

“REDD Methodology Framework” – REDD-MF

Version - April 2010

I. GENERAL GUIDANCE

Scope

This 'REDD Methodology Framework' is the basic structure of a modular REDD methodology. It provides the generic functionality of the methodology, which frames pre-defined VCS-approved modules and tools that perform a specific function. It constitutes, together with the modules and tools it calls upon, a complete VCS-approved REDD baseline and monitoring methodology.

The modules and tools called upon in this document are applicable to project activities that reduce emissions from planned (APD) and unplanned (AUDD) deforestation, and for activities to reduce emissions from forest degradation.

This Framework follows the structure and procedural steps as defined in the latest version of the VCS “Tool for AFOLU Methodological Issues”.

The reference to this Framework and the modules used to construct the project-specific methodology shall be given in the VCS-PD.

Definitions

Current VCS definitions apply for:

Forest, Deforestation, Forest Degradation, Avoiding Planned Deforestation (APD) and Avoiding Unplanned Deforestation and Degradation (AUDD)

Reference Period refers to the historical period prior to the project start date that serves as the source of data for defining the baseline.

Baseline Period refers to the period of time with a fixed baseline (typically 10 years)

Modules and tools

Module: Component of a methodology that can be applied on its own to perform a specific task.

Tool: Guideline or procedure for performing an analysis (e.g., “Determination of the significance of emissions sources and changes in carbon stocks in REDD project activities”) or to help use or select a module or methodology.

This Framework uses the following VCS-approved modules and tools:

Carbon Pool Modules:

- CP-AB** “Estimation of carbon stocks and changes in carbon stocks in the above- and below-ground biomass carbon pools”
- CP-D** “Estimation of carbon stocks and changes in carbon stocks in the dead-wood carbon pool”
- CP-L** “Estimation of carbon stocks in the litter carbon pool”
- CP-S** “Estimation of carbon stocks in the soil organic carbon pool”
- CP-W** “Estimation of carbon stocks and changes in carbon stocks in the wood products carbon pool”

Baseline Modules:

- BL-PL** “Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation”
- BL-UP** “Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation”
- BL-DFW** “Estimation of baseline emissions from forest degradation caused by extraction of wood for fuel”

Leakage Modules:

- LK-ASP** “Estimation of emissions from activity shifting for avoided planned deforestation”
- LK-ASU** “Estimation of emissions from activity shifting for avoided unplanned deforestation”
- LK-ME** “Estimation of emissions from market-effects leakage”
- LK-DFW** “Estimation of emissions from displacement of fuel wood extraction”

Emissions Modules (applicable to baseline, project scenario and leakage):

- E-BB** “Estimation of non-CO₂ emissions from biomass burning”
- E-FFC** “Estimation of emissions from fossil fuel combustion”
- E-NA** “Estimation of direct N₂O emissions from nitrogen application” – latest CDM-EB approved version

Monitoring Module:

- M-EXP** “Monitoring for ex-post monitoring of greenhouse gas emissions and removals”

Miscellaneous Modules:

- X-STR** “Methods for stratifying the project area of REDD project activities”
- X-UNC** “Estimation of uncertainty for REDD project activities”

Tools:

- T-SIG** “Determination of the significance of emissions sources and changes in carbon stocks in REDD project activities”
- T-AMI** VCS “Tool for AFOLU Methodological Issues” – latest VCS-approved version
- T-ADD** “Tool for the Demonstration and Assessment of Additionality in REDD Project Activities”
- T-BAR** “Tool for AFOLU non-permanence risk analysis and buffer determination” – latest VCS-approved version

REDD projects under the Methodology Framework are divided between three broad activity types: unplanned deforestation, planned deforestation and forest degradation through collection of wood for fuel and production of charcoal. A single project may include one, two or all three of these activity types. In table 1 the modules and tools are listed and it is indicated when use of modules/tools are mandatory under each activity type. The tool **T-SIG** should be used to justify the omission of carbon pools and emission sources.

Table 1. List of modules/tools and determination of when module/tool use is mandatory (M) or optional (O).

		Unplanned Deforestation	Planned Deforestation	Degradation (Fuel Wood / Charcoal)
Always Mandatory	REDD-MF	M	M	M
	M-EXP	M	M	M
	T-ADD	M	M	M
	T-BAR	M	M	M
	X-UNC	M	M	M
	X-STR	M	M	M
Baselines	BL-UP	M	-	-
	BL-PL	-	M	-
	BL-DFW	-	-	M
Leakage	LK-ASU	M	-	-
	LK-ASP	-	M	-
	LK-DFW	-	-	M
	LK-ME	(m) ¹	(m) ¹	(m) ²
Pools*	CP-AB	M	M	M
	CP-D	(m) ³	(m) ³	(m) ³
	CP-L	O	O	O
	CP-S	O	O	O
	CP-W	(m) ¹	(m) ¹	-
Emissions*	E-BB	M	M	M
	E-FCC	O	O	O
	E-NA	O	O	O

M Modules marked with an M are fully mandatory, the indicated modules and tools must be used

O Modules marked with an O are fully optional, the indicated pools and sources can be included or excluded as decided by the project but if included in the baseline they must also be included in the with-project scenario

(m)¹ Mandatory where the process of deforestation involves timber harvesting for commercial markets

(m)² Mandatory where fuel wood or charcoal is harvested for commercial markets

(m)³ Mandatory if greater in baseline (post-deforestation/degradation) than project scenario and significant, otherwise can be conservatively omitted

* The tool **T-SIG** should be used to justify the omission of carbon pools and emission sources

Applicability Conditions

This REDD Methodology Framework is applicable to all project activities that fall within the AFOLU project category “REDD” as defined in the latest version of the VCS AFOLU Guidance document. By choosing the appropriate modules, a project-specific methodology can be constructed. The justification of the choice of modules and why they are applicable to the proposed project activity shall be given in the VCS-PD.

Specific applicability conditions exist for each module and must be met for the module to be used.

This methodology includes forest degradation caused only by extraction of wood for fuel. No modules are included for activities to reduce emissions from forest degradation caused by illegal harvesting of trees for timber¹.

Use of the methodology framework is subject to the following applicability conditions:

All Activity Types

- Land in the project area has qualified as forest at least 10 years before the project start date (VCS 2007.1, 2008 p 16)
- Project proponents must be able to show control over the project area and ownership of carbon rights for the project area
- Baseline deforestation and baseline forest degradation in the project area fall within one or more of the following categories:
 - Unplanned deforestation
 - Planned deforestation
 - Degradation through extraction of wood for fuel (fuelwood and charcoal production)

¹ Illegal timber harvest may be occurring in the project area in the baseline but conservatively no benefit can be calculated for preventing timber harvests and any emissions arising from timber harvests in the with-project case shall be monitored and deducted from calculated project net emission reductions

- All land areas registered under the CDM or under any other carbon trading scheme (both voluntary and compliance-orientated) must be transparently reported and excluded from the project area. The exclusion of land in the project area from any other carbon trading scheme shall be monitored over time and reported in the monitoring reports
- If land is not being converted to an alternative use but will be allowed to naturally regrow (i.e. temporarily unstocked), this framework shall not be used
- Leakage avoidance activities shall not include:
 - Agricultural lands that are flooded to increase production (e.g. paddy rice)
 - Intensifying livestock production through use of “feed-lots”² and/or manure lagoons³

Unplanned Deforestation

- Data on past land use, land cover, and forest cover are available for at least three points in time, spanning a period of 3-12 years before the start of the project activities.
- The entire project area must be under threat of deforestation during the baseline period.
- Only applicable where the baseline agents of deforestation: (i) clear the land for settlements, crop production (agriculturalist) or ranching, where such clearing for crop production or ranching does not amount to large scale industrial agriculture activities⁴; (ii) have no documented and uncontested legal right to deforest the land for these purposes; and (iii) are either resident in the reference region (cf. section 1 below) or immigrants.
- Post-deforestation land use shall not constitute reforestation
- The resulting baseline must be renewed every 10 years after the start of the project except where forests in the project area are undergoing degradation in the baseline and the estimated difference in carbon stocks between the baseline and project is greater than a *de minimus*⁵. In this situation the baseline must be revised every 5 years

Planned Deforestation

- Conversion of forest lands to a deforested condition must be legally permitted
- The boundaries of the planned deforestation must be clearly defined and documented
- Documentation must be available to clearly demonstrate with credible evidence and documentation that indeed the land would have been converted to non-forest use if not for the REDD project.

² Feedlots are defined as areas in which naturally grazing animals are confined to an area which produces no feed and are fed on stored feeds

³ Anaerobic lagoons that function as receptacles for animal waste flushed from animal pens. Anaerobic organisms naturally present in the manure and the environment decompose the waste in the lagoon

⁴ Small-scale / Large-scale agriculture to be defined and justified by the project

⁵ According to the VCS standards the de minimus is 5% or less of the total difference

- Planned deforestation must be projected to occur within ten years of the project start date
- Prior to the area being deforested, the forest carbon stocks in the project area must be constant or increasing in the absence of the project.
- Degradation occurring in areas projected to be deforestation must be prevented in the project case and monitoring shall be implemented to quantify any degradation that may occur.
- Areas subject to unsustainable⁶ fuel wood collection, unsustainable illegal logging or degrading human-induced fires in the absence of the project shall be excluded. For these areas this module shall not be used.

Degradation (fuelwood / charcoal)

- In the baseline case wood collection for fuel and charcoal production must be stable or increasing in the baseline period.
- The individuals / households involved in collecting firewood / producing charcoal in the project area must be identifiable and must be willing to share information on fuel wood consumption and/or charcoal production.
- The framework is not applicable to situations where fuel wood collection and charcoal production in the project area are decreasing or are likely to decrease in the near-future (1-3 years) due to a lack of available stocks
- If degradation is caused by either illegal or legal tree extraction for timber, this framework cannot be used

Initial Requirements

To use this REDD framework methodology the following are required:

1. Determine which pools and emissions are significant using the **T-SIG** tool.
2. Estimates of carbon stocks of all carbon pools selected must be made within 5 years of the project start date.
3. The sampling framework, including sample size, plot size, plot shape, and determination of plot location must be designed and must be specified in the VCS-PD.
 - a. To determine the sample size and allocation among strata, this methodology must use the latest version of the CDM tool for the "Calculation of the number of sample plots for measurements within A/R CDM project activities". The targeted precision level for

⁶ Unsustainable here is defined as any woody biomass removed that is not demonstrably renewable. Forest biomass is considered demonstrably renewable where:

- a. The land area remains a forest; and
 - b. Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvest); and
 - c. Any national or regional forestry and nature conservation regulations are complied with.
- (Derived directly from EB 23, Annex 18.

aboveground biomass estimation across the project is +/- 10% of the mean at a 90% confidence level. However, for this REDD methodology framework, temporary plots are permissible in contrast to the CDM methodology⁷.

4. An uncertainty analysis is required for all estimates related to change in area, change in carbon stocks and emissions for both the baseline and project case.
5. The use of a Geographical Information System (GIS) and the use of Global Positioning System receivers are recommended.

II. EX-ANTE ASSESSMENTS

General

Project proponents shall use the latest version of the VCS “Tool for AFOLU Methodological Issues” for the determination of project type and land eligibility, project boundary, carbon pools, baseline, leakage and the net project GHG benefits (see www.v-c-s.org). Additional methodology is provided in this section.

The methodological procedure for the *ex-ante* assessment is implemented by applying the following 5 steps:

- STEP 0. Identification of the VCS-eligible activity
- STEP 1. Definition of the project boundaries
- STEP 2. Demonstration of additionality
- STEP 3. Estimation of baseline carbon stock changes and GHG emissions
- STEP 4. *Ex-ante* estimation of total net GHG emissions reductions (net of project minus baseline and leakage)
- STEP 5. Monitoring Plan

STEP 0. Identification of the VCS-eligible activity

To identify the type of VCS-eligible REDD project activity use the following decision tree. The decision tree shall be used to provide a broad indication of likely baseline type and applicability. Ultimately the relevant baseline modules (BL-UP – avoided unplanned deforestation; BL-PL – avoided planned deforestation; BL-DFW – avoided forest degradation (fuelwood/charcoal)) must be applied with relevant applicability conditions and criteria.

Is the forest land expected to be converted to non-forest land in the baseline case?	
YES ⁸	NO
Is the land legally authorized and	Is the forest expected to degrade by fuel

⁷ Name of tool: Calculation of the number of sample plots for measurements within A/R CDM project activities, available at <http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-03-v2.pdf>

⁸ If the answer is “yes” evidence shall be provided based on the application of the appropriate baseline module (BL-PL for APD and BL-UP for AUDD).

documented to be converted to non-forest?		wood extraction or charcoal production, in the baseline case	
YES ⁹	NO	YES	NO
Avoided planned deforestation	Avoided unplanned deforestation	Avoided forest degradation	Proposed project is not a VCS REDD ¹⁰ activity currently covered by the module framework

Provide all the necessary¹¹ evidence to demonstrate the type of eligible activity as given in each module.

A project can include areas subject to different eligible activities (e.g. Area A = avoided planned deforestation; Area B = avoided unplanned deforestation; Area C = avoided degradation). In such cases the areas that are eligible for different categories shall be clearly delineated and the procedures outlined below applied to each of them separately.

The demonstration of eligibility shall be reported in the VCS-PD.

STEP 1. Definition of the project boundaries

The following categories of boundaries shall be defined:

- The geographic boundaries relevant to the project activity;
- The temporal boundaries;
- The carbon pools that the project will consider, and
- The sources and associated types of greenhouse gas emissions that the project will affect.
- The sources of leakage

a. Geographical boundaries

To be eligible for VCS crediting, land defined as “forest” shall meet accepted definitions of what constitutes a forest as given in the VCS standards for REDD activities and shall be under the control of the project proponent. The boundary of the REDD activity shall be clearly delineated and defined and include only land qualifying as “forest” for a minimum of 10 years prior to the project start date.

⁹ If the answer is “yes” evidence shall be provided based on the application of the BL-PL module. Users are required to show legal permissibility to deforest, suitability of project area for conversion and intent to deforest

¹⁰ If degradation is occurring through legal or sanctioned timber production then this is an IFM eligible activity.

¹¹ Refer to the VCS “Tool for AFOLU Methodological Issues” for guidance.

Project proponents shall clearly define the spatial boundaries of a project so as to facilitate accurate measuring, monitoring, accounting, and verifying of the project's emissions reductions and removals. The REDD project activity may contain more than one discrete area of land. When describing physical project boundaries, the following information shall be provided per discrete area:

- Name of the project area (e.g., compartment number, allotment number, local name);
- Unique ID for each discrete parcel of land;
- Map(s) of the area (preferably in digital format);
- Geographic coordinates of each polygon vertex along with the documentation of their accuracy (preferably obtained from a GPS or from a geo-referenced digital map - the error must be less than or equal to 30 m.
- Total land area; and
- Details of forestland rights holder and user rights.

In REDD project activities, various kinds of boundaries must be distinguished, depending on the REDD category (planned or unplanned deforestation, forest degradation), i.e. in case of:

- Avoided planned deforestation: project area and proxy area(s). Refer to **BL-PL** for the detailed procedures to define these boundaries.
- Avoided unplanned deforestation: project area, reference region, and leakage belt area. Refer to **BL-UP** for the detailed procedures to define these boundaries.
- Avoided forest degradation. Refer to **BL-DFW** (for degradation due to removals for wood fuel or charcoal) for the detailed procedures to define these boundaries.

The geographic boundaries of a REDD project are fixed (ex-ante) and thus can not change over the baseline period (ex-post). Where multiple baselines exist (planned deforestation, unplanned deforestation, forest degradation) there shall be no overlap in boundaries between areas appropriate to each of the baselines.¹²

Methods for establishing the boundaries of areas subject to leakage from activity shifting are provided in the following VCS-approved modules:

- For avoided planned deforestation: **LK-ASP**
- For avoided unplanned deforestation: **BL-UP**

b. Temporal boundaries

The following temporal boundaries shall be defined:

¹² For planned and unplanned the baseline is based on the reference area and for degradation the baseline is based on the project area.

Start date and end date of the “historical reference period”

The historical reference period is the temporal domain from which information on historical deforestation is extracted, analyzed and projected into the future. A historical reference period shall be defined for all eligible REDD categories. The starting date of this period shall be between 9 and 12 years in the past and the end date shall be within 2 years of project start.

Start date and end date of the “crediting period”

The crediting period is the period of time for which the net GHG emissions reductions or removals will be verified, which under the VCS is equivalent to the project lifetime. The project must have a robust operating plan covering this period.

The project crediting period for REDD projects shall be between 20 and 100 years. The duration of the project activity/crediting period shall be reported in the VCS-PD.

Projections of baseline emissions shall be presented in the PD for the first 10 year period after the start of the project. VCU's will only be issued for 10-year periods for which the baseline is fixed and a monitoring plan has been implemented.

Date at which the project baseline shall be revised

- For planned deforestation projects, all deforestation must occur within 10 years of the project start so there is no need to revise the baseline.
- For unplanned deforestation, the project baseline shall be revised every 10 years¹³ after the year of project start, i.e. at year 10, year 20, etc. The date of the next revision shall be specified in the VCS-PD and shall be 10 years after the project start date. Baseline emissions estimated for the 10-year period preceding the revision date are “frozen” (except for improved estimates of carbon stocks, as explained below). The starting point for the baseline revision of the project will be its modelled forest cover projected to exist at the end of the 10-year period. Projections for each 10-year revision date will be subject to independent verification.
- For degradation, the key factor used in estimating the emissions from extraction of wood for fuel and charcoal is the local rates of harvest of such material. At the end of the 10 year period, if a re-assessment shows a decline of wood harvest rates in the reference area, then the project will be terminated as the project will now be in violation of the applicability condition.

¹³ Although baselines must be revised on a fixed 10-year schedule there also exist thresholds or “triggers” that will lead to an immediate baseline revision. No baseline triggers exist for BL-PL. The following will trigger baseline revision for BL-UP and BL-DFW:

- Construction and / or paving of a road through the project and / or leakage belt, or within 500 m of project geographic boundary
- A rate of population growth that differs by $\geq 15\%$ from official government projections made prior to the start of the baseline period

For BL-UP the following additional trigger exists:

- Forest scarcity relative to the baseline deforestation rate (see BL-UP)

Duration of the monitoring periods

Issuance of Voluntary Carbon Units (VCUs) is subject to monitoring and verification. The minimum duration of a monitoring period is one year and the maximum duration is 10 years. Project proponents are free to decide the periodicity of verifications.

Baseline projections shall be annual and be available for each proposed future verification date.

Data on baseline deforestation and degradation rates shall be included in the PDD. Data collection for future baseline revision shall be included in the monitoring report.

c. Carbon pools

The project shall account for any significant decrease in carbon stock that is reasonably attributable to project activities. The carbon pools included in or excluded from the project boundary are shown in Table 2.

Harvested wood products and dead-wood shall be included when they increase more or decrease less in the baseline than in the project scenario. In all other cases only above-ground biomass is mandatory. If a carbon pool is included in the baseline accounting, it shall also be included in project scenario and leakage accounting.

Where the carbon pool in harvested wood products and dead-wood increases more or decreases less in the baseline case than in the project case, the VCS-approved tool “Determining the significance of emissions sources and changes in carbon pools in REDD project activities” (T-SIG) shall be used to determine whether they are significant. Insignificant pools can always be ignored.

Table 2: Carbon pools in REDD project activities

Carbon pools	Included / Excluded	Justification / Explanation of choice
Above-ground	Included	At minimum, the stock change in the above-ground tree biomass shall be estimated. If the non-herbaceous non-tree aboveground carbon stocks are greater in the post-deforestation stratum than the pre-deforestation stratum they must be estimated in the post-deforestation stratum.
Below-ground	Included	Should be included as it is always significant, but omission is conservative.
Dead-wood	Included	Shall be included if greater in baseline than project scenario and significant, otherwise can be conservatively

		omitted.
Harvested wood products	Included	Shall be included if greater in baseline than project scenario and significant, otherwise can be conservatively omitted.
Litter	Included	Generally not significant so project proponents can decide to conservatively omit.
Soil organic carbon	included	May be included if emissions are greater in baseline than project scenario and significant. Exclusion is always conservative, but it makes sense to include when avoiding deforestation on highly organic mineral soils and on peats (e.g. peat swamp forests).

Table 1 with the selection of carbon pools and the appropriate justification must be presented in the VCS-PD.

d. Sources of greenhouse gases

The project shall account for any significant increases in emissions of carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄) that are reasonably attributable to the project activity. The GHG emission sources included in or excluded from the project boundary are shown in Table 3.

The latest version of the VCS-approved tool “Determining the significance of emissions sources and changes carbon pools in REDD project activities” (T-SIG) shall be used to determine whether an emissions source is significant. If a source is included in the estimation of baseline emissions¹⁴, it shall also be included in the calculation of project and leakage emissions.

Table 3: Sources of emissions and associated greenhouse gases in REDD project activities

Sources	Gas	Included/Excluded	Justification / Explanation of choice
Biomass burning	CO ₂	Excluded	However, carbon stock decreases due to burning are accounted as a carbon stock change
	CH ₄	Included	Non-CO ₂ gases emitted from woody biomass burning -- it is conservative to

¹⁴ E.g. CH₄ or N₂O emission from agriculture that results from deforestation or fire to clear forest land.

	N ₂ O	Included	exclude in the baseline but must be included in the project case if fire occurs in areas that were projected to be deforested in the baseline.
Combustion of fossil fuels	CO ₂	Included	Can be neglected if excluded from baseline accounting.
	CH ₄	Excluded	Potential emissions are negligibly small
	N ₂ O	Excluded	Potential emissions are negligibly small
Use of fertilizers	CO ₂	Excluded	Potential emissions are negligibly small
	CH ₄	Excluded	Potential emissions are negligibly small
	N ₂ O	Included	Can be neglected if excluded from baseline accounting.

Table 3 with the selection of sources and the appropriate justification shall be presented in the VCS-PD.

e. Sources of leakage

Activity shifting shall be considered for all activities using the appropriate leakage module:

- LK-ASP** Leakage due to displacement of planned deforestation
- LK-ASU** Leakage due to displacement of unplanned deforestation
- LK-DFW** Leakage due to displacement of fuel-wood/charcoal collection

Where applicable, leakage due to market effects shall be considered using **LK-ME**. Market effects shall be considered where the project leads to a decrease in the production of timber, fuel wood or charcoal.

Leakage prevention activities may lead to the increase in combustion of fossil fuels or use of fertilizers, however, any increase in emissions is considered insignificant.

As per the applicability conditions leakage prevention may not include the flooding of agricultural lands (e.g. for new rice paddies) nor the creation of livestock feedlots and/or manure lagoons.

The list of leakage sources with appropriate justification shall be presented in the VCS-PD.

STEP 2. Demonstration of additionality

Project participants shall use the “Tool for the Demonstration and Assessment of Additionality in REDD Project Activities” (**T-ADD**) to identify credible alternative land use scenarios and to evaluate both the alternatives and the proposed project scenarios and to demonstrate the additionality of the project scenario.

The assessment and demonstration of additionality shall be presented in the VCS-PD.

STEP 3. Estimation of baseline carbon stock changes and greenhouse gas emissions

The baseline of a REDD project activity is estimated *ex ante*. It can be monitored in a reference area (unplanned deforestation) or proxy area (planned deforestation) for the purpose of periodically adjusting the baseline. *Ex-ante* baseline estimations are therefore used in both the *ex-ante* and *ex-post* estimation of net carbon stock changes and GHG emission reductions.

Methods for estimating baseline carbon stock changes and greenhouse gas emissions are provided in the following VCS-approved modules¹⁵:

- For planned deforestation: **BL-PL**
- For unplanned deforestation: **BL-UP**
- For forest degradation from extraction of wood for fuel: **BL-DFW**

If carbon stocks in the project area are not homogeneous, stratification shall be carried out¹⁶. Different methods for stratifying may be required for the baseline and project scenarios to achieve optimal accuracy and precision of the estimates of net GHG emissions reductions. The latest version of the VCS-approved module on “Methods for stratifying the project area of REDD project activities” (**X-STR**) shall be used to decide whether stratification is needed and how it shall be performed.

For the estimation of baseline greenhouse gas emissions (other than carbon stock changes), the baseline modules call for the following specific modules: “Estimation of non-CO₂ emissions from biomass burning in REDD project activities” (**E-BB**), “Estimation of CO₂ emissions from fossil fuel combustion in REDD project activities” (**E-FFC**), and “Estimation of direct N₂O emissions from nitrogen application” (**E-NA**). As specified in Step 1.d, these sources of emissions only need to be accounted for if they are higher in the project scenario than in the baseline scenario and if they are significant. If a source is included in the estimation of baseline emissions, it shall also be included in the estimation of project and leakage emissions.

A description of how the baseline scenario is identified and the description of the identified baseline scenario shall be given in the VCS-PD.

The results of the estimations shall be presented in the VCS-PD.

STEP 4. *Ex-ante* estimation of total net GHG emissions reductions (net of project minus baseline and leakage)

¹⁵ These three modules call upon various other modules by using parameters originating from other modules or by referring to other modules for specific estimations, or both. For instance, the module for estimating baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation (**BL-UP**) requires a previous application of the modules for estimating the rate (**BL-UR**) and location (**BL-UL**) of unplanned deforestation.

¹⁶ If, on the basis of existing or pilot data, the mean biomass stock of any spatially discrete sub-population, representing $\geq 10\%$ of the project area, differs from the population level mean by $\geq 20\%$, stratification must be used and the distinct sub-population(s) delineated

Under the VCS standard¹ project proponents shall present conservative *ex-ante* estimations of the total net GHG emissions reductions of the REDD project activity, which are calculated as follows:

$$C_{REDD,t} = \Delta C_{BSL} - \Delta C_P - \Delta C_{LK} \quad (1)$$

Where:

$C_{REDD,t}$	Total net greenhouse emission reductions at time t ; t CO ₂ -e
ΔC_{BSL}	Sum of the carbon stock changes and greenhouse gas emissions under the baseline scenario up to time t ; t CO ₂ -e
ΔC_P	Sum of the carbon stock changes and greenhouse gas emissions under the project scenario up to time t ; t CO ₂ -e (from module M-EXP)
ΔC_{LK}	Sum of the carbon stock changes and greenhouse gas emissions due to leakage up to time t ; t CO ₂ -e

$$\Delta C_{BSL} = \Delta C_{BSL,planned} + \Delta C_{BSL,unplanned} + \Delta C_{BSL,deg\ rad-FW/C} \quad (2)$$

Where:

ΔC_{BSL}	Sum of the carbon stock changes and greenhouse gas emissions under the baseline scenario up to time t ; t CO ₂ -e
$\Delta C_{BSL,planned}$	Baseline net greenhouse gas emissions through planned deforestation; t CO ₂ -e (from module BL-PL)
$\Delta C_{BSL,unplanned}$	Net CO ₂ equivalent emissions in the baseline from unplanned deforestation; t CO ₂ -e (from module BL-UP)
$\Delta C_{BSL,deg\ rad-FW/C}$	Baseline net greenhouse gas emissions through degradation; t CO ₂ -e (from module BL-DFW)

$$\Delta C_{LK} = \Delta C_{LK-AS,planned} + \Delta C_{LK-AS,unplanned} + \Delta C_{LK-AS,deg\ rad-FW/C} + \Delta C_{LK-ME} \quad (3)$$

Where:

ΔC_{LK}	Sum of the carbon stock changes and greenhouse gas emissions due to leakage up to time t ; t CO ₂ -e
$\Delta C_{LK-AS,planned}$	Net CO ₂ emissions due to activity shifting leakage for projects preventing planned deforestation; t CO ₂ -e (from module LK-ASP)
$\Delta C_{LK-AS,unplanned}$	Sum of carbon stock changes and greenhouse gas emissions due to activity shifting from avoided unplanned deforestation; t CO ₂ -e (from module LK-ASU)

ΔC_{LK-ME}	Total GHG emissions due to market- effects leakage; t CO ₂ -e (from module LK-ME)
$\Delta C_{LK-AS,degrad-FW/C}$	Net CO ₂ -e emissions due to activity shifting leakage for degradation caused by extraction of wood for fuel; t CO ₂ -e (from module LK-DFW)

For *ex-ante* estimation project proponents should refer to the appropriate modules. Upon selecting all significant carbon pools and emission sources, the final calculations shall be performed using Equation 1. If certain carbon pools and sources of emissions are to be excluded according to results of the significance analysis, the estimated baseline, project and leakage emissions shall be recalculated.

Significance analysis

A significance analysis is recommended to decide whether selected sources of emissions and carbon pools are significant or not. A significance analysis can be performed using the latest version of the tool “Determination of the significance of GHG emissions and changes in carbon stocks in REDD project activities” (**T-SIG**).

Uncertainty analysis

Project proponents shall use the latest version of the module “Estimation of uncertainty for REDD project activities” (**X-UNC**) to combine uncertainty information and conservative estimates and produce an overall uncertainty estimate of the total net GHG emission reductions.

Calculation of Voluntary Carbon Units

The number of Voluntary Carbon Units is calculated as follows:

$$VCU_t = (C_{REDD,t_2} - C_{REDD-t_1}) - BRR \quad (4)$$

Where:

VCU_t	Number of Voluntary Carbon Units at time $t = t_2 - t_1$ Note: The proportion of VCU_t to be withheld in the VCS Buffer is to be determined using the VCS-approved “Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination”.
C_{REDD,t_2}	Cumulative total net GHG emissions reductions up to time t_2
C_{REDD,t_1}	Cumulative total net GHG emissions reductions up to time t_1
BRR	Portion of carbon credits to be withheld as a buffer reserve

Buffer reserve should be calculated using *VCS Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination*¹⁷.

¹⁷ Available at: <http://www.v-c-s.org/docs/Tool%20for%20AFOLU%20Non-Permanence%20Risk%20Analysis%20and%20Buffer%20Determination.pdf>

The estimated cumulative net anthropogenic GHG emission reductions shall be adjusted to account for uncertainty as indicated in the module **X-UNC**¹⁸.

These VCUs will then be subject to a deduction based on the risk analysis described in the VCS guidelines.

STEP 5. Monitoring Plan

Project proponents shall include a single monitoring plan in the VCS-PD.

For monitoring changes in forest cover and carbon stock changes, the monitoring plan shall use the methods given in the latest version of the approved module “Monitoring for ex-post greenhouse gas emissions and removals” (**M-EXP**). All relevant parameters from the modules are to be included in the monitoring plan.

The monitoring plan shall address the following monitoring tasks, which should be standard headers in the Monitoring Plan:

- 10-year revision of the baseline
- Monitoring of actual carbon stock changes and greenhouse gas emissions
- Monitoring of leakage carbon stock changes and greenhouse gas emissions
- Estimation of *ex-post* net carbon stock changes and greenhouse gas emissions.

For each of these tasks, the monitoring plan shall include the following sections:

- a) Technical description of the monitoring task.
- b) Data to be collected. The list of data and parameters to be collected shall be given in VCS-PD.
- c) Overview of data collection procedures.
- d) Quality control and quality assurance procedure.

¹⁸ If $C_{REDD_ERROR} \leq 10\%$ of $C_{REDD,t}$ then no deduction should result for uncertainty
If $C_{REDD_ERROR} > 10\%$ of $C_{REDD,t}$ then the modified value for $C_{REDD,t}$ to account for uncertainty should be:

$$= \frac{100 - C_{REDD_ERROR}}{100} * C_{REDD,t}$$

Where:

$C_{REDD,t}$ Net anthropogenic greenhouse emission reductions at time t ; t CO₂-e

C_{REDD_ERROR} Total uncertainty for REDD project activity; %

For details see **X-UNC**

- e) Data archiving.
- f) Organisation and responsibilities of the parties involved in all the above.

A description of the monitoring plan including the items “c” to “f” listed above shall be given in the VCS-PD.

III. *EX-POST* ESTIMATION

Ex-post estimations are to be implemented after the project start and include two main tasks:

- 1) Monitoring according to the monitoring plan; and
- 2) 10-yr revision of the baseline as needed.

Task 1: Monitoring according to the monitoring plan

Monitoring of key baseline driver variables

Information required to periodically reassess the project baseline shall be collected during the entire project crediting period. Key variables to be measured are:

- Changes in forest cover in the reference region (at a minimum of every 10 years).
- Driver variables used to model the rate of future deforestation, as specified in the latest version of the VCS-approved module **BL-UP**. As a minimum, the variables used in the first baseline assessment shall be monitored.
- If a modelling approach has been used to project the rate of unplanned baseline deforestation, the variables of the model shall be monitored at the time of the re-assessment to determine if they have changed.
- Spatial data on the driver variables used to model the location of deforestation, as specified in the latest version of the VCS-approved module **BL-UP**. As a minimum, the variables used in the first baseline assessment shall be monitored at the time of the re-assessment to determine if they have change.
- Where required, carbon stock data as specified in the latest version of the VCS-approved module **M-EXP**

Monitoring of actual carbon stock changes and greenhouse gas emissions

Changes in forest cover in the project area (and leakage belt for unplanned deforestation), shall be measured before each verification as part of the monitoring. Methods shall be consistent with the methodology given in the latest version of the VCS-approved module **M-EXP** and any technical guidance specified in the monitoring plan.

Carbon stocks in most cases will not have to be monitored during the baseline period, except in the following cases:

- The project proponent wishes to increase the accuracy and precision of the *ex-ante* carbon stock estimates, which are also used for *ex-post* calculations. Verifiable evidence shall be provided to VCS verifiers that the accuracy and precision of the carbon stock estimates has improved compared to previous estimates. Any change in carbon stock densities will be subject to validation.
- The project proponent wishes to claim credits for avoided forest degradation caused by extraction of wood for fuel or charcoal or carbon sequestration in forest land that would have been deforested in the baseline case. In such cases, the methods described in the latest version of the VCS-approved **M-EXP** module (Monitoring of ex-post greenhouse gas emissions and removals).

Carbon stocks shall be reassessed at every baseline revision.

Where emissions are included in the baseline, they shall be monitored in the project case, following the methodological procedures described in the latest version of the VCS-approved emission modules (**E-BB**, **E-FFC**, and **E-NA**).

The calculations of actual carbon stock changes and greenhouse gas emissions shall be reported using transparent procedures.

Monitoring of leakage

All significant sources of leakage identified in the VCS-PD are subject to monitoring, following the procedures outlined in the monitoring plan. Such procedures shall be consistent with the latest versions of the applicable VCS-approved leakage modules (**LK-ASP**, **LK-ASU**, **LK-ME**, **LK-DFW**). All relevant parameters in the leakage modules shall be included in the monitoring plan.

The calculations of leakage carbon stock changes and greenhouse gas emissions shall be reported.

Ex-post total net greenhouse gas emission reductions

These are calculated using Equations 1-3 and the corresponding modules.

Calculation of Voluntary Carbon Units and of the Buffer

These are performed using the same equations as the *ex-ante* assessment (considering uncertainty - **X-UNC**).

The proportion of VCU_t to be saved in the VCS Buffer is to be determined using the VCS-Approved “Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination”

Revising the baseline projections for future crediting periods

Baselines shall be revised over time because agents, drivers and underlying causes of deforestation change dynamically. The methodological procedure used to update the baseline shall be the same as used in the first estimation.

Triggers for baseline revision

Although baselines must be revised on a fixed 10-year schedule there also exist triggers that will lead to an immediate baseline revision. No baseline triggers exist for **BL-PL**. The following will trigger baseline revision for **BL-UP** and **BL-DFW**:

- Construction and / or paving of a road through the project and / or leakage belt, or within 500 m of project geographic boundary
- A rate of population growth that differs by $\geq 15\%$ from official government projections made prior to the start of the baseline period

For **BL-UP** the following additional trigger exists:

- Forest scarcity relative to the baseline deforestation rate (see **BL-UP**)

IV. PARAMETERS ORIGINATING IN OTHER MODULES

Data / parameter:	$\Delta C_{BSL,degrade-FW/C}$
Data unit:	t CO ₂ -e
Used in equations:	2
Description:	Baseline net greenhouse gas emissions through degradation
Module parameter originates in:	BL-DFW
Any comment:	

Data / parameter:	$\Delta C_{BSL,planned}$
Data unit:	t CO ₂ -e
Used in equations:	2
Description:	Baseline net greenhouse gas emissions through planned deforestation
Module parameter originates in:	BL-PL
Any comment:	

Data / parameter:	$\Delta C_{BSL,unplanned}$
Data unit:	t CO ₂ -e
Used in equations:	2
Description:	Net CO ₂ equivalent emissions in the baseline from unplanned deforestation
Module parameter originates in:	BL-UP
Any comment:	

Data / parameter:	$\Delta C_{LK-AS,degrade-FW/C}$
Data unit:	t CO ₂ -e
Used in equations:	3
Description:	Net CO ₂ -e emissions due to activity shifting leakage for degradation caused by extraction of wood for fuel
Module parameter originates in:	LK-DFW
Any comment:	

Data / parameter:	$\Delta C_{LK-AS,planned}$
Data unit:	t CO ₂ -e
Used in equations:	3
Description:	Net CO ₂ emissions due to activity shifting leakage for projects preventing planned deforestation
Module parameter originates in:	LK-ASP
Any comment:	

Data / parameter:	$\Delta C_{LK-AS,unplanned}$
Data unit:	t CO ₂ -e
Used in equations:	3
Description:	Sum of carbon stock changes and greenhouse gas emissions due to activity shifting from avoided unplanned deforestation
Module parameter originates in:	LK-ASU
Any comment:	

Data / parameter:	ΔC_{LK-ME}
Data unit:	t CO ₂ -e
Used in equations:	3
Description:	Total GHG emissions due to market- effects leakage
Module parameter originates in:	LK-ME
Any comment:	

Data / parameter:	ΔC_P
Data unit:	t CO ₂ -e
Used in equations:	1
Description:	Sum of the carbon stock changes and greenhouse gas emissions under the project scenario up to time t
Module parameter originates in:	M-EXP
Any comment:	