\Delta C_B$ = Annual change in carbon stocks in biomass, (tonnes C $yr^{-1}$); $\Delta C_G$ = Annual gain (removals) of carbon in biomass due to biomass growth considering the total area (tonnes C $yr^{-1}$); $\Delta C_L$ = Annual loss (emissions) of carbon in biomass due to biomass loss considering the total area (tonnes C $yr^{-1}$).

The following table lists the baseline GHG sources and sinks modelled by this methodology:

| Table 4.1: Baseline GHG Sources and Sinks | Acronym |
|---|---|
| Included in Modelling: | |
| Above Ground Biomass Emitted as a result of baseline deforestation | AGBE |
| Below Ground Biomass Emitted as a result of baseline activity | BGBE |
| Removals sequestered into the long-term wood product pool | ltWP |
| Baseline Removals | BR |
| Excluded from Modelling: | |
| Emissions from fossil fuel components of baseline activity | |

Calculation of Baseline Scenario carbon dioxide emissions and removals involves the application of the equations presented in this section of this methodology to complete the carbon accounting for all land parcels in the Baseline Scenario. The baseline and project emissions and removal calculations are based on conservative default values applied to empirical measurement of baseline timber harvesting rates.

According to Section 5 of the Plan Vivo Standard (2013, p18):

*5.17. Where climate services are affected by cyclical management activity, e.g. harvesting or naturally occurring cycles, the quantification period must be representative of the services provided throughout the full cycle of events.*

The equations calculate the total emissions across the crediting period for each emission source.

| Table 4.1a: Evidence Requirement: Baseline Scenario GHG Emissions/Removals | |
|---|---|
| # | Name/Description |
| 4.1a | Above Ground Biomass inventory for the Eligible Forest Area. |

## 4.1.1 Step 1 – Above Ground Biomass Emitted (AGBE)

Above Ground Biomass Emitted (AGBE) represents the total above ground deadwood caused by deforestation, and is measured in $m^3$ per year and is calculated by means of a stratified biomass inventory for each land parcel in the project area applying this Technical Specifications Module.

### 4.1.1.1 Survey Design

The methodology uses a set of randomly located permanent plots to provide an unbiased estimate of the carbon stored in the area of old-growth forest, and provides a baseline for assessing changes over time. Permanent plots are used because they provide a means of verifying the carbon stock estimate. They also offer significant advantages for monitoring change because they factor-out spatial variability that would otherwise mask temporal changes.

The forest inventory is required to provide an estimate of the biomass (and therefore carbon[7]) stocks that would be lost if the area was deforested that is ±10 percent of the true value at a 95% level of confidence. The number of inventory plots required to achieve this would normally be assessed using data from a pilot study. For the Loru inventory, which covers a smallish area of relatively homogeneous forest, the strategy will be to establish plots that are randomly located throughout the survey area until such time as analysis of the data shows the required level of accuracy has been achieved.

#### 4.1.1.2 Sample Plot Location

It is important to establish the position of each plot as accurately as possible so future measurement teams can relocate it without difficulty. A Global Positioning System (GPS) unit is used to determine the location of each plot. When using the GPS unit to fix the position of a plot, use the instrument to navigate to within approximately 30 metres of the plot location. Then use the compass bearing and the horizontal distance reading displayed by the GPS unit to find the exact location of the plot. This forms corner D of the plot (see Figure 1). Where a GPS unit is used to determine direction, ensure the direction function is set to magnetic.

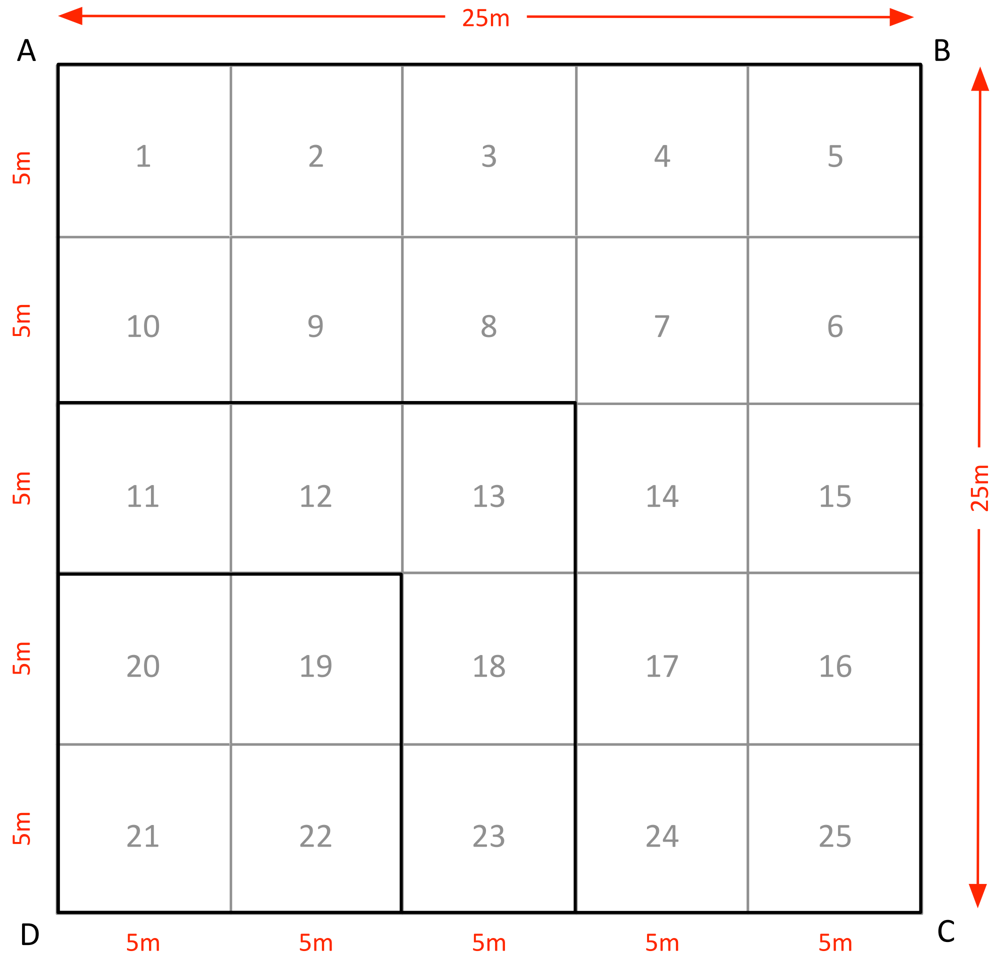
This procedure is recommended because the accuracy with which a GPS unit can locate a specified point decreases as the point is approached. Once the position of the plot has been determined, use the GPS unit to refix the position or, where this is not possible, to refix the position of an identifiable point (e.g. landscape feature) at a specified distance and magnetic bearing from the plot. Wherever possible the refixed position should be an averaged reading as this increases the accuracy for re-location purposes.

#### 4.1.1.3 Plot Layout

From corner D, identify the bearing that runs along the predominant contour of the slope. Lay a 25-m tape along this bearing to form the lower boundary of the plot (D–C in Fig. 1). Where the terrain is flat (i.e., there is no discernable slope) orient the D–C boundary along the north-south axis. Lay two 25-m tapes at right angles to the first, one at each end. Join the open ends with a fourth 25-m tape to form a 25 × 25 m square. Tapes should be pulled tight when laying out a plot on even ground. When the plot is in a gully or on a ridge etc. the tapes should follow the ground surface. Use a 3-4-5 triangle to ensure the plot corners are at right angles.

[7] Woody biomass is c. 50% carbon

*Figure 4.1.1.3. Layout of 25 x 25m plot*




Measure and record the bearing, slope distance and slope angle for each of the four plot axes (A–B, B–C, C–D, D–A). If complex terrain obstructs the line of sight, measure the slope distance and angle in two steps. Where a plot axis is measured in more than one step, ensure that each segment has the same bearing. This information is used to calculate the horizontal area of the plot. Record it on the Site Description plot sheet (Appendix 2).

Permanently mark the four corners of the plot (A, B, C, D) with a stake. Stakes should be driven into the ground as deeply as possible so that they will not be easily dislodged by soil movement or animal activities. Stakes should be resistant to decay and not of a material that is seen as valuable in the local community and therefore vulnerable to theft.

Nail a permolat strip to a tree (or other clearly visible object) near each corner stake, but outside the plot area. Leave at least 2 cm of the nail protruding to allow for tree growth. On these permolat strips record the distance and magnetic bearing from the tree base to the nearest corner stake (e.g. Corner A – 1.6 m @ 205$^{o}$), and use an arrow to indicate the direction of the stake.

Subdivide the plot into 25 equal-sized (5 × 5 m) squares using additional tapes or cords. Tapes should be pulled tight when laying out a plot on even ground. When the plot is in a gully or on a ridge etc. the tapes should follow the ground surface. The purpose of subdividing the plot into smaller units is twofold: i) it defines the nested quadrats that are used to measure trees of differing size classes and ii) it reduces the likelihood that trees will be missed or double counted.

When laying out and measuring a plot keep disturbance to the plot area and its immediate surroundings to a minimum, to minimize the possibility that changes observed on future visits may have resulted from earlier measurement activities.

### 4.1.1.4 Edge Plots

Where a sample point is located at or close to the edge of the survey area, the plot is established if at least 50 percent of the plot area (i.e. half of the 5 × 5 m subplots) falls within the survey area. Where more than 50 percent of the plot area lies outside the survey area the sample point is abandoned. For plots that lie across the survey boundary record the subplots that fall outside the survey area. This enables the plot area to be adjusted when the data are analysed. Record this information on the Site Description plot sheet (Appendix 2).

### 4.1.1.5 Plot Description

This describes the physical and biological characteristics of the sample plot. Data and information are recorded on the Site Description plot sheet (Appendix 2).

***Identification Information***

Table 4.1.1.5a Physical and Biological Characteristics of Sample Plot

| Identifier | Description |
|---|---|
| Survey name | Record the name of the project that will use the data from the plots that are being established or re-measured. |
| Plot identifier | This is the unique number/letter code (e.g. K21) that identifies the data and information collected from the plot. |
| Location | The area where the plot is situated (e.g. Loru, eastern Espiritu Santo, Vanuatu). |
| GPS make & model | Record the make and model of the GPS receiver. |
| Grid reference | Record the Easting and Southing in the space provided, whether the fix was 2D or 3D, whether the reading was a single or averaged position, and the precision obtained (e.g. ± 8 m). For guidelines on obtaining this information refer to the instruction manual for the GPS receiver being used. |
| Datum | Record which geodetic datum was used to obtain the grid reference (e.g. WGS 84) |
| Approach notes | Record a description of how to get to the site. The description should be sufficiently detailed to enable people who have not previously been to the plot to locate it without extensive searching. |
| Location diagram | Sketch the route to the plot emphasizing prominent landscape features (e.g. slips, gullies, bluffs, roads, streams, large tree-fall gaps). Where possible include GPS references for significant way-points. Centre the sketch on the plot location. Wherever possible supplement this with a photographic record to assist future parties to locate the plot. |
| Date measured | Record day/month/year in full |
| Measured by | Record the full name of each member of the plot measurement team. |

***Site Description***

| Table 4.1.1.5b Site Description Parameters | |
|---|---|
| **Attribute** | **Description** |
| Altitude | Measure to the nearest 10 m using an altimeter. Barometric altimeters should be corrected each morning, or more frequently during changeable weather, from points of known altitude on a topographical map. Do not use a GPS unit to measure altitude, or infer plot height from a topographical map. |
| Physiography | Describe using one of the following categories: Ridge (including spurs), Face, Gully or Terrace. If more than one category could apply, circle the predominant option. |
| Aspect | Determine the physiography of the plot before measuring the aspect. Use a compass to measure the predominant aspect of the plot to the nearest 5 degrees. An aspect measurement is taken at right angles to the general lie of the plot. Where there is a major change in aspect across the plot record the measurements (and the associated physiography information) in the Notes section. For plots with a slope of < 5 degrees, aspect cannot be determined and should be recorded as X. **Do not use zero to indicate a missing value or the aspect of a flat site.** |
| Slope | Measure the average slope of the plot along the predominant aspect to the nearest degree, using an Abney level or equivalent instrument. Sight the instrument on an object at eye level 10 m upslope and 10 m downslope, and average the readings. The shape of the slope along the predominant aspect should be described as Convex, Concave, or Linear. |
| NB: These parameters should be measured from the centre of the plot. | |
| Subplots outside the survey area | Record the numbers (1 – 25) of all subplots that are wholly or mostly (> 50%) **outside** the designated survey area. |
| Additional Biological Information | |
| Average top height | Estimate the average height of the dominant canopy trees, to the nearest metre. Where trees are emergent above the forest canopy record their top height as well. |
| Canopy cover | Use the Foliage Cover Scale (Appendix 2) to estimate to the nearest 10% the percentage of sky blocked out by the vegetation. Estimate cover at the centre of the plot, and halfway between the centre and each corner, and average the five results. |
| Cultural | Record direct evidence (e.g. cut stumps, mine tailings) of human interference using one or more of the following categories – None, Fire, Logged, Cleared, Mined, Grazed, Tracked. Use the notes section to justify your choice(s), and record indirect evidence (e.g. plant species characteristic of post-fire communities as evidence of past fire) of human activity. |
| Dominant tree species | List the dominant tree species on the plot. |
| Other plant species | Note other plant species that are unusual or have local or cultural significance. |
| Fauna | Record the presence of mammal/bird/reptile/invertebrate species that can be positively identified by sight or sound. |

## 4.1.1.6 Measuring Trees

Diameter and height data are used to calculate carbon estimates for live and dead standing trees. A tree is classed as being within the plot if at least 50% of its trunk is within the bounded area.

Where there are a large number of stems on a plot, use chalk or some other non-permanent marker to keep track of which stems have been tagged and measured. This reduces the likelihood that stems will be missed or double counted. When recording the data, leave a blank line between the data from successive subplots.

**Diameter measurements**

***What to tag and measure***

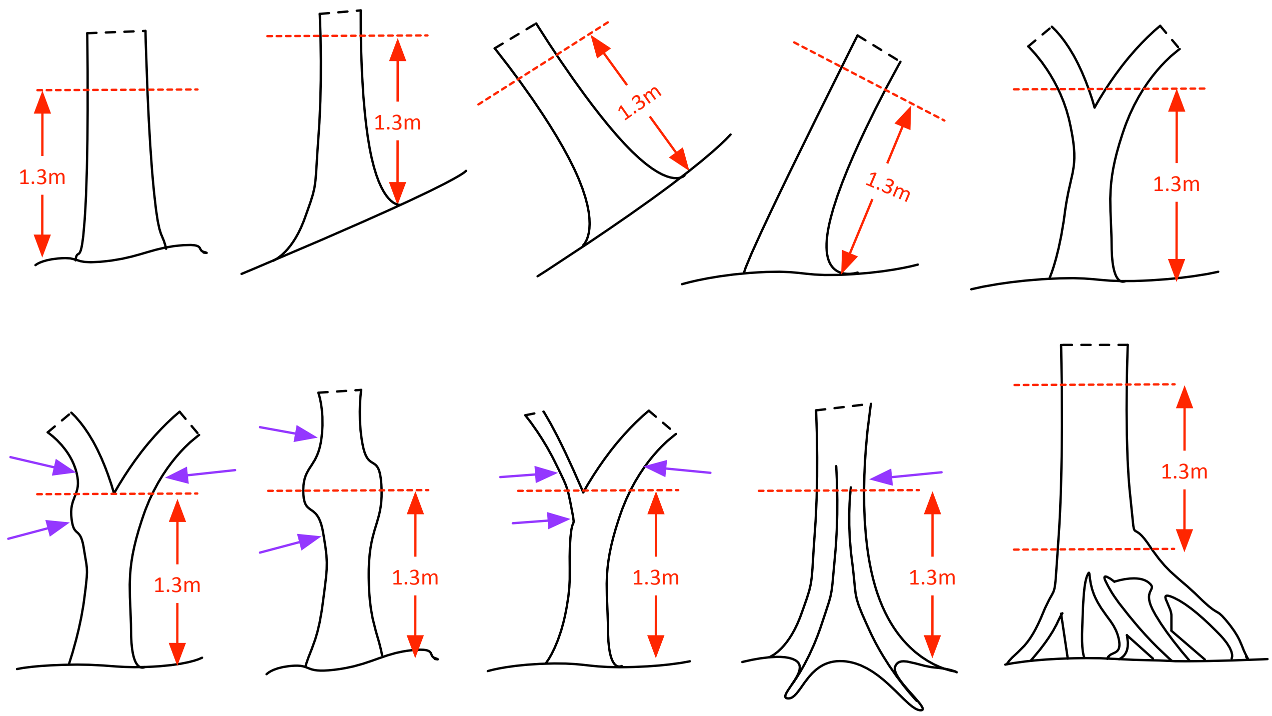
The methodology uses a nested plot design. Small stems (5.0 – 9.9 cm) are measured over four of the 5 × 5 m subplots (100m$^2$), those between 10.0 and 19.9 cm are measured over nine subplots (225 m$^2$), and larger stems (20.0+ cm) are measured over the entire 625 m$^2$ plot area (Fig. 4.1.1.6, Table 4.1.1.6).

*Table 4.1.1.6. Subplots used to measure the diameter of small, medium and larger trees.*

| Stem Diameter | Subplots in which trees are to be tagged and measured |
|---|---|
| 5 – 9.9 cm | 19 – 22 |
| 10.0 – 19.9 cm | 11 – 13 & 18 – 23 |
| 20.0 + cm | 1 – 25 |

- Tag and measure the stem diameter at breast height (1.3 m) of all live trees ≥ 5.0 cm diameter. Note that on sloping plots breast height is measured from the uphill side of the tree.
- If a tree forks below breast height, tag each stem individually and on the field sheet bracket the stems belonging to the same tree.
- If stem division occurs at breast height, tag and measure the stem or stems at the closest practical point either above or below breast height.
- Where stems are malformed at breast height they should be tagged and measured as close to breast height as possible, where the stem form becomes more regular.
- Where tree trunks are fluted or buttressed, measure the stem diameter just above the height at which the stem form becomes more regular.
- Where tree trunks are supported by aerial root structures, measure the stem 1.3 m above the top of the aerial roots.
- Leaning stems should be tagged and measured 1.3 m along the stem. Only tag and measure stems that are rooted within the plot area.

*Figure 4.1.1.6. Where to measure trees*




***How to tag and measure it***

- Use a galvanized flathead nail to attach a numbered aluminium tag to each tree at breast height (1.3 m). The nail should protrude at least 2 cm (to allow for growth), and be positioned so as to allow the tag to sit flush against the trunk. Do not place the tag in a position where it is likely to be overgrown, e.g., between two leaders that are likely to fuse as the tree grows. Remember that on sloping plots breast height is measured from the uphill side of the tree.
- Before measuring the stem diameter, clear moss and other debris in the vicinity of the tag, and loosen any lianes that will interfere with the diameter measurement. Take care not to damage the bark.
- Measure the diameter of the stem 1 cm above the tag. Keep the tape at right angles to the axis of the stem. Any deviation from this position will produce a positive bias in the measurement.
- Record the subplot (1-25), the local and/or botanical name, the diameter class (small, medium, large) and the stem diameter on the stem diameter record sheet (Appendix 4).
  - For stems with a diameter between 5.0 and 9.9 cm at breast height (small stems) this is the 10 × 10 m quadrat area.
  - For stems with a diameter between 10.0 and 19.9 cm at breast height (medium stems) this is the 15 × 15 m quadrat area.
  - For stems with a diameter of 20+ cm at breast height (large stems) this is the 25 × 25 m quadrat area.
- Do not tag or measure dead standing trees.

**Height measurements**

Tree height is not measured on the plots because it is usually difficult or impossible to see the tops of tall trees within a closed forest environment. Instead a height: diameter relationship developed for Fiji indigenous forests (Payton & Weaver 2011) is applied, or if time permits collect data to allow the development of a site-specific height: diameter curve.

## Before leaving the plot

- Check to see that all fields on the data sheets have been completed. It is much easier to do this on-site than have to deal with missing data or information at a later date.
- Ensure that the plot corners are properly marked and that the corner posts are secure.
- Check that all tapes, strings and other plot measuring equipment are accounted for, and that the plot site is left in the same state as it was before the field team arrived.

## 4.1.1.7 Data Analysis

**Background**

Carbon stock estimation requires an understanding of the size of the area under consideration, and the average carbon stock per hectare for that area. The former is normally determined from maps, aerial photos or satellite images. The latter is typically obtained from plot-based measurements, although in some instances models may also be an option.

Carbon stocks are estimated in this TS Module from field measurements as follows:

- Above-ground live – diameter and height measurements are converted to biomass (and therefore carbon[8]) stocks using allometric relationships which may incorporate a species-specific density term. Density estimators derived from biomass harvests (or national or regional defaults) are used to convert the resulting volume to a mass.
- Below ground – estimated as a percentage of the above-ground live pool using values obtained from experimental studies.
- Above Ground Dead biomass – length and diameter measurements are used to obtain a volume, which is converted to mass using a species-specific density factor and a decay-stage modifier (measurement of above ground dead biomass is optional in this Technical Specifications Module).

The above ground live biomass estimate is further restricted to the trees, because this is where the bulk of the above ground live carbon stocks reside.

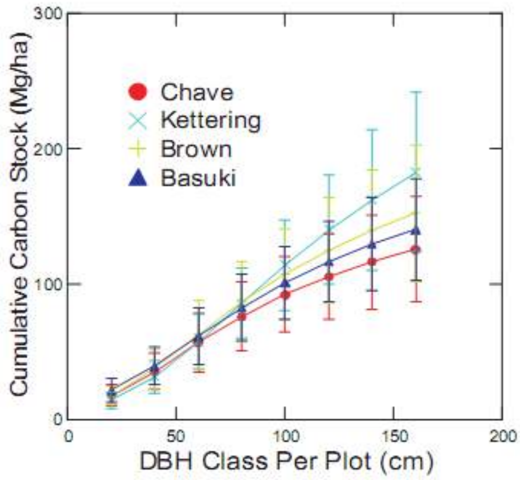
**Allometry**

Allometric equations are used to enable data gathered through field measurements of one parameter (e.g. tree diameter) to be converted to another related parameter (carbon stock) that is not measured in the inventory. There are a wide range of allometric equations to

[8] Woody biomass is c. 50% carbon

choose from, many of which give differing results, especially when predicting the carbon stock of large trees. This Technical Specifications Module conservatively applies Chave et al. (2005) (see Figure 4.1.1.7), and is consistent with methodological guidelines adopted by both the Government of Vanuatu and the Government of Fiji in their national REDD+ Programmes[9].

*Figure 4.1.1.7a Cumulative carbon stock predicted by four allometric equations commonly used for carbon stock estimation in tropical forests[10]. Equations from Chave et al. (2005), Ketterings et al. (2001), Brown et al. (1989), and Basuki et al. (2009).*




AGBE is estimated using the allometric equation recommended by Chave et al. (2005) for moist tropical forests (Equation. 4.1.1.7a).

**Equation 4.1.1.7a:** $AGBE_{si} = \exp(-2.977 + \ln(\rho D^2 H)) = 0.0509 \times \rho D^2 H$

Parameters

| | |
|---|---|
| $AGBE_{si}$ | Above ground live biomass within sample plot for stratum i ($m^3\ yr^{-1}$) |
| D | Stem diameter at breast height within sample plot (cm) |
| H | Top height of sampled tree (m) derived from a diameter-height equation |
| ρ | Density of sampled tree wood ($g/cm^3$) derived from regional defaults. |

### Diameter – Height Ratio

Estimating tree height (H in Equation 4.1.1.7a) is a large source of data error in Above Ground Live Biomass inventory. For this reason, this Technical Specifications Module applies

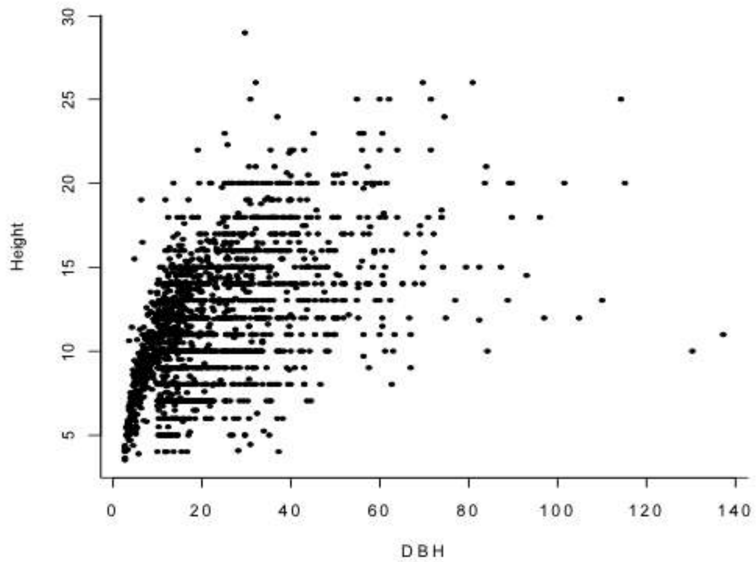
[9] Government of Fiji (2014). Government of Vanuatu (2013).

[10] Diagram sourced from ALLREDDI Brief 02. Available at http://www.worldagroforestrycentre.org/sea/Publications/files/policybrief/PB0019-11.PDF

a conservative height:diameter equation (Equation 4.1.1.7b) instead of estimating tree height in forest inventory (unless reliable local height data is available and/or a more suitable equation can be determined to fit local data).

Tree height (m) and diameter (cm) data from Permanent Sample Plot datasets from Fiji (Figure 4.1.1.7b) were used to derive a generalised height:diameter equation for indigenous forest species for Fiji (Equation 4.1.1.7b)[11]. This is used to estimate the height of all stems. The height:diameter equation, which includes species of widely differing forms, accounts for only 35% of the variability in the dataset. However, where sufficient data were available for individual species (e.g. Kaudamu, *Myristica castaneifolia*) height:diameter relationships accounted for upwards of 75% of the variability in the dataset (Payton & Weaver 2011).

*Figure 4.1.1.7b. Relationship between stem diameter (cm) and height (m) for tree species in Fiji's indigenous forests.*




**Equation 4.1.1.7b:** $$\text{Height}_{\text{(Indigenous forest species)}} = 1.52 \times \text{DBH}^{0.31}$$

Parameters

| | |
|---|---|
| DBH | Stem diameter at breast height within sample plot (cm) |

**Wood Density**

Wood density measured in (g/cm$^3$) is derived from local wood density data where available, or by applying conservative defaults from the latest version of the IPCC Guidelines on National GHG Inventories (e.g. IPCC 2006: Table 4.13, p 4.64).

[11] Payton and Weaver 2011.

**Above Ground Dead Biomass (AGDB)**

The calculation of Above Ground Dead Biomass (AGDB) is optional in this Technical Specifications Module. If measured, the above ground dead biomass is added to above ground live biomass to generate a value for Total AGBE that incorporates both live and dead biomass. When projects elect to not measure AGDB it is conservatively neglected.

## 4.1.2 Step 2 – Below Ground Biomass Emitted (BGBE)

Below Ground Biomass Emitted (BGBE) represents the below ground live biomass (roots) killed by deforestation and is calculated by means of a default factor. The IPCC ratio of below-ground biomass to above ground biomass for tropical rainforest is 0.37[12]. The default factor used in this methodology is 0.37 of AGBE and is calculated using the following equation:

**Equation 4.1.2:** $BGBE = AGBE \times 0.37$

Parameters

| | |
|---|---|
| BGBE | Below ground biomass emitted within EFA ($m^3 yr^{-1}$) |
| AGBE | Above ground biomass emitted within EFA ($m^3 yr^{-1}$) |

## 4.1.3 Step 3 – Total Emitted Wood Volume in Cubic Metres (TM3)

Total Emitted Wood Volume in cubic meters (TM3) represents the volume of above ground and below-ground live wood volume that is emitted as a result of deforestation.

TM3 is calculated using the following equation:

**Equation 4.1.3:** $TM3 = AGBE + BGBE$

Parameters

| | |
|---|---|
| TM3 | Total emitted wood volume in cubic meters within EFA ($m^3 yr^{-1}$) |
| AGBE | Above ground biomass within EFA ($m^3 yr^{-1}$) |
| BGBE | Below ground biomass within EFA ($m^3 yr^{-1}$) |

[12] IPCC 2006. 2006 IPCC Guidelines on National Greenhouse Gas Inventories. Vol. 4 Ch 4. p49.

### 4.1.4 Step 4 – Gross Total Emissions in $tCO_2e$ (GTCO2)

Gross Total Emissions in $tCO_2e$ from deforestation (GTCO2) is calculated by means of converting TM3 (cubic meters) to $tCO_2e$ using the following procedure:[13] The estimation of greenhouse gases that would result from the combustion or decomposition of wood is calculated in the following three steps as specified in this methodology:

1. Convert green wood volume to dry tonnes of wood
2. Convert dry tonnes of wood to carbon
3. Convert carbon to carbon dioxide

#### 4.1.4a Convert Green Wood Volume To Dry Tonnes Of Wood

The conversion of moist wood volume to dry tonnes is calculated as follows:

**Equation 4.1.4a:** DW = TM3 x WDP

Parameters

| | |
|---|---|
| DW | Dry wood biomass within EFA (dry t $yr^{-1}$) |
| WDP | Mean wood density for Project forests (dry t / moist $m^3$) |
| TM3 | Total emitted wood volume in cubic meters within EFA ($m^3$ $yr^{-1}$) |

#### 4.1.4b Calculate Carbon Content Of Dry Wood

The carbon fraction for conversion of dry wood to carbon in this methodology is 0.47[14]. The conversion is calculated as follows:

**Equation 4.1.4b:** TTC = DW x 0.47

Parameters

| | |
|---|---|
| TTC | Total tonnes of carbon within EFA (t $yr^{-1}$) |
| DW | Dry wood biomass within EFA (dry t $yr^{-1}$) |

#### 4.1.4c Convert Carbon To Carbon Dioxide

The mass of carbon dioxide equivalent is calculated by multiplying the mass of carbon by the ratio of the mass of carbon dioxide equivalent to the mass of carbon, which is 44/12 or 3.66:

**Equation 4.1.4c:** GTCO2 = TTC x 3.66

Parameters

| | |
|---|---|
| GTCO2 | Total (gross) $CO_2e$ emissions within EFA ($tCO_2e$ $yr^{-1}$) |
| TTC | Total tonnes of carbon within EFA (t $yr^{-1}$) |

[13] From IPCC (2006) Vol 4. Ch 2. p11 (section 2.2.3)

[14] Carbon fraction for Tropical Rainforest (wood and foliage) IPCC (2006) Vol 4. Ch.4, p48.

#### 4.1.4d Summary: Convert m³ Of Moist Biomass To Total $CO_2$e Emissions

In summary, the default equation for the conversion of tree volume to mass of carbon dioxide equivalent is:

**Equation 4.1.4d:** GTCO2 = ((TM3 x DW) x 0.47) x 3.66

Parameters

| | |
|---|---|
| GTCO2 | Total (gross) $CO_2$e emissions within EFA ($tCO_2e\ yr^{-1}$) |
| TM3 | Total emitted wood volume in cubic meters within EFA ($m^3\ yr^{-1}$) |
| DW | Dry wood biomass within EFA (dry t $yr^{-1}$) |
| 0.47 | Carbon fraction for tropical rainforest (wood & foliage) |
| 44/12 | Mass ratio of $CO_2$e to C |

### 4.1.5 Step 5 – Gross Baseline Emissions (GBEWP)

Gross Baseline Emissions over the 30 year project period assuming a deforestation event at the start of the baseline period, and taking into account carbon sequestered into the long term Wood Products pool (GBEWP) is calculated by subtracting the removals sequestered into the long term Wood Products pool ($ltWP_{R1}$) from GTCO2 and is represented in the following equation:

**Equation 4.1.5:** GBEWP = GTCO2 – ltWP

Parameters

| | |
|---|---|
| GBEWP | Gross Baseline Emissions ($tCO_2e\ yr^{-1}$) over the 30 yr project period |
| GTCO2 | Gross Total $CO_2$e emissions within EFA ($tCO_2e\ yr^{-1}$) |
| ltWP | Sequestration into long term Wood Products pool ($tCO_2e\ yr^{-1}$) |

### 4.1.6 Step 6 – Sequestration into Long Term Wood Products (ltWP)

Removals sequestered into the long-term Wood Products pool (ltWP) is calculated *ex ante* in the baseline case. This accounts for carbon stored in wood products for more than 100 years, and uses the simplifying and conservative assumption that the proportion remaining after 100 years is "permanent". This methodology uses the approach similar to that in the VCS REDD Methodology Modules module for commercial inventory estimation to account for carbon stock in harvested wood products[15], using the following steps:

Step A: Calculate the biomass carbon of the commercial species volume extracted as a result of deforestation as follows:

i. Calculate the Commercial Species Volume (CSV) extracted in a deforestation baseline.

[15] VCS VMD0005 version 1.0. REDD Methodology Module: estimation of carbon stocks in the long-term wood products pool (CP-W), Sectoral Scope 14.

ii. Dividing CSV by the area of each stratum to convert to Above Ground Biomass per hectare for commercial species ($AGBE_{CSha}$) ($m^3ha^{-1}$).

This calculates the volume of Above Ground Biomass Emitted for commercial species ($AGBE_{CSha}$) per hectare for the eligible forest area. This biomass volume ($AGBE_{CSha}$) is then used for determining $C_{XB,ty,i}$ in Step D (Equation 4.1.6) below.

#### 4.1.6.1 Commercial Timber Species Volume (CSV)

The Commercial Species Volume (CSV) is measured in $m^3$ and is calculated by assessing the volume of Above Ground Live Biomass that is comprised of commercial timber species in the baseline. This is measured in order to calculate baseline carbon stocks recruited into the Long Term Wood Products pool (ltWP). The whole above ground tree (including crown and branches) is included in this calculation.

Step B: Identify the wood product class(es) *(ty)*; defined here as sawnwood (s), wood-based panels (w), other industrial roundwood (oir), paper and paper board (p), and other (o)) that are the anticipated end use of the extracted carbon calculated in Step A. For each wood product type, assign a fraction representing the different proportions of biomass volume attributed to each wood product type ($\%WP_{ty}$) (dimensionless).

Step C: For each wood product type, multiply $AGBE_{CSha}$ by the relevant fraction ($\%WP_{ty}$) to calculate the proportional wood product type biomass volume ($AGBE_{\%WPty}$) ($m^3ha^{-1}$).

Step D: Convert each proportional wood product type biomass volume ($AGBE_{\%WPty}$) to $tCO_2$ using Equations 4.1.4 (a-d) to derive $C_{XB,ty,I}$ ($tCO_2e\ ha^{-1}$).

Step E: For each wood product type apply each subsequent step of Equation 4.1.6 using defaults provided in VCS VMD0005 (Data and Parameters not monitored). This calculates the sum of $CO_2$ stored in the long-term wood product pool ($C_{WP,i}$). NB: $C_{WP,I}$ = ltWP but uses nomenclature consistent with VCS VMD0005 for clarity.

**Equation 4.1.6:**

$$C_{WP,i} = \sum_{ty=s,w,oir,p,o} C_{XB,ty,i} * (1 - WW_{ty}) * (1 - SLF_{ty}) * (1 - OF_{ty})$$

Parameters

| | |
|---|---|
| $C_{WP,i}$ | Carbon stock in long-term wood products pool (stock remaining in wood products after 100 yrs) from stratum *i* post deforestation (= ltWP); ($tCO_2e\ ha^{-1}$) |
| $C_{XB,ty,i}$ | Mean stock of extracted biomass carbon by class of wood product *ty* from stratum *i*; ($tCO_2e\ ha^{-1}$) |
| $WW_{ty}$ | Wood waste. The fraction immediately emitted through mill inefficiency by class of wood product *ty*; dimensionless |
| $SLF_{ty}$ | Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood product *ty*; dimensionless |
| $OF_{ty}$ | Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product *ty*; dimensionless |
| *ty* | Wood product class – defined here as sawnwood (s), wood-based panels (w), other industrial roundwood (oir), paper and paper board (p), and other (o) |
| *i* | *1,2,3,…M*strata |

## 4.1.7 Step 7 – Gross Baseline Emissions Avoided (GBEA)

Gross Baseline Emissions Avoided (GBEA) is the annual baseline emissions avoided, and is calculated by dividing Gross Baseline Emissions (GBEAWP) by 30 and is depicted in the following equation:

**Equation 4.1.7:** GBEA = GBEAWP / 30

Parameters

| | |
|---|---|
| GBEWP | Gross Baseline Emissions ($tCO_2e\ yr^{-1}$) |
| 30 | Project period (yrs) |

## 4.1.8 Step 8 – Baseline Removals (BR)

Baseline Removals (BR) is the annual carbon sequestration under the baseline scenario. This is equal to the annualised estimated mean carbon stock projected under the baseline scenario (e.g. coconut plantation mixed with fallow ground), and is represented by the following equation:

**Equation 4.1.8:** BR = MBCS / 30

Parameters

| | |
|---|---|
| BR | Baseline Removals ($tCO_2e\ yr^{-1}$) |
| MBCS | Mean Baseline Carbon Stocks for the project period ($tCO_2e\ yr^{-1}$) |
| 30 | Project period (yrs) |

### 4.1.9 Step 9 – Net Baseline Emissions Avoided (NBEA)

Net Baseline Emissions Avoided (NBEA) is equal to the carbon stock change as a result of Baseline emissions from deforestation (Gross Baseline Emissions Avoided – GBEA) *minus* Baseline Removals (BR) and represented by the following equation:

**Equation 4.1.9:** $NBEA = GBEA - BR$

Parameters

| | |
|---|---|
| NBEA | Net Baseline Emissions Avoided ($tCO_2e\ yr^{-1}$) |
| GBEA | Gross Baseline Emissions Avoided ($tCO_2e\ yr^{-1}$) |
| BR | Baseline Removals ($tCO_2e\ yr^{-1}$) |

### 4.1.10 Baseline Scenario Variants

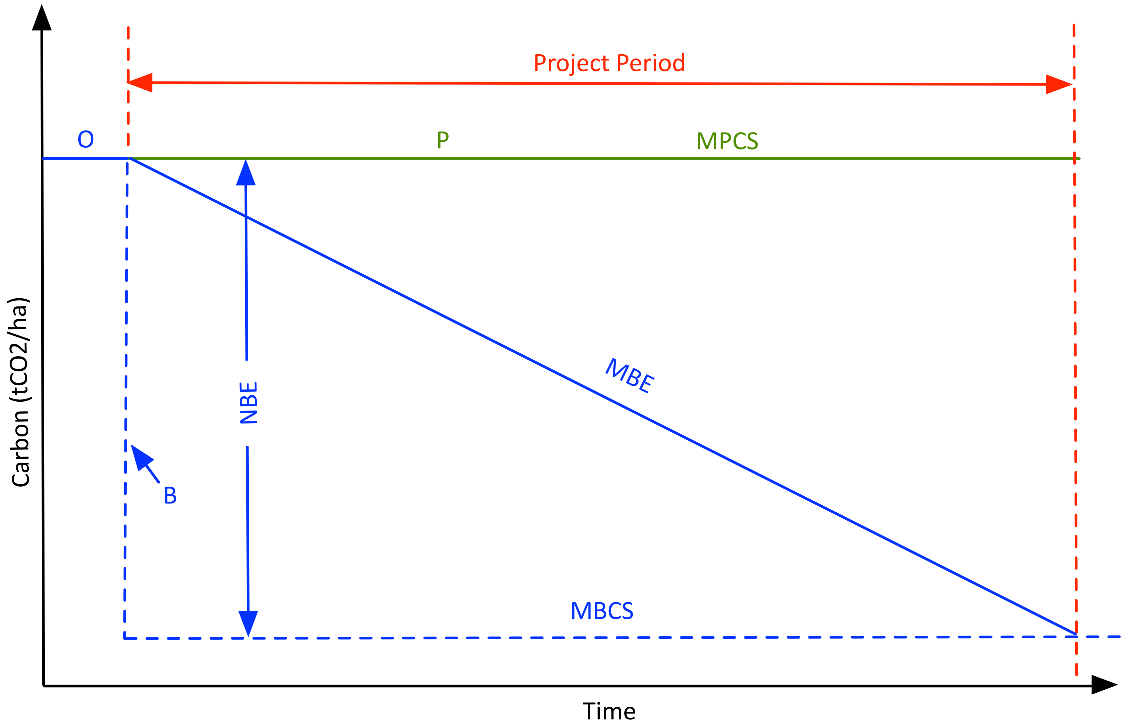
This methodology models deforestation by calculating the total carbon stocks stored in the above and below ground live biomass carbon pools to be removed by deforestation. It then annualises emissions from deforestation over the 30-year Project Period by dividing the total carbon emissions from deforestation by 30. This has the effect of conservatively modelling deforestation emissions over a 30-year period when in practice baseline deforestation would likely take place in a series of activities.

For smaller project areas (e.g. less than 500ha) for example, baseline deforestation is likely to take place in the space of the first few years of the project period, but is modelled as if it were incremental and evenly spread over the entire 30-year project period.

There are two baseline scenario variants depending on the original condition of the forest (see Figures 4.1.10a,b,c below). Variant 1 (Unlogged Forest) covers a baseline scenario where the original condition of the forest is an “old growth” forest where mean carbon stocks are relatively constant through time. Variant 2 (Logged Forest) covers a baseline scenario where the original condition of the forest is a regenerating forest recovering from previous logging or other anthropogenic disturbance. Variant 3 (Logged Forest) covers a baseline where the original condition of the forest is forest degradation with a steadily declining annual carbon balance.

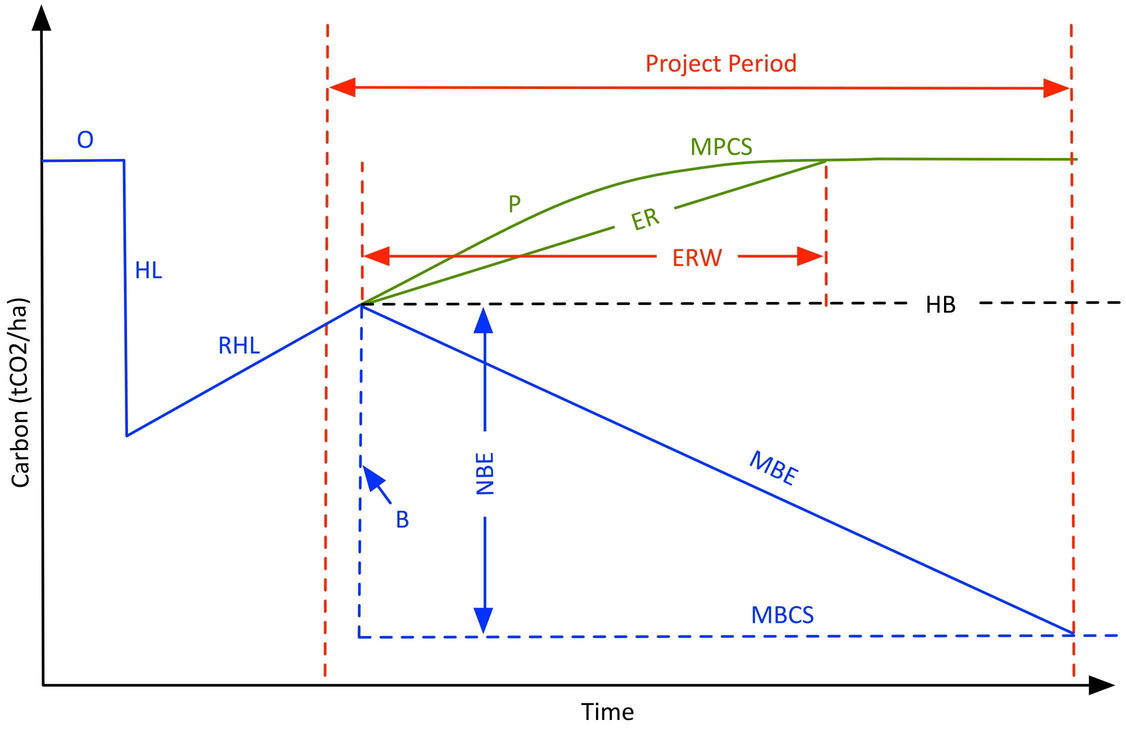
The selection of one or other of these baseline scenario variants will influence whether or not the project will apply a calculation of Enhanced Removals arising from carbon sequestration in the Project Scenario. This will apply only where a project selects Variants 2 and 3 (i.e. where the original condition of the forest at the start of the project period is a regenerating forest or a degrading forest).

*Figure 4.1.10a. Variant 1 - Concept diagram: AD-DtPF$_{ULF}$ in unlogged (old growth) forest.*



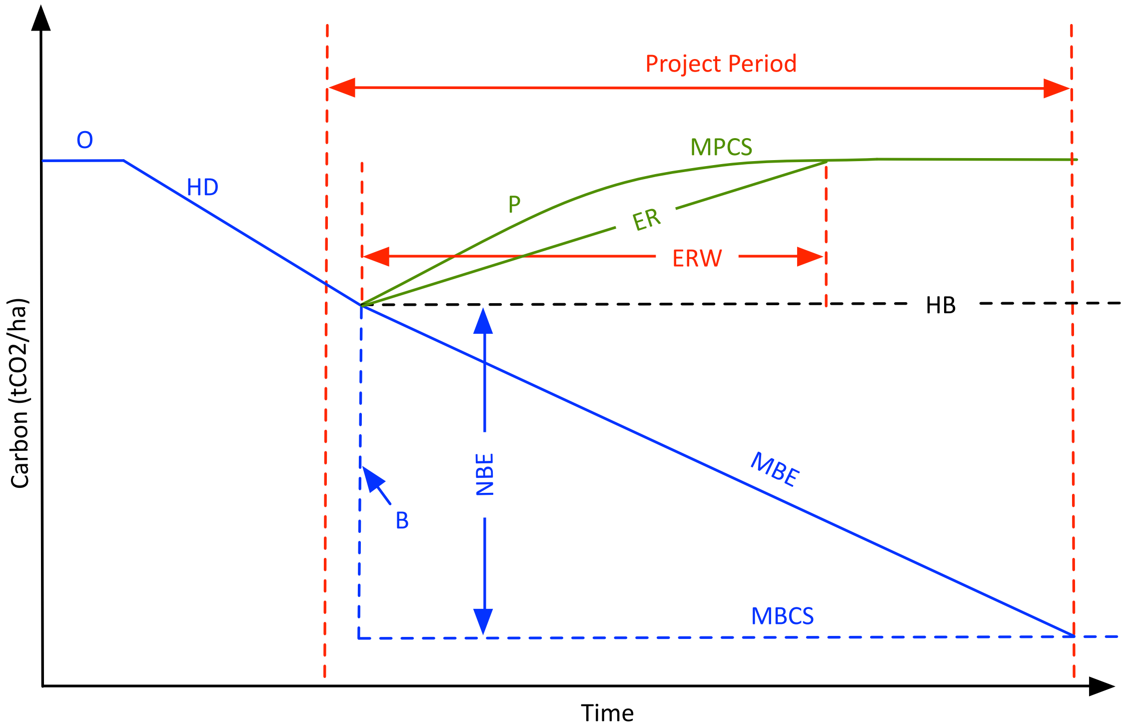

| | | |
|---|---|---|
| Key: | O = | Original mean carbon stocks in old growth undisturbed forest ($tCO_2e$) |
| | B = | Change in carbon stocks under Baseline Scenario ($tCO_2e$) |
| | P = | Project Scenario carbon stocks under forest protection regime ($tCO_2e$) |
| | MPCS = | Mean Project carbon stocks ($tCO_2e$) |
| | MBCS = | Mean Baseline carbon stocks ($tCO_2e$) |
| | NBE = | Net Baseline Emissions (Total) ($tCO_2e$) |
| | MBE = | Modelled Baseline Emissions (annualised) ($tCO_2e$) |

*Figure 4.1.10b. Variant 2 - Concept diagram: AD-DtPF$_{LF}$ in logged (regenerating) forest.*




| | | |
|---|---|---|
| Key: | O = | Original mean carbon stocks in old growth undisturbed forest ($tCO_2e$) |
| | B = | Change in carbon stocks under Baseline Scenario ($tCO_2e$) |
| | HL = | Change in carbon stocks resulting from historical logging ($tCO_2e$) |
| | RHL = | Regeneration following historical logging ($tCO_2e$) |
| | P = | Project Scenario carbon stocks under forest protection regime ($tCO_2e$) |
| | HB = | Harvest baseline (mean carbon stocks at start of baseline timber harvesting) ($tCO_2e$) |
| | MPCS = | Mean Project carbon stocks ($tCO_2e$) |
| | MBCS = | Mean Baseline carbon stocks ($tCO_2e$) |
| | NBE = | Net Baseline Emissions (Total) ($tCO_2e$) |
| | MBE = | Modelled Baseline Emissions (annualised) ($tCO_2e$) |
| | ER = | Enhanced Removals (Project Scenario) ($tCO_2e$) |
| | ERW = | Enhanced Removals Window (Project Scenario) (60 years) |

*Figure 4.1.10c. Variant 3 - Concept diagram: AD-DtPF$_{LF}$ in logged (degrading) forest.*




| | | |
|---|---|---|
| Key: | O = | Original mean carbon stocks in old growth undisturbed forest ($tCO_2e$) |
| | B = | Change in carbon stocks under Baseline Scenario ($tCO_2e$) |
| | HL = | Change in carbon stocks resulting from historical logging ($tCO_2e$) |
| | RHL = | Regeneration following historical logging ($tCO_2e$) |
| | P = | Project Scenario carbon stocks under forest protection regime ($tCO_2e$) |
| | HB = | Harvest baseline (mean carbon stocks at start of baseline timber harvesting) ($tCO_2e$) |
| | MPCS = | Mean Project carbon stocks ($tCO_2e$) |
| | MBCS = | Mean Baseline carbon stocks ($tCO_2e$) |
| | NBE = | Net Baseline Emissions (Total) ($tCO_2e$) |
| | MBE = | Modelled Baseline Emissions (annualised) ($tCO_2e$) |
| | ER = | Enhanced Removals (Project Scenario) ($tCO_2e$) |
| | ERW = | Enhanced Removals Window (Project Scenario) (60 years) |

# 5. Quantifying Project Emission Reductions & Removal Enhancements

According to Section 5 of the Plan Vivo Standard (2013):

5.2. *Sources of data used to quantify ecosystem services, including all assumptions and default factors, must be specified and as up-to-date as possible, with a justification for why they are appropriate.*

According to Section 5.8 of the ISO 14064-2 Standard:

*The project proponent shall select or establish criteria, procedures and/or methodologies for quantifying GHG emission reductions and removal enhancements during project implementation.*

*The project proponent shall apply the criteria and methodologies selected or established to quantify GHG emission reductions and removal enhancements for the GHG project. GHG emission reductions or removal enhancements shall be quantified as the difference between the GHG emissions and/or removals from GHG sources, sinks and reservoirs relevant for the project and those relevant for the baseline scenario.*

*The project proponent shall quantify, as appropriate, GHG emission reductions and removal enhancements separately for each relevant GHG and its corresponding GHG sources, sinks and/or reservoirs for the project and the baseline scenario*

*The project proponent shall use tonnes as the unit of measure and shall convert the quantity of each type of GHG to tonnes of $CO_2e$ using appropriate GWPs.*

## 5.1 PROJECT GHG EMISSIONS AND REMOVALS

Project activity emissions are excluded from this methodology and as such Project GHG emissions focuses on Enhanced Removals (ER) where relevant. Enhanced Removals are calculated for annual forest growth in Logged Forest land parcels for the Project Period. The rate of Enhanced Removals is set at the mean sequestration rate for the forest type.

The next step is to determine the period for which projects can claim ER for Logged Forest land parcels. This will depend on the timing of historical logging for each Logged Forest land parcel and the sequestration curve for that forest type.

Figure 4.1.10b depicts a grey triangle representing (not to scale) enhanced removals in the project scenario. Enhanced Removals represent carbon benefits that can be credited in addition to Baseline Emissions Avoided, but only for Logged Forest areas that are actively regenerating and naturally increasing in carbon stocks annually in the original condition (i.e. in the baseline but prior to any projected baseline logging activity). If the baseline logging activity is undertaken then this would prevent natural regeneration from occurring and carbon stocks would not naturally increase. Displacing the baseline scenario by imposing the project scenario would enable natural regeneration to continue uninterrupted and this would represent the enhanced removal made possible by the project.

Enhanced Removals are creditable for a limited time period called the Enhanced Removals Window (ERW). This is depicted in Figure 4.1.10b but in a miniature form to fit it into the graph. In practice the ERW is likely to be close to 100 years given that it takes at least this long for a forest to regenerate to a fully old-growth mature forest system.

### 5.1.1 Step 10 – Enhanced Removals (ER)

Enhanced Removals (ER) is calculated by multiplying the total area (ha) of Logged Forest in the Eligible Forest Area (EFA) by the mean sequestration rate ($tCO_2e\ ha^{-1}\ yr^{-1}$) for the Removals Period for the particular forest type.

The mean sequestration rate (MSR) for the project forest type/s is determined from IPCC or FAO regional defaults or more localised (including on-site inventory) data where available.

Enhanced Removals ($ER_{TOT}$) is calculated by the following equation:

**Equation 5.1.1a:** $ER_{TOT} = \sum ER_{FT1} + \sum ER_{FT2,} + \sum ER_{FT3}$

Parameters

| | |
|---|---|
| $ER_{TOT}$ | Enhanced Removals Total within EFA ($tCO_2e\ yr^{-1}$) |
| $\sum ER_{FT1}$ | Sum of Enhanced Removals for Forest Type 1 areas within EFA = $EFA_{LF} \times MSR_{FT1}$ ($tCO_2e\ yr^{-1}$) |
| $\sum ER_{FT2}$ | Sum of Enhanced Removals for Forest Type 2 areas within EFA = $EFA_{LF} \times MSR_{FT2}$ ($tCO_2e\ yr^{-1}$) |
| $\sum ER_{FT3}$ | Sum of Enhanced Removals for Forest Type 3 areas within EFA = $EFA_{LF} \times MSR_{FT3}$ ($tCO_2e\ yr^{-1}$) |
| $MSR_{FT1}$ | Mean sequestration rate for Forest Type 1 ($tCO_2e\ yr^{-1}$) |
| $MSR_{FT2}$ | Mean sequestration rate for Forest Type 2 ($tCO_2e\ yr^{-1}$) |
| $MSR_{FT3}$ | Mean sequestration rate for Forest Type 3 ($tCO_2e\ yr^{-1}$) |

The Mean Sequestration Rate can either be generated from local growth rate data where available, or be derived from the IPCC default value for the relevant biome. For example the IPCC default value for carbon sequestration tropical rainforest for the region Asia (other) is set at $11.78tCO_{2e}ha^{-1}yr^{-1}$ - assuming a 0.47 carbon fraction (IPCC 2006, Ch 4, p 4.59 – Table 4.10).

### 5.1.2 Step 11 – Enhanced Removals Window (ERW)

Enhanced Removals applies only to eligible forest in Logged Forest land parcels. For this methodology the Enhanced Removals Window is conservatively deemed to be 60 years and applies to the first two (30-year) Project Periods (i.e. 60 years from the Project Start Date), unless the Project Coordinator can demonstrate that the historical logging occurred at a sufficiently high intensity and at a sufficiently recent date to justify extending the ERW into the third Project Period. The rate of carbon absorption is greatest in forests during the earliest stages of regeneration and declines as a forest matures. In situations of over-maturity, the absorption - natural emission relationship is reversed. The forests of the Island Pacific are subjected to frequent cyclone damage and for this reason it is questionable as to whether situations of over-maturity are able to be demonstrated, whereby, cyclone damage keeps forests in a state of disturbance and recovery when in an 'old-growth condition'. For this reason, this methodology simplifies its treatment of this dynamic by conservatively reducing the enhanced removals window to 60 years.

## 5.2 PROJECT LEAKAGE

According to Section 5 of the Plan Vivo Standard (2013, p18):

*5.19. All potential sources of leakage and the location of areas where leakage could occur must be identified and any appropriate mitigation measures described.*

*5.20. Where leakage is likely to be significant, i.e. likely to reduce climate services by more than 5%, an approved approach must be used to monitor leakage and subtract actual leakage from climate services claimed, or as a minimum, make a conservative estimation of likely leakage and deduct this from the climate services claimed.*

According to the VCS AFOLU Requirements, VCS Version 3, 2011:

*Methodologies shall establish procedures to quantify all significant sources of leakage. Leakage is defined as any increase in GHG emissions that occurs outside the project boundary (but within the same country), and is measurable and attributable to the project activities. All leakage shall be accounted for, in accordance with this Section 4.6. The three types of leakage are:*

1. *Market leakage occurs when projects significantly reduce the production of a commodity causing a change in the supply and market demand equilibrium that results in a shift of production elsewhere to make up for the lost supply.*
2. *Activity shifting leakage occurs when the actual agent of deforestation and/or degradation moves to an area outside of the project boundary and continues their deforesting activities elsewhere.*
3. *Ecological leakage occurs in PRC projects where a project activity causes changes in*

*GHG emissions or fluxes of GHG emissions from ecosystems that are hydrologically connected to the project area.*

This Technical Specifications Module requires Project Coordinators to address activity shifting leakage and market leakage (where the latter is significant). This enables the derivation of Total Leakage (TLK).

### 5.2.1 Step 12 – Total Activity Shifting Leakage (TAL)

According to the GreenCollar IFM LtPF v1.0 VCS approved Methodology VM0010 (2011):

*There may be no leakage due to activity shifting.*

*Where the project proponent controls multiple parcels of land within the country the project proponent must demonstrate that the management plans and/or land-use designations of other lands they control have not materially changed as a result of the planned project (designating new lands as timber concessions or increasing harvest rates in lands already managed for timber) because such changes could lead to reductions in carbon stocks or increases in GHG emissions.*

*This must be demonstrated through:*

- *Historical records showing trends in harvest volumes paired with records from the with-project time period showing no deviation from historical trends;*
- *Forest management plans prepared ≥24 months prior to the start of the project showing harvest plans on all owned/managed lands paired with records from the with-project time period showing no deviation from management plans.*

*At each verification, documentation must be provided covering the other lands controlled by the project proponent where leakage could occur, including, at a minimum, their location(s), area and type of existing land use(s), and management plans.*

*Where activity shifting occurs or a project proponent is unable to provide the necessary documentation at first and subsequent verification, the project shall not meet the requirements for verification. Therefore, the project shall be subject to the conditions described in the VCS AFOLU Guidance Document on projects, which fail to submit periodic verification after the commencement of the project. Project proponents may optionally choose to submit a methodology deviation with their future verifications to address activity shifting leakage.*

*Where the project proponent has control only over resource use in the project area and has no access to other forest resource, then the only type of leakage emissions calculated is GHG emissions due to market effects that result from project activity.*

Total Activity Shifting Leakage (TAL) is calculated following the GreenCollar IFM LtPF v1.0 VCS approved methodology VM0010 (2011) for leakage due to activity shifting.

### 5.2.2 Step 13 - Total Leakage (TLK)

Total Leakage (TLK) is the combination of Total Activity Shifting Leakage (TAL) and Total Market Leakage (TML) but market leakage is not measured in this Technical Specifications Module because the driver for deforestation is small-scale, village based agricultural production. Total Leakage (TLK) ($tCO_2e\ yr^{-1}$) is therefore equal to Total Activity Shifting Leakage.

## 5.3 NET GREENHOUSE GAS EMISSION REDUCTIONS

Greenhouse gas emission calculations undertaken through Steps 1 to 13 above allows an *ex-ante* estimation of the net GHG Emission Reductions brought about by replacing the Baseline Scenario with the Project Scenario. This involves the calculation of Net Baseline Emissions Avoided (NBEA), Net Project Emissions (i.e. Enhanced Removals) and accounting for leakage.

This provides a basis to calculate Net Project Removals (NPR) in the baseline timeline.

### 5.3.1 Step 14 – Net Project Removals

Net Project Removals (NPR) is calculated by subtracting Total Leakage from Enhanced Removals (ER) for the baseline timeline.

Net Project Removals (NPR) is calculated as:

**Equation 5.3.1:** $NPR = ER - TLK$

Parameters

| | |
|---|---|
| NPR | Net project removals within EFA ($tCO_2e\ yr^{-1}$) expressed as a +ve number |
| ER | Enhanced Removals within EFA ($tCO_2e\ yr^{-1}$) initially expressed as a -ve number to denote enhanced removals |
| TLK | Total leakage ($tCO_2e\ yr^{-1}$) expressed as a +ve number |

## 5.4 NON-PERMANENCE RISK AND BUFFER DETERMINATION

*According to Section 6 of the Plan Vivo Standard (2013, p19):*

*6.1. Risks to the delivery of ecosystem services and sustainability of project interventions must be identified and appropriate mitigation measures described.*

*6.2. Projects must review their risk assessment at least every 5 years and resubmit to the Plan Vivo Foundation.*

For buffer determination projects are required to apply a 20% buffer.

### 5.4.1 Step 15 – Buffer Credits

According to Section 6 of the Plan Vivo Standard (2013, p19):

*6.3. A proportion of expected climate services must be held in a risk buffer to protect the project from unexpected reductions in carbon stocks or increases in emissions, unless there is no risk of reversal associated with the project intervention.*

*6.4. The level of risk buffer must be determined using an approved approach and be a minimum of 10% of climate services expected.*

#### 5.4.1.1 Project Buffer Rating

The Project Buffer Rating (PBR) is used to calculate the Buffer for the baseline timeline. The Project Buffer Rating (PBR) is equal to 0.2 in this Technical Specifications Module.

#### 5.4.1.2 Buffer Credits For Net Baseline Emissions Avoided

Buffer Credits associated with Net Baseline Emissions Avoided (NBEA) for the baseline timeline for the Project Scenario are calculated using the following equation:

**Equation 5.4.1a:** $$BUFNBEA = NBEA \times PBR$$

Parameters

| | |
|---|---|
| BUFNBEA | Buffer Credits associated with Net Baseline Emissions Avoided ($tCO_2e\ yr^{-1}$) f |
| NBEA | Net Baseline Emissions Avoided ($tCO_2e\ yr^{-1}$) |
| PBR | Project Buffer Rating (dimensionless) |

#### 5.4.1.3 Buffer Credits For Net Project Removals

Buffer Credits associated with Net Project Removals (NPR) for the baseline timeline for the Project Scenario are calculated using the following equation:

**Equation 5.4.1b:** $BUF_{NPB} = NPR \times PBR$

Parameters

| | |
|---|---|
| $BUF_{NPB}$ | Buffer Credits associated with Net Project Benefits ($tCO_2e\ yr^{-1}$) |
| NPR | Net Project Removals within EFA ($tCO_2e\ yr^{-1}$) = expressed as a +ve number |
| PBR | Project Buffer Rating (dimensionless) |

#### 5.4.1.4 Buffer Account Attributes

The most recent VCS AFOLU Pooled Buffer Account guidelines, contained in the *VCS Registration and Issuance Process* document, provide the framework for the operation of the pooled buffer account under this Technical Specifications Module. Buffer Account Attributes are also subject to the Plan Vivo review of Buffer Account Attributes for the standard (on-going at the time of TS Module development and auditing).

The key features of the buffer account for this methodology include:

| Table 5.5.2: Buffer Account Attributes | |
|---|---|
| **Assignment** | When credits are issued to a project, a portion of the net change in the project's carbon stocks are deposited as buffer credits into the AFOLU pooled buffer account. |
| | The volume of buffer credits is calculated based on a multiple of a project's non-permanence risk rating and the net change in the project's carbon stocks for the relevant period, with a minimum of 20% net carbon benefits assigned to the buffer. |
| **Administration** | The Programme Operator administers the pooled buffer account. |
| **Title** | Title to the buffer credits remains with the Programme Operator and does not pass to the Project Owner, unless the Programme Operator elects to do so. |
| **Change to Risk Rating** | Where a project's risk rating reduces at a subsequent verification, the volume of buffer credits to be held against that project is adjusted based on the new risk rating and total carbon stock changes for the project. Excess buffer credits must be released and issued as saleable credits. |
| | Where a project's risk rating increases at a subsequent verification, no release of buffer credits may occur. |
| **Netting Off** | The deposit and release of buffer credits will be netted off to provide a single transaction. |
| **Cancellation** | Where a verification report indicates a negative net change in GHG emissions, no credits may be issued to the project until a further verification report indicates the deficit is remedied. Where credits were previously issued to the project, buffer credits equivalent to the negative net change in GHG emissions must be cancelled from the buffer account. |
| | Buffer credits are cancelled for negative net changes in GHG emissions in |

| | |
|---|---|
| | unavoidable reversals only. This is consistent with the Climate Action Reserve forest carbon protocols. |
| | Where the reversal is avoidable, buffer credits are left untouched and the Project Owner is responsible for retiring carbon credits of a standard equivalent to saleable credits issued to the project and volume equivalent to the reversal. |
| **Suspension** | Where a project fails to submit a verification report within seven years of the last report, 50% of the buffer credits associated with the project will be put on hold. After a further three years, all remaining buffer credits will be put on hold. Where no subsequent verification report is presented, buffer credits equivalent to the total number of live credits issued to the project will be cancelled (including buffer credits put on hold). |
| | Where buffer credits are put on hold for failure to submit a verification report, the project may reclaim the buffer credits on submitting a new verification report. |
| **Final Cancellation** | The remaining balance of buffer credits associated with a project will be managed by the Programme Operator for the benefit of the Programme. |

## 5.5 NET CARBON CREDITS

Net carbon credits issued to the project are calculated as the sum of Net Baseline Emissions Avoided (NBEA) (the avoided emissions component) and Net Project Benefits (NPB) (the enhanced removals component) for each land parcel and stratum, minus the buffer for each.

The timing of credit issuance is dependent on the crediting plan for the particular project. Each project must have a crediting plan that is aligned to a benefit-sharing plan, has been approved by the Project Owner, and is subject to the Project Participation Protocol (see Sections 3.4 of the Nakau Methodology Framework).

### 5.5.1 Step 16 – Net Carbon Credits (NCC)

Net Carbon Credits (NCC) are calculated in three steps:

**Step A:** Subtracting the Buffer Credits associated with Net Baseline Emissions Avoided (BUFNBEA) from Net Baseline Emissions Avoided (NBEA).

**Step B:** Subtracting the Buffer Credits associated with Net Project Removals for (BUFNPR) from Net Project Removals (NPR).

**Step C:** Sum the result of Step A and Step B.

Net Carbon Credits is calculated using the following equation:

**Equation 5.5.1:** $$NCC = (NBEA - BUFNBEA) + (NPR - BUFNPR)$$

Parameters

| | |
|---|---|
| NCC | Net Carbon Credits ($tCO_2e\ yr^{-1}$) |
| NBEA | Net Baseline Emissions Avoided ($tCO_2e\ yr^{-1}$) |
| BUFNBEA | Buffer Credits associated with Net Baseline Emissions Avoided ($tCO_2e\ yr^{-1}$) |
| NPR | Net Project Removals ($tCO_2e\ yr^{-1}$) |
| BUFNPR | Buffer Credits associated with Net Project Removals ($tCO_2e\ yr^{-1}$) |

## 5.6 MANAGING LOSS EVENTS

According to Section 5 of the Plan Vivo Standard (2013, p18):

*5.16. Any alteration of project intervention areas during the project, or before the project starts but attributable to the project, that results in a loss of ecosystem services, e.g. clearing of vegetation or other site preparation prior to afforestation, must be accounted for in the technical specification.*

This Technical Specifications Module uses the most recent version of the VCS 'AFOLU Guidance: Example for GHG Credit Accounting Following a Loss Event' for addressing loss events during the Project Period.

# 6. Quantifying Project Habitat Hectare Enhancements

According to Section 5 of the Plan Vivo Standard (2013):

*5.2. Sources of data used to quantify ecosystem services, including all assumptions and default factors, must be specified and as up-to-date as possible, with a justification for why they are appropriate.*

Projects applying this TS Module can elect to produce a second PES unit type (Habitat Hectare units) from the same rainforest protection and QA/QC activity. Habitat Hectare units represent one hectare of rainforest protected for one year within the eligible forest area. As with carbon offsets Habitat Hectare units are also subject to a 20% buffer.

The purpose of Habitat Hectare units is to enable the project to market itself to buyers not interested in carbon offsetting but interested more directly in rainforest protection through a Payment for Ecosystem Service (PES) arrangement.

This TS Module requires that Habitat Hectare units be issued by a registry or standard. Such issuance can be for Habitat Hectare units *per se*, or through the issuance/retirement of the equivalent volume of Carbon Credits per Habitat Hectare sold (i.e. a registry proxy). In this way, Habitat Hectare units are mutually exclusive to Carbon Credits from an ecosystem accounting perspective. For example, if a project marketing effort results in the sale of one habitat hectare unit, the equivalent volume of Carbon Credits issued to the same project will be retired at the point of sale (i.e. no secondary market is permitted for Habitat Hectare units).

If a buyer seeks to use Habitat Hectare units as biodiversity offsets, it is the responsibility of the buyer to transparently determine and account for no-net-loss in relation to the biodiversity loss to be offset through such Habitat Hectare unit purchases.

## 6.1 BASELINE HABITAT HECTARES

Projects are required to quantify baseline hectares of protected rainforest within the eligible forest area including any qualitative condition of rainforest in the case of a forest-remaining-as-forest activity type. Rainforest protection can include:

1. Prevention of rainforest deforestation
2. Prevention of rainforest degradation
3. Rainforest habitat enhancements

The baseline activity for Habitat Hectare production is the same as that identified for Carbon Credit production as specified in Section 3 of this document. The description of the baseline for Habitat Hectare production shall specify the habitat impacts of baseline activity.

Quantification of the baseline hectares of rainforest protection can include a statement of the deforestation and/or degradation expected as a result of baseline activities, but must include the number of hectares so affected.

## 6.2 PROJECT HABITAT HECTARES

Projects are required to quantify project hectares of protected rainforest within the eligible forest area including any qualitative condition of rainforest in the case of a forest-remaining-as-forest activity type.

## 6.3 LEAKAGE

Projects are required to quantify leakage of project hectares using the leakage assessment provided in Section 5 of this document.

## 6.4 QUANTIFICATION OF HABITAT HECTARE UNITS

Projects are required to quantify the net Habitat Hectare units to be issued to the project, noting that Habitat Hectare units are mutually exclusive to Carbon Credits issued by the same project.

### 6.4.1 Gross Habitat Hectares

Gross Habitat Hectares (GHH) is the total number of hectares within the eligible forest area.

### 6.4.2 Habitat Hectare Buffer

The Habitat Hectare Buffer (BUFHH) is calculated by applying a 20% buffer to the Gross Habitat Hectare number.

### 6.4.3 Net Habitat Hectares

Net Habitat Hectares (NHH) is calculated by subtracting the 20% buffer from GHH.

NHH is calculated using the following equation:

**Equation 6.4.3:** NHH = GHH x 0.2

Parameters

| | |
|---|---|
| NHH | Net Habitat Hectares (ha) |
| GHH | Gross Habitat Hectares (ha) |
| 0.2 | Buffer factor (20%) |

### 6.4.4 Net Carbon Credit Equivalent

Net Carbon Credit Equivalent (NCCE) is calculated by multiplying NHH by the Net Carbon Credits Per Habitat Hectare (NCC/HH). This calculation must produce the same result (in $tCO_2e\ yr^{-1}$) as Net Carbon Credits in the carbon accounting section of this document.

This calculation is conducted by the following equation:

**Equation 6.4.4:** NCCE = NHH x NCC/HH

Parameters

| | |
|---|---|
| NCCE | Net Carbon Credit Equivalent ($tCO_2e\ yr^{-1}$) |
| NCC/HH | Net Carbon Credit Equivalent per Habitat Hectare ($tCO_2e\ yr^{-1}$) |
| NHH | Net Habitat Hectares (ha) |

### 6.4.5 Net Carbon Credits Per Habitat Hectare

Net Carbon Credits Per Habitat Hectare (NCC/HH) is calculated by dividing the sum of Net Baseline Emissions minus Buffer (NBEA-BUF) and Net Project Removals minus Buffer (NPR-BUF) by the Net Habitat Hectares (Eligible Forest Area minus Buffer). This is calculated by the following equation:

**Equation 6.4.5:** NCC/HH = (NBEA-BUF + NPR-BUF)/NHH

Parameters

| | |
|---|---|
| NCC/HH | Net Carbon Credits Per Habitat Hectare ($tCO_2e\ yr^{-1}$) |
| NBEA-BUF | Net Baseline Emissions Avoided minus Buffer ($tCO_2e\ yr^{-1}$) |
| NPR-BUF | Net Project Removals minus Buffer ($tCO_2e\ yr^{-1}$) |
| NHH | Net Habitat Hectares (ha) |

## 6.5 MANAGING LOSS EVENTS

Managing loss events for Habitat Hectares units involves applying rules for Managing Loss Events for carbon accounting. Accounting for reversals in Habitat Hectares applies the same Habitat Hectare to Carbon Credit equivalence.

# 7. Assessment of Uncertainty

This Technical Specifications Module is guided by the uncertainty assessment developed by the VCS.

According to the Plan Vivo Standard (2013, p17):

*5.11. Projects must identify and describe where uncertainty exists in quantifications of ecosystem services and estimate the approximate level or range of uncertainty. The level of uncertainty must be factored into the level of conservativeness applied in the accounting method for quantifying ecosystem services.*

According to the Approved VCS Tool for the Estimation of Uncertainty for IFM Project Activities VT0003 V1.0 (2010):

*Conservative estimates can be used instead of uncertainties, provided that they are based on verifiable literature sources or expert judgment. In this case the uncertainty is assumed to be zero. However, this tool provides a procedure to combine uncertainty information and conservative estimates resulting in an overall ex-post project uncertainty.*

*It is important that the process of project planning consider uncertainty. Procedures including stratification and the allocation of sufficient measurement plots can help ensure that low uncertainty in carbon stocks results and ultimately full crediting can result.*

## 7.1 UNCERTAINTY IN BASELINE GHG EMISSIONS AND REMOVALS

### 7.1.1 Above Ground Biomass Emitted

The core of the avoided emissions component of the baseline calculation is based on a conservative estimate of the woody biomass volume to be removed (deforested) in the baseline activity. Uncertainty is addressed by means of a forest biomass inventory required to gather data aiming at a precision of ±10% of the true value of the mean at the 95% confidence level for above ground live biomass in each stratum. Plot location uses a stratified random sampling approach.

This Technical Specifications Module conservatively applies allometry from Chave et al. (2005) (see Figure 4.1.1b), in turn using a conservative diameter:height ratio derived from Payton and Weaver 2011 (derived from diameter:height data from indigenous forest in Fiji).

Wood density data in this Technical Specifications Module is derived from conservative defaults from the latest version of the IPCC Guidelines on National GHG Inventories (e.g. IPCC 2006: Table 4.13, p 4.64).

Uncertainty in above ground dead biomass leaf litter, as well as soil carbon is addressed by exclusion where exclusion is conservative.

### 7.1.2 Below Ground Biomass Emitted

Uncertainty in the calculation of Below Ground Biomass Emitted (BGBE) is addressed in this methodology by applying the default value for below ground biomass used by the IPCC 2006 Inventory Guidelines (Chapter 4, pg. 49) of 0.37. When the target tree species for commercial timber harvesting in the baseline includes species known to regrow from stumps Project Coordinators are required to:

1. Calculate the proportion of AGBE attributable to these species
2. Include the AGBE attributable to these species and remove the corresponding BGBE attributable to these species in the baseline.

Removing the BGBE component attributable to these species by default is conservative because these species do not always regenerate from stumps but this methodology assumes that they always do.

### 7.1.3 Gross Total Emissions in $tCO_2$

Uncertainty in the calculation of Gross Total Emissions in $tCO_2e$ (GTCO2) is addressed in this methodology by:

a. Following the IPCC procedure for converting moist wood volume to carbon dioxide, and
b. Using the mean wood density for the species mix contained in the Harvest Rate data. Where local (country-specific) wood density data are unavailable, this methodology uses the most recent IPCC GHG Inventory Guidelines for default values for applicable genera and families.

## 7.2 PROJECT GHG EMISSIONS AND REMOVALS

### 7.2.1 Enhanced Removals

A conservativeness factor built into the calculation of Enhanced Removals in the form of a conservative default value for the sequestration rate.

# 8. Monitoring The GHG Project

According to Section 5 of the Plan Vivo Standard (2013, p17):

*5.9. A monitoring plan must be developed for each project intervention which specifies:*

- *5.9.1. Performance indicators and targets to be used and how they demonstrate if ecosystem services are being delivered. Performance targets may be directly or indirectly linked to the delivery of ecosystem services, e.g. based on successful implementation of management activities or other improvements but must serve to motivate participants to sustain the project intervention*
- *5.9.2. Monitoring approaches (methods)*
- *5.9.3. Frequency of monitoring*
- *5.9.4. Duration of monitoring*

According to section 5.10 of the ISO 14064-2 Standard:

*The project proponent shall establish and maintain criteria and procedures for obtaining, recording, compiling and analysing data and information important for quantifying and reporting GHG emissions and/or removals relevant for the project and baseline scenario (i.e. GHG information system). Monitoring procedures should include the following:*

- *a) Purpose of monitoring;*
- *b) Types of data and information to be reported, including units of measurement;*
- *c) Origin of the data;*
- *d) Monitoring methodologies, including estimation, modelling, measurement or calculation approaches;*
- *e) Monitoring times and periods, considering the needs of intended users;*
- *f) Monitoring roles and responsibilities;*
- *g) GHG information management systems, including the location and retention of stored data.*

*Where measurement and monitoring equipment is used, the project proponent shall ensure the equipment is calibrated according to current good practice.*

*The project proponent shall apply GHG monitoring criteria and procedures on a regular basis during project implementation.*

## 8.1 PROJECT MONITORING PLAN

Credits are issued to each project applying this Technical Specifications Module as a result of 3rd party verification of each Project Monitoring Report, which contains data sufficient to provide evidence to support a GHG assertion for the Project Monitoring Period in question.

Project Monitoring reports will be produced using the latest VCS Monitoring Report Template at a maximum of 5-yearly intervals covering each Project Monitoring Period. The Project Monitoring Report will be produced in the year following the final year of the Project Monitoring Period.

### 8.1.1 Monitored And Non-Monitored Parameters

Some data parameters are derived from default values or are measured at one time only. These are non-monitored parameters. Other data parameters are monitored during each Monitoring Period.

Monitored and non-monitored data are listed in Table 7.1.1 below, and presented in the sequence in which measurement of GHG emissions and emission reductions are calculated.

Table 8.1.1 Monitored and Non-Monitored Parameters (monitored parameters in green)

| Notation | Parameter | Unit | Equa-tion | Origin | Monitored |
|---|---|---|---|---|---|
| EFA | Eligible Forest Area | ha | - | PD | Monitored |
| LF/ULF | Forest stratification (logged/unlogged forest) | ha | - | PD | Area calculated in PD |
| AGBE | Above Ground Biomass Emitted | $m^3\ yr^{-1}$ | 4.1.1 | Calculated from inventory | Not monitored Updated each Baseline Revision |
| BGBE | Below Ground Biomass Emitted | $m^3\ yr^{-1}$ | 4.1.2 | Root-shoot ratio (proportion of AGBE) | Not monitored Updated each Baseline Revision |
| TM3 | Total Emissions in $m^3$ | $m^3\ yr^{-1}$ | 4.1.3 | Sum of AGBE and BGBE | Not monitored Updated each Baseline Revision |
| GTCO2 | Gross Total Emissions in $tCO^2e$ | $tCO_2e\ yr^{-1}$ | 4.1.4a 4.1.4b 4.1.4c 4.1.4d | Conversion factors from wood volume to emissions | Not monitored Updated each Baseline Revision |
| GBEWP | Gross Baseline Emissions | $tCO_2e\ yr^{-1}$ | 4.1.5 | Conversion factors from wood products calculation | Not monitored Updated each Baseline Revision |
| ltWP | Long Term Wood Products | $tCO_2e\ yr^{-1}$ | 4.1.6 | Calculated through conversion factors based on volume of wood harvested. | Not monitored |

| | | | | | |
|---|---|---|---|---|---|
| NBEA | Net Baseline Emissions Avoided | $tCO_2e\ yr^{-1}$ | 4.1.7 | Default factors based on GBE | Not monitored<br>Updated each Baseline Revision |
| ER | Enhanced Removals | $tCO_2e\ yr^{-1}$ | 5.1.1 | Default values derived from mean sequestration rates for relevant forest types and subsequently derived from project-specific data | Not Monitored<br>Updated each Monitoring Period |
| TAL | Total Activity Shifting Leakage | $tCO_2e\ yr^{-1}$ | 5.2.1 | Derived from Activity Shifting Leakage Analysis | Monitored<br>Updated each Monitoring Period |

### 8.1.2 Monitored Parameters

Monitored data and parameters are summarized in the tables below.

| **Data Unit / Parameter:** | **Eligible Forest Area (Eligible Forest Area)** |
|---|---|
| Data unit: | ha |
| Description: | Forest area included in baseline and project scenario, and area upon which crediting is based ($EFA_{LF}$ &/or $EFA_{ULF}$) |
| Source of data: | Aerial imagery and Project Boundary Inspection |
| Description of measurement methods and procedures to be applied: | Aerial imagery (sub-meter accuracy) to define Eligible Forest Area boundary; boundary survey inspections (sub-meter accuracy) using GPS.<br>Measure any reversals occurring in the Eligible Forest Area. Monitored by means of Eligible Forest Boundary Inspections that record any reversal incident occurring within the Eligible Forest Area. The area of any reversal above and beyond the *de minimis* threshold is measured using GPS units set up for sub-meter accuracy and measuring tapes. Area subject to reversal is removed from the Eligible Forest Area until the reversal has recovered the carbon volume lost in the reversal. This is calculated by means of sequestration rates and the estimate of the forest age for the area subject to the reversal. Forest age of the area subject to the reversal is calculated by:<br>• Dendrochronology on stumps in the case of a timber harvest reversal<br>• Dendrochronology on adjacent living trees of equivalent size of burnt stumps |
| Frequency of monitoring/recording: | Aerial imagery: 5-yearly<br>Eligible Forest Boundary inspections: annually |
| Value monitored: | Area |
| Monitoring equipment: | Aerial imagery/satellite data to sub-meter accuracy<br>Hand held GPS unit, photography |
| QA/QC procedures to be applied: | 5-yearly 3rd party verification of Project Management Reports. |
| Calculation method: | Subtract reversal area from the Eligible Forest Area and recalculate the Net Carbon Credits by means of the Buffer Account Rules (Section |

| | |
|---|---|
| | 5.5.2 this document). |

| **Data Unit / Parameter:** | **Total Activity Shifting Leakage** |
|---|---|
| Data unit: | $tCO_2e/yr$ |
| Description: | Leakage caused by activity shifting |
| Source of data: | Project Area Inspection (outside Eligible Forest Area) |
| Description of measurement methods and procedures to be applied: | Site visit of indigenous forest lands owned and controlled by the Project Owner to assess commercial timber harvesting activity in comparison with the Baseline Activity and Project Activity as stated in the PD.<br><br>Where commercial indigenous timber harvesting is occurring on lands owned and controlled by the Project Owner but lying outside the Eligible Forest Area, and where such harvesting has been declared in the PD, the following assessment will be undertaken:<br><br>• Records of timber harvesting activity are inspected and verified against the timber harvesting plan stated in the PD.<br>• Timber harvesting sites are inspected to verify that they are occurring in the areas specified in the PD.<br><br>Where commercial indigenous timber harvesting is occurring on lands owned and controlled by the Project Owner but lying outside the Eligible Forest Area, and where such harvesting has not been declared in the PD (i.e. and thereby constitutes Activity Shifting Leakage), the following assessment will be undertaken:<br><br>• Records of timber harvesting activity are inspected and annual timber harvesting volumes and species are recorded.<br>• Timber harvesting sites are inspected to determine area of harvesting activity.<br>• Calculations are made using the baseline GHG emissions measurement methodology in the Technical Specifications Module 2.1 (C) (AD-DtPF), to determine the volume of Activity Shifting Leakage.<br>• Net Carbon Credits are recalculated to account for Total Activity Shifting Leakage (TAL)<br>• The Project Owner is notified of the consequence of any continuation of Activity Shifting Leakage in terms of the reduction in Net Carbon Credits for the Project.<br><br>The Project Owner is instructed to terminate Activity Shifting timber harvesting or risk suspension or termination from the Pacific REDD+ Program. |
| Frequency of monitoring/recording: | Annual Leakage Inspection and results incorporated into the annual Project Management Report. 5-yearly 2nd party verification of Project Management Reporting by the Programme Operator. |
| Value monitored: | $m^3\ yr^{-1}$ |

| | |
|---|---|
| Monitoring equipment: | GPS unit, measuring tape, photography |
| QA/QC procedures to be applied: | 5-yearly 3rd party verification of Project Management Reports. |
| Calculation method: | Activity Shifting Leakage method specified in Section 5.2.1 of the Technical Specifications Module 2.2.1 (C) (AD-DtPF). |

### 8.1.3 Monitoring Roles And Responsibilities

Specific project monitoring roles for projects applying this Technical Specifications Module are summarised in Table 8.1.3. Project Owners and Project Coordinators are required to assign specific roles to specific stakeholders in the PD, and use this convention in the implementation and monitoring of the Project Activity.

Table 7.1.3 Project Monitoring Roles/Responsibilities

| Task | Responsibility |
|---|---|
| Eligible Forest Area Boundary Inspections | To be determined in consultation with the Project Owner and incorporated into the monitoring plan |
| Eligible Forest Area Inspections | To be determined in consultation with the Project Owner and incorporated into the monitoring plan |
| Project Management Reporting | To be determined in consultation with the Project Owner and incorporated into the monitoring plan |
| Aerial imagery/mapping | To be determined in consultation with the Project Owner and incorporated into the monitoring plan |
| Project Monitoring data management | To be determined in consultation with the Project Owner and incorporated into the monitoring plan |

### 8.1.4 GHG Information Management Systems

All projects applying this Technical Specifications Module will use the information management system described in Section 7.1 of the Nakau Methodology Framework.

### 8.1.5 Simplified Project Monitoring Report Methodology

Projects are able to submit a simplified Project Monitoring Report for their first verification. The Simplified Project Monitoring Report will fulfil all components of the latest VCS Monitoring Report Template with the exception that Section 3.2 will list the data and parameters monitored but the full monitoring procedures will not be implemented until the second verification. In place of data generated from monitoring activities the Project Owner will supply the equivalent of a Director's Certificate to assert that the Project Activity has taken place according to the requirements of the Nakau Methodology Framework and this Technical Specification Module between the Project Start Date and the end of the first Monitoring Period.

### 8.1.6 Standard Operating Procedure: Project Monitoring

All projects applying this Technical Specifications Module are required to develop a Standard Operating Procedure (SOP) for Monitoring. Projects have the option to submit a simplified SOP for Monitoring when submitting the PD for validation and/or for first verification. Projects electing to supply a simplified SOP for Monitoring for PD and first verification are required to establish a simplified SOP for Monitoring for first verification and then follow the full monitoring SOP thereafter. The simplified SOP for Monitoring requires the Project Coordinator to prepare the first Project Monitoring Report based on the requirements of the Nakau Methodology Framework and this Technical Specifications Module.

### 8.1.7 Monitoring Resources and Capacity

According to Section 5 of the Plan Vivo Standard (2013, p17):

*5.9. A monitoring plan must be developed for each project intervention which specifies:*
*5.9.6. Resources and capacity required*

The Project Monitoring Plan must identify (and provide evidence for) the resources available to undertake monitoring, including:

- Financial resources and the source of such finance (e.g. unit pricing, grants, fees)
- Human resources and capability required.

### 8.1.8 Community Monitoring

According to Section 5 of the Plan Vivo Standard (2013, p17):

*5.9. A monitoring plan must be developed for each project intervention which specifies:*
*5.9.7. How communities will participate in monitoring, e.g. by training community members and gradually delegating monitoring activities over the duration of the project*
*5.9.8. How results of monitoring will be shared and discussed with participants*

*5.10. Where participants are involved in monitoring, a system for checking the robustness of monitoring results must be in place, e.g. checking a random sample of monitoring results by the project coordinator.*

The Project Monitoring Plan must include:

- A description of how the Project Owner and/or other local people will participate in monitoring in compliance with the Project Participation Protocol specified in Section 3.1 of the PD (applying Section 3.1 of the Nakau Methodology Framework).
- A description of how the results of monitoring will be shared and discussed with participants with reference to the Project Monitoring Workshops specified in Section 3.1.7 of the PD (applying Section 3.1.7 of the Nakau Methodology Framework).
- A description of the quality controls used to safeguard the integrity and accuracy of data gathered from monitoring activities involving Project Owners and/or other local people.

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# Appendices

## APPENDIX 1: DEFINITIONS

| | |
|---|---|
| A/R | Afforestation/Reforestation |
| Activity Type | Specifically defined carbon project activity combining a reference activity and a project activity to generate carbon benefits |
| Afforestation | Establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest (FAO 2010). See Explanatory Note below. |
| AFOLU | Agriculture, Forestry and Other Land Uses |
| Baseline Scenario | Carbon balance arising from baseline (BAU) activities |
| BAU | Business-as-Usual |
| Carbon balance | Sum of carbon in a system into account carbon stored in reservoirs, emissions of carbon from sources, and sequestration of carbon into sinks |
| Carbon benefits | Net $CO_2e$ benefits arising from total net avoided emissions and net enhanced removals |
| Carbon flux | Movement of carbon through different carbon pools |
| Carbon pool | Component of the earth system that stores carbon |
| Carbon reservoir | Carbon pool that stores carbon for long time scales |
| Carbon sink | Carbon pool that absorbs/sequesters carbon dioxide by transforming gaseous $CO_2e$ into a carbon-based liquid or solid |
| Carbon source | Carbon pool that emits carbon from a liquid or solid form into a gas |
| CCB | Climate Community and Biodiversity Standard |
| CDM | Clean Development Mechanism |
| $CO_2e$ | Carbon dioxide equivalent: translation of non-$CO_2$ GHG tonnes into equivalent $CO_2$tonnes through conversion using global warming potential of non-$CO_2$ GHG |
| Compliance Space | What is contained within the GHG accounting boundary of a compliance GHG accounting regime (e.g. Kyoto Protocol, NZ ETS) |
| COP | Conference of Parties (to the UNFCCC) |
| CSR | Corporate Social Responsibility |
| Deforestation | The conversion of forest to other land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold (FAO 2010). See Explanatory Note below. |
| DOE | Designated Operational Entity |
| Eligible Area | Subset of Forest Area comprising area of forest eligible for crediting |

| | |
|---|---|
| Enhanced removals | Carbon sequestration assisted by management intervention to a level above what would occur naturally |
| Ex ante | Before the event (referring to future activities) |
| Ex post | After the fact (referring to past activities) |
| Forest Area | Subset of Project Area comprising forest land within Project Area |
| Forest Degradation | The reduction of the capacity of a forest to provide goods and services. |
| Forest Land | Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use (FAO 2010). See Explanatory Note below. |
| GHG | Greenhouse Gas |
| GIS | Geographical Information System |
| GPG | Good Practice Guidance |
| HWP | Harvested Wood Products |
| IFM | Improved Forest Management |
| IFM-LtPF | Improved forest management – logged to protected forest activity type |
| IPCC | Intergovernmental Panel on Climate Change |
| ISO | International Standards Organisation |
| LULUCF | Land Use, Land Use Change and Forestry |
| MRV | Measurement/Monitoring Reporting and Verification |
| Non-Forest Land | All land that is not classified as Forest or Other wooded land (FAO 2010). See Explanatory Notes for 'Other Land' below). Same definition as 'Other Land'. |
| Operational Forest Area | Term used in sustainable forest management plans delimiting area eligible for timber harvesting |
| Other Land | All land that is not classified as Forest or Other wooded land (FAO 2010). See Explanatory Notes below). Same definition as 'Non-Forest Land'. |
| Other Wooded Land | Land not classified as Forest, spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use (FAO 2010). See Explanatory Note below. |
| Participants | The adult land/resource rights holders involved in the project – including, but not limited to the project owner group board/committee members. |
| PD | Project Description |
| PDD | Project Design Document (synonymous with PD in this document) |
| PES | Payment for Ecosystem Services |

| | |
|---|---|
| Project Area | Land ownership boundary within which carbon project will take place |
| Project Coordinator | The entity assisting the Project Owner to develop and implement the forest carbon project. |
| Project Governing Board | Subset of the Project Owner community appointed by the Project Owner community to govern the project in the interests of the Project Owner community. |
| Project Scenario | Carbon balance arising from project activities |
| Programme Operator | The entity that owns and administers the Nakau Programme. This entity is responsible for safeguarding the integrity of the Nakau Programme and its role is to a) govern the Nakau Programme; b) own the IP associated with Nakau Programme methodologies and protocols; c) be the beneficiary of any covenant on the land title of the Project Owner that protects the forest; d) own the buffer credits of the Nakau Programme; e) administer the buffer account with the registry; and f) act as the guardian of the Nakau Programme. |
| Project Owner | The owner of the forest and forest carbon rights subject to the project |
| Project Proponent | The Project Owner and Project Coordinator combined. |
| Project Scenario | Carbon balance arising from Project activities (carbon project change from BAU) |
| Protected Forest | Halting or avoiding activities that would reduce carbon stocks and managing a forest to maintain high and/or increasing carbon stocks |
| RED | Reducing Emissions from Deforestation |
| REDD | Reducing Emissions from Deforestation and Degradation |
| Reforestation | Re-establishment of forest through planting and/or deliberate seeding on land classified as forest (FAO 2010). See Explanatory Note below. |
| REL | Reference Emission Level: rate of GHG emissions under BAU |
| Removals | Carbon sequestered from the atmosphere into a carbon sink |
| SFM | Sustainable Forest Management |
| UNFCCC | United Nations Framework Convention on Climate Change |
| Validation | Independent audit of Project Description (PD) and/or Methodology |
| VCS | Verified Carbon Standard |
| Verification | Independent audit of Project Monitoring Reports |

## Explanatory Notes

All definitions and explanatory notes relating to forest and non-forest land, afforestation, reforestation, deforestation, forest degradation is taken from the FAO Global Forest Resources Assessment 2010.

### Forest Land:

1. Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters in situ.

2. Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of 10 percent and tree height of 5 meters. It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used.

3. Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest.

4. Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters.

5. Includes abandoned shifting cultivation land with a regeneration of trees that have, or is expected to reach, a canopy cover of 10 percent and tree height of 5 meters.

6. Includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.

7. Includes rubber-wood, cork oak and Christmas tree plantations.

8. Includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met.

9. Excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover. Note: Some agroforestry systems such as the “Taungya” system where crops are grown only during the first years of the forest rotation should be classified as forest.

### Other Wooded Land

1. The definition above has two options:

- The canopy cover of trees is between 5 and 10 percent; trees should be higher than 5 meters or able to reach 5 meters in situ.
- The canopy cover of trees is less than 5 percent but the combined cover of shrubs, bushes and trees is more than 10 percent. Includes areas of shrubs and bushes where no trees are present.

2. Includes areas with trees that will not reach a height of 5 meters in situ and with a canopy cover of 10 percent or more, e.g. some alpine tree vegetation types, arid zone mangroves, etc.

3. Includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met.

## Other Land

1. Includes agricultural land, meadows and pastures, built-up areas, barren land, land under permanent ice, etc.

2. Includes all areas classified under the sub-category “Other land with tree cover”.

## Afforestation

1. Implies a transformation of land use from non-forest to forest.

## Reforestation

1. Implies no change of land use.

2. Includes planting/seeding of temporarily unstocked forest areas as well as planting/seeding of areas with forest cover.

3. Includes coppice from trees that were originally planted or seeded.

4. Excludes natural regeneration of forest.

## Deforestation

1. Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural perturbation.

2. Deforestation includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas.

3. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures. Unless logging is followed by the clearing of the remaining logged-over forest for the introduction of alternative land uses, or the maintenance of the clearings through continued disturbance, forests commonly regenerate, although often to a different, secondary condition.

4. In areas of shifting agriculture, forest, forest fallow and agricultural lands appear in a dynamic pattern where deforestation and the return of forest occur frequently in small patches. To simplify reporting of such areas, the net change over a larger area is typically used.

5. Deforestation also includes areas where, for example, the impact of disturbance, over utilization or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10 percent threshold.

# APPENDIX 2. SITE DESCRIPTION PLOT SHEET

| SITE DESCRIPTION PLOT SHEET | | | | |
|---|---|---|---|---|
| **Survey name:** | | | | **Date measured:** |
| **Plot identifier:** | | | | **Measured by:** |
| **Location:** | | | | |
| | | | | |
| **Plot layout:** | | | | **GPS make & model** |
| | **Bearing** | **Slope distance** | **Slope angle** | **Easting:** |
| **A–B** | | | | **Southing:** |
| **B–C** | | | | **Single/averaged 2D/3D ± m** |
| **C–D** | | | | **Datum:** |
| **D–A** | | | | |
| | | | | **Location diagram:** |
| **Altitude (m)** | | | | |
| **Physiography: ridge gully face terrace** | | | | |
| **Aspect (0 - 359°)** | | | | |
| **Slope (°) concave convex linear** | | | | |
| **Average top height (m)** | | | | |
| **Canopy Cover (%)** | | | | |
| **Cultural: none burnt logged cleared mined grazed tracked** | | | | |
| **Subplots outside survey area:** | | | | |
| | | | | **Approach notes:** |
| **Dominant tree species:** | | | | |
| | | | | |
| | | | | |
| **Other plant species:** | | | | |
| | | | | |
| **Fauna:** | | | | **Notes:** |
| | | | | |
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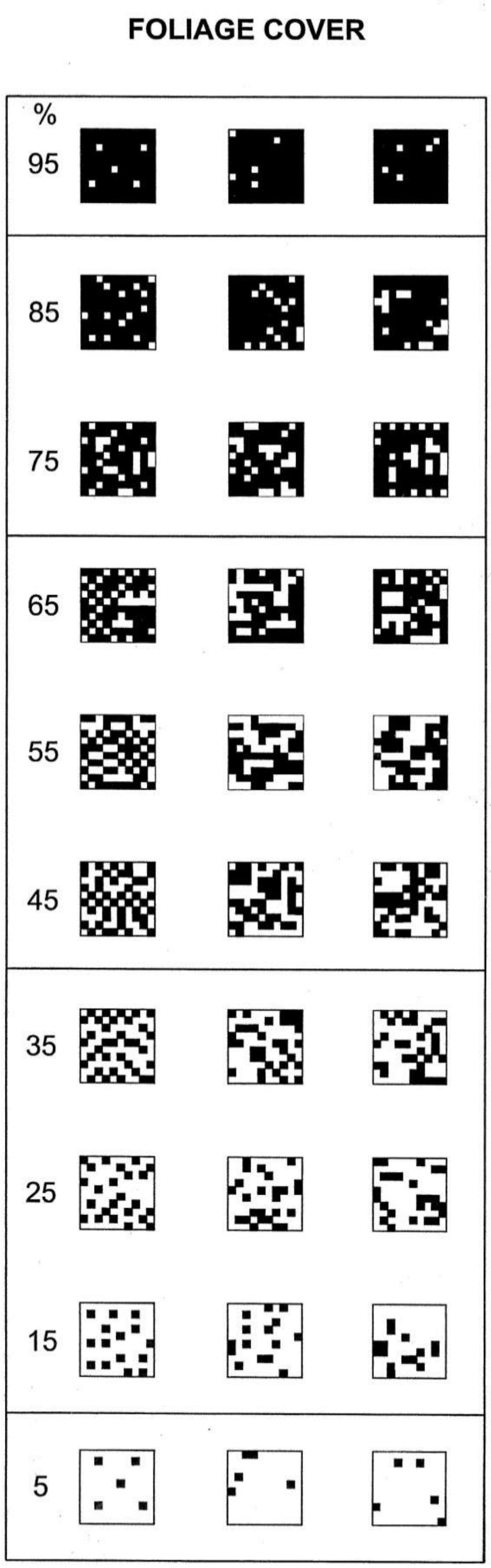
# APPENDIX 3. FOLIAR COVER SCALE



# APPENDIX 4. STEM DIAMETER RECORD SHEET

| | |
|---|---|
| Plot Identifier: | Measured by: |
| Date: | Recorded by: |

| Subplot | Tag No. | Local name | Botanical name | Diameter | Notes |
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