Technical Specifications Module: (C) IFM-LtPF

Technical Specifications Module (C) 1.1 (IFM-LtPF):
Improved Forest Management – Logged 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

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

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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 develop 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) 1.1 (IFM-LtPF): Improved Forest Management – Logged to Protected Forest (this document) measures greenhouse gas ecosystem services derived from improved forest management activities in forest-remaining-as-forest land use that reduce or avoid forest degradation. The improved forest management sub-type for this module is: conversion of logged to protected forest (IFM-LtPF). 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

Technical Specifications Module (C) 1.1 (IFM-LtPF) 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 the Technical Specifications Module (C) 1.1 (IFM-LtPF) 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

[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.

avoidance of commercial timber harvesting and the protection of forest that would be subject to logging in the absence of finance from payment for ecosystem services (PES).

The Technical Specifications Module (C) 1.1 (IFM-LtPF) 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 Rarakau Programme 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 lands' as of 31 December 2009.
b. Baseline and project activities in eligible forests comprise management of carbon stocks in forest-remaining-as-forest activities.
c. Projects will account for AFOLU GHG emissions and removals in the baseline and project scenarios.
d. 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 at any time during the Project Period.
e. Eligible forests must meet the additionality conditions of this methodology and in so doing demonstrate the high probability that the forests of the project area would have been logged within the project period in the absence of project activities.

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 aerial imagery and maps.
	Provided in Part A, Section 2.3.5 of the PD.
1.1.1b	Evidence demonstrating that the project encompasses a forest-remaining-as-

	forests activity.
	Provided in Part B, Sections 2.2, 2.5 and 3 of the PD.
1.1.1c	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.
1.1.1d	Evidence that PES units generated from this project will not be subject to PES unit claims by other relevant entities shall be provided in the following way: a. A statement by the Project Owner asserting that the eligible forest area is not subject to any other project-scale crediting project or program. 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 lands[2] managed for wood products such as sawn timber, pulpwood, and fuelwood and are included in the IPCC category "forests remaining as forests", whereby the logging activities to produce such wood products would have occurred during the project period in the absence of project activities.

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

This activity type applies only to baseline activities that involve timber and fuelwood harvesting, that result in a reduction in mean carbon stocks and an increase in associated GHG emissions. Baseline activities can also include activities that measurably reduce carbon stocks from other than timber harvesting (e.g. fire used as a management tool).

The baseline scenario for this activity type is restricted to forest management activities as defined in forestry regulations of the host country.

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 commercial wood harvesting 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

[2] See definitions in Appendix 1.

	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 commercially viable wood volumes capable of supporting a commercial wood harvesting operation. This information is to be provided in a timber harvesting plan in combination with a financial additionality test undertaken as part of this methodology.
	Documentation to be provided in Appendix 1.1.2b of Part B of the PD.
1.1.2c	Documentation providing evidence of the high probability of baseline activities occurring during the project period in the absence of the project.
	Documentation to be provided in Appendix 1.1.2c 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, and the active conservation management of 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. Active conservation management of the Project Area will principally involve regular inspections of the Project Area to monitor any potential activities that do not comply with the legal protection of the forests. The active conservation management of the Project Area is to be included as a component of the Nakau Management Plan (see Section 3.1.4 of the Nakau Methodology Framework).

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 1.1.3a of Part B of the PD.
1.1.3b	The Nakau Management Plan includes a description of the active conservation management requirements for the forests protected under this project. The Project Monitoring Plan includes activities consistent with the active conservation management requirements of the Nakau Management Plan.
	To be provided in the Nakau Management Plan and the Project Monitoring Plan.
1.1.3c	Inputs for project activities including active conservation management, need to be clearly stated in the assignment of roles and responsibilities included in Section 2.13.3 of Part A of the PD, the Nakau Management Plan, the Project Participation Protocol, and the PES Agreement.
	To be provided in the Nakau Management Plan and the Project Monitoring Plan.

1.1.4 Eligible Forest Strata

Eligible forests will include two forest 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 (e.g. harvesting records) 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. 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.

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

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

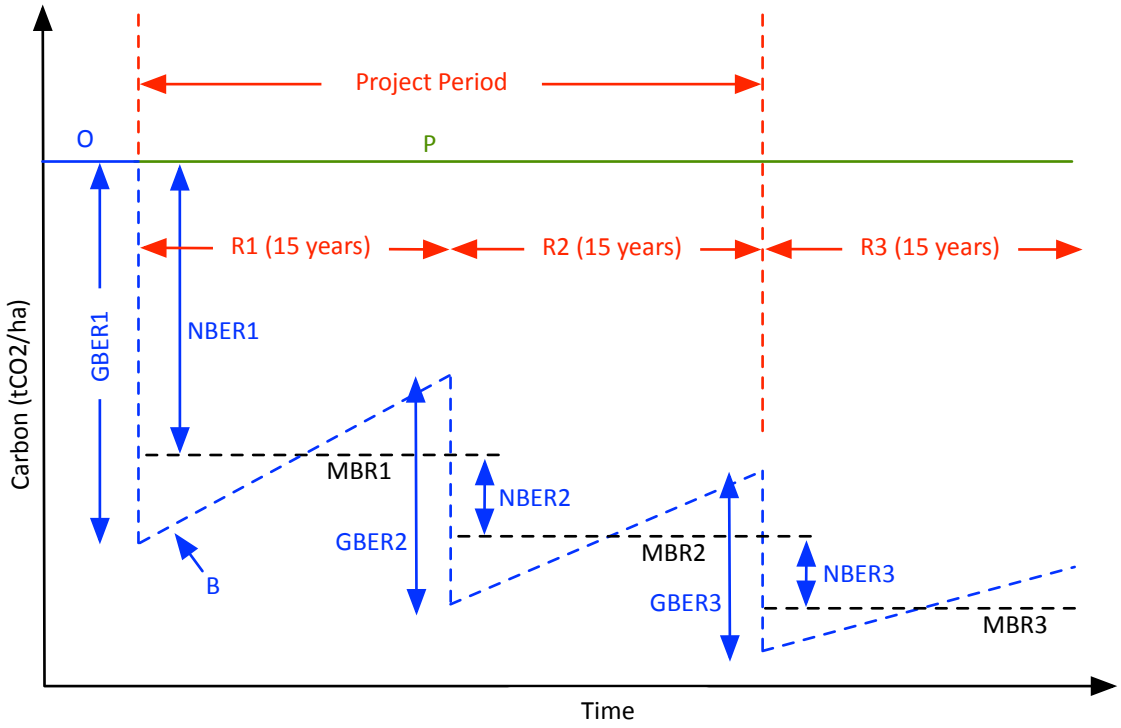
Variant 2: Avoided timber harvesting in a regenerating forest (Fig 1.1.4b).

Under Variant 1 (Figure 1.1.4a) the project scenario involves avoiding wood harvesting 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.

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

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 and 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).

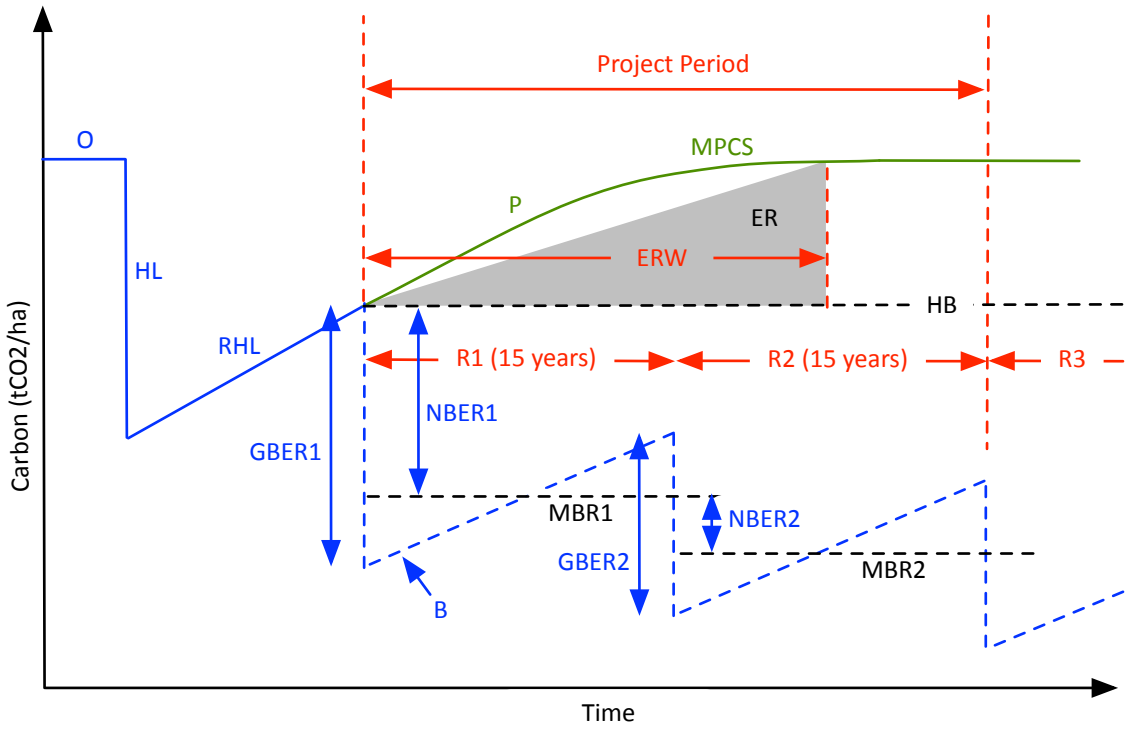
Figure 1.1.4a. Variant 1 - Concept diagram: IFM-LtPF$_{ULF}$ in Unlogged (old growth) Forest.



Key:

	O =	Original mean carbon stocks in old growth undisturbed forest
	B =	Baseline Scenario carbon stocks under timber harvesting regime (harvest/regrowth)
	P =	Project Scenario carbon stocks under forest protection regime
	MB_{R1} =	Mean Baseline carbon stocks during Rotation 1
	MB_{R2} =	Mean Baseline carbon stocks during Rotation 2
	MB_{R3} =	Mean Baseline carbon stocks during Rotation 3
	GBE_{R1} =	Gross Baseline Emissions during Rotation 1
	GBE_{R2} =	Gross Baseline Emissions during Rotation 2
	GBE_{R3} =	Gross Baseline Emissions during Rotation 3
	NBE_{R1} =	Net Baseline Emissions during Rotation 1
	NBE_{R2} =	Net Baseline Emissions during Rotation 2
	NBE_{R3} =	Net Baseline Emissions during Rotation 3

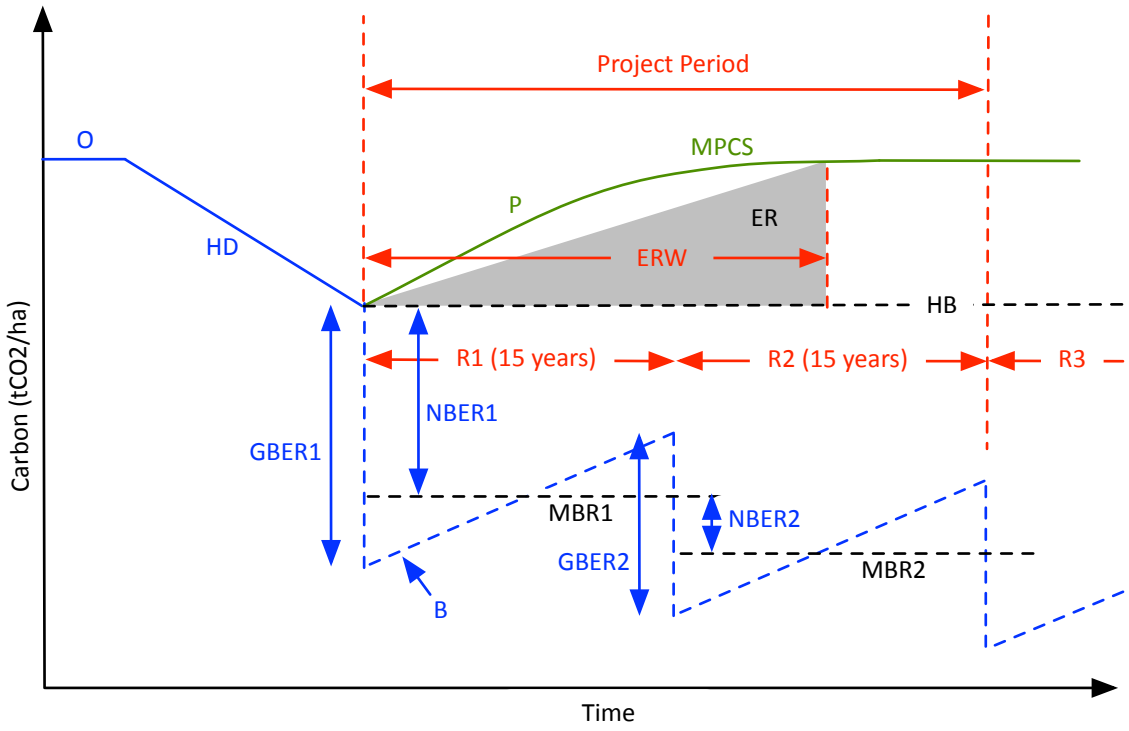
Figure 1.1.4b. Variant 2a - Concept diagram: IFM-LtPF$_{LF}$ in Logged (regenerating) Forest.



Key:

	O =	Original mean carbon stocks in old growth undisturbed forest
	HL =	Historical logging
	RHL =	Regeneration following historical logging
	B =	Baseline Scenario carbon stocks under timber harvesting regime (harvest/regrowth)
	P =	Project Scenario carbon stocks under forest protection regime
	HB =	Harvest baseline (mean carbon stocks at start of baseline timber harvesting)
	MB_{R1} =	Mean Baseline carbon stocks during Rotation 1
	MB_{R2} =	Mean Baseline carbon stocks during Rotation 2
	MB_{R3} =	Mean Baseline carbon stocks during Rotation 3
	GBE_{R1} =	Gross Baseline Emissions during Rotation 1
	GBE_{R2} =	Gross Baseline Emissions during Rotation 2
	GBE_{R3} =	Gross Baseline Emissions during Rotation 3
	NBE_{R1} =	Net Baseline Emissions during Rotation 1
	NBE_{R2} =	Net Baseline Emissions during Rotation 2
	NBE_{R3} =	Net Baseline Emissions during Rotation 3
	ER =	Enhanced Removals (Project Scenario)
	ERW =	Enhanced Removals Window (Project Scenario)

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



Key:

	O =	Original mean carbon stocks in old growth undisturbed forest
	HD =	Historical degradation
	B =	Baseline Scenario carbon stocks under timber harvesting regime (harvest/regrowth)
	P =	Project Scenario carbon stocks under forest protection regime
	HB =	Harvest baseline (mean carbon stocks at start of baseline timber harvesting)
	MB_{R1} =	Mean Baseline carbon stocks during Rotation 1
	MB_{R2} =	Mean Baseline carbon stocks during Rotation 2
	MB_{R3} =	Mean Baseline carbon stocks during Rotation 3
	GBE_{R1} =	Gross Baseline Emissions during Rotation 1
	GBE_{R2} =	Gross Baseline Emissions during Rotation 2
	GBE_{R3} =	Gross Baseline Emissions during Rotation 3
	NBE_{R1} =	Net Baseline Emissions during Rotation 1
	NBE_{R2} =	Net Baseline Emissions during Rotation 2
	NBE_{R3} =	Net Baseline Emissions during Rotation 3
	ER =	Enhanced Removals (Project Scenario)
	ERW =	Enhanced Removals Window (Project Scenario)

As can be seen when comparing Figures 1.1.4b and 1.1.4c the key to carbon management and carbon accounting is the contrast between baseline and project scenarios as projected under a logging baseline.

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

a. Generate emissions, and
b. Cause compensatory regrowth in harvest patches at a higher sequestration rate than outside the harvest patches, and
c. Interrupt the process of natural regeneration by harvesting timber starting from a harvest baseline (HB), removing annual permitted timber volumes (and allowing compensatory regrowth), in an unsustainable harvest cycle that shows step-wise reduction in mean carbon stocks through time.

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

a. The existing timber stocking rate of the forest as the Harvest Baseline,
b. The mean sequestration rate for this forest type, and
c. The allowed duration of the Enhance Removals Window (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 an activity that protected Logged Forest land parcels and prevented timber harvesting 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 any removals occurring below the Harvest Baseline in the harvest/regrowth cycle in the Baseline Scenario is deemed carbon neutral under this activity type and methodology and is accounted for in the 'avoided emissions' component of carbon accounting.

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 commercial timber or fuelwood harvesting.

e. Planned timber harvest must be estimated using forest inventory methods that determine allowable annual commercial timber harvest volumes (m^3 ha^{-1}).
f. 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 harvest commercial timber or fuelwood. This could include a logging concession or a property right, as well as reference to relevant laws and regulations at the relevant tier/s of government specifying legal sanction to undertake commercial timber or fuelwood harvesting.
	To be provided in Appendix 1.1.5c of the PD.
1.1.5d	Evidence that planned timber harvest in the baseline scenario has been estimated using forest inventory methods that determine allowable annual timber harvest volumes (m^3 ha^{-1}). This could be demonstrated by using data for baseline calculations derived from a commercial harvesting plan for the project area forests.
	To be provided as a reference to commercial timber harvest plan data in Part B, Section 4.1.1 of the PD.
1.1.5e	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_2e 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 provides for this 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 has also passed a technical review audit by an auditor[4] accredited to the CDM, VCS and ISO14064-2 standards. This technical review audit was completed on a previous draft[5] of this Technical Specifications Module that is materially identical to the carbon accounting elements of this document. The only changes since have been cosmetic. The auditor concluded that the carbon accounting elements of this Technical Specifications Module "meets all relevant requirements of ISO 14064-2, VCS and IPCC and is technically sound for carbon accounting."

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: • Plan Vivo Standard (2013) • Plan Vivo PDD Template • Plan Vivo PIN Template • 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: • The carbon stock change calculations framework used in this methodology

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

[5] Then named: "Pacific REDD Methodology V1.0. An Improved Forest Management – Logged To Protected Forest, Grouped Project Methodology For Pacific Island Indigenous Forest".

	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. • 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. 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: • VCS AFOLU Requirements V3.4 • VCS Guidance for Loss Events (8 March 2011) • VCS Tool the demonstration and assessment of additionality in VCS agriculture, forestry and other land use (AFOLU) project activities (VT0001, V3.0). • 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. • 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	
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		7
5.9.1		7
5.9.2		7
5.9.3		7
5.9.4		7
5.9.5	6.2.2	
5.9.6		7.1.8
5.9.7		7.1.9
5.9.8		7.1.9
5.10		7.1.9
5.11		6
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
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_2e emissions from above ground woody biomass removed from the forest.
	CO_2e emissions from above ground woody biomass entering the deadwood pool in the form of discarded crown and branches of harvested (target) trees.
	CO_2e emissions from additions to the above ground deadwood carbon pool resulting from collateral damage to non-target trees due to wood harvest activities.
	CO_2e emissions from the decomposition of below ground biomass resulting from above ground wood harvesting and collateral damage.
Sinks	CO_2e sequestered in the natural background rate of natural forest regeneration.
	CO_2e 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 and below ground carbon pools is not measured in this methodology apart from the empirical (inventory-based) estimation of commercial timber stocks in the baseline scenario. 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	At a minimum, the stock change in the above-ground tree biomass shall be estimated.
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 (ABGE) 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 always conservative when forests remain as forests.

The inclusion/exclusion of greenhouse gases in this methodology are shown in Table 3c. Sources, sinks and reservoirs defined in the baseline scenario will be the same for the project scenario.

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)	Included	Included only where significant in the project scenario. Otherwise conservatively neglected.
	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)	Included	Included only where significant in the project scenario. Otherwise conservatively neglected.
	Burning of biomass	Included	Included only where significant in the project scenario. Otherwise conservatively neglected.
Nitrous oxide (N_2O)	Combustion of fossil fuels (in vehicles, machinery and equipment)	Included	Included only where significant in the project scenario. Otherwise conservatively neglected.
	Nitrogen based fertilizer	Included	Included only where significant in the project scenario.
	Burning of biomass	Included	Included only where significant in the project scenario. Otherwise conservatively neglected.

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 those implemented on forest lands[6] managed for wood products such as sawn timber, pulpwood, and fuelwood and are included in the IPCC category "forests-remaining-as-forests".

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

[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

This Technical Specifications Module applies only to baseline activities that involve commercial timber and/or fuelwood harvesting, that result in a reduction in mean carbon stocks and associated emissions.

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 project applying Technical Specifications Module 1.1 (C) (IFM-LtPF) must determine the Baseline Scenario as wood harvesting according to a wood harvesting plan based on an inventory of commercially viable wood stocks and growth rates for each land parcel in the Project Area.

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 harvest volume of timber that is legally sanctioned under a wood harvest plan and is commercially viable to harvest for that land parcel.

An economic analysis of each wood harvest plan is required for all projects applying this Technical Specifications Module. This economic analysis can be used as a basis for establishing the scale of baseline activity. There are varying degrees of diligence to which an economic assessment can be carried out, which are summarised below:

- Assumption that current situation will prevail, based solely on the previous economic analysis.
- Assumption that current situation will prevail, based on updated economic analysis.
- Recognition that economic situation will vary temporally, assessment based on best available economic forecasts.
- Use a new methodology that allows for ex-post updating of the baseline by updating parameters of economic model.

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 current situation 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 Technical Specifications Module 1.1 (C) (IFM-LtPF) 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 project 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 evidence of the forest not 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: ΔC_{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: ΔC_B = Annual change in carbon stocks in biomass, (tonnes C yr^{-1}); ΔC_G = Annual gain (removals) of carbon in biomass due to biomass growth considering the total area (tonnes C yr^{-1}); ΔC_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:	
Emissions arising from the volume of timber extracted from the forest as sawlogs (Harvest Rate) as calculated in a timber harvesting plan	HR
Emissions from the Total Wood Harvested includes the HR and the above ground waste wood	TWH
Emissions from Collateral Damage to non-target trees is caused by tree felling and timber extraction (including hauling and roading) in the baseline activity	CD
Above Ground Biomass Emitted as a result of baseline activity	AGBE
Below Ground Biomass Emitted as a result of baseline activity	BGBE
Removals sequestered into the long-term wood product pool	$ltWP_{R1}$
Emissions from fossil fuel components of baseline activity: included if significant in the Project Scenario, otherwise conservatively neglected)	

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 and for each baseline timber harvest rotation (Rotation 1 – 15 years; Rotation 2 – 15 years; Rotation 3 – 15 years). These calculations are based on the emissions calculations for Rotation 1 and are then conservatively scaled downwards for Rotations 2 and 3 following a conservative model of forest degradation in the baseline scenario.

Data for input into these carbon stock change calculations for the Baseline Scenario must be established from the same data used to create the allowable timber harvest volume in the timber harvest plan for the land parcels within the Project Area.

Table 4.1a: Evidence Requirement: Baseline Scenario GHG Emissions/Removals	
#	Name/Description
4.1a	Commercial timber harvest plan for the Eligible Forest Area.

4.1.1 Step 1 – Harvest Rate (HR)

The "Harvest Rate" (HR) corresponds to the component of an Annual Logging Plan that specifies the annual harvest rate for each land parcel within the Project Area for Rotation 1. The HR is measured in m^3 per year.

The HR represents the harvested wood volume remaining after the crown and branches have been removed. The HR is calculated as the commercial log-harvesting rate in standard timber harvest plans using standard commercial timber forestry methods. The calculation of HR for baseline emissions is equal to the Harvest Rate (HR m^3 yr^{-1}) for each timber species type recorded in the timber harvest plan.

4.1.2 Step 2 – Total Wood Harvested (TWH)

'TWH' stands for the total wood harvested for target trees harvested in the baseline annual harvest regime and is measured in m^3 per year for Rotation 1. TWH represents the wood volume combining a) the log harvested (HR) and b) residual target tree above ground wood (crown and branches) left to form deadwood in the forest during Rotation 1. TWH and CD (below) are used in place of a biomass expansion factor (BEF), and derived from inventory data.

TWH is calculated by assuming that 50% of the above ground biomass from harvested (target) trees contributes to the waste wood carbon pool.[7] This assumes a mean recovery rate of useable log of 50%.

The calculation of the TWH uses the HR totals for each timber species type and uses the following equation:

Equation 4.1.2: $TWH = HR_{R1} / 0.50$

Parameters

TWH	Total Wood Harvested within the EFA for Rotation 1 (m^3 rotation 1^{-1})
HR_{R1}	Harvest Rate (m^3 rotation 1^{-1})

4.1.3 Step 3 – Collateral Damage (CD)

"Collateral damage" represents the deadwood caused by damage to non-target above ground live biomass resulting from the timber harvesting operation in Rotation 1. Collateral

[7] Based on (Kilkki 1992:10) who defines logging residue factors for Fiji, Solomon Islands, and PNG to be 1, 2, and 2 respectively. The figure of 50% corresponds to a mean residue factor of 1 for the Pacific Island region. Data from Enters (2001) shows the mean recoverable log percentage for indigenous logging in Malaysia, Indonesia, Ghana and Cameroon to be 57.4%.

damage is calculated as equivalent to 15% of the TWH and measured in m^3 per year.[8] CD is calculated using the following equation:

Equation 4.1.3: $CD = TWH \times 0.15$

Parameters

CD	Collateral damage within EFA ($m^3\ yr^{-1}$)
TWH	Total Wood Harvested within EFA ($m^3\ yr^{-1}$)

4.1.4 Step 4 – Above Ground Biomass Emitted (AGBE)

Above Ground Biomass Emitted (AGBE) represents the total above ground deadwood caused by logging in Rotation 1 is calculated as the sum of the total wood harvested and the collateral damage for Rotation 1. Note that AGBE is calculated for Rotations 2 and 3 using default values based on Rotation 1.

Above ground biomass emitted is and measured in m^3 per year and is calculated using the following equation:

Equation 4.1.4: $AGBE = TWH_{TOT} + CD$

Parameters

AGBE	Above ground biomass emitted within EFA ($m^3\ yr^{-1}$)
CD	Collateral damage within EFA ($m^3\ yr^{-1}$)
TWH_{TOT}	Total Wood Harvested all species within EFA ($m^3\ yr^{-1}$)

4.1.5 Step 5 – Below Ground Biomass Emitted (BGBE)

Below Ground Biomass Emitted (BGBE) represents the below ground live biomass (roots) killed by logging (the roots of target and non-target trees killed in a logging operation) and is calculated by means of a default factor for Rotation 1. The IPCC ratio of below-ground biomass to above ground biomass for tropical rainforest is 0.37[9]. The default factor used in this methodology is 0.37 of AGBE and is calculated using the following equation:

[8] Based on Kilkki, R. 1992. Reduction of wood waste by small-scale log production and conversion in tropical high forest. FAO. ISSN: 1014-9945. Available here: http://www.fao.org/docrep/u7890E/u7890E00.htm. Calculated from Table 3 in this study and taking the trees (>20cm BHD) damaged per ha (21.2) as a percentage of total trees per ha (119.4).

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

Equation 4.1.5: $BGBE = AGBE \times 0.37$

Parameters

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

There is one exception to this default rule: When the target tree species for commercial timber harvesting in the baseline includes species known to sprout from stumps. When such species are present in the timber harvesting plan Project Proponents 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.

4.1.6 Step 6 – Total Emitted Wood Volume in Cubic Metres (TM3)

Total Emitted Wood Volume for Rotation 1 in cubic meters (TM3) represents the volume of above ground and below ground live wood volume that is killed as a result of logging.

TM3 is the sum of AGBE and BGBE and is calculated using the following equation:

Equation 4.1.6: $TM3 = AGBE + BGBE$

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 ($m^3\ yr^{-1}$)

4.1.7 Step 7 – Gross Total Emissions in tCO_2e (GTCO2)

Gross Total Emissions in tCO_2e for Rotation 1 (GTCO2) is calculated by means of converting TM3 (cubic meters) to tCO_2e using the following procedure:[10] 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

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

4.1.7a Convert Green Wood Volume To Dry Tonnes Of Wood

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

Equation 4.1.7a: 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})

4.1.7b Calculate Carbon Content Of Dry Wood

The carbon fraction for conversion of dry wood to carbon in this methodology is 0.49[11]. The conversion is calculated as follows:

Equation 4.1.7b: TTC = DW x 0.49

Parameters

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

4.1.7c 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 4.1.7c: GTCO2 = TTC x 3.66

Parameters

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

4.1.7d Summary: Convert m^3 Of Moist Biomass To Total CO_2e Emissions

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

Equation 4.1.7d: GTCO2 = ((TM3 x DW) x 0.49) x 3.66

Parameters

GTCO2	Total (gross) CO_2e emissions within EFA calculated for Rotation 1 (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})
0.49	Carbon fraction for tropical rainforest (wood only)
44/12	Mass ratio of CO_2e to C

[11] Carbon fraction for Tropical Rainforest (wood ≥ 10cm dbh) IPCC (2006) Vol 4. Ch.4, p48.

4.1.8 Step 8 – Gross Baseline Emissions For Rotation 1 (GBE_{R1})

Gross Baseline Emissions for Rotation 1 (GBE_{R1}) is calculated by subtracting the removals sequestered into the long term Wood Products pool for Rotation 1 ($ltWP_{R1}$) from GTCO2 and is represented in the following equation:

Equation 4.1.8: $GBE_{R1} = GTCO2 - ltWP_{R1}$

Parameters

GTCO2	Gross Total CO_2e emissions within EFA calculated for Rotation 1 ($tCO_2e\ yr^{-1}$)
$ltWP_{R1}$	Sequestration into long term Wood Products pool for Rotation 1 ($tCO_2e\ yr^{-1}$)

4.1.9 Step 9 – Sequestration into Long Term Wood Products for Rotation 1 ($ltWP_{R1}$)

Removals sequestered into the long-term Wood Products pool for Rotation 1 ($ltWP_{R1}$) 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[12], using the following steps:

Step A: Calculate the biomass carbon of the commercial volume extracted prior to or in the process of timber harvesting as follows:

i. Calculating the recoverable sawlog volume extracted in a commercial logging baseline for a time period (HR = Harvest Rate) (see 4.1.1 Step 1 above)
ii. Adding the above ground waste wood (crown and branches) by multiplying the Harvest Rate by a residue factor (default) to derive the Total Wood Harvested (TWH) (see 4.1.2 Step 2 above).
iii. Adding a Collateral Damage (CD) factor (another default) to account for damage to non-target trees (see 4.1.3 Step 3 above).
iv. Dividing the total biomass carbon from (i), (ii) and (iii) by the area of the stratum to convert to on a per hectare basis ($AGBE_{ha}$) (m^3ha^{-1})

This calculates the volume of Above Ground Biomass Emitted (AGBE) per hectare for the eligible forest area for Rotation 1. This biomass volume ($AGBE_{ha}$) is then used for determining $C_{XB,ty,i}$ in Step E (Equation 4.1.9) below.

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

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 $AGBE_{ha}$ 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 4.1.7(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 4.1.9 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 for Rotation 1 ($C_{WP,i}$).

Equation 4.1.9:

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

Parameters

$C_{WP,i}$	Carbon stock in long-term wood products pool (stock remaining in wood products after 100 yrs) from stratum *i* post harvest in Rotation 1; ($tCO_2e\ ha^{-1}$)
$C_{XB,ty,i}$	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

4.1.10 Step 10 – Net Baseline Emissions For Rotation 1 (NBE_{R1})

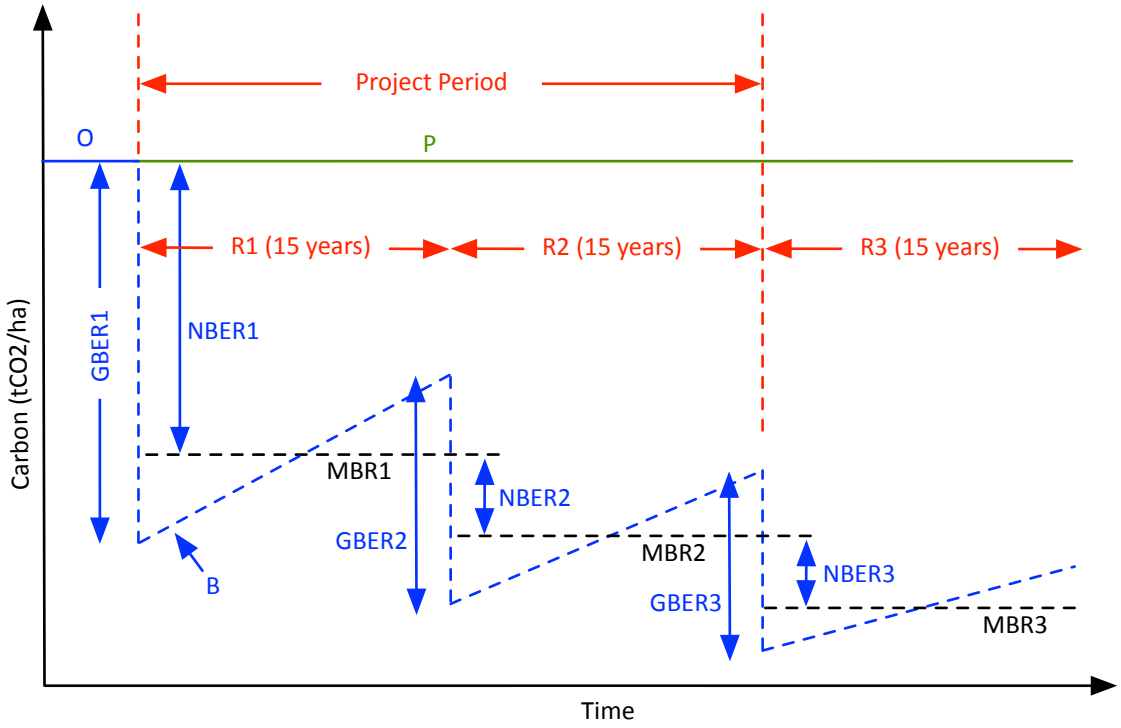
Net Baseline Emissions for Rotation 1 (NBE_{R1}) is equal to the carbon stock change as a result of:

a. Baseline emissions from timber harvests in Rotation 1 (Gross Baseline Emissions – GBE_{R1})
   minus
b. Sequestration into the Long Term Wood Products pool for Rotation 1 ($ltWP_{R1}$)
   minus
c. Baseline Removals (BR) from enhanced forest regrowth in harvest patches for each rotation in the baseline (R1, R2, and R3).

This methodology assumes that the timber harvest regime in the baseline will follow a recurring rotation with a degrading mean carbon stock when logging is unsustainable.

There are two baseline scenario variants depending on the original condition of the forest (see Figures 4.1.10a,b 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.

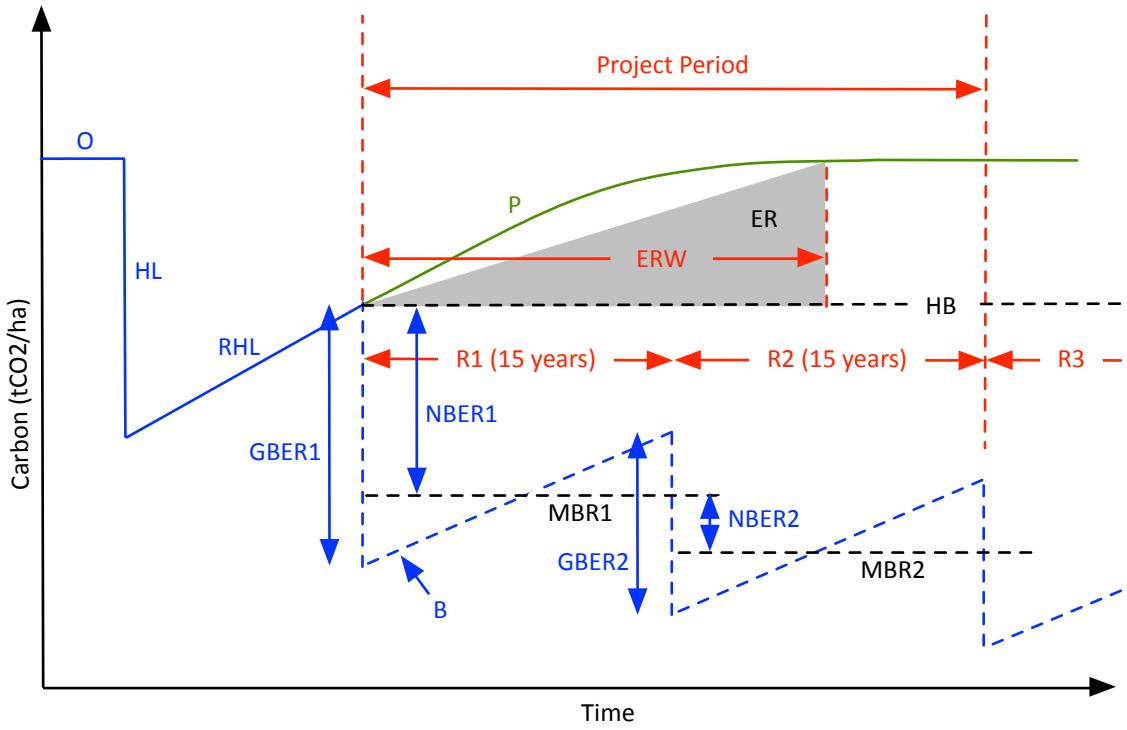
Figure 4.1.10a. Variant 1 - Concept diagram: IFM-LtPF$_{ULF}$ in unlogged (old growth) forest.



Key:

	O =	Original mean carbon stocks in old growth undisturbed forest
	B =	Baseline Scenario carbon stocks under timber harvesting regime (harvest/regrowth)
	P =	Project Scenario carbon stocks under forest protection regime
	MB_{R1} =	Mean Baseline carbon stocks during Rotation 1
	MB_{R2} =	Mean Baseline carbon stocks during Rotation 2
	MB_{R3} =	Mean Baseline carbon stocks during Rotation 3
	GBE_{R1} =	Gross Baseline Emissions during Rotation 1
	GBE_{R2} =	Gross Baseline Emissions during Rotation 2
	GBE_{R3} =	Gross Baseline Emissions during Rotation 3
	NBE_{R1} =	Net Baseline Emissions during Rotation 1
	NBE_{R2} =	Net Baseline Emissions during Rotation 2
	NBE_{R3} =	Net Baseline Emissions during Rotation 3

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



Key:

	O =	Original mean carbon stocks in old growth undisturbed forest
	HL =	Historical logging
	RHL =	Regeneration following historical logging
	B =	Baseline Scenario carbon stocks under timber harvesting regime (harvest/regrowth)
	P =	Project Scenario carbon stocks under forest protection regime
	HB =	Harvest Baseline (carbon stocks at start of harvest regime)
	MB_{R1} =	Mean Baseline carbon stocks during Rotation 1
	MB_{R2} =	Mean Baseline carbon stocks during Rotation 2
	MB_{R3} =	Mean Baseline carbon stocks during Rotation 3
	GBE_{R1} =	Gross Baseline Emissions during Rotation 1
	GBE_{R2} =	Gross Baseline Emissions during Rotation 2
	GBE_{R3} =	Gross Baseline Emissions during Rotation 3
	NBE_{R1} =	Net Baseline Emissions during Rotation 1
	NBE_{R2} =	Net Baseline Emissions during Rotation 2
	NBE_{R3} =	Net Baseline Emissions during Rotation 3
	ER =	Enhanced Removals (Project Scenario)
	ERW =	Enhanced Removals Window (Project Scenario)

Baseline carbon stocks in both variants of the IFM-LtPF activity type reduce in a step-wise fashion in baseline modelling to capture the change in mean carbon stocks for each baseline rotation. In reality the baseline carbon stocks more closely follow the saw-tooth pattern of harvest and regrowth shown in the dashed blue line in Figures 4.1.10a and 4.1.10b. To simplify carbon accounting, carbon stock reduction in each baseline rotation is represented by the steps from one Mean Baseline position to another (O to MBR1; MB_{R1} to MB_{R2} etc).

The net reduction in carbon stocks in each baseline rotation ($NBE_{R1,R2,R3}$) is represented as a single event (and rewarded as a single credit issuance in the project scenario) because each reduction in mean carbon stocks (when averaged over each rotation), occurs (in this methodology) as a single carbon accounting event.

The left hand vertical dotted blue line in Figure 4.1.10a & b above represents the first baseline timber harvest event in the baseline harvest rotation. This is represented as instantaneous when in practice it is likely to occur over perhaps a 5-year period. In practice the emissions from the first rotation timber harvest will reduce the carbon stocks represented by the full length of the left hand vertical dotted blue line in Figures 4.1.10a & b. This blue dotted line represents Gross Baseline Emissions for Rotation 1 (GBE_{R1}). GBE_{R1} is larger than NBE_{R1}. This is because NBE_{R1} represents the mean carbon stock change averaged over the entire first rotation rather than the actual emissions from baseline harvesting at the beginning of the rotation.

The key point here is that we need to account for Baseline Removals (i.e. sequestration after timber harvesting) as well as Baseline Emissions (from timber harvesting) when calculating Net Baseline Emissions (i.e. Gross Baseline Emissions minus Baseline Removals). Instead of trying to model the actual blue dotted line as it goes up and down the saw tooth of harvest and regrowth, we can do a simpler (and conservative) form of carbon accounting by estimating the average carbon stocks for the entire first rotation (MB_{R1}).

The black line MB_{R1} runs half way across the diagonal line B in Rotation 1 (R1) in Figures 4.1.10a & b. Half of the blue dotted line is below MBR1 and half is above MBR1. Here the portions below and above MBR1 cancel each other out. This enables the modelling of the mean carbon stocks for Rotation 1 (R1) as a flat line.

The mean carbon stock change volume (Net Baseline Emissions Avoided in Rotation 1 - NBEAR1) delimited between HB and MBR1 is modelled conservatively at 75% of GBER1. NBEAR2 is modelled conservatively as 25% of NBEAR1, and NBEAR3 is modelled conservatively as 50% of NBEAR2. The mean carbon stocks keep reducing in each rotation because the baseline timber harvesting operation is not sustainable and would follow a reducing timber stock baseline, as the forest degrades through time in the baseline scenario.

Each timber harvesting rotation in the baseline scenario is modelled as a 20-year cycle.

Net Baseline Emissions (NBE) is calculated by the following equation:

Equation 4.1.10a: $NBE = \sum NBE_{R1,2,3}$

Parameters

NBE_{R1}	Net baseline emissions within EFA for Rotation 1 ($tCO_2e\ yr^{-1}$) (+ve number)
NBE_{R2}	Net baseline emissions within EFA for Rotation 2 ($tCO_2e\ yr^{-1}$) (+ve number)
NBE_{R3}	Net baseline emissions within EFA for Rotation 3 ($tCO_2e\ yr^{-1}$) (+ve number)

Net Baseline Emissions for each Rotation ($NBE_{R1,2,3}$) is calculated by the following equations:

Equation 4.1.10b:

$$NBE_{R1} = (GBE_{R1} \times 0.75)$$
$$NBE_{R2} = (NBE_{R1} \times 0.25)$$
$$NBE_{R3} = (NBE_{R2} \times 0.5)$$

Parameters

NBE_{R1}	Net baseline emissions within EFA for Rotation 1 ($tCO_2e\ yr^{-1}$) (+ve number)
NBE_{R2}	Net baseline emissions within EFA for Rotation 2 ($tCO_2e\ yr^{-1}$) (+ve number)
NBE_{R3}	Net baseline emissions within EFA for Rotation 3 ($tCO_2e\ yr^{-1}$) (+ve number)
GBE_{R1}	Gross baseline emissions within EFA for Rotation 1 ($tCO_2e\ yr^{-1}$) (+ve number)

When calculating the carbon benefits associated with implementation of the project scenario, the name NBE_{Rx} is converted into Net Baseline Emissions Avoided ($NBEA_{Rx}$).

4.1.10.1 Baseline Emissions Across Project Periods

Projects extending to additional Project Periods need to model a realistic baseline timber harvest and emissions scenario based on the baseline assertion in the first project period. Forest degradation baselines imply that commercially viable timber harvesting can only realistically continue for a relatively small number of rotations due to the decline in standing timber volume.

This Technical Specifications Module requires the demonstration of commercially viable baseline timber harvesting, which in turn forms the basis of avoided emissions assertions in the Project Scenario. If the baseline modelling indicates that commercial timber harvesting is unlikely to be economically viable after a number of baseline timber harvest rotations following the project start date (e.g. after 3 baseline harvest rotations) then any continuation of carbon crediting with carbon accounting integrity requires the application of the Improved Forest Management – Degraded to Protected Forest (IFM-DtPF) activity type and associated Technical Specifications Module.

In practice this may mean that the second project period involves the application two TS Modules sequentially with this TS Module (IFM-LtPF) for the first 15 years of the second Project Period (3rd baseline timber harvest rotation since the project start date), followed by the application of the IFM-DtPF TS module for the second 15 years of that 30-year Project Period. In practice, this will encompass a very low avoided emissions credit volume per ha for the third (and final) baseline timber harvest rotation (years 31-45) combined with Enhanced Removals, followed by Enhanced Removals only in years 46-60.

Crediting for avoided emissions can resume only when modelled forest regeneration (starting with the end of the last baseline timber harvest rotation) "grows" sufficient commercial timber to justify a realistic resumption to commercial logging, based on costs and prices at that future date. If for example, the Modelled Sequestration Rate (MSR) (see Section 5.1.1 and 5.1.2) indicates that the forest will have recovered sufficient commercial timber stock to justify a resumption in commercial timber harvesting 80 years following the

end of the commercial timber harvesting, then avoided emissions crediting can resume at that time. In the mean time carbon crediting can only be awarded for enhanced removals until the end of the first Enhanced Removals Window. With the modelled resumption of logging and avoided emissions, a new Enhanced Removals Window is assigned for its second cycle and the cycle of avoided emissions and enhanced removals runs for a second time.

A significant practical challenge for Project Coordinators is to be in a position to offer the forest owners a realistic incentive to continue the project for a second Project Period when there may be very real commercial incentives not to. This is because the first project period will have grown the actual commercial timber stocks by a 30-year margin increasing the commercial value per ha for logging. At the same time, the end of the first 30-year Project Period may also culminate in the end of legal protection of the project forests, thus allowing forest owners to seriously reconsider the option of commercial logging. This poses a very real threat to the investment made by carbon buyers during the first Project Period (even though they knew that credits purchased were only protecting the forest for 30 years). It also poses a threat to the ecological infrastructure and associated suite of ecosystem services (biodiversity, downstream water quality, flood mitigation, drought mitigation, climate resilience) that has been enhanced in that 30-year period.

Clearly, to succeed in enabling projects to run for more than one Project Period, sufficient attention needs to be given to the incentive package offered to forest owners for the next project period. The headwinds include a reduced number of credits able to be issued to the project in the second Project Period (i.e. enhanced removals only and only for logged forest land parcels), and concurrently an increase in the commercial incentive to log the forest due to the increased volume of commercial timber.

To maintain carbon accounting integrity it would not be safe to issue a renewed volume of avoided emissions credits at the start of Project Period 2 (even though there is a very real threat of renewed emissions), simply because this would issue credits for emissions that had already been avoided or removed in the first Project Period. One way around this is to reward forest owners for enhancing the value of the ecological infrastructure under their stewardship, by issuing non-carbon PES certificates based on that value enhancement (e.g. biodiversity, water quality, flood mitigation, drought mitigation, climate resilience). This will be contingent on measurement, reporting and verification of these value enhancements and the location of buyers with an appetite for units representing them. This could also be combined with marketing efforts capable of commanding a premium for carbon credits issued. Project Coordinators, therefore, are required to prepare a strategy for supporting project recruitment into subsequent Project Periods by the mid point of the current Project Period, and update this strategy as required in each monitoring report thereafter until the end of the current Project Period.

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 4.1.8b depicts a grey triangle representing 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) (see Section 5.1.2).

5.1.1 Step 11 – 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 Modelled Sequestration Rate ($tCO_2e\ ha^{-1}\ yr^{-1}$) for the Removals Period for the particular forest type. Determination of the Modelled Sequestration Rate (MSR) for each forest type involves calculating the mean sequestration rate, assuming linear sequestration from time zero (t_i) (i.e. point of transition from non-forest to forest in the model) to the point when the sequestration rate becomes zero at forest maturity (t_{ii}) (see Figure 5.1.2a). The Modelled Sequestration Rate (MSR) for the project forest type/s is determined from localised data where available, or from national defaults, or regional (IPCC or FAO) defaults if localised data is unavailable. Where regional and or national defaults are used, projects are required to:

a. Apply a conservativeness factor sufficient to account for the larger error margin in regional and/or national data, and
b. Improve data quality through time by applying more localised data as it becomes available through project-specific data gathering, with the first MSR revision required at the second baseline revision (10 years after the project start date).

Net Project Emissions (NPE_{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} x MSR_{FT1} ($tCO_2e\ yr^{-1}$)
$\sum ER_{FT2}$	Sum of Enhanced Removals for Forest Type 2 areas within EFA = EFA_{LF} x MSR_{FT2} ($tCO_2e\ yr^{-1}$)
$\sum ER_{FT3}$	Sum of Enhanced Removals for Forest Type 3 areas within EFA = EFA_{LF} x MSR_{FT3} ($tCO_2e\ yr^{-1}$)
MSR_{FT1}	Modelled sequestration rate for Forest Type 1 ($tCO_2e\ yr^{-1}$)
MSR_{FT2}	Modelled sequestration rate for Forest Type 2 ($tCO_2e\ yr^{-1}$)
MSR_{FT3}	Modelled sequestration rate for Forest Type 3 ($tCO_2e\ yr^{-1}$)

An example of a regional default is the IPCC default value for carbon sequestration in tropical rainforest for the region Asia (other) set at $11.78tCO_{2e}ha^{-1}yr^{-1}$ - assuming a 0.47 carbon fraction (wood and foliage) (IPCC 2006, Ch 4, p 4.59 – Table 4.10) – see equation 5.1.1b.

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

Equation 5.1.1b: $ER_{Si} = (((NDM * RSR) * 0.47) * 3.66) * Area_{Si}$

Parameters

ER_{Si}	Enhanced Removals for Stratum i within EFA ($tCO_2e\ yr^{-1}$) –ve number to denote removal
NDM	Net annual above ground dry matter increment ($t\ yr^{-1}$) for tropical rainforest in region Asia (other) (IPCC 2006, Ch 4, Table 4.10, p4.59)
RSR	Root:Shoot ratio for tropical rainforest (IPCC 2006, Ch4, Table 4.4, p4.49)
0.47	Carbon fraction for tropical rainforest (wood & foliage) (IPCC 2006, Ch 4, Table 4.3, p4.48)
3.66	Conversion of carbon to CO_2
$Area_{Si}$	Area of Stratum *i* (ha)

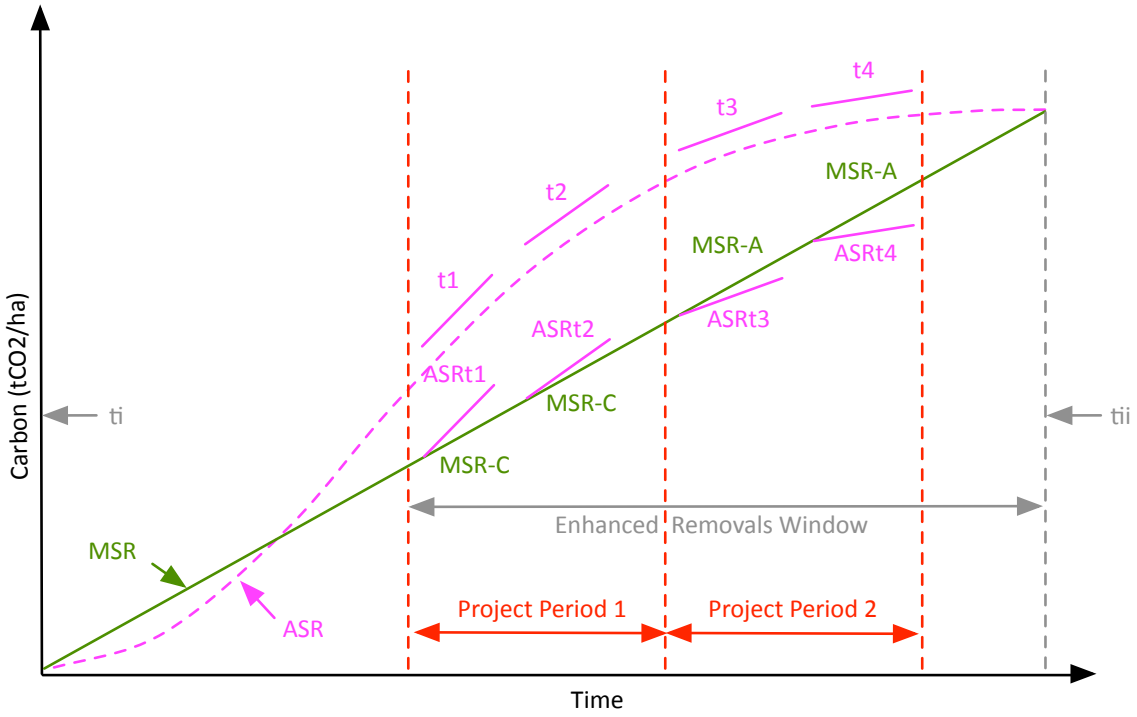
5.1.2 Step 12 – Enhanced Removals Window (ERW)

Enhanced Removals applies only to eligible forest in Logged Forest land parcels. The Enhanced Removals Window extends from the beginning of the first Project Period to the point at which the estimated actual sequestration rate reaches zero (i.e. the estimated point at which the regenerating forest has reached maturity in terms of biomass saturation).

Under the growth curve of a regenerating forest, growth rates begin slowly, increase to their highest rate for a period during the middle of the regeneration process (i.e. the steepest part of the sequestration curve) and then declines as regenerating forest approaches maturity. But a linear MSR is applied in this methodology for purposes of crediting. As can be seen in

Figure 5.1.2a the Modelled Sequestration Rate is conservative in comparison with the Actual Sequestration Rate during early and middle stages of regeneration, but aggressive during later stages of regeneration.

Figure 5.1.2a Modelling Enhanced Removals across two project periods



Key:

MSR =	Modelled Sequestration Rate (mean sequestration rate t_i-t_{ii}) (where t_i = 0; t_{ii} = end of ERW in this example).
ASR =	Actual Sequestration Rate.
t1, t2, t3, t4 =	Time period 1, Time period 2, Time period 3, Time period 4. t1-t4 are associated with a carbon sequestration rate for that time period represented by a short pink line showing alignment with the Actual Sequestration Rate.
ASR1 =	Actual Sequestration Rate at Time period 1 dropped down to visually connect with the MCS line for comparison of the angle of these lines (sequestration rate).
ASR2 =	Actual Sequestration Rate at Time period 2 " "
ASR3 =	Actual Sequestration Rate at Time period 3 " "
ASR4 =	Actual Sequestration Rate at Time period 4 " "
MPSR-C =	Modelled Sequestration Rate is Conservative.
MPSR-A =	Modelled Sequestration Rate is Aggressive.

In Figure 5.1.2a the under-allocation of credits in time periods 1 and 2 are cancelled out by over-allocation of credits in time periods 3 and 4. When time periods 3 and 4 occur in a subsequent project period, the project can only benefit from the balancing of conservative and aggressive credit allocation if the project continues for longer than one project period. Furthermore, the second Project Period is required to apply the same MSR as the first Project Period unless a baseline revision involves a revision of the MSR (see below).

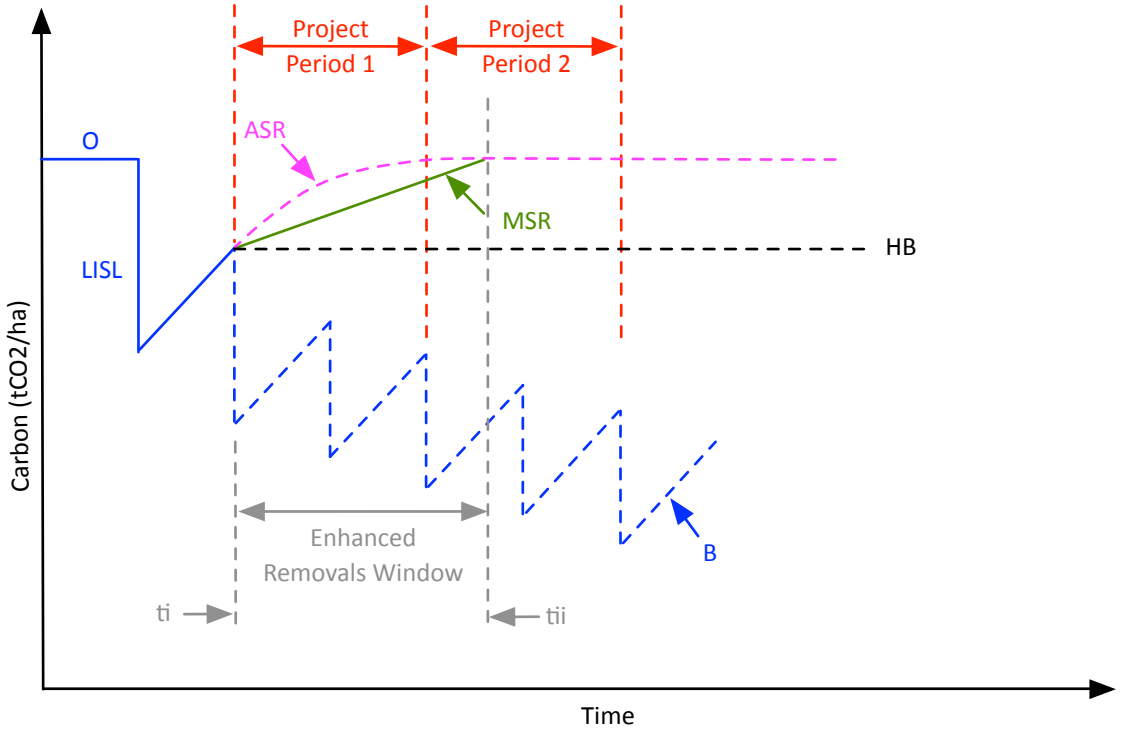
Note that high intensity selective logging in several Pacific Island countries is commonly followed by site invasion by invasive herbaceous vine thicket that impedes natural regeneration by creating unfavourable growing conditions for woody vegetation due to aggressive light harvesting and smothering by vines (*Meremia sp*.). For this reason it is justifiable to calculate the project MSR by modelling linear sequestration between t_i time zero (the start of modelled regeneration from non-forest) and t_{ii} the end of the regeneration process when the rate of sequestration becomes zero at forest maturity. This approach to enhanced removals is particularly relevant to baseline situations involving conventional logging where commonly 80% or more of the standing biomass is harvested during logging, resetting the regeneration clock back to a relatively early stage in the regeneration cycle.

A different approach to calculating the MSR is applied if the following two criteria are met:

1. The original condition of the project forest (i.e. immediately prior to both the project and the baseline activities) is a relatively mature regenerating forest, and
2. The baseline activity comprises low intensity selective logging (harvesting ≤40% of standing biomass).

Under these conditions projects are required to calculate the Modelled Sequestration Rate (MSR) as the mean sequestration rate between two time periods (t_i to t_{ii}) as before, but where t_i corresponds with the beginning of baseline timber harvesting (see Figure 5.1.2b).

Figure 5.1.2b Calculating MSR for low intensity logging baseline in late succession forest.



Key:

MSR =	Modelled Sequestration Rate (mean sequestration rate t_i-t_{ii}) where t_i = 0; t_{ii} =
ASR =	Actual Sequestration Rate.
O =	Original forest prior to historical low intensity selective logging
LISL =	Low intensity selective logging
B =	Baseline scenario
HB =	Harvest Baseline
ti =	Beginning of Modelled Sequestration Rate growth curve (start of ERW in this example)
tii =	End of Enhanced Removals Window (ERW) when sequestration rate becomes zero

5.1.2.1 Revising Baselines

There is opportunity for revising the Modelled Sequestration Rate (MSR) during baseline revisions. If the revised MSR applied is higher than the pre-revision MSR, *ex post* adjustment to prior crediting (i.e. additional credits issued to account for eligible credits not awarded) is permitted. This is because the pre-revision MSR proved overly conservative. If the revised MSR is lower than the pre-revision MSR, the revised MSR will be more conservative than the previous one, and as a result it will become apparent that previous credit issuances were aggressive and in need of remedy. Under these circumstances, projects are required to calculate the over-allocation of credits issued for previous monitoring periods and subtract these from future allocations until the over-allocation is cancelled out. This rule applies within and across project periods.

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.*

Leakage in IFM projects can result from activities shifting within the project proponent's operations. It shall be demonstrated that there is no leakage to areas that are outside the project area but within the project proponent's operations, such as areas where the project proponent has ownership of, management of, or legally sanctioned rights to use forest land within the country. It shall be demonstrated that the management plans and/or land-use designations of all other lands operated by the project proponent (which shall be identified by location) have not materially changed as a result of the project activity (eg, harvest rates have not been increased or land has not been cleared that would otherwise have been set aside). Where the project proponent is an entity with a conservation mission, it may be demonstrated that there have been no material changes to other lands managed or owned by the project proponent by providing documented evidence that it is against the policy of the organization to change the land use of other owned and/or managed lands including

evidence that such policy has historically been followed.

This Technical Specifications Module requires Project Coordinators to address both activity shifting and market leakage based on the VCS AFOLU leakage requirements. This enables the derivation of Total Leakage (TLK).

5.2.1 Step 13 – 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 14 – Total Market Leakage (TML)

This Technical Specifications Module follows the GreenCollar IFM LtPF v1.0 VCS approved Methodology VM0010 (2011) for calculating Total Market Leakage (TML).

Leakage due to market effects is equal to the net emissions from planned timber harvest activities in the baseline scenario multiplied by an appropriate leakage factor:

Equation 5.2.2: $TML = NBE \times MLF$

Parameters

TML	Total market leakage ($tCO_2e\ yr^{-1}$)
NBE	Net baseline emissions ($tCO_2e\ yr^{-1}$)
MLF	Market leakage factor

The leakage factor (see Box 1) is determined by considering where in the country logging will be increased as a result of the decreased timber supply caused by the project.

If the mean carbon stock per unit area in the areas liable to be logged (e.g. outside the project area) is higher than in the project area, it is likely that additional logging will be performed in these areas as a result of reduced logging in the project area in the project scenario.

The leakage factor is thus defined as a dimensionless number with values between 0 and 1 assigned ex ante on the basis of a comparison between the mean carbon stock per unit area across all strata in the base year, and the mean national forest carbon stock per unit area for the country where the project activity will be implemented.

Projects shall present their own analysis of if and where logging is likely to be displaced to as a result of the project. This will be different for different countries depending on the location of domestic and/or international logging companies and infrastructure. It will also take into account a range of factors affecting the likelihood of a reduction of commercial timber supply caused by the project to lead to an increase in timber harvesting elsewhere in the country. Such factors include national trends in commercial indigenous timber extraction rates and associated trends in indigenous timber markets.

Box 1. Leakage Factor Determination

The leakage factor is determined by considering where in the country logging will be increased as a result of the decreased supply of the timber caused by the project. If the areas liable to be logged have a higher carbon stock than the project area it is likely that the proportional leakage is higher and vice versa:

Therefore, *MLF* = 0 if it can be demonstrated that no market-effects leakage will occur within national boundaries.

The amount of leakage is determined by where in the country's forest estate harvesting would likely be displaced. If harvesting is displaced to forests where a lower proportion of forest biomass is merchantable material from harvestable species than in the project area, then in order to extract a given volume higher emissions should be expected as more trees will need to be cut to supply the same volume.

In contrast if a higher proportion of the total biomass of commercial species is merchantable in the displacement forest than in the project forests, then a smaller area would have to be harvested and lower emissions would result.

Therefore, each project shall calculate within each stratum the proportion of total biomass in commercial species that is merchantable (PMP_i). This shall then be compared to mean proportion of total biomass that is merchantable for each forest type (PML_{FT}).

The following deduction factors (*MLF*) shall be used:

PML_{FT} *is equal (± 15%) to* PMP_i	*MLF* = 0.4
PML_{FT} *is > 15% less than* PMP_i	*MLF* = 0.7
PML_{FT} *is > 15% greater than* PMP_i	*MLF* = 0.2

Where:

PML_{FT} = mean merchantable biomass as a proportion of total aboveground tree biomass for each forest type;

PMP_i = merchantable biomass as a proportion of total aboveground tree biomass for stratum *i* within the project boundaries; and

MLF = Leakage factor for market-effects calculations; dimensionless.

Where sufficient variation exists in PMP_i relative to PML_{FT} that multiple values of *MLF* result then an area weighted final value for *MLF* shall be calculated.

5.2.3 Step 15 - Total Leakage (TLK)

Total Leakage (TLK) is the combination of Total Activity Shifting Leakage (TAL) and Total Market Leakage (TML). Total Leakage (TLK) is calculated as:

Equation 5.2.3: $TLK = TAL + TML$

Parameters

TKL	Total leakage ($tCO_2e\ yr^{-1}$)
TAL	Total activity shifting leakage ($tCO_2e\ yr^{-1}$)
TML	Total market leakage ($tCO_2e\ yr^{-1}$)

5.3 NET GREENHOUSE GAS EMISSION REDUCTIONS

Greenhouse gas emission calculations undertaken through Steps 1 to 15 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 Benefits (NPB) for each rotation in the baseline timeline.

5.3.1 Step 16 – Net Project Benefits

Net Project Benefits (NPB) is used to calculate Net Carbon Credits for the project period. NPB is calculated by subtracting Total Leakage from Enhanced Removals for each rotation in the baseline timeline.

Net Project Benefits (NPB) is calculated as:

Equation 5.3.1: $NPB_{Rx} = ER_{Rx} - TLK_{Rx}$

Parameters

NPB_{Rx}	Net project benefits within EFA for Rotation x ($tCO_2e\ yr^{-1}$)
ER_{Rx}	Enhanced Removals within EFA for Rotation x ($tCO_2e\ yr^{-1}$)
TLK_{Rx}	Total leakage for Rotation x ($tCO_2e\ yr^{-1}$)

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 either apply a default 20% buffer.

5.4.1 Step 17 – 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 each rotation in the baseline timeline for the Project Scenario are calculated using the following equation:

Equation 5.4.1a: $BUF_{NBEARx} = NBEA_{Rx} \times PBR$

Parameters

$BUFNBEA_{Rx}$	Buffer Credits associated with Net Baseline Emissions Avoided for Rotation x etc ($tCO_2e\ yr^{-1}$)
$NBEA_{Rx}$	Net Baseline Emissions Avoided for Rotation x within EFA ($tCO_2e\ yr^{-1}$)
PBR	Project Buffer Rating (dimensionless)

5.4.1.3 Buffer Credits For Net Project Benefits

Buffer Credits associated with Net Project Benefits (NPB) for each rotation in the baseline timeline for the Project Scenario are calculated using the following equation:

Equation 5.4.1b: $BUF_{NPBRx} = NPB_{Rx} \times PBR$

Parameters

BUF_{NPBRx}	Buffer Credits associated with Net Project Benefits for Rotation x ($tCO_2e\ yr^{-1}$)
NPB_{Rx}	Net Project Benefits for Rotation x 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.

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

Table 5.4.1: 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 for each rotation in the baseline timeline (Rx) 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 and cross check throughout).

5.5.1 Step 18 – Net Carbon Credits (NCC_{Rx})

Net Carbon Credits for each rotation in the baseline timeline (NCC_{Rx}) are calculated in three steps:

Step A: Subtracting the Buffer Credits associated with Net Baseline Emissions Avoided for Rotation x ($BUFNBEA_{ARx}$) from Net Baseline Emissions Avoided for Rotation x ($NBEA_{Rx}$).

Step B: Subtracting the Buffer Credits associated with Net Project Removals for Rotation x ($BUFNPR_{Rx}$) from Net Project Benefits for Rotation x (NPR_{Rx}).

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

Net Carbon Credits for each rotation is calculated using the following equation:

Equation 5.5.1: $NCC_{Rx} = (NBEA_{Rx} - BUF_{NBEARx}) + (NPR_{Rx} - BUF_{NPBRx})$

Parameters

NCC_{Rx}	Net Carbon Credits for Rotation x ($tCO_2e\ yr^{-1}$)
$NBEA_{Rx}$	Net Baseline Emissions Avoided for Rotation x ($tCO_2e\ yr^{-1}$)
$BUFNBEA_{Rx}$	Buffer Credits associated with Net Baseline Emissions Avoided for Rotation x ($tCO_2e\ yr^{-1}$)
NPR_{Rx}	Net Project Removals for Rotation x ($tCO_2e\ yr^{-1}$)
$BUFNPR_{Rx}$	Buffer Credits associated with Net Project Benefits for Rotation x ($tCO_2e\ yr^{-1}$)

Note that the duration of Rotations 1, 2 and 3 is 15 years each.

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 methodology 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: $NHH = GHH \times 0.2$

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: $NCCE = NHH \times NCC/HH$

Parameters	
NCCE	Net Carbon Credit Equivalent ($tCO_2e\ yr^{-1}$)
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: $NCC/HH = (NBEA\text{-}BUF + NPR\text{-}BUF)/NHH$

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 Harvest Rate (HR)

The core of the avoided emissions component of the baseline calculation is based on a conservative estimate of the timber volume to be logged in the baseline activity. This estimate is calculated conservatively on the basis of commercial timber volumes harvested in the baseline at 80% of the harvestable wood volume available.

7.1.2 Total Wood Harvested

Uncertainty in the calculation of TWH is addressed by applying a conservative default factor of 0.5 for the conversion of above ground biomass to sawlog. This assumes that the mean recovery rate of sawlog per above ground tree biomass is 50%. In practice, waste wood (baseline emissions) will commonly be higher than this. As such the calculation is conservative.

7.1.3 Collateral Damage

"Collateral damage" represents the non-target trees and tree limbs killed as a consequence of timber harvesting operations (including felling target trees, roading, log hauling, and skid sites). Collateral damage is conservatively calculated as equivalent to 15% of the TWH and measured in m^3 per year. This estimation is not based on published literature on this topic because no published literature was discovered during methodology development that made this calculation for forest management timber harvesting in the Pacific Islands. The Nakau Programme will endeavour to improve the accuracy of this default value in this methodology through time by seeking to discover/support/collaborate on future research that can generate Collateral Damage data from sustainable forest management timber harvesting operations.

7.1.4 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.

7.1.5 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

Conservative estimates are incorporated in the calculation of Enhanced Removals (ER) in two ways.

The first is the stratification of the Eligible Forest Area into Logged and Unlogged Forest. Only Logged Forest is eligible to claim the Enhanced Removals component of the Project Scenario carbon benefits even though unlogged forest land parcels may be carbon sinks due to the cycle of natural disturbance. To be classified as 'Logged Forest' in this methodology the forest must have been logged between 1 January 1930 and 31 December 2009, with evidence supplied to enable verification of historical logging.

The second conservativeness factor built into the calculation of Enhanced Removals is the use of default values for the Modelled Sequestration Rate that incorporates a conservativeness factor when the defaults are derived from regional or national data. The Modelled Sequestration Rate is also required to apply locally derived data within the first 10 years of the Project Period followed by a baseline revision that adjusts the MSR according to local project-specific data and accounts for any potential over-allocation of credits in previous issuances by requiring post-baseline revision crediting to be adjusted to ensure that any over-crediting of Enhanced Removals is cancelled out.

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 the Technical Specifications Module 1.1 (C) (IFM-LtPF) 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 8.1.1 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 / Timber Harvest Plan	Monitored
LF/ULF	Forest stratification (logged/unlogged forest)	ha	-	PD	Area calculated in PD
TSV	Total Standing Volume	m^3	-	Timber Harvest Plan /PD	Calculated in PD
HR	Harvest Rate	$m^3\ yr^{-1}$	-	Timber Harvest Plan/PD	Monitored Updated each Baseline Revision
TWH	Total Wood Harvested	$m^3\ yr^{-1}$	4.1.2	Timber Harvest Plan	Not monitored Updated each Baseline Revision
CD	Collateral Damage	$m^3\ yr^{-1}$	4.1.3	Default value derived from a proportion of the TWH	Not monitored Updated each Baseline Revision
AGBE	Above Ground Biomass Emitted	$m^3\ yr^{-1}$	4.1.4	Sum of TWH and CD	Not monitored Updated each Baseline Revision
BGBE	Below Ground Biomass Emitted	$m^3\ yr^{-1}$	4.1.5	Root-shoot ratio (proportion of AGBE)	Not monitored Updated each Baseline Revision
TM3	Total Emissions in m^3	$m^3\ yr^{-1}$	4.1.6	Sum of AGBE and BGBE	Not monitored Updated each Baseline Revision
GTCO2	Gross Total Emissions in tCO^2e	$tCO_2e\ yr^{-1}$	4.1.7a 4.1.7b 4.1.7c	Conversion factors from wood volume to emissions	Not monitored Updated each Baseline Revision

			4.1.7d		
GBE_{R1}	Gross Baseline Emissions Rotation 1	$tCO_2e\ yr^{-1}$	4.1.8	Conversion factors from wood products calculation	Not monitored Updated each Baseline Revision
$NBEA_{Rx}$	Net Baseline Emissions Avoided in each Rotation	$tCO_2e\ yr^{-1}$	4.1.10a 4.1.10b	Default factors based on GBE_{R1}	Not monitored 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 Updated each Monitoring Period
TAL	Total Activity Shifting Leakage	$tCO_2e\ yr^{-1}$	5.2.1	Derived from Activity Shifting Leakage Analysis	Monitored Updated each Monitoring Period
MLF	Market Leakage Factor	Dimen-sionless	Box in Section 5.2.2	Derived from Activity Shifting Leakage Analysis	Monitored Updated each Monitoring Period
TML	Total Market Leakage	$tCO_2e\ yr^{-1}$	5.2.2	Derived from Market Leakage Analysis	Not monitored Updated each Baseline Revision
ORR	Overall Risk Rating	Dimen-sionless	5.5.1	Derived from project risk assessment	Monitored 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 where possible otherwise sub-10m accuracy) to define Eligible Forest Area boundary; boundary survey inspections using GPS. 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:

	• Dendrochronology on stumps in the case of a timber harvest reversal • Dendrochronology on adjacent living trees of equivalent size of burnt stumps
Frequency of monitoring/recording:	Aerial imagery: 5-yearly Eligible Forest Boundary inspections: annually
Value monitored:	Area
Monitoring equipment:	Aerial imagery/satellite data to sub-meter accuracy 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:	**Harvest Rate (HR)**
Data unit:	m^3 ha^{-1} rotation 1^{-1}
Description:	The rate of timber harvesting in the baseline scenario for the project forest
Source of data:	Project-specific, and reference area data on tree growth rates for the relevant forest types.
Description of measurement methods and procedures to be applied:	80% of the sawlog volume (excluding branches and crown) for each timber species in the EFA for which there is sufficient standing volume to justify commercial harvesting.
Frequency of monitoring/recording:	Each baseline revision
Value monitored:	m^3
Monitoring equipment:	GPS unit, diameter tape, hip chain, vertex clinometer, increment borer
QA/QC procedures to be applied:	5-yearly 3rd party verification of Project Management Reports.
Calculation method:	Harvest Rate method in commercial timber harvest plan.

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. 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: • Records of timber harvesting activity are inspected and verified against the timber harvesting plan stated in the PD. • Timber harvesting sites are inspected to verify that they are occurring in the areas specified in the PD. 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: • Records of timber harvesting activity are inspected and annual timber harvesting volumes and species are recorded. • Timber harvesting sites are inspected to determine area of harvesting activity. • Calculations are made using the baseline GHG emissions measurement methodology in the Technical Specifications Module 1.1 (C) (IFM-LtPF), to determine the volume of Activity Shifting Leakage. • Net Carbon Credits are recalculated to account for Total Activity Shifting Leakage (TAL) • 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. 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 1.1 (C) (IFM-LtPF).

Data Unit / Parameter:	**Market Leakage Factor (MLF)**
Data unit:	Dimensionless
Description:	Leakage caused by market effects. The proportion of domestic indigenous timber supply in comparison with equivalent imported timber volumes.
Source of data:	Local data on timber supply
Description of measurement methods	Determined by considering where in the country logging will be increased as a result of the decreased timber supply caused by the

and procedures to be applied:	project.
Frequency of monitoring/recording:	5-yearly
Value monitored:	Dimensionless
Monitoring equipment:	Desktop
QA/QC procedures to be applied:	5-yearly 3rd party verification of Project Management Reports.
Calculation method:	Market Leakage factor component of the GreenCollar IFM LtPF v1.0 VCS approved Methodology VM0010 (2011).

Data Unit / Parameter:	**Overall Risk Rating**
Data unit:	Dimensionless
Description:	Risk factor used in buffer determination.
Source of data:	Various sources
Description of measurement methods and procedures to be applied:	Following the most recent version of the Verified Carbon Standard AFOLU Non-Permanence Risk Tool and elaborated in Section 5.5 of the Technical Specifications Module 1.1 (C) (IFM-LtPF). This involves assessing the following risk types: • Internal Risk • External Risk • Natural Risk The Overall Risk Rating is calculated as the aggregate risk rating for the three risk types.
Frequency of monitoring/recording:	5-yearly coinciding with each 3rd party verification.
Value monitored:	Risk Rating
Monitoring equipment:	Calculated
QA/QC procedures to be applied:	5-yearly verification 3rd party verification of Project Management Reports by 3rd party verifier.
Calculation method:	Following calculation method specified in Section 5.5 of the Technical Specifications Module 1.1 (C) (IFM-LtPF).
Responsibility:	Project Owner or delegated entity (e.g. Project Coordinator)

8.1.3 Monitoring Roles And Responsibilities

Specific project monitoring roles for projects applying the Technical Specifications Module 1.1 (C) (IFM-LtPF) 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 the Technical Specifications Module 1.1 (C) (IFM-LtPF) 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 the Technical Specifications Module 1.1 (C) (IFM-LtPF) 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 Direct Measurement Of Forest Carbon Stock Change

This Technical Specifications Module is based initially on the use of default values for carbon stock change measurement, empirical measurement of the total standing volume as part of the timber harvest plan for the baseline calculation, a series of conservative conversion factors, and defaults derived from national and regional data sets.

All projects will be required to increase the locally-specific data used for baseline and project carbon stock change calculations, as sub-national (locally specific) and project-specific data becomes available.

Each project applying this Technical Specifications Module is required to use carbon stock change data derived from the relevant strata and forest type, specific to the biome within which that project is located. Until default data is available for the biome in which the project is located, each project is required to generate data from Permanent Sample Plots (PSPs). This project-specific data will contribute to the generation of defaults specific to that biome.

The measurement of PSPs will use the PSP methodology adopted by the host government in its national forest carbon monitoring programme (if one exists). Where a national forest carbon monitoring programme does not exist, projects shall use a PSP methodology that has been adopted in the national forest carbon monitoring programme of another nation that has the same biome types.

Until defaults specific to the relevant biome are available, projects are required to establish PSPs in three strata:

1. Canopy gaps.
2. Closed canopy in regenerating tall forest (if present).
3. Old-growth forest patches in old growth (no longer regenerating) forest (if present).

Parameters to be measured are those specified in the carbon pools used by this Technical Specifications Module (Section 2) (excluding below ground live biomass which will continue to use default values).

The specific methodologies for measuring project-specific carbon sequestration rates will be consistent with the requirements of IPCC Tier 3 forest carbon stock measurement.

8.1.8 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.

8.1.9 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. These quality controls need to include:
    - Evidence of adherence to the Project Monitoring Plan
    - Monitoring supervision and training provided to the Project Coordinator and the Project Owner by a suitably qualified forest carbon inventory expert for the first project monitoring exercise
    - On-going monitoring supervision and training provided to the Project Owner by the Project Coordinator once the latter has demonstrated its competence in forest carbon inventory
    - Technical Review of draft monitoring data by a suitably qualified forest carbon inventory expert prior to submission of Project Monitoring Reports to the Programme Operator.

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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
Avoidable Reversal	A Reversal arising from the negligence, or willful breach of the Programme Documents by the Project Owner, or from a third party properly exercising rights under an agreement or a legal interest in the Project Area.
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_2tonnes 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
Reversal	An event that materially reverses GHG Reductions in the Project Area.
Removals	Carbon sequestered from the atmosphere into a carbon sink
SFM	Sustainable Forest Management
Unavoidable Reversal	A Reversal that is not an Avoidable Reversal.
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.