

+REDD Methodological Module

“Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation” – BL-PL

Version - April 2010

I. SCOPE, APPLICABILITY AND PARAMETERS

Scope

This module allows for estimating GHG emissions related to planned deforestation¹ in the baseline case. The module assesses GHG emissions within the project area for the 10 year baseline period.

Applicability

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

Where timber would be harvested as part of baseline deforestation the market effects leakage must be considered using Module LK-ME.

Required conditions²

- This module must be used in conjunction with the Module “Estimation of emissions from activity shifting for avoided planned deforestation” (LK-ASP)
- Conversion of forest lands to a deforested condition must be legally permitted (Section 1.2)

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 VCS Guidance for AFOLU Projects; p14.)

² Required conditions are full applicability criteria, non-compliance leads to non-applicability of the module and by extension non-applicability of the methodology

- The boundaries of the planned deforestation must be clearly defined and documented. Entire properties shall be included except for areas which already do not have forest cover (such areas shall be excluded)
- The module requires documentation to be available to clearly demonstrate that indeed the land would have been converted to non-forest use if not for the REDD project. The project developer must be able to provide credible evidence and documentation (section 1.2)
- 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.

Exclusionary conditions³

- If land is not being converted to an alternative use but will be allowed to naturally regrow, this module shall not be used (section 1.4)
- If deforestation is illegal / unsanctioned, this module shall not be used
- Areas subject to unsustainable⁴ 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
- *TÜV If there is deforestation allowed in the project project case, Planned deforestation must be lower than baseline deforestation – otherwise there is no project case*

Parameters

This module provides procedures to determine the following parameter:

Parameter	SI Unit	Description
$\Delta C_{BSL,planned}$	t-CO ₂ -e	Net CO ₂ equivalent emissions in the baseline from planned

³ Exclusionary conditions are full applicability criteria, non-compliance leads to non-applicability of the module and by extension non-applicability of the methodology

⁴ Unsustainable here defined as any woody biomass removed that is not demonstrably renewable. Forest biomass is considered demonstrably renewable where:

- The land area remains a forest; and
- 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
- Any national or regional forestry and nature conservation regulations are complied with.

(Derived directly from EB 23, Annex 18.

		deforestation
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II. PROCEDURE

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

$$\Delta C_{BSL,planned} = \sum_{t=1}^{t^*} \sum_{i=1}^{M_B} \left((D\%_{planned,i,t} * A_{planned,i} * L - D_i) * \Delta C_{BSL,i} \right) + GHG_{BSL-E,i,t} \quad (1)$$

Where:

$\Delta C_{BSL,planned}$	Baseline net greenhouse gas emissions through planned deforestation; t CO ₂ -e
$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum i at year t . If actual annual proportion is known and documented (e.g. 25% per year for 4 years), set to proportion; if not known, use Eq. 2 to calculate; % year ⁻¹
$A_{planned,i}$	Total area of planned deforestation over the baseline period for stratum i ; ha
$L-D_i$	Likelihood of deforestation for stratum i ; %
$\Delta C_{BSL,i}$	Net carbon stock changes in all pools in the baseline stratum i ; t CO ₂ -e ha ⁻¹
$GHG_{BSL-E,i,t}$	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline stratum i at project year t ; t CO ₂ -e year ⁻¹
i	1, 2, 3 ... M_B strata in the baseline scenario
t	1, 2, 3, ... t^* years elapsed since the projected start of the REDD project activity

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.

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” shall be identified. Examples of deforestation agent classes include:

- Entities (individuals, companies, associations) practicing similar deforestation practices and post deforestation land use practices such as:
- Agribusinesses implementing industrial scale agriculture

- Large scale agriculturalists practicing farming on parcels larger than 500 ha
- Ethnic or religious groups pursuing large scale agriculture
- 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 shall follow the guidance and procedures of Module **X-STR**.

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 10 years from the project start date.

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

- Legal permissibility for deforestation⁵;
- Suitability of project area for conversion to alternative non-forest land use⁶;
- 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

⁵ Permissibility shall be with reference to relevant laws and legal requirements

⁶ Suitability should include accessibility to relevant markets, suitability of soils, topography and climate.

- Documentation that a request for approval has been filed with the relevant government department for permission to deforest and convert to alternative land use;
- Intent to deforest⁷—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 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.

1.2 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 shall be used.

If no verifiable plan exists, the rate shall 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 agents⁸. A minimum of 6 proxy areas shall be included.

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

1. Land conversion practices shall be the same as those used by the baseline agent or class of agent

⁷ Intent to deforest by baseline agent of deforestation

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.

2. The post deforestation land use shall be the same in the proxy areas as expected in the project area under business as usual
3. The proxy areas shall have the same management and land use rights type as the proposed project area under business as usual
4. If suitable sites exist they shall be in the immediate area of the project; if an insufficient number of sites exists in the immediate area of the project, sites shall be identified elsewhere in the same country as the project; if an insufficient number of sites exists in the country, sites shall 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 shall have occurred within the 10 years prior to the project start date.
7. The four following conditions shall be met:
 - The forest types surrounding the proxy area or in the proxy area prior to deforestation shall be in the same proportion as in the project area (±20%).
 - 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 shall be (+/- 20%) the same of the ratio in the project area.
 - Elevation classes (500m classes) in the proxy area shall 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 rate would be calculated with Equation 2:

$$D\%_{planned,i,t} = \sum_{pn=1}^{pn^*} \left(\left(\frac{D\%_{pn,i}}{Yrs_{pn}} \right) / n \right) \quad (2)$$

Where:

$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum i at year t . If actual annual proportion is known and documented (e.g. 25% per year for 4 years), set to proportion; % year ⁻¹
$D\%_{pn,i}$	Percent of deforestation in land parcel ⁹ pn etc in stratum i of a proxy area as a result of planned deforestation as defined in this module; %
$Yrs_{pn,i}$	Number of years over which deforestation occurred in land parcel pn in stratum i 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_B strata in the baseline scenario

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

1.3 Likelihood of deforestation $L-D_i$

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 ($L-D_i$) 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), $L-D_i$ shall be equal to 1.

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

1.4 Risk of abandonment

Identify a minimum of 5 proxy areas¹⁰ 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 shall not be used.

Part 2. Baseline carbon stocks¹²

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 is harvested and stored long-term in wood products.

$$\boxed{\Delta C_{BSL,i} = C_{BSL,i} - C_{BSL,post,i} - C_{BSL,WP,i}} \quad (3)$$

Where:

$\Delta C_{BSL,i}$	Net carbon stock changes in all pools in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{BSL,i}$	Carbon stock in all pools in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{BSL,post,i}$	Carbon stock in all pools in the baseline post-deforestation in stratum i ; t CO ₂ -e ha ⁻¹
$C_{BSL,WP,i}$	Carbon stock sequestered in wood products in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
i	1, 2, 3 ... M_B strata in the baseline scenario

For calculation of carbon stock sequestered in wood products, see the Module "Estimation of carbon stocks and changes in carbon stocks in the harvested wood products carbon pool in REDD project activities" (CP-W).

With regard to emissions, instead of tracking annual emissions through burning and/or decomposition, this methodology employs the simplifying assumption that all carbon stocks are emitted in the year deforested and that no stocks are permanently sequestered (beyond 100 years after deforestation). This assumption applies regardless of whether burning is employed as part of the forest conversion process or as part of post conversion land use activities.

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 shall occur for the pools defined through the framework module REDD-MF

2.1 Forest carbon stocks

$$C_{BSL,i} = C_{AB_tree,i} + C_{BB_tree,i} + C_{DW,i} + C_{LI,i} + C_{SOC,i} \quad (4)$$

Where:

$C_{BSL,i}$	Carbon stock in all pools in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{AB_tree,i}$	Carbon stock in aboveground biomass in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{BB_tree,i}$	Carbon stock in belowground biomass in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{DW,i}$	Carbon stock in dead wood in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{LI,i}$	Carbon stock in litter in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{SOC,i}$	Carbon stock in soil organic carbon in the baseline in stratum i ; t CO ₂ -e ha ⁻¹

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 the framework module – REDD-MF**.

2.2 Post-deforestation carbon stocks

Post-deforestation carbon stocks should be the long-term average stocks on the land following deforestation. Post-deforestation carbon stocks can be measured in proxy areas or values may 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 shall be used and where stocks are in a cycle¹³ the mean stock across the cycle¹⁴ shall be used.

$$C_{BSL,post,i} = C_{AB_tree,i} + C_{BB_tree,i} + C_{non-tree,i} + C_{DW,i} + C_{LI,i} + C_{SOC,i} \quad (5)$$

Where:

$C_{BSL,post,i}$	Carbon stock in all pools in the baseline post-deforestation in stratum i ; t CO ₂ -e ha ⁻¹
$C_{AB_tree,i}$	Carbon stock in aboveground tree biomass in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{BB_tree,i}$	Carbon stock in belowground tree biomass in the baseline in stratum i ; t CO ₂ -e ha ⁻¹

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

¹⁴ Cycles shall not exceed 14 years. If a cycle exceeds 14 years then the highest stock in the cycle shall be used

$C_{non-tree,i}$	Carbon stock in non-tree vegetation in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{DW,i}$	Carbon stock in dead wood in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{LI,i}$	Carbon stock in litter in the baseline in stratum i ; t CO ₂ -e ha ⁻¹
$C_{SOC,i}$	Carbon stock in soil organic carbon in the baseline in stratum i ; t CO ₂ -e ha ⁻¹

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 the Framework module – **REDD-MF**.

Part 3. Greenhouse gas emissions

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

$$GHG_{BSL,E,i,t} = ET_{FC,t} + E_{BiomassBurn,t} + N_2O_{direct-N,t} \quad (6)$$

Where:

$GHG_{BSL,E}$	Greenhouse gas emissions as a result deforestation activities within the project boundary in the baseline stratum i at project year t ; t CO ₂ -e
$ET_{FC,t}$	CO ₂ emission from fossil fuel combustion during year t in the baseline; t CO ₂ -e year ⁻¹
$E_{BiomassBurn,t}$	Non-CO ₂ emissions due to biomass burning as part of deforestation activities during the year t in the baseline; t CO ₂ -e year ⁻¹
$N_2O_{direct-N,t}$	Direct N ₂ O emission as a result of nitrogen application on the alternative land use within the project boundary in year t in the baseline; t CO ₂ -e year ⁻¹
t	1, 2, 3 ... t^* years elapsed since the start of the REDD VCS project activity

For the calculation of $ET_{FC,t}$, $E_{BiomassBurn,t}$ and $N_2O_{direct-N,t}$ the VCS-approved Modules “Estimating emissions from fossil fuel combustion in REDD project activities (**E-FFC**)”, “Estimating non-CO₂ emissions from biomass burning in REDD project activities (**E-BB**)” and the latest A/R CDM tool “Estimation of direct nitrous oxide emission from nitrogen fertilization”¹⁵ shall be used.

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

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**.

III. DATA AND PARAMETERS NOT MONITORED (DEFAULT OR MEASURED ONE TIME)

Data / parameter:	$A_{planned,i}$
Data unit:	Ha
Used in equations:	1
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
Measurement procedures (if any):	N/A
Any comment:	

Data / parameter:	$D\%_{planned,i,t}$
Data unit:	% year ⁻¹
Used in equations:	1,2
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
Measurement procedures (if any):	N/A
Any comment:	

Data / parameter:	$L-D_i$
Data unit:	%
Used in equations:	1
Description:	Likelihood of deforestation in stratum i
Source of data:	Analysis of Remote Sensing data and/or legal records for a number of proxy areas
Measurement procedures (if any):	N/A
Any comment:	For all areas not both under Government control and zoned for

	<p>deforestation, $L-D_i$ shall be equal to 1</p> <p>For areas under Government control and zoned for deforestation $L-D_i$ shall 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.</p>
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IV. PARAMETERS ORIGINATING IN OTHER MODULES

Data / parameter:	$C_{AB,tree,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Used in equations:	4,5
Description:	Carbon stock in aboveground biomass in trees in the baseline in stratum i
Module parameter originates in:	CP-AB
Any comment:	

Data / parameter:	$C_{BB,tree,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Used in equations:	4,5
Description:	Carbon stock in belowground biomass in trees in the baseline in stratum i
Module parameter originates in:	CP-AB
Any comment:	

Data / parameter:	$C_{nontree,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Used in equations:	5
Description:	Carbon stock in non-tree vegetation in the baseline in stratum i
Module parameter originates in:	CP-AB
Any comment:	Herbaceous vegetation considered <i>de minimis</i> in all instances

Data / parameter:	$C_{DW,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Used in equations:	4,5
Description:	Carbon stock in dead wood in the baseline in stratum <i>i</i>
Module parameter originates in:	CP-W
Any comment:	

Data / parameter:	$C_{LI,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Used in equations:	4,5
Description:	Carbon stock in litter in the baseline in stratum <i>i</i>
Module parameter originates in:	CP-L
Any comment:	

Data / parameter:	$C_{SOC,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Used in equations:	4,5
Description:	Carbon stock in soil organic carbon in the baseline in stratum <i>i</i>
Module parameter originates in:	CP-S
Any comment:	

Data / parameter:	$C_{WP,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Used in equations:	4,5
Description:	Carbon stock in wood products in the baseline in stratum <i>i</i>
Module parameter originates in:	CP-W

Any comment:	
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Data / parameter:	$E_{BiomassBurn,t}$
Data unit:	t CO ₂ -e year ⁻¹
Used in equations:	6
Description:	Non-CO ₂ emissions due to biomass burning as part of degradation activities during the year t in the baseline; t CO ₂ -e
Module parameter originates in:	E-BB
Any comment:	

Data / parameter:	$ET_{FC,t}$
Data unit:	t CO ₂ -e year ⁻¹
Used in equations:	6
Description:	CO ₂ emission from fossil fuel combustion during year t in the baseline; t CO ₂ -e
Module parameter originates in:	E-FFC
Any comment:	

Data / parameter:	$N_2O_{direct-N,t}$
Data unit:	t CO ₂ -e year ⁻¹
Used in equations:	6
Description:	Direct N ₂ O emission as a result of nitrogen application on the alternative land use within the project boundary in year t in the baseline; t CO ₂ -e year ⁻¹
Module parameter originates in:	E-NA
Any comment:	