REDD Methodological Module

"Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation"

Version 1.0 – April 2009

I. SCOPE, APPLICABILITY, DATA REQUIREMENT AND OUTPUT PARAMETERS

Scope

This module allows for estimating carbon stock changes and GHG emissions related to unplanned deforestation in the baseline case (VCS eligible category AUDD[1]).

Applicability

The module is applicable for estimating the baseline emissions from unplanned conversion of forest land to non-forest land in the baseline case.

The forest landscape configuration can be either mosaic or frontier.

Before being deforested, certain forest strata can be subject to carbon stock changes (degradation and carbon stock decrease, or growth and carbon stock enhancement).

Data requirements

Data on annual deforestation areas, carbon stocks and carbon stock changes per stratum are required to use this module. If greenhouse gas emissions (other than carbon stock changes) are included in the baseline, additional data are required to estimate them.

This module calls upon the following other Modules and Tools:

CP-A "Estimation of carbon stocks and changes in carbon stocks in the above-ground biomass carbon pool" – Version 1.0

CP-B "Estimation of carbon stocks and changes in carbon stocks in the below-ground biomass carbon pool" – Version 1.0

CP-D "Estimation of carbon stocks and changes in carbon stocks in the dead-wood carbon pool" – Version 1.0

CP-L "Estimation of carbon stocks in the litter carbon pool" – Version 1.0

[1] **Avoiding Unplanned Deforestation and Degradation (AUDD)** reduces GHG emissions by stopping deforestation/degradation of degraded to mature forests at the frontier that are been expanding historically, or will expand in the future, as result of improved forest access (frontier configuration) or occurring under the mosaic configuration (mosaic deforestation).

CP-S "Estimation of carbon stocks in the soil organic carbon pool" – Version 1.0

CP-W "Estimation of carbon stocks and changes in carbon stocks in the wood products carbon pool" – Version 1.0

BL-UR "Estimation of the baseline rate of unplanned deforestation" – Version 1.0

BL-UL "Location and quantification of the threat of unplanned baseline deforestation" - Version 1.0

BL-DFW "Estimation of baseline emissions from forest degradation caused by extraction of wood for fuel" – Version 1.0

LK-ASU "Estimation of emissions from activity shifting for avoided unplanned deforestation" – Version 1.0

E–BB "Estimation of non-CO_2 emissions from biomass burning" – Version 1.0

E-FFC "Estimation of emissions from fossil fuel combustion" – Version 1.0

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

M-FCC "Methods for the monitoring forest cover changes in REDD project activities" – Version 1.0

X -STR "Methods for stratifying the project area of REDD project activities"– Version 1.0

X-SIG "Determination of the significance of emissions sources and changes in carbon stocks in REDD project activities" – Version 1.0

REDD-MF "REDD Methodology Framework" – Version 1.0

Output parameters

This module provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$\Delta C_{BSL,unplanned}$	t CO_2-e	Sum of baseline carbon stock changes from unplanned deforestation
$GHG_{BSL,unplanned}$	t CO_2-e	Sum of baseline greenhouse gas emissions from unplanned deforestation

II. PROCEDURE

The methodology procedure is divided in the following five steps:

STEP 1. Estimation of annual areas of unplanned baseline deforestation

STEP 2. Stratification of the total area subject to deforestation

STEP 3. Estimation of carbon stocks and carbon stock changes per stratum

STEP 4. Estimation of the sum of baseline carbon stock changes

STEP 5. Estimation of the sum of baseline greenhouse gas emissions

Step 1. Estimation of annual areas of unplanned baseline deforestation

The annual areas subject to unplanned deforestation are estimated using the Module BL-UR. This module produces the following outputs:

$A_{BSL,PA,unplanned,t}$	Annual area of unplanned baseline deforestation in the Project Area at year t; ha yr^{-1}
$A_{BSL,RR,unplanned,t}$	Annual area of unplanned baseline deforestation in the Reference Regionat year t; ha yr^{-1}
$A_{BSL,LK,unplanned,t}$	Annual area of unplanned baseline deforestation in the Leakage Belt at year t; ha yr^{-1}

Use Table 1 to transparently report the result of the estimated areas. This table also allows for the calculation of the total areas subject to deforestation in the Project Area and Leakage Belt:

$$A_{BSL,PA,unplanned} = \sum_{t=1}^{t^*} A_{BSL,PA,unplanned,t} \quad (1)$$

$$A_{BSL,LK,unplanned} = \sum_{t=1}^{t^*} A_{BSL,LK,unplanned,t} \quad (2)$$

Where:

$A_{BSL,PA,unplanned}$	Total area of unplanned baseline deforestation in the Project Area; ha
$A_{BSL,LK,unplanned}$	Total area of unplanned baseline deforestation in the Leakage Belt; ha
$A_{BSL,PA,unplanned,t}$	Annual area of unplanned baseline deforestation in the Project Area at year t; ha yr^{-1}
$A_{BSL,LK,unplanned,t}$	Annual area of unplanned baseline deforestation in the Leakage Belt at year t; ha yr^{-1}
t	*1, 2, 3 … t** years elapsed since the start of the project activity

Table 1. Projected unplanned baseline deforestation during the crediting period

Project year		Reference Region		Project Area		Leakage Area	
		annual	cumulative	annual	cumulative	annual	cumulative
Nr	yr	ha	ha	ha	ha	ha	ha
1							
2							
3							
…	…						
N							
	SUM						
		$= A_{BSL,unplanned,RR}$		$= A_{BSL,unplanned,PA}$		$= A_{BSL,unplanned,LK}$	

Notes:

N = Number of years

The columns for the leakage area shall be filled out depending on the choices made to address leakage (See Module LK-ASU)

Step 2. Stratification

Pre-deforestation strata (forest strata)

In most cases, the carbon density of the forest will not be homogeneous. The Module X –STR shall be used to stratify the total area subject to deforestation in the Project Area ($A_{BSL,PA,unplanned}$) and Leakage Belt area ($A_{BSL,LK,unplanned}$) in M_F Forest Strata.

After stratification of the forest area, each forest stratum shall correspond to one forest class with a constant average carbon density (stock per hectare) over time. If certain strata are expected to undergo significant changes in carbon density due to growth or degradation (before being deforested), the following methodological procedures shall be applied:

- Strata undergoing degradation (and carbon stock decrease):
    - Ignore degradation in both the baseline and project scenario (in both *ex-ante* and *ex-post* estimations). In this case no credits will be claimed if the degradation is avoided in the project scenario.
    - If credits are to be claimed, use Module BL-DFW (for degradation due to removals for wood fuel or charcoal) to determine the degradation baseline. Changes in carbon stocks of degradation strata are to be described using Table 2.
- Strata undergoing growth (and carbon stock enhancement):
    - Ignore growth in both the baseline and project scenario (in both *ex-ante* and *ex-post* estimations). In this case no credits will be claimed for carbon sequestration in forests that grow in the project case and are deforested in the baseline case.
    - If credits are to be claimed:
        - In the baseline scenario, either assume no growth or estimate the rate of carbon stock change based on a combination of expert opinion and literature sources for each stratum undergoing changes in carbon stocks. Use Table 2 to describe the stock changes and make conservative growth assumptions.
        - In the project scenario:
            - For *ex-ante* estimations: either conservatively assume no growth or conservatively estimate the rate of carbon stock change based on a combination of expert opinion and literature sources for each stratum undergoing changes in carbon stocks. Use Table 2 to describe the stock changes and make conservative growth assumptions.
            - For *ex-post* estimations: this will be done by directly monitoring carbon stocks using modules CP-A, CP-B and CP-D in the project in strata projected to be deforested in the baseline.

Use Table 3 to report the list of forest strata with the forest classes found in each of them.

Table 2. Description of carbon stocks in forest strata undergoing degradation and/or growth

Project year		ΔCD_{AB}		ΔCD_{BB}		ΔCD_{DW}		ΔCD_{WP}		ΔCD_{L}		ΔCD_{SOC}		ΔCD_{TOT}	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
Nr	yr	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e	tCO_2-e	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e
0															
1															
2															
…	…														
N															

N = Number of years

Table 3. Description of forest classes and post-deforestation classes

Class Identifier (ID from Table 4.a)		Source of data	Average carbon stock and its 90% Confidence Interval											
			CD_{AB}		CD_{BB}		CD_{DW}		CD_{L}		CD_{SOC}		CD_{TOT}	
ID	Name		t CO_2e ha^{-1}	90% CI (%)	t CO_2e ha^{-1}	90% CI (%)	t CO_2e ha^{-1}	90% CI (%)	t CO_2e ha^{-1}	90% CI (%)	t CO_2e ha^{-1}	90% CI (%)	t CO_2e ha^{-1}	90% (%
1														
2														
…														
n														

n = Number of forest classes

Table 4. Strata

a) Forest strata and their classes

Forest stratum Identifier		Forest Class			
		With constant carbon stock		*With changing carbon stock*	
ID	Name	ID	Name	ID	Name
1					
2					
…					
M_F					

(Add as many lines as needed)

b) Post deforestation strata and their classes

Post-deforestation stratum Identifier		Land-use class 1			Land-use class 2		
ID	Name	ID	% of stratum	Name	ID	% of stratum	Name
1							
2							
…							
M_{PD}							

(Add as many lines as needed)

Table 5. Activity data

a) Project Area: Forest strata

Project year		*Forest Stratum 1* (ID and Name)		*Forest Stratum 2* (ID and Name)		*Forest Stratum ...* (ID and Name)		*Forest Stratum M_F* (ID and Name)		Total	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
Nr	yr	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
1											
2											
3											
...											
N											
	SUM										

b) Project Area: Post-deforestation strata

Project year		*Post-Deforest Stratum 1* (ID and Name)		*Post-Deforest Stratum 2* (ID and Name)		*Post-Deforest Stratum ...* (ID and Name)		*Post-Deforest Stratum M_{PD}* (ID and Name)		Total	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
Nr	yr	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
1											
2											
3											
...											
N											
	SUM										

c) Leakage Belt Area: Forest strata

Project year		*Forest Stratum 1* (ID and Name)		*Forest Stratum 2* (ID and Name)		*Forest Stratum ...* (ID and Name)		*Forest Stratum M_F* (ID and Name)		Total	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
Nr	yr	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
1											
2											
3											
...											
N											
	SUM										

d) Leakage Belt Area: Post-deforestation strata

Project year		*Post-Deforest Stratum 1* (ID and Name)		*Post-Deforest Stratum 2* (ID and Name)		*Post-Deforest Stratum ...* (ID and Name)		*Post-Deforest Stratum M_{PD}* (ID and Name)		Total	
		annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
Nr	yr	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
1											
2											
3											
...											
N											
	SUM										

Post-deforestation strata (non-forest strata)

Post-deforestation carbon stocks will depend on post-deforestation land uses. The areas expected to be deforested ($A_{BSL,PA,unplanned}$ and $A_{BSL,LK,unplanned}$) shall therefore be stratified in M_{PD} Post-Deforestation Strata. Each post-deforestation stratum will be represented by one or more post-deforestation land-use classes for which the long-term average carbon stock will have to be determined in Step 3. The land uses of each stratum shall be justified taking into account current land uses in proxy areas and observed land-uses in areas deforested during the historical reference period.

Use Table 4 to report the list of post-deforestation strata and the land-use classes found in each of them.

Activity data

Using a GIS, determine activity data (annual areas deforested) in each Forest Stratum and Post-Deforestation Stratum. Do this for the Project Area and the Leakage Belt. Use Table 5 to report baseline activity data for the Project Area and the Leakage Belt.

Step 3. Estimation of carbon stocks and carbon stock changes per stratum

3.1 Forest carbon stocks

Depending on the choices made in the previous step, each forest stratum will be represented by one forest class with a single long-term average carbon stock, or an estimate of carbon stock changes over time.

Use the methods described in the VCS-approved carbon pool modules to determine the average carbon stock or the carbon stock changes of each forest stratum. In the situation where the baseline includes harvesting of long-lived wood products the harvested wood products carbon pool shall be included.

Forest strata with constant carbon stocks (forest classes):

$$C_{TOT-FOR,iF} = C_{AB,iF} + C_{BB,iF} + C_{DW,iF} + C_{LI,iF} + C_{SOC,iF} \quad (3)$$

Where:

$C_{TOT-FOR,iF}$	Carbon stock in all carbon pools in the forest stratum *iF*; t CO_2-e ha^{-1}
$C_{AB,iF}$	Carbon stock in aboveground biomass in the forest stratum *iF*; t CO_2-e ha^{-1}
$C_{BB,iF}$	Carbon stock in belowground biomass in the forest stratum *iF*; t CO_2-e ha^{-1}
$C_{DW,iF}$	Carbon stock in dead wood in the forest stratum *iF*; t CO_2-e ha^{-1}
$C_{LI,iF}$	Carbon stock in litter in the forest stratum *iF*; t CO_2-e ha^{-1}

$C_{SOC,iF}$ Carbon stock in soil organic carbon in the forest stratum *iF*; t CO_2-e ha^{-1}

iF 1, 2, 3 … M_F forest strata

Note: the time index *t* is omitted as in these strata stocks are assumed to be constant

Carbon pools excluded from the project can be counted as zero. For determining which carbon pools shall be included in the calculations as a minimum, see Module X-SIG.

The result of the estimation of carbon stocks of each forest stratum shall be reported using Table 2.

Forest strata with changing carbon stocks:

$$\Delta C_{TOT,iF,t} = \Delta C_{AB,iF,t} + \Delta C_{BB,iF,t} + \Delta C_{DW,iF,t} + \Delta C_{WP,iF,t} + \Delta C_{LI,iF,t} + \Delta C_{SOC,iF,t} \quad (4)$$

Where:

$\Delta C_{TOT,iF,t}$ Carbon stock change in all carbon pools in the forest stratum *iF* at year *t*; t CO_2-e $ha^{-1}yr^{-1}$

$\Delta C_{AB,iFt}$ Carbon stock change in aboveground biomass in the forest stratum *iF* at year *t*; t CO_2-e $ha^{-1}yr^{-1}$

$\Delta C_{BB,iF,t}$ Carbon stock change in belowground biomass in the forest stratum *iF* at year *t*; t CO_2-e $ha^{-1}yr^{-1}$

$\Delta C_{DW,iF,t}$ Carbon stock change in dead wood in the forest stratum *iF* at year *t*; t CO_2-e $ha^{-1}yr^{-1}$

$\Delta C_{WP,iF,t}$ Carbon stock change in harvested wood products in the forest stratum *I F*at year *t*; t CO_2-e $ha^{-1}yr^{-1}$

$\Delta C_{LI,iF,t}$ Carbon stock change in litter in forest stratum *iF* at year *t*; t CO_2-e $ha^{-1}yr^{-1}$

$\Delta C_{SOC,iF,t}$ Carbon stock change in soil organic carbon in the forest stratum *iF* at year *t*; t CO_2-e $ha^{-1}yr^{-1}$

iF 1, 2, 3 … M_F forest strata

Carbon pools excluded from the project can be counted as zero. For determining which carbon pools shall be included in the calculations as a minimum, see Module X-SIG.

The result of the estimation of carbon stock changes per each stratum shall be reported using Table 2.

3.2 Post-deforestation carbon stocks

Post-deforestation carbon stocks are assumed to be the long-term average stocks on the land following deforestation. These stocks depend on the assumed land-uses after deforestation in each post-deforestation stratum.

Three options are available to determine the carbon stocks of these strata:

Option 1 - Simple conservative approach: A list of likely post-deforestation land uses within each post-deforestation stratum is established taking into account land uses on recently deforested areas and proxy areas. The land uses with the highest long-term carbon stocks are considered representative of future post-deforestation land uses. A simple average carbon stock is calculated from the top 50% high-carbon stock classes of a stratum and used as a proxy for all post-deforestation carbon stocks in that stratum during the project term.

Option 2 – Historical area-weighted average: An historical mix of post-deforestation land-uses is assumed to be representative of future changes in each post-deforestation stratum. The area-weighted average of the carbon stock is calculated from the historical land-use change matrix of a stratum and used as a proxy for all post-deforestation carbon stocks in that stratum during the project term.

Option 3 - Suitability modeling: The future spatial distribution of post-deforestation land uses is modeled to determine the exact location of each post-deforestation land use.

Post-deforestation carbon stocks of the selected land-uses can be measured in proxy areas or values may be taken from credible and representative literature sources. Where stocks accumulate through time, the ultimate stock shall be used and where stocks are in a cycle such as in shifting cultivation, the mean stock across the cycle shall be used.

$$C_{TOT-post,iPD} = C_{AB,iPD} + C_{BB,iPD} + C_{DW,iPD} + C_{LI,iPD} + C_{SOC,iPD} \quad (5)$$

Where:

$C_{TOT-post,iPD}$	Carbon stock in all pools in the post-deforestation stratum *iPD*; t CO_2-e ha^{-1}
$C_{AB,iPD}$	Carbon stock in aboveground biomass in the post-deforestation stratum *iPD*; t CO_2-e ha^{-1}
$C_{BB,iPD}$	Carbon stock in belowground biomass in the post-deforestation stratum *iPD*; t CO_2-e ha^{-1}
$C_{DW,iPD}$	Carbon stock in dead wood in the post-deforestation stratum *iPD*; t CO_2-e ha^{-1}
$C_{LI,iPD}$	Carbon stock in litter in the post-deforestation stratum *iPD*; t CO_2-e ha^{-1}
$C_{SOC,iPD}$	Carbon stock in soil organic carbon in the post-deforestation stratum *iPD*; t CO_2-e ha^{-1}
iPD	1, 2, 3 … M_{PD} post-deforestation strata

Carbon pools excluded from the project can be accounted as zero. For the determination which carbon pools shall be included in the calculations as a minimum, see Module X-SIG.

The result of the estimation of carbon stocks of each post-deforestation class used to calculate the average carbon stock of a stratum shall be added to the Table 3. The area-weighted average carbon stock of each post-deforestation stratum shall be reported in Table 4.b.

Step 4. Estimation of the sum of baseline carbon stock changes

The sum of baseline carbon stock changes is estimated as follows:

$$\Delta C_{BSL,unplanned} = C_{TOT-For} - C_{TOT-post} - C_{TOT-wp} \quad (6)$$

$$C_{TOT-For} = \sum_{t=1}^{t^*} \sum_{iF}^{MF} ((C_{TOT-FOR,iF} + \Delta C_{TOT-FOR,iF,t}) * A_{unplanned,iF,t}) \quad (7)$$

$$C_{TOT-post} = \sum_{t=1}^{t^*} \sum_{iPD}^{MPD} (C_{TOT-post,iPD} * A_{unplanned,iPD,t}) \quad (8)$$

$$C_{TOT-hp} = \sum_{t=1}^{t^*} \sum_{iF}^{MF} (C_{HP,t} * A_{unplanned,iF,t}) \quad (9)$$

Where:

$\Delta C_{BSL,unplanned}$	Sum of the baseline carbon stock change in all pools up to time t^*; t CO_2-e
$C_{TOT-For}$	Total forest carbon stock in areas deforested up to time t^*; t CO_2-e
$C_{TOT-Post}$	Total post-deforestation carbon stock in areas deforested up to time t^*; t CO_2-e
C_{TOT-hp}	Total carbon stock in harvested wood products up to time t^*; t CO_2-e
$C_{TOT-FOR,iF,t}$	Carbon stock in all carbon pools in the forest stratum *iF* at year t; t CO_2-e ha^{-1}
$C_{TOT-FOR,iF}$	Carbon stock in all carbon pools in the forest stratum *iF* (at project start); t CO_2-e ha^{-1}
$\Delta C_{TOT,iF,t}$	Carbon stock change in all carbon pools in the forest stratum *iF* at year *t*; t CO_2-e $ha^{-1}yr^{-1}$
$A_{unplanned,iF,t}$	Area of unplanned deforestation in forest stratum *iF* at year *t*; ha
$C_{TOT-post,iPD}$	Carbon stock in all carbon pools in the post-deforestation stratum *iPD*; t CO_2-e ha^{-1}
$A_{unplanned,iPD,t}$	Area of unplanned deforestation in post deforestation stratum *iPD* at year *t*; ha
$C_{HP,iF,t}$	Carbon stock sequestered in wood products from forest stratum *iF* at the year *t* = *td*when deforestation occurs; t CO_2-e ha^{-1}
t	1, 2, 3, … t^* years elapsed since the projected start of the REDD VCS project activity
iF	1, 2, 3 … M_F forest strata
iPD	1, 2, 3 … M_{PD} post-deforestation strata

For calculation of carbon stock sequestered in wood products, see Module CP-W.

Report the result of the baseline assessment of carbon stock changes using Table 3 of the "REDD Methodology Framework" (REDD-MF).

Step 5.Estimation of the sum of baseline greenhouse gas emissions

The sum of baseline greenhouse gas emissions is estimated as follows:

$$GHG_{BSL,unplanned} = GHG_{BSL-BiomassBurn} + GHG_{BSL-FossilFuel} + GHG_{BSL-NApplication} \quad (11)$$

$$GHG_{BSL-BioassBurn} = \sum_{t=1}^{t^*} \sum_{iF}^{MF} (E_{BSL-FOR-BiomassBum,iF,t} * A_{iF,unplanned,t}) \quad (12)$$

$$GHG_{BSL-FossilFuel} = \sum_{t=1}^{t^*} E_{BSL-FossilFuel,t} \quad (13)$$

$$GHG_{BSL-NApplication} = \sum_{t=1}^{t^*} E_{BSL-directN,t} \quad (14)$$

Where:

$GHG_{BSL,unplanned}$	Sum of baseline greenhouse gas emissions from unplanned deforestation up to time *t**; t CO_2-e
$GHG_{BSL-BiomassBurn}$	Sum of baseline greenhouse gas emissions from biomass burning as part of deforestation activities up to time *t**; t CO_2-e
$GHG_{BSL-FossilFuel}$	Sum of baseline CO_2 emissions from fossil fuel consumption up to time *t**; t CO_2-e
$GHG_{BSL-NApplication}$	Sum of baseline N_2O emission as a result of nitrogen application on deforested land up to time *t**; t CO_2-e
$E_{BSL-FOR-BiomassBurn,iF,t}$	Baseline non-CO_2 emissions due to biomass burning as part of deforestation activities in forest stratum IF at year *t*; t CO_2-e $ha^{-1}yr^{-1}$
$A_{iF,unplanned,t}$	Area of unplanned deforestation in forest stratum *iF* at year *t*; ha
$E_{BSL-FossilFuel,t}$	Baseline CO_2 emission from fossil fuel combustion during year *t*; t CO_2-e yr^{-1}
$E_{BSL-directN,t}$	Baseline direct N_2O emission as a result of nitrogen application during year *t*; t CO_2-e yr^{-1}
t	*1, 2, 3 …t** years elapsed since the start of the project activity

For detailed information regarding the calculation of $E_{BSL\text{-}FOR\text{-}BiomassBurn,iF,t}$, $ET_{BSL\text{-}FossilFuel,t}$ and $E_{BSL\text{-}directN,t}$ refer to Modules E-BB, E-FFC and E-NA, respectively.

GHG emission sources excluded from the project boundary can be neglected, i.e. accounted as zero. For the determination which sources of emissions shall be included in the calculations as a minimum, see Module X-SIG.

The result of the estimation of baseline greenhouse gas emissions shall be reported in Table 4 of the "REDD Methodology Framework"(REDD-MF).

III. Data and parameters used and generated in this module

Data/parameter	Unit	Used in equations	Descripiton	Source of data	Measurement procedure (if any)	Comments
$A_{BSL,LK,unplanned}$	ha	2	Total area of unplanned baseline deforestation in the Leakage Belt			
$A_{BSL,LK,unplanned,t}$	ha yr^{-1}	2	Annual area of unplanned baseline deforestation in the Leakage Belt at year t			BL-UR
$A_{BSL,PA,unplanned}$	ha	1	Total area of unplanned baseline deforestation in the Project Area			
$A_{BSL,PA,unplanned,t}$	ha yr^{-1}	1	Annual area of unplanned baseline deforestation in the Project Area at year t			BL-UR
$A_{iF,unplanned,t}$	ha	6-14	Area of unplanned deforestation in forest stratum *iF* at year *t*			
$A_{iPD,unplanned,t}$	ha	6- 10	Area of unplanned deforestation in post-deforestation stratum *iPD* at year *t*			
$C_{TOT-For}$	t CO_2-e	6- 10	Total forest carbon stock in areas deforested up to time *t**			
$C_{TOT-Post}$	t CO_2-e	6- 10	Total post-deforestation carbon stock in areas deforested up to time *t**			
C_{TOT-wp}	t CO_2-e	6- 10	Total carbon stock in harvested wood products up to time *t**			
$C_{AB,iF}$	t CO_2-e ha^{-1}	3	Carbon stock in aboveground biomass in the forest stratum *iF*			
$C_{AB,iPD}$	t CO_2-e ha^{-1}	5	Carbon stock in aboveground biomass in trees in the post-deforestation stratum *iPD*			
$C_{BB,iF}$	t CO_2-e ha^{-1}	3	Carbon stock in belowground biomass in the forest stratum *iF*			
$C_{BB,iPD}$	t CO_2-e ha^{-1}	5	Carbon stock in belowground biomass in trees in the post-deforestation stratum *iPD*			
$C_{DW,iF}$	t CO_2-e ha^{-1}	3	Carbon stock in dead wood in the forest stratum *iFi*			

Data/parameter	Unit	Used in equations	Descripiton	Source of data	Measurement procedure (if any)	Comments
$C_{DW,iPD}$	t CO_2-e ha^{-1}	5	Carbon stock in dead wood in the post-deforestation stratum *iPD*			
$C_{LI,iF}$	t CO_2-e ha^{-1}	3	Carbon stock in litter in the forest stratum *iF*			
$C_{LI,iPD}$	t CO_2-e ha^{-1}	5	Carbon stock in litter in the post-deforestation stratum *iPD*			
$C_{SOC,iF}$	t CO_2-e ha^{-1}	3	Carbon stock in soil organic carbon in the forest stratum *iF*			
$C_{SOC,iPD}$	t CO_2-e ha^{-1}	5	Carbon stock in soil organic carbon in the post-deforestation stratum *iPD*			
$C_{TOT\text{-}FOR,iF}$	t CO_2-e ha^{-1}	3, 6-10	Carbon stock in all carbon pools in the forest stratum *iF*			
$C_{TOT\text{-}FOR,iF,t}$	t CO_2-e ha^{-1}	6- 10	Carbon stock in all carbon pools in the forest stratum *iF* at year t			
$C_{TOT\text{-}post,iPD}$	t CO_2-e ha^{-1}	5	Carbon stock in all carbon pools in the post-deforestation stratum *iPD*			
$C_{TOT\text{-}post,iPD}$	t CO_2-e ha^{-1}	6- 10	Carbon stock in all carbon pools in the post-deforestation stratum *iPD*			
$C_{WP,iF,t}$	t CO_2-e ha^{-1}	6- 10	Carbon stock sequestered in wood products from forest stratum *iF* at the year $t = td$ when deforestation occurs			
$E_{BSL\text{-}directN,t}$	t CO_2-e yr^{-1}	11- 14	Baseline direct N_2O emission as a result of nitrogen application during year *t*			
$E_{BSL\text{-}FOR\text{-}BiomassBurn,iF,t}$	t CO_2-e ha^{-1} yr^{-1}	11- 14	Baseline non-CO_2 emissions due to biomass burning as part of deforestation activities in forest stratum IF at year *t*			
$E_{BSL\text{-}FossilFuel,t}$	t CO_2-e yr^{-1}	11- 14	Baseline CO_2 emission from fossil fuel combustion during year *t*			
$GHG_{BSL,unplanned}$	t CO_2-e	11- 14	Sum of baseline greenhouse gas emissions from unplanned deforestation up to time *t**			

$GHG_{BSL\text{-}BiomassBurn}$	t CO_2-e	11- 14	Sum of baseline greenhouse gas emissions from biomass burning as part of deforestation activities up to time *t**			
$GHG_{BSL\text{-}FossilFuel}$	t CO_2-e	11- 14	Sum of baseline CO_2 emissions from fossil fuel consumption up to time *t**			
$GHG_{BSL\text{-}Napplication}$	t CO_2-e	11- 14	Sum of baseline N_2O emission as a result of nitrogen application on deforested land up to time *t**			
iF	number	3, 4, 6-10	1, 2, 3 … M_F forest strata			
iPD	number	5, 6-10	1, 2, 3 … M_{PD} post-deforestation strata			
t	number	1, 2, 6-14	*1, 2, 3 … t** years elapsed since the start of the project activity			
$\Delta C_{AB,iFt}$	t CO_2-e $ha^{-1}yr^{-1}$	4	Carbon stock change in aboveground biomass in the forest stratum *iF* at year *t*			
$\Delta C_{BB,iF,t}$	t CO_2-e $ha^{-1}yr^{-1}$	4	Carbon stock change in belowground biomass in the forest stratum *iF* at year *t*			
$\Delta C_{BSL,unplanned}$	t CO_2-e	6- 10	Sum of the baseline carbon stock change in all pools up to time *t**			
$\Delta C_{DW,iF,t}$	t CO_2-e $ha^{-1}yr^{-1}$	4	Carbon stock change in dead wood in the forest stratum *I F*at year *t*			
$\Delta C_{WP,iF,t}$	t CO_2-e $ha^{-1}yr^{-1}$	4	Carbon stock change in harvested wood products in the forest stratum *iF* at year *t*			
$\Delta C_{LI,iF,t}$	t CO_2-e $ha^{-1}yr^{-1}$	4	Carbon stock change in litter in forest stratum *iF* at year *t*			
$\Delta C_{SOC,iF,t}$	t CO_2-e $ha^{-1}yr^{-1}$	4	Carbon stock change in soil organic carbon in the forest stratum *iF* at year *t*			
$\Delta C_{TOT,iF,t}$	t CO_2-e $ha^{-1}yr^{-1}$	4, 6-10	Carbon stock change in all carbon pools in the forest stratum *iF* at year *t*			