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REDD Project for the Luki Biosphere Reserve

Located in the south-west of the Democratic Republic of Congo and about 120 km east of the Atlantic coast, Luki Biosphere Reserve represents the humid tropical rain-forest ecosystem. In former times, this area was reserved in order to protect its natural resources for colonial interests. In an altitude between 150 and 500 meters above sea level, many different habitats can be distinguished such as primary forests with *Gossweilerodendron balsamiferum, Gilletiodendron kisantuense* or *Terminalia superba*, secondary forests with *Terminalia superba*, woody and herbaceous savannah as well as agro-ecosystems and agroforestry systems. The plant resources of the area are used for both commercial purposes (e.g. palm oil, coffee, and cacao) and traditional nutrition (banana, taro, manioc, rice, corn, etc.).

About 7,100 people live within the biosphere reserve and some 64,200 nearby (2002). The main economic activity is agriculture and agroforestry. However, the biosphere reserve faces problems due to illegal forest exploitation (e.g. for fuel wood and house construction), carbonisation, hunting and fishing. There is a great need for a plant and animal inventory of the biosphere reserve since many species disappear without being noticed. A guide to the sustainable development of the biosphere reserve's fauna has been developed recently (2002).

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The Luki Biosphere Reserve is one of only two remaining areas of primary rainforest in Bas Congo province. It is unfortunately in the process of a long term collapse from a species rich haven into a landscape of degraded secondary forest and subsistence agriculture. Radical solutions are needed to ensure its survival. The reserve is located 20km north of the city of Boma and has an area of 330 km^2. It is not a National Park under ICCN management, but instead is a UNESCO Biosphere reserve, with a unique governance structure composed of elements of the Ministry of Environment, Nature Conservation and Tourism, The Ministry of Scientific Research, local government and volunteers.

Originally established as an agricultural and forestry research centre, the reserve has three main zones: 1) a central zone of 80km2 – designated as fully protected; 2) a middle zone, reserved for forestry but excluding permanent settlements and 3) a buffer zone permitting mixed use.

The reserve environment is hilled forest of high biodiversity and is effectively an island of forest completely surrounded by agricultural activities: the nearest similar natural environment is located approximately 80 km north, close to the Angola Kabinda border. The pressures on the reserve are multi-fold and severe. There are approximately 100,000 people living in close proximity to the reserve and entire villages have become established illegally inside the protected areas. A commercial bush-meat trade out of Boma is driving poaching on a grand scale – wildlife snares can be found and shots are heard in all parts of the reserve. Artisanal fuel-wood collection and a commercial charcoal trade are resulting in rapid deforestation. In 2004, WWF started a protection and conservation project for the reserve. The scope of work includes agricultural diversification activities for surrounding villages, awareness raising and subsidisation of reserve wardens. This well intentioned project with dedicated staff is facing a highly difficult situation – essentially the issues are well understood but the governance situation is unfavourable and current resources are nowhere near enough to halt or reverse the degradation. Without a radical change in the current trends the Luki Reserve is expected to be largely destroyed as a protected area within 10 years and disappear as a primary forest within a generation. In such cases, the choice for the government is stark: intervene substantially or concede the reserve in all practical terms to the forces of degradation.

The recommendation is for intervention – but with a different strategy than at present. The value of Luki lies not in its size but its isolation and its unique land tenure situation – it is both part park and part forestry concession. It is this uniqueness that can drive the practicalities of a potential solution without a major long-term infusion of foreign aid – which probably will not be obtainable and so should not be factored into any credible plan.

1. Introduction

The current proposal is elaborated in perspective of the potential GHG emission reductions resulting from the deforestation process that is under way in the Democratic Republic of Congo (DRC). As per the initial evaluation of temporal sequence of images attached, we have identified significant and reasonable evidence of the evolution of deforestation in the region of the Biosphere Reserve of Luki.

We propose to undertake a feasibility analysis in order to proceed into a more complete elaboration of a PROJECT DESIGN DOCUMENT in a second phase with the certainty of generating a REDD project in the region.

Pro-Natura International (PNI) should therefore and subsequently to the feasibility study, propose a full advisory service and implementation solutions.

2. Financial and technical feasibility studies

Under the feasibility study, PNI will perform financial and technical analysis on the REDD project opportunity in Congo Luki Biosphere Reserve region. The following aspects will be assessed:

- Technical Barriers
    - Satellite image analysis for quantifying current deforestation[1]

[1] To be performed in partnership with SPOTIMAGE, for REDD projects.

    - Satellite image analysis for evidencing past deforestation[1]
    - Quantification of effectively eligible areas
    - Development of baseline scenarios

- Institutional Barriers
    - Inconsistency with VCS premises
    - Inconsistency with national or local policy
    - Issues on land tenure and property rights
    - Analysis of general non-conformity (if applicable)

- Financial Barriers
    - Project scale and potential carbon revenues
    - Estimative of project costs

- Local and regional deforestation patterns and drivers

- Evaluation of potential risks for project permanence

- Methodologies currently available and methodological needs

This survey will be based on desk review of available literature and satellite imaging analysis, consultations with certifiers, specialists and stakeholders etc.

Once the first version of the feasibility analysis is ready, Pro-Natura specialists will travel to Luki and do a 10 day survey in the region in order to validate the available information and finalize the work for delivery of the final version of this report.

3. Chronogram and budget

The consultancy activities of this proposal will be accomplished in **3 months**, starting from the signature of the corresponding contract.

In terms of field trip, it will be Mr. Wilfrid Manfrinato together with another expert who will spend 2 weeks in the field.

	Details	Quantity	Unit Price	Price (€)
		days	*lump-sum*	
Technical Barriers				**19 000**
Satellite image analysis for quantifying current deforestation	partnership with SPOTIMAGE			5 000
Satellite image analysis for evidencing past deforestation	partnership with SPOTIMAGE			5 000
Quantification of effectively eligible areas	satellite imaging analysis and literature	5	800	4 000
Development of baseline scenarios	consultations with stakeholders	5	1 000	5 000
Institutional Barriers				**12 000**
Inconsistency with VCS premises	literature and certifiers	3	800	2 400
Inconsistency with national or local policy	literature, specialists and stakeholders	9	800	7 200
Issues on land tenure and property rights	specialists and stakeholders	2	800	1 600
Analysis of general non-conformity (if applicable)	literature, specialists and stakeholders		800	800
Financial Barriers				**3 200**
Project scale and potential carbon revenues		2	800	1 600
Estimative of project costs	certifiers	2	800	1 600
Local and regional deforestation patterns and drivers	literature, specialists and stakeholders	10	1 000	**10 000**
Evaluation of potential risks for project permanence	literature and stakeholders	7	800	**5 600**
Methodologies currently available and methodological needs	specialists and certifiers	10	1 000	**10 000**
Administration & Communication				**7 500**
Per diems and trips	approximative estimate of travelling			**7 000**
TOTAL				**74 300**

4. Methodology

See next page.

Approved VCS Methodology VM0007
Version 1.0
REDD Methodology Module
REDD Methodology Framework (REDD-MF)
Sectoral Scope 14

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 modules and tools that perform a specific function. It constitutes, together with the modules and tools it calls upon, a complete 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.

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

Definitions

Where not explicitly defined in this document, current VCS definitions apply. Where new VCS definitions are issued they shall take precedence over definitions in this methodology. Current VCS definition for the following terms should be referenced in the VCS PD by project proponents:

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

Forest Degradation is the persistent reduction of canopy cover and/or carbon stocks in a forest due to human activities such as animal grazing, fuelwood extraction, timber removal or other such activities, but which does not result in the conversion of forest to non-forest land (which would be classified as deforestation), and falls under the *IPCC 2003 Good Practice Guidance* land category of “forest remaining forest”.

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 modules and tools:

Carbon Pool Modules:

CP-AB "VMD0001 Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools"

CP-D "VMD0002 Estimation of carbon stocks in the dead-wood pool"

CP-L "VMD0003 Estimation of carbon stocks in the litter pool"

CP-S "VMD0004 Estimation of stocks in the soil organic carbon pool"

CP-W "VMD0005 Estimation of carbon stocks in the long-term wood products pool"

Baseline Modules:

BL-PL "VMD0006 Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation"

BL-UP "VMD0007 Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation"

BL-DFW "VMD0008 Estimation of baseline emission from forest degradation caused by extraction of wood for fuel"

Leakage Modules:

LK-ASP "VMD0009 Estimation of emissions from activity shifting for avoided planned deforestation"

LK-ASU "VMD0010 Estimation of emissions from activity shifting for avoided unplanned deforestation"

LK-ME "VMD0011 Estimation of emissions from market-effects"

LK-DFW "VMD0012 Estimation of emissions from displacement of fuelwood extraction"

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

E–BB "VMD0013 Estimation of greenhouse gas emissions from biomass burning"

E-FFC "VMD0014 Estimation of emissions from fossil fuel combustion"

E-NA "Estimation of direct N_2O emissions from nitrogen application" – latest CDM-EB approved version

Monitoring Module:

M-MON "VMD0015 Methods for monitoring of greenhouse gas emissions and removals"

Miscellaneous Modules:

X -STR "VMD0016 Methods for stratification of the project area"

X-UNC "VMD0017 Estimation of uncertainty for REDD project activities"

Tools:

T-SIG "Tool for testing significance of GHG emissions in A/R CDM project activities" – latest CDM-EB approved version

T-ADD "VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities" – latest VCS approved version

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 is 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 (Fuelwood / Charcoal)
Always Mandatory	**REDD-MF**	M	M	M
	M-MON	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	(m)[4]	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 fuelwood or charcoal is harvested for commercial markets

(m)[3] Mandatory if this carbon pool is greater in baseline (post-deforestation/degradation) than project scenario and significant; otherwise can be conservatively omitted

(m)[4] Mandatory where leakage prevention activities include increases in the use of fertilizers

* VCS requirements and the tool T-SIG shall be used to justify the omission of carbon pools and emission sources

Applicability Conditions

This REDD Methodology Framework is a compilation of modules and tools that together define the project activity and necessary methodological steps. 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 timber[1].

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

a. All Activity Types

- Land in the project area has qualified as forest at least 10 years before the project start date.
- The project area can include forested wetlands[2] (such as bottomland forests, floodplain forests, mangrove forests) as long as they do not grow on peat. Peat shall be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm[3]. If the project area includes a forested wetlands growing on peat (e.g. peat swamp forests), this methodology is not applicable.
- Project proponents must be able to show control over the project area and ownership of carbon rights for the project area at the time of verification.
- Baseline deforestation and baseline forest degradation in the project area fall within one or more of the following categories:
    - Unplanned deforestation (VCS category AUDD);
    - Planned deforestation (VCS category APD);
    - Degradation through extraction of wood for fuel (fuelwood and charcoal production) (VCS category AUDD).
- Baselines shall be renewed every 10 years after the start of the project except where triggers lead to a more frequent renewal.
- 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.

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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.

2 Forested wetlands are defined as forests that are inundated or saturated by surface or ground water at such a frequency and duration that under natural conditions they support organisms (flora and/or fauna) that are adapted to poorly aerated and/or saturated soil (Lugo, AE, M Brinson, S Brown, Editors, 1990. Ecosystems of the World 15: Forested Wetlands. Elsevier Science Publishers, Amsterdam, The Netherlands.

3 Rieley, J.O. and S.E Page. 2005. Wise Use of Tropical Peatland: Focus on Southeast Asia. Alterra, Wageningen, The Netherlands. 237 p. ISBN 90327-0347-1. the definition used here has not been approved by the VCS. At such a future time when a definition for peat is approved and included in the VCS standard, the VCS definition shall be used.

- 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.
- Where post-deforestation land use constitutes reforestation 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"[4] and/or manure lagoons.[5]

b. Unplanned Deforestation

- Baseline agents of deforestation shall: (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 activities[6]; (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. Under any other condition this framework shall not be used.
- It shall be demonstrated that post-deforestation land use shall not constitute reforestation.
- Where, pre-project, unsustainable fuelwood collection is occurring within the project boundaries modules BL-DFW and LK-DFW shall be used to determine potential leakage

c. Planned Deforestation

- Conversion of forest lands to a deforested condition must be legally permitted.
- 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.
- It shall be demonstrated that post-deforestation land use shall not constitute reforestation.
- Where, pre-project, unsustainable fuelwood collection is occurring within the project boundaries modules BL-DFW and LK-DFW shall be used to determine potential leakage

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4 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

5 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

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

d. Degradation (fuelwood / charcoal)

- Fuelwood collection and charcoal production must be "non-renewable"[7] in the baseline period.
- If degradation is caused by either illegal or legal tree extraction for timber, this framework cannot be used.

II. ASSESSMENT OF NET GREENHOUSE GAS EMISSION REDUCTIONS

General

The methodological procedure for the assessment is implemented by applying the following five steps:

STEP 0. Identification of the most plausible VCS-eligible activity(ies)

STEP 1. Definition of the project boundaries

STEP 2. Demonstration of additionality

STEP 3. Development of Monitoring Plan

STEP 4. Estimation of baseline carbon stock changes and GHG emissions

STEP 5. Estimation of total net GHG emissions reductions (net of project minus baseline and leakage)

The same steps shall be followed *ex-ante* and *ex-post*. For parameters that will be monitored subsequent to project initiation guidance is given in the parameter tables of the relevant modules for the values that shall be used in *ex-ante* calculations.

STEP 0. Identification of the most plausible VCS-eligible activity(ies)

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.

[7] As defined in BL-DFW

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 documented to be converted to non-forest?		Is the forest expected to degrade by fuelwood 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 necessary 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:

a. The geographic boundaries relevant to the project activity;

b. The temporal boundaries;

c. The carbon pools that the project will consider;

d. The sources and associated types of greenhouse gas emissions that the project will affect; and

e. The sources of leakage.

a. <u>Geographical boundaries</u>

To be eligible for VCS crediting, land defined as "forest" shall meet the VCS definition of forest and shall be under the control of the project proponent at the time of verification. The

[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).

[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 eligible IFM activity.

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.

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 (from a geo-referenced digital map – data must be provided in the format specified / required by the VCS).
- 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 regions, 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 cannot change over the project life-time (*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. Thus two project types cannot occur on the same piece of land.

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

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

b. <u>Temporal boundaries</u>

The following temporal boundaries shall be defined:

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 two years of project start.

Start date and end date of the "project crediting period"

The project 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. VCUs 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, the baseline must be revised every ten years for ongoing planned deforestation.
- For unplanned deforestation, the project baseline shall be revised every 10 years after the year of project start. A baseline revision shall be triggered whenever forest scarcity is encountered relative to the baseline rate of deforestation. If five or more years have passed since the start of the baseline period the baseline shall be immediately revised, if less than five years have passed the baseline shall be revised once five years have passed (see BL-UP).
- For degradation, the baseline must be revised every ten years.

The date of the next scheduled revision shall be specified in the VCS PD. The starting point for the baseline revision of the project will be forest cover projected to exist at the end of the baseline period. Projections for each baseline revision will be subject to independent verification.

Duration of the monitoring periods

Issuance of Verified Carbon Units (*VCU*s) 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 VCS-PD. Data collection for future baseline revision shall be included in the monitoring report.

c. Carbon pools

The project shall account for any significant decreases in carbon stock in the project scenario and any significant increases in carbon stock in the baseline scenario, and may account for decreases in the baseline scenario and increases in the project scenario. 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 aboveground 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 tool T-SIG shall be used to determine whether significant. Insignificant pools can always be ignored.

Table 2. Carbon pools in REDD project activities

Carbon pools	Included / Excluded	Justification / Explanation of choice
Aboveground	Included	At minimum, the stock change in the aboveground 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.
Belowground	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	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.

Table 2 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 (CO_2), nitrous oxide (N_2O) and methane (CH_4) relative to the baseline 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.

T-SIG shall be used to determine whether an emissions source is significant. If a source is included in the estimation of baseline emissions[11], 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 exclude in the baseline but must be included in the project case if fire occurs.
	N_2O	Included	
Combustion of fossil fuels	CO_2	Included	Can be neglected if excluded from baseline accounting.
	CH_4	Excluded	Potential emissions are negligibly small
	N_2O	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_2O	Included	Can be neglected if excluded from baseline accounting except in the situation where fertilizer use is enhanced as a leakage avoidance mechanism.

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

[11] E.g. CH_4 or N_2O emission from agriculture that results from deforestation or fire to clear forest land.

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, fuelwood, or charcoal.

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

Where leakage prevention leads to a significant increase in the use of fertilizers, module E-NA shall be used. T-SIG can be used to determine significance.

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 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. Development of 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 M-MON. 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:

- 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.

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.

STEP 4. 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 greenhouse gas emission reductions.

Methods for estimating baseline carbon stock changes and greenhouse gas emissions are provided in the following modules[12]:

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

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 5. Estimation of total net greenhouse gas emissions reductions (net of project minus baseline and leakage)

The total net greenhouse gas emissions reductions of the REDD project activity 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}	Net greenhouse gas emissions under the baseline scenario; t CO_2-e
ΔC_P	Net greenhouse gas emissions within the project area under the project scenario; t CO_2-e (from M-MON)
ΔC_{LK}	Net greenhouse gas emissions due to leakage; t CO_2-e

[12] 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.

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

Where:

ΔC_{BSL}	Net greenhouse gas emissions under the baseline scenario; t CO_2-e
$\Delta C_{BSL,planned}$	Net greenhouse gas emissions in the baseline from planned deforestation; t CO_2-e (from BL-PL)
$\Delta C_{BSL,unplanned}$	Net greenhouse gas emissions in the baseline from unplanned deforestation; t CO_2-e (from BL-UP)
$\Delta C_{BSL,degrad-FW/C}$	Net greenhouse gas emissions in the baseline from degradation caused by fuelwood collection and charcoal making; t CO_2-e (from BL-DFW)

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

Where:

ΔC_{LK}	Net greenhouse gas emissions due to leakage; t CO_2-e
$\Delta C_{LK-AS,planned}$	Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation; t CO_2-e (from LK-ASP)
$\Delta C_{LK-AS,unplanned}$	Net greenhouse gas emissions due to activity shifting leakage for projects preventing unplanned deforestation; t CO_2-e (from LK-ASU)
ΔC_{LK-ME}	Net greenhouse gas emissions due to market-effects leakage; t CO_2-e (from LK-ME)
$\Delta C_{LK-AS,degrad-FW/C}$	Net greenhouse gas emissions due to activity shifting leakage for degradation caused by extraction of wood for fuel; t CO_2-e (from LK-DFW)

Under the VCS standard project proponents shall present conservative *ex-ante* estimations of the total net GHG emissions reductions of the REDD project activity.

For *ex-ante* estimation for specific parameters project proponents shall refer to the parameter tables in the appropriate modules.

a. Calculation of VCS buffer

The number of credits to be held in the permanence risk buffer (as per the VCS) is determined as a percentage of the total carbon stock benefits. This is equal to the net emissions in the baseline minus emissions from fossil fuel use and fertilizer use minus the net emissions in the

project case minus emissions from fossil fuels and fertilizer use. Leakage emissions do not factor into the buffer calculations.

$$Buffer_{PLANNED} = \left(\left(\Delta C_{BSL,planned} - \sum_{\substack{t=1 \\ Baseline}}^{t^*} \sum_{\substack{i=1 \\ Planned}}^{M} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) - \left(\Delta C_{P.(PlannedDeforestationAreas)} - \sum_{\substack{t=1 \\ Project}}^{t^*} \sum_{\substack{i=1 \\ Planned}}^{M} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) \right) * \left(1 - Buffer\%\right) \quad (4)$$

$$Buffer_{UNPLANNED} = \left(\left(\Delta C_{BSL,unplanned} - \sum_{\substack{t=1 \\ Baseline}}^{t^*} \sum_{\substack{i=1 \\ Unplanned}}^{M} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) - \left(\Delta C_{P.(UnplannedDeforestationAreas)} - \sum_{\substack{t=1 \\ Project}}^{t^*} \sum_{\substack{i=1 \\ Unplanned}}^{M} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) \right) * \left(1 - Buffer\%\right) \quad (5)$$

$$Buffer_{DEGRAD-FW/C} = \left(\left(\Delta C_{BSL,degrad-FW/C} - \sum_{\substack{t=1 \\ Baseline}}^{t^*} \sum_{\substack{i=1 \\ Degrad-FW/C}}^{M} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) - \left(\Delta C_{P.(FW/CDegradationAreas)} - \sum_{\substack{t=1 \\ Project}}^{t^*} \sum_{\substack{i=1 \\ Degrad-FW/C}}^{M} \left(E_{FC,i,t} + N_2O_{direct,i,t} \right) \right) \right) * \left(1 - Buffer\%\right) \quad (6)$$

Where:

$Buffer_{PLANNED}$	Buffer withholding for planned deforestation project areas; t CO_2-e
$Buffer_{UNPLANNED}$	Buffer withholding for unplanned deforestation project areas; t CO_2-e
$Buffer_{DEGRAD-FW/C}$	Buffer withholding for degradation through extraction of fuelwood project areas; t CO_2-e
$\Delta C_{BSL,planned}$	Net greenhouse gas emissions in the baseline from planned deforestation; t CO_2-e
$\Delta C_{BSL,unplanned}$	Net greenhouse gas emissions in the baseline from unplanned deforestation; t CO_2-e
$\Delta C_{BSL,degrad-FW/C}$	Net greenhouse gas emissions in the baseline from degradation caused by fuelwood collection and charcoal making; t CO_2-e

ΔC_P Net greenhouse gas emissions within the project area under the project scenario; t CO_2-e

(The project emissions shall be divided between the emissions arising from the respective project areas for planned and unplanned deforestation and degradation through fuelwood extraction/charcoal production)

$E_{FC,i,t}$ Emission from fossil fuel combustion in stratum *i* in year *t*; t CO_2-e

$N_2O_{direct\text{-}N,i,t}$ Direct N_2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum *i* in year *t*; t CO_2-e

Fossil fuel and fertilizer usage shall be summed by stratum and time. The strata considered shall only be those relevant to the baseline (planned planned and unplanned deforestation and degradation through fuelwood extraction/charcoal production) and time shall be split between the baseline case (subtracted from ΔC_{BSL}) and the project case (subtracted from ΔC_P).

Buffer% Buffer withholding percentage; %

Buffer withholding percentages are based on the project's overall risk classification, the percentage of carbon credits generated by the approved project activity that must be deposited into the AFOLU Pooled Buffer Account to cover non-permanence related project risks. Buffer withholding percentage shall be calculated using *VCS Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination* (T-BAR)[13]. Different percentages will likely be calculated for each of the baseline types as relevant.

i 1, 2, 3, …*M* strata

t 1, 2, 3, …t^* years elapsed since the start of the REDD VCS project activity

$$Buffer_{TOTAL} = Buffer_{PLANNED} + Buffer_{UNPLANNED} + Buffer_{DEGRAD-FW/C} \quad (7)$$

Where:

$Buffer_{TOTAL}$ Total permanence risk buffer withholding; t CO_2-e

$Buffer_{PLANNED}$ Buffer withholding for planned deforestation project areas; t CO_2-e

$Buffer_{UNPLANNED}$ Buffer withholding for unplanned deforestation project areas; t CO_2-e

$Buffer_{DEGRAD\text{-}FW/C}$ Buffer withholding for degradation through extraction of fuelwood project areas; t CO_2-e

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

b. Uncertainty analysis

Project proponents shall use X-UNC to combine uncertainty information and conservative estimates and produce an overall uncertainty estimate of the total net GHG emission reductions.

The estimated cumulative net anthropogenic GHG emission reductions shall be adjusted at each point in time to account for uncertainty as indicated in the module X-UNC[14]. X-UNC calculates an adjusted value for C_{REDD} for any point in time. This adjusted $Adjusted_C_{REDD,\,t}$ shall be the basis of calculations at each point in time in equation 8.

c. Calculation of Verified Carbon Units

To estimate the number of Verified Carbon Units (VCUs) for the monitoring period $T = t2\text{-}t1$, this methodology uses the following equation:

$$VCU_t = \left(Adjusted_C_{REDD,t_2} - Adjusted_C_{REDD-t_1}\right) - Buffer_{TOTAL} \tag{8}$$

Where:

VCU_t	Number of Verified Carbon Units at time $t = t_2 - t_1$; VCU
$Adjusted_C_{REDD,t2}$	Cumulative total net GHG emissions reductions at time t_2 adjusted to account for uncertainty; t CO_2-e
$Adjusted_C_{REDD,t1}$	Cumulative total net GHG emissions reductions at time t_1; t CO_2-e
$Buffer_{TOTAL}$	Total permanence risk buffer withholding; t CO_2-e

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[14] The allowable uncertainty under this methodology is ± 15% of $C_{REDD,t}$ at the 95% confidence level. Where this precision level is met then no deduction should result for uncertainty. Where uncertainty exceeds 15% of $C_{REDD,t}$ at the 95% confidence level then the deduction shall be equal to the amount that the uncertainty exceeds the allowable level.

The adjusted value for $C_{REDD,\,t}$ to account for uncertainty shall be calculated as:

$$Adjusted_C_{REDD,t} = C_{REDD,t} * \left(100\% - C_{REDD_ERROR} + 15\%\right)$$

Where:

$Adjusted_\ C_{REDD,\,t}$	Cumulative total net GHG emission reductions at time *t* adjusted to account for uncertainty; t CO_2-e
$C_{REDD,\,t}$	Cumulative total net GHG emission reductions at time *t*; t CO_2-e
C_{REDD_ERROR}	Total uncertainty for REDD project activity; %

*For details see **X-UNC***

III. *EX-POST* MONITORING

Ex-post monitoring shall have two key aspects:

TASK 1. Monitoring According to Monitoring Plan

TASK 2. Revising the baseline for future crediting periods

TASK 1. Monitoring according to the monitoring plan

a. 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 regions (at a minimum of every 10 years) as specified in M-MON and where relevant in BL-UP.
- Spatial variable datasets used to model the location of deforestation, as specified in 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 changed.
- Where required, carbon stock data as specified in M-MON.

b. 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 M-MON 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 M-MON (Monitoring of 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 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.

c. 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 applicable 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.

TASK 2. Revising the baseline 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.

IV. PARAMETERS ORIGINATING IN OTHER MODULES

Data / parameter:	$\Delta C_{BSL,degrad\text{-}FW/C}$
Data unit:	t CO_2-e
Used in equations:	2, 6
Description:	Net greenhouse gas emissions in the baseline from degradation caused by fuelwood collection and charcoal making
Module parameter originates in:	BL-DFW
Any comment:	

Data / parameter:	$\Delta C_{BSL,planned}$
Data unit:	t CO_2-e
Used in equations:	2, 4

Description:	Net greenhouse gas emissions in the baseline from 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, 5
Description:	Net greenhouse gas emissions in the baseline from unplanned deforestation
Module parameter originates in:	BL-UP
Any comment:	

Data / parameter:	$\Delta C_{LK\text{-}AS,degrad\text{-}FW/C}$
Data unit:	t CO_2-e
Used in equations:	3
Description:	Net greenhouse gas 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:	$\Delta C_{LK\text{-}AS,planned}$
Data unit:	t CO_2-e
Used in equations:	3
Description:	Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation
Module parameter originates in:	LK-ASP
Any comment:	

Data / parameter:	$\Delta C_{LK\text{-}AS,unplanned}$
Data unit:	t CO_2-e
Used in equations:	3
Description:	Net greenhouse gas emissions due to activity shifting for projects preventing unplanned deforestation
Module parameter originates in:	LK-ASU
Any comment:	

Data / parameter:	$\Delta C_{LK\text{-}ME}$
Data unit:	t CO_2-e
Used in equations:	3
Description:	Net greenhouse gas 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, 4, 5, 6
Description:	Net greenhouse gas emissions within the project area under the project scenario
Module parameter originates in:	M-MON
Any comment:	

Data / parameter:	$E_{FC,i\,t}$
Data unit:	t CO_2-e
Used in equations:	4,5,6
Description:	Emission from fossil fuel combustion in stratum *i* in year *t*
Module parameter	E-FFC

originates in:	
Any comment:	

Data / parameter:	$N_2O_{direct\text{-}N,i,t}$
Data unit:	t CO_2-e
Used in equations:	4,5,6
Description:	Direct N_2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum *i* in year *t*
Module parameter originates in:	E-NA
Any comment:	