VCS Module

VMD0006

Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation/forest degradation and planned wetland degradation (BL-PL)

Version 1.3

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Sectoral Scope 14

Methodology developed by:

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1 SOURCES

This module is one of numerous modules that comprise the VCS approved methodology *VM0007 REDD Methodology Framework (REDD+ MF)*.

This module uses the latest version of the following modules and tools:

- *Module M-REDD VMD0015 Methods for monitoring of greenhouse gas emissions and removals in REDD project activities*
- *Module LK-ASP VMD0009 Estimation of emissions from activity shifting for avoiding planned deforestation/planned forest degradation and avoiding planned wetland degradation*
- *Module CP-AB VMD0001 Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools*
- *Module CP-D VMD0002 Estimation of carbon stocks in the dead-wood pool*
- *Module CP-L VMD0003 Estimation of carbon stocks in the litter pool*
- *Module CP-S VMD0004 Estimation of carbon stocks in the soil organic carbon pool (mineral soils)*
- *Module CP-W VMD0005 Estimation of carbon stocks in the long-term wood products pool*
- *Module BL-DFW VMD0008 Estimation of baseline emission from forest degradation caused by extraction of wood for fuel*
- *Module LK-DFW VMD0012 Estimation of emissions from displacement of fuelwood extraction*
- *Module E-BPB VMD0013 Estimation of greenhouse gas emissions from biomass and peat burning*
- *Module E-FFC VMD0014 Estimation of emissions from fossil fuel combustion*
- *Module E-NA CDM tool Estimation of direct N_2O emissions from nitrogen application*
- *Module BL-PEAT VMD0042 Estimation of baseline soil carbon stock changes and greenhouse gas emissions in peatland rewetting and conservation project activities*
- *Module BL-TW VMD0050 Estimation of baseline carbon stock changes and greenhouse gas emissions in tidal wetland restoration and conservation project activities*
- *Tool T-SIG CDM Tool for testing significance of GHG emissions in A/R CDM project activities*

2 SUMMARY DESCRIPTION OF THE MODULE

This module allows for estimating GHG emissions related to planned deforestation[1], planned degradation and planned wetland degradation in the baseline case. The module assesses GHG emissions within the project area for the baseline period. Hereafter in this module, "deforestation" refers to both deforestation and planned degradation.

This module was originally developed for APD project activities. It is also mandatory for use in APWD project activities and for this purpose the following translation table must be used.

Table 1: Translation between REDD and WRC Terminology

Where the module refers to:	It must be understood as referring to:
Deforestation / deforested / cleared	Wetland degradation / degraded / degraded
APD	APWD
REDD project	CIW project or CIW-REDD project
Conversion of forest land to non-forest land	Conversion of intact or partially altered wetland to degraded wetland or non-wetland
Forest area	Wetland area

When applying *BL-PL* for REDD-APWD or stand-alone APWD project activities, disregard the references to Module *CP-S* in Part 2 and instead use Module *BL-TW* or *BL-PEAT* (whichever is relevant) for soil GHG accounting. When comparing biophysical parameters (Chapter 4, Section 1.1), elevation classes must be appropriate to the use in tidal wetlands, to be justified by the project proponent. Hydrology and salinity are additional factors to be considered.

3 DEFINITIONS AND ACRONYMS

Definitions

This modules uses the definitions set out in the VCS Program document Program Definitions and VCS methodology *VM0007 REDD+ MF*.

[1] **Avoiding planned deforestation (APD)**: reduces GHG emissions by stopping deforestation on forest lands that are legally authorized and documented to be converted to non-forest land, and enhances carbon stock of degraded and secondary forests (if present in the project area) that would be deforested in the absence of the REDD project activity. This REDD practice can occur in degraded to mature forests at the forest frontier or in the forest mosaic configuration. (from the applicable VCS AFOLU requirements).

Acronyms

Acronyms used in naming variables that are not used in the text of the module are not listed here. Definitions of each variable are included following the applicable formula and in the parameter section of this module for easier reference.

APWD – Avoiding Planned Wetland Degradation
CIW – Conservation of Intact Wetland
SOC – Soil Organic carbon
WRC – Wetland Restoration and Conservation

For definitions of VCS AFOLU project categories refer to the *VCS Standard.*

4 APPLICABILITY CONDITIONS

The module is applicable for estimating the baseline emissions on forest[2] lands (usually privately or government owned) that are legally authorized and documented to be converted to non-forest land.

Where, pre-project, unsustainable fuelwood collection is occurring within the project boundaries Modules *BL-DFW* and *LK-DFW* must be used to determine potential leakage[3].

5 PROCEDURES

The baseline net GHG emissions for planned deforestation will be determined as:

For REDD project activities (non-wetland):

$$\Delta C_{BSL,planned} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \left(\Delta C_{BSL,i,t} + GHG_{BSL-E,i,t} \right) \quad (1)$$

For APWD-REDD project activities (terrestrial carbon pools):

Use Equation 1.

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2 Mangrove forests are excluded from any tree height requirement in a forest definition, as they consist of (close to) 100% mangrove species, which often do not reach the same height as other tree species, and occupy contiguous areas and their functioning as a forest is independent of tree height. See REDD+ MF Section 4.3

3 Where a project claims no fuelwood collection was occurring this must be evidenced through a PRA process. Where fuelwood collection is claimed to be sustainable, the following criteria must in the absence of the project be met:

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.

This definition follows the CDM: EB 23, Annex 18

Additional emission reductions cannot be claimed for application of Module *BL-DFW* within the boundaries as defined in Module *BL-PL*.

For APWD-REDD and stand-alone APWD project activities (wetland SOC pool):

Use Module *BL-PEAT* or *BL-TW* (whichever is relevant) to estimate soil GHG emissions following wetland degradation ($GHG_{WPS-PEAT}$ or GHG_{WPS-TW}).

On peatland:

$$GHG_{BSL-PEAT,planned} = GHG_{BSL-PEAT} \quad (2)$$

On tidal wetland:

$$GHG_{BSL-TW,planned} = GHG_{BSL-TW} \quad (3)$$

Where:

$\Delta C_{BSL,planned}$	Net greenhouse gas emissions in the baseline from planned deforestation up to year t^*; t CO_2-e
$\Delta C_{BSL,i,t}$	Net carbon stock changes in all pools in the baseline stratum i in year t; t CO_2-e
$GHG_{BSL-E,i,t}$	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i in year t; t CO_2-e yr^{-1}
i	1, 2, 3, … M strata
t	1, 2, 3, … t^* years elapsed since the projected start of the project activity
$GHG_{BSL-PEAT,planned}$	Net GHG emissions in the baseline scenario from planned peatland degradation up to year t^*; t CO_2e
$GHG_{BSL-TW,planned}$	Net GHG emissions in the baseline scenario from planned tidal wetland degradation up to year t^*; t CO_2e
$GHG_{BSL-PEAT}$	Net GHG emissions in the APWD-REDD or stand-alone APWD baseline scenario on peatland up to year t^*; t CO_2e
GHG_{BSL-TW}	Net GHG emissions in the APWD-REDD or stand-alone APWD baseline scenario on tidal wetland up to year t^*; t CO_2e

When using Modules *BL-PEAT* or *BL-TW*, $A_{BSL,i,t}$ (Area of stratum i in year t in the project area in the baseline scenario) must be quantified. These areas are subject to stratification[4] (see Module *X-STR* for general guidance). The sum of strata must be equal to $A_{planned,i,t}$.

Part 1. Calculating annual area of land deforested

1.1 Identify the agent of planned deforestation in each baseline stratum *i*

In the simplest scenario the agent is an already defined individual, organization or corporation.

[4] Module *BL-PEAT*, for example, distinguishes area of ditch and other open water, area of peat burnt and area of peatland (not open water, not burnt).

If the agent is not yet defined (i.e. the Government or an alternative agent currently controls the land and the exact agents of deforestation are yet to be determined but will have government sanction) then the most likely "class of deforestation agents" must be identified. Examples of deforestation agent classes include:

- Entities (individuals, companies, associations) practicing similar deforestation practices and post deforestation land use practices such as:
    - Agri/aquabusinesses implementing industrial scale agri/aquaculture
    - Large scale agri/aquaculturalists practicing farming/aquaculture on parcels larger than 500 ha
    - Ethnic or religious groups pursuing large scale agri/aquaculture
- Individuals or entities implementing specific legal land use regulation(s)

The selection of class of agent must be justified through stratification of the region and demonstration with historical records that the identified class of agent is the most common purchaser of similar lands in the identified strata. Stratification must follow the following guidance and procedures:

Strata must be spatially discrete and defined on the basis of forest carbon stocks. Strata must reflect biophysical parameters relating to forest productivity, and activity-driven parameters relating to distinct conversion practices. Illustrative parameters include:

Biophysical parameters

a. Soil type
b. Elevation
c. Precipitation regime
d. Temperature
e. Slope and aspect
f. Tree species composition
g. Age class/disturbance history
h. Stand density

Activity-related parameters

a. Distance to transportation networks (roads, rivers)
b. Distance to deforested land or forest edge
c. Distance to towns and villages

1.2 Area of deforestation $A_{planned,i}$

For all instances of planned deforestation REDD projects, there must be an **immediate site-specific threat of deforestation**. The threat must be concrete and would lead to deforestation within a defined period of time.

This threat must be demonstrated by documentary proof of the following:

- Legal permissibility for deforestation[5];
- Suitability of project area for conversion to alternative non-forest land use[6];
- If applicable, evidence of likely transfer of ownership to baseline agent of deforestation or class of agent of deforestation must be demonstrated by one of the following forms of evidence originating prior to the date of all evidence on pursuit of carbon finance/consideration of REDD:
    - Bona fide bidding process for the project area that reflects value of the area and with the expressed intent to deforest;
    - Purchase offer of the project area by an entity that is clearly dedicated to agricultural, grazing or urban development activities;
    - Other evidence that control of the project area would have been transferred to the baseline agent or class of agents in the absence of the project;
- If government approval is required for deforestation to occur, the intention to deforest within the project area must be demonstrated by evidence:
    - Recent approval from relevant government department (local to national) for conversion of forest to an alternative land use; or
    - Documentation that a request for approval has be filed with the relevant government department for permission to deforest and convert to alternative land use;
- Intent to deforest[7]—intention to deforest must be demonstrated by the following form of evidence originating prior to the date of all evidence on pursuit of carbon finance/consideration of REDD:
    - Where deforestation is by an identified class of agents: A documented history (for example government data or maps) of similar planned deforestation activities by class of agents, of planned deforestation within the five years previous to without-project deforestation.
    - Where a specific baseline agent has been identified: Either a valid and verifiable land use management plan for deforesting the project area, or a documented history (for example government data or maps) of similar planned deforestation activities by the baseline

5 Permissibility must be with reference to relevant laws and legal requirements. When considering legal permissibility the area of allowed deforestation must be considered relative to total property areas including areas already deforested.
6 Suitability should include accessibility to relevant markets, suitability of soils, topography and climate.
7 Intent to deforest by baseline agent of deforestation

agent of planned deforestation within the five years previous to without-project deforestation.

The proportion of the total parcel area planned to be deforested cannot exceed the legal mandate unless common practice in a proxy area shows that the mandates are not enforced.

1.3 Rate of deforestation $D\%_{planned,i,t}$

The methodology requires knowledge of the rate (area deforested per year) at which the planned areas will be deforested to give an area per stratum (*i*) per year (*t*) through the project period.

Where a valid verifiable plan exists for rate at which deforestation is projected to occur, this rate must be used.

If no verifiable plan exists, the rate must be established by examining proxy areas. Proxy areas may or may not be under the management of the project area's baseline agent of deforestation or class of deforestation agents[8]. A minimum of 6 proxy areas must be included.

The following criteria for applicability of proxy areas for determination of deforestation rate must be met:

1. Land conversion practices must be the same as those used by the baseline agent or class of agent
2. The post-deforestation land use must be the same in the proxy areas as expected in the project area under business as usual
3. The proxy areas must have the same management and land use rights type as the proposed project area under business as usual
4. If suitable sites exist they must be in the immediate area of the project; if an insufficient number of sites exists in the immediate area of the project, sites must be identified elsewhere in the same country as the project; if an insufficient number of sites exists in the country, sites must be identified in neighboring countries
5. Agents of deforestation in proxy areas must have deforested their land under the same criteria that the project lands must follow (legally permissible and suitable for conversion—see section 1.1 above).
6. Deforestation in the proxy area must have occurred within the 10 years prior to the baseline period.
7. The three following conditions must be met:
    - The forest types surrounding the proxy area or in the proxy area prior to deforestation must be in the same proportion as in the project area (±20%).

[8] Note the difference between baseline deforestation on proxy lands, that may or may not be managed by the agent/class of deforestation, and baseline deforestation in Module *LK-ASP* "*WoPR*," which is on land specifically managed by the agent/class of deforestation.

- Soil types that are suitable for the land-use practice used by the agent of deforestation in the project area must be present in the proxy area in the same proportion as the project area (±20%). The ratio of slope classes "gentle" (slope <15%) to "steep" (slope ≥15%) in the proxy areas must be (±20%) the same of the ratio in the project area.
- Elevation classes (500m classes) in the proxy area must be in the same proportion as in the project area (±20%).

The proxy area will be used to estimate an average proportion of land that is cleared each year, thus a sufficient number of parcels are needed to be representative of the common practice in the proxy area, and hence also in the project area.

Examination of proxy areas may be through original data collection (field measurements and/or remote sensing analysis) or where appropriate use of directly applicable existing data generated from credible sources.

The annual deforestation would be calculated with Equation 4:

$$D\%_{planned,i,t} = \left(\sum_{pn=1}^{n^*} \left(D\%_{pn} / Yrs_{pn} \right) \right) / n \quad (4)$$

Where:

$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum *i* during year *t*. If actual annual proportion is known and documented (e.g. 25% per year for 4 years), set to proportion; %
$D\%_{pn}$	Percent of deforestation in land parcel[9] *pn* etc of a proxy area as a result of planned deforestation as defined in this module; %
$Yrs_{pn,}$	Number of years over which deforestation occurred in land parcel *pn* in proxy area; years
n	Total number of land parcels examined
pn	1, 2, 3, …n^* land parcels examined in proxy area
i	1, 2, 3, …*M* strata

If no proxy area exists under the same land use management/rights type, then representative areas under different land use right types must be examined and documentation must be provided establishing that the lands are representative.

[9] Parcels are a unit of land area. A stratum may contain many parcels.

1.4 Likelihood of deforestation $L\text{-}D_i$

Where forest areas are under government control and the areas have been zoned for deforestation, a suitable representative sample of similar zoned areas must be examined to define the likelihood of deforestation occurring. The likelihood ($L\text{-}D_i$) will be equal to the proportion of similarly zoned proxy areas deforested within the previous five years within the appropriate stratum.

The criteria for selection of proxy areas is given in Section 1.2.

For all other planned deforestation areas (i.e. areas not both under government control and zoned for deforestation), $L\text{-}D_i$ must be equal to 100%.

1.5 Risk of abandonment

Identify a minimum of 5 proxy areas[10] deforested by the same 'class of deforestation agent'[11] at least ten years previously. If any of the proxy areas have been abandoned to forest regrowth then the planned deforestation activity is not eligible and this module must not be used.

1.6 Annual area of deforestation $AA_{planned,i,t}$

The annual area of deforestation in the baseline case is thus:

$$AA_{planned,i,t} = \left(A_{planned,i} * D\%_{planned,i,t}\right) * L - D_i \quad (\mathbf{5})$$

Where:

$AA_{planned,i,t,}$	Annual area of baseline planned deforestation for stratum *i* at time *t*; ha
$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum *i* during year *t*. If actual annual proportion is known and documented (e.g. 25% per year for 4 years), set to proportion; %
$A_{planned,i,}$	Total area of planned deforestation over the baseline period for stratum *i*; ha
$L\text{-}D_i$	Likelihood of deforestation for stratum *i*; %

Part 2. Baseline carbon stock change[12]

The net carbon stock changes in the baseline is equal to the baseline pre-deforestation stock minus the long-term carbon stock after deforestation and minus the baseline stock that enters the wood products pool at the time of deforestation (i.e. not emitted from aboveground biomass at the time of deforestation).

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10 See Part 1.2 for criteria for acceptable proxy areas

11 See Part 1.1; if the agent is an already defined individual, organization or corporation identify the class of agent the agent belongs to

12 Stock estimates must occur for the pools defined through *REDD+ MF*

Carbon pools excluded from the project can be accounted as zero. For the determining which carbon pools must be included in the calculations as a minimum, see Tool *T-SIG* and *REDD+ MF*.

Post-deforestation carbon stocks must be the long-term average stocks on the land following deforestation. Post-deforestation carbon stocks can be measured in proxy areas or values can be taken from credible and representative literature sources (e.g., the peer-reviewed literature or data published by the IPCC or the FAO). Where stocks accumulate through time the ultimate (highest) stock must be used and where stocks are in a cycle[13] the mean stock across the cycle must be used.

Carbon pools excluded from the project can be accounted as zero. Herbaceous non-tree vegetation is considered to be *de minimis* in all instances. For the determination which carbon pools must be included in the calculations as a minimum, see Tool *T-SIG* and *REDD+ MF*.

For terrestrial carbon pools, stock changes in each pool are calculated by subtracting post-deforestation carbon stocks from forest carbon stocks.

For REDD project activities (non-wetland):

$$\Delta C_{AB_{tree},i} = C_{AB_{tree_{bsl}},i} - C_{AB_{tree_{post}},i} \quad (\mathbf{6})$$

$$\Delta C_{AB_{non-tree},i} = C_{AB_{non-tree_{bsl}},i} - C_{AB_{non-tree_{post}},i} \quad (\mathbf{7})$$

$$\Delta C_{BB\_tree,i} = C_{BB_{tree_{bsl}},i} - C_{BB_{tree_{post}},i} \quad (\mathbf{8})$$

$$\Delta C_{BB_{non-tree},i} = C_{BB_{non-tree,bsl,i}} - C_{BB_{non-tree,post,i}} \quad (\mathbf{9})$$

$$\Delta C_{DW,i} = C_{DW,bsl,i} - C_{DW,post,i} \quad (\mathbf{10})$$

$$\Delta C_{LI,i} = C_{LI,bsl,i} - C_{LI,post,i} \quad (\mathbf{11})$$

$$\Delta C_{SOC,i} = C_{SOC,bsl,i} - C_{SOC,PD-BSL,i} \quad (\mathbf{12})$$

Where:

$\Delta C_{AB\_tree,i}$	Baseline carbon stock change in aboveground tree biomass in stratum *i*; t CO_2-e ha^{-1}
$C_{AB\_tree,bsl,i}$	Forest carbon stock in aboveground tree biomass in stratum *i*; t CO_2-e ha^{-1}
$C_{AB\_tree,post,i}$	Post-deforestation carbon stock in aboveground tree biomass in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{BB\_tree,i}$	Baseline carbon stock change in belowground tree biomass in stratum *i*; t CO_2-e ha^{-1}
$C_{BB\_tree,bsl,i}$	Forest carbon stock in belowground tree biomass in stratum *i*; t CO_2-e ha^{-1}
$C_{BB\_tree,post,i}$	Post-deforestation carbon stock in belowground tree biomass in stratum *i*; t CO_2-e ha^{-1}

[13] Examples include fallow-based agricultural systems (including slash and burn)

$\Delta C_{AB\_non\text{-}tree,i}$	Baseline carbon stock change in aboveground non-tree biomass in stratum *i*; t CO_2-e ha^{-1}
$C_{AB\_non\text{-}tree,bsl,i}$	Forest carbon stock in aboveground non-tree vegetation in stratum *i*; t CO_2-e ha^{-1}
$C_{AB\_non\text{-}tree,post,i}$	Post-deforestation carbon stock in aboveground non-tree vegetation in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{BB\_non\text{-}tree,i}$	Baseline carbon stock change in belowground non-tree biomass in stratum *i*; t CO_2-e ha^{-1}
$C_{BB\_nontree,bsl,i}$	Forest carbon stock in belowground non-tree biomass in stratum *i*; t CO_2-e ha^{-1}
$C_{BB\_nontree,post,i}$	Post-deforestation carbon stock in belowground non-tree biomass in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{DW,i}$	Baseline carbon stock change in dead wood in stratum *i*; t CO_2-e ha^{-1}
$C_{DW,bsl,,i}$	Forest carbon stock in dead wood in stratum *i*; t CO_2-e ha^{-1}
$C_{DW,post,i}$	Post-deforestation carbon stock in dead wood in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{LI,i}$	Baseline carbon stock change in litter in stratum *i*; t CO_2-e ha^{-1}
$C_{LI,bsl,i}$	Forest carbon stock in litter in stratum *i*; t CO_2-e ha^{-1}
$C_{LI,post,i}$	Post-deforestation carbon stock in litter in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{SOC,i}$	Baseline carbon stock change in soil organic carbon in stratum *i*; t CO_2-e ha^{-1}
$C_{SOC,bsl,i}$	Forest carbon stock in soil organic carbon in stratum *i*; t CO_2-e ha^{-1}
$C_{SOC,PD\text{-}BSL,i}$	Post-deforestation carbon stock in soil organic carbon in stratum *i*; t CO_2-e ha^{-1}
i	1, 2, 3, … *M strata*

For APWD-REDD and stand-alone APWD project activities, GHG emissions from the soil organic carbon pool are not quantified using Equation 12, see below.

In the situation where the baseline includes harvesting of long-lived wood products the harvested wood products carbon pool (Module *CP-W*) must be included. For calculation of carbon stock sequestered in wood products, see Module *CP-W*.

Stock changes in aboveground biomass and litter are emitted at the time of deforestation. Following deforestation, emissions from belowground biomass, dead wood, soil and wood products take place gradually over time. Stock changes in belowground biomass and dead wood are emitted at an annual rate of 1/10 of the stock change for 10 years, and at an annual rate of 1/20 of the stock change for 20 years for soil organic carbon (for non-wetland soils). Carbon stocks entering the wood products pool at the time of deforestation and that are expected to be emitted over 100-years are emitted at an annual rate of 1/20 of the stock for 20 years. Thus, for a given year *t*, emissions are summed across areas deforested from time *t-10* up to time *t* (for belowground biomass and dead wood) and from time *t-20* up to time *t* (for soil organic carbon and wood products), in the Equation 13. Use Modules *CP-AB*, *CP-W*, *CP-D*, *CP-LI* and *CP-S*. for REDD project activities not implemented on wetlands.

For APWD-REDD project activities, Equation 13 and Module *CP-S* must not be used. Instead, use Equation 14 for carbon stock change in all pools except soil, and Equations 15 or 16 for the quantification of GHG

emissions from the SOC pool. For APWD-REDD and stand-alone APWD project activities, use Module *BL-PEAT* or *BL-TW* (whichever is relevant) to estimate soil GHG emissions following wetland degradation ($GHG_{BSL\text{-}PEAT}$ or $GHG_{BSL\text{-}TW}$).

When using Modules *BL-PEAT* or *BL-TW*, $A_{BSL,i,t}$ (Area of stratum *i* in year *t* in the project area in the baseline scenario) must be quantified. This area is subject to stratification[14] (see Module *X-STR* for general guidance). The sum of strata must be equal to $A_{planned,i,t}$.

For REDD project activities (non-wetland):

$$\Delta C_{BSL,i,t} = AA_{planned,i,t} * (\Delta C_{AB_{tree},i} - \Delta C_{WP,i} + \Delta C_{AB_{non-tree},i} + \Delta C_{LI,i}) + (\sum_{t-10}^{t} A_{planned,i,t}) * (\Delta C_{BB_{tree},i} + \Delta C_{BB_{non-tree},i} + \Delta C_{DW,i}) * \left(\frac{1}{10}\right) + (\sum_{t-20}^{t} AA_{unplanned,i,t}) * \left(C_{WP100,i} + \Delta C_{SOC,i}\right) * \left(\frac{1}{20}\right) \quad (\mathbf{13})$$

For APWD-REDD project activities (terrestrial carbon pools):

$$\Delta C_{BSL,i,t} = AA_{planned,i,t} \times (\Delta C_{AB_{tree},i} - \Delta C_{WP,i} + \Delta C_{AB_{non-tree},i} + \Delta C_{LI,i}) + (\sum_{t-10}^{t} AA_{planned,i,t}) \times (\Delta C_{BB_{tree},i} + \Delta C_{BB_{non-tree},i} + \Delta C_{DW,i}) * \left(\frac{1}{10}\right) + (\sum_{t-20}^{t} AA_{planned,i,t}) \times \left(C_{WP100,i}\right) * \left(\frac{1}{20}\right) \quad (\mathbf{14})$$

For APWD-REDD and stand-alone APWD project activities (wetland SOC pool):

On peatland: see Equation 2.

On tidal wetland: see Equation 3.

Where:

$\Delta C_{BSL,i,t}$	Sum of the baseline carbon stock change in all terrestrial pools in stratum *i* in year *t*, t CO_2-e
$AA_{planned,i,t}$	Annual area of baseline planned deforestation for stratum *i* in year *t*; ha
$C_{WP100,i}$	Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{AB\_tree,i}$	Baseline carbon stock change in aboveground tree biomass in stratum *i*; t CO_2-e ha^{-1}

[14] Module *BL-PEAT*, for example, distinguishes area of ditch and other open water, area of peat burnt and area of peatland (not open water, not burnt).

$\Delta C_{BB\_tree,i}$	Baseline carbon stock change in belowground tree biomass in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{AB\_non\text{-}tree,i}$	Baseline carbon stock change in aboveground non-tree biomass in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{BB\_non\text{-}tree,i}$	Baseline carbon stock change in belowground non-tree biomass in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{WP,i}$	Baseline carbon stock change in wood products in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{DW,i}$	Baseline carbon stock change in dead wood in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{LI,i}$	Baseline carbon stock change in litter in stratum *i*; t CO_2-e ha^{-1}
$\Delta C_{SOC,i}$	Baseline carbon stock change in soil organic carbon in stratum *i*; t CO_2-e ha^{-1}
i	1, 2, 3, … *M* strata
t	1, 2, 3, … *t** years elapsed since the projected start of the project activity

Part 3. Greenhouse gas emissions

The GHG emissions in the baseline within the project boundary must be estimated as:

$$GHG_{BSL,E,i,t} = E_{FC,i,t} + E_{BiomassBurn,i,t} + N_2O_{direct-N,i,t} \quad (\mathbf{15})$$

Where:

$GHG_{BSL,E}$	Greenhouse gas emissions as a result deforestation activities within the project boundary in the stratum *i* in year *t*; t CO_2-e
$E_{FC,i,t}$	Net CO_2e emission from fossil fuel combustion in stratum *i* in year *t*; t CO_2-e
$E_{BiomassBurn,i,t}$	Non-CO_2 emissions due to biomass burning 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
i	1, 2, 3, …*M* strata
t	1, 2, 3, …*t** years elapsed since the start of the REDD VCS project activity

For the calculation of $E_{FC,i,t}$, $E_{BiomassBurn,i,t}$ and $N_2O_{direct\text{-}N,i,t}$ the VCS-approved Modules "Estimating emissions from fossil fuel combustion in REDD project activities (Module *E-FFC*)", "Estimating non-CO_2 emissions from biomass burning in REDD project activities (Module *E-BPB*)" and the latest A/R CDM tool "Estimation of direct nitrous oxide emission from nitrogen fertilization"[15] (Module *E-NA*) must be used.

For the determination which sources of emissions must be included in the calculations as a minimum, see Tool *T-SIG* and the framework module – *REDD+ MF*.

[15] http://cdm.unfccc.int/EB/033/eb33_repan16.pdf

Part 4. Frequency of baseline renewal

The baseline must be revised every ten years for ongoing planned deforestation.

6 PARAMETERS

Data Unit / Parameter:	$A_{planned,i}$
Data unit:	ha
Used in equations:	5
Description:	Total area of planned deforestation over the fixed baseline period for stratum *i*
Source of data:	GPS coordinates and/or Remote Sensing data and/or legal parcel records
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	

Data Unit / Parameter:	$D\%_{planned,i,t}$
Data unit:	% year^{-1}
Used in equations:	4, 5
Description:	Projected annual proportion of land that will be deforested in stratum *i* at year *t*
Source of data:	Analysis of Remote Sensing data and/or legal records for a number of proxy areas
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	Must be revisited at the time of baseline revision

Data Unit / Parameter:	$L\text{-}D_i$
Data unit:	%
Used in equations:	5
Description:	Likelihood of deforestation in stratum *i*
Source of data:	N/A

Justification of choice of data or description of measurement methods and procedures applied:	For all areas not both under Government control and zoned for deforestation, $L\text{-}D_i$ must be equal to 1 For areas under Government control and zoned for deforestation $L\text{-}D_i$ must be calculated as the summed proxy areas in the appropriate stratum divided by the areas within these proxy areas that has been deforested within the previous five years. Must be revisited at the time of baseline revision
Any comment:	Alternatively, *BCEF*, where not directly available, can be calculated as wood density (t dry mass m^{-3} green volume) * *BEF* (Biomass Expansion Factor = ratio of aboveground biomass to biomass of the commercial volume). If using *BCEF*s developed outside the project country (cases (c) and (d) above under Source of data), it is necessary to validate the applicability of *BCEF*s used. Validation is performed by: 1. Limited Measurements • Select at least 20 plots in the project area covering a wide range of commercial volumes. • Obtain tree measurements (e.g. DBH, height to a 10 cm diameter top) from which to calculate commercial volume and total biomass. • Calculate commercial volume per unit area (e.g. using Smalian's formula) and total biomass per unit area (using the biomass equation(s) selected for application in Module *CP-AB*) for each plot • Calculate *BCEF* for each plot (biomass (t) / commercial volume (m^3) • Graph the plot-level estimates of *BCEF* versus commercial volume along with the *BCEF* equation (predicted) to be validated. If the estimated *BCEF*s of the measured plots are distributed both above and below the predicted value the *BCEF* equation may be used. The *BCEF* equation may also be used if the measured plots have a *BCEF* consistently lower than that predicted. If graphing the *BCEF* of the measured plots indicates a systematic bias to overestimation of *BCEF* (>75% of the plots below the

	predicted value) then another BCEF equation must be selected or developed anew.

Data Unit / Parameter:	$C_{AB\_tree,i}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	6, 13, 14
Description:	Carbon stock in aboveground biomass in trees in the baseline in stratum *i*
Module parameter originates in:	Module *CP-AB*
Any comment:	

Data Unit / Parameter:	$C_{BB\_tree,i}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	7, 13, 14
Description:	Carbon stock in belowground biomass in trees in the baseline in stratum *i*
Module parameter originates in:	Module *CP-AB*
Any comment:	

Data Unit / Parameter:	$C_{AB\_nontree,i,}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	8, 13, 14
Description:	Carbon stock in aboveground non-tree vegetation in the baseline in stratum *i*
Module parameter originates in:	Module *CP-AB*
Any comment:	*Herbaceous vegetation considered de minimis in all instances*

Data Unit / Parameter:	$C_{BB\_nontree,i,}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	9, 13, 14
Description:	Carbon stock in belowground non-tree vegetation in the baseline in stratum *i*
Module parameter originates in:	Module *CP-AB*

Any comment:	*Herbaceous vegetation considered de minimis in all instances*

Data Unit / Parameter:	$C_{DW,i}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	10, 13, 14
Description:	Carbon stock in dead wood in the baseline in stratum *i*
Module parameter originates in:	Module *CP-D*
Any comment:	

Data Unit / Parameter:	$C_{LI,i}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	11, 13, 14
Description:	Carbon stock in litter in the baseline in stratum *i*
Module parameter originates in:	Module *CP-L*
Any comment:	

Data Unit / Parameter:	$C_{SOC,i}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	12, 13
Description:	Mean carbon stock in soil organic carbon in the baseline in stratum *i*
Module parameter originates in:	Module *CP-S*
Any comment:	

Data Unit / Parameter:	$C_{SOC,PD-BSL,i}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	12
Description:	Mean post-deforestation stock in soil organic carbon in the post deforestation stratum *i*
Module parameter originates in:	Module *CP-S*
Any comment:	

Data Unit / Parameter:	$C_{WP,i}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	13, 14
Description:	Mean carbon stock entering the wood products pool at the time of deforestation from stratum *i*
Module parameter originates in:	Module *CP-W*
Any comment:	

Data / parameter:	$GHG_{BSL-PEAT}$
Data unit:	t CO_2e
Used in equations:	2
Description:	Net GHG emissions in the APWD-REDD or stand-alone APWD baseline scenario on peatland up to year *t**
Module parameter originates in:	Module *BL-PEAT*
Any comment:	The description of the parameter deviates from the one in Module *BL-PEAT* for clarity of its use in this module.

Data / parameter:	GHG_{BSL-TW}
Data unit:	t CO_2e
Used in equations:	3
Description:	Net GHG emissions in the APWD-REDD or stand-alone APWD baseline scenario on tidal wetland in up to year *t**
Module parameter originates in:	Module *BL-TW*
Any comment:	The description of the parameter deviates from the one in Module *BL-TW* for clarity of its use in this module.

Data Unit / Parameter:	$E_{BiomassBurn,i,t}$
Data unit:	t CO_2-e
Used in equations:	15

Description:	Non-CO_2 emissions due to biomass burning in stratum *i* in year *t*
Module parameter originates in:	Module *E-BPB*
Any comment:	

Data Unit / Parameter:	$E_{FC,i\,t}$
Data unit:	t CO_2-e
Used in equations:	15
Description:	Emission from fossil fuel combustion in stratum *i* in year *t*
Module parameter originates in:	Module *E-FFC*
Any comment:	

Data Unit / Parameter:	$N_2O_{direct\text{-}N,i,t}$
Data unit:	t CO_2-e
Used in equations:	15
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:	Module *E-NA*
Any comment:	

DOCUMENT HISTORY

Version	Date	Comment
v1.0	3 Dec 2010	Initial version released
v1.1	20 Nov 2012	The scope of this module was expanded to include avoided planned degradation as an allowable activity and the following revisions were made: • Renamed “planned deforestation” to “planned deforestation and planned degradation” • Removed the applicability condition “where post-deforestation land use constitutes reforestation this module must not be used” • Added the text “hereafter in this module, “deforestation” refers to both deforestation and planned degradation” The module was updated to appropriately account for the decay of carbon from the belowground biomass, dead wood, soil carbon and harvested wood products pools and the following revisions were made: • The annual area of deforestation was removed from equation 1 and moved to section 1.6. • Equations 4 to 10 account for the carbon stock change in each pool separately • In equation 11, the carbon stock is emitted annually over 10 years for belowground biomass and dead wood and emitted annually over 20 years for soil carbon and the harvested wood products portion that will be emitted before year 100.
v1.2	3 May 2013	The module has been revised to correct a mathematical error in equation 1.
v1.3	8 Sep 2020	The scope of this module was expanded to include avoided planned wetland degradation as an allowable activity and the following revisions were made: • Added procedures for avoided planned wetland degradation. • Updated text to indicate applicable procedures for non-wetland REDD activities, stand-alone APWD activities, and APWD-REDD activities.