VCS MODULE VMD0009

REDD METHODOLOGICAL MODULE:

ESTIMATION OF EMISSIOSNS FROM ACTIVITY SHIFTING FOR AVOIDED PLANNED DEFORESTATION AND PLANNED DEGRADATION (LK-ASP)

Version 1.1

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Sectoral Scope 14

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1 SOURCES

This module is one of numerous modules that comprise the VCS approved methodology VM0007: REDD Methodology Modules.

2 SUMMARY DESCRIPTION OF THE MODULE

This module allows for estimating GHG emissions caused by the activity shifting leakage of planned deforestation and planned degradation carbon projects. Hereafter in this module, “deforestation” refers to both deforestation and planned degradation.

3 APPLICABILITY CONDITIONS

The module is applicable for estimating the leakage emissions due to activity shifting from forest lands that are legally authorized and documented to be converted to non-forest land.

The module is mandatory if BL-PL has been used to define the baseline and the applicability criteria in BL-PL must be complied with in full.

Under this situation, displacement of baseline activities can be controlled and measured directly by monitoring the baseline deforestation agents or class of agents.

In countries with peatland and where the planned deforestation baseline land use is for a commodity that can be produced on drained peatland, the specific agent shall be identified.

4 PROCEDURE

Parameters

This module produces the following parameter:

Parameter	SI Unit	Description
$\Delta C_{LK\text{-}AS,planned}$	t-CO_2-e	Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation

PART 1: WHERE THE SPECIFIC DEFORESTATION AGENT HAS BEEN IDENTIFIED

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

Where:

$\Delta C_{LK\text{-}AS,planned}$ Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation; t CO_2-e

$LKA_{planned,i,t}$	The area of activity shifting leakage in stratum *i* at time *t*; ha
$\Delta C_{BSL,i}$	Net carbon stock changes in all pools in baseline stratum *i*; t CO_2-e ha^{-1}
$GHG_{LK,E,i,t}$	Greenhouse gas emissions as a result of leakage of avoided deforestation activities in stratum *i* in year *t*; t CO_2-e
$LK_{peat,t}$	Net greenhouse gas emissions due to leakage to peatlands as a result of implementation of a planned deforestation project at time *t*; t CO_2-e
i	1, 2, 3, … *M* strata
t	1, 2, 3, … *t** years elapsed since the start of the REDD project activity

The approach is to calculate the total area of deforestation forecast to occur across the land managed by the baseline agent of deforestation (including the baseline projected deforestation within the project boundaries). By calculating the total area of deforestation across all the lands managed by the agent it makes it possible to monitor possible activity shifting by agents to other areas under their management. The predicted deforestation within the project boundary is then subtracted from the total deforestation across all the land managed by the baseline agent/class. This subtraction gives the deforestation expected if no leakage occurs. If this deforestation is subtracted from the total area of deforestation by the baseline agent of deforestation the result is the area of leaked deforestation.

STEP 1: Determine the baseline rate of forest clearance for the deforestation agent

Two options exist for estimating the baseline rate of forest clearance by the deforestation agent. Only if a historic trend analysis (Option 1.1) is not feasible shall Option 1.2 be used:

Option 1.1: Baseline deforestation based on historic deforestation trend

With this approach, the baseline annual deforestation by the baseline deforestation agent can be estimated by extrapolating the historical annual trend using a linear regression. Survey the deforestation agent and examine official records[1] to determine the total area deforested by the deforestation agent each year over the previous five years within the country. To use this option, *annual* data for a minimum of five years and a maximum of ten years must be used to create linear regression. The results of the analysis must produce a statistically significant regression with a $p \leq 0.05$ and an adjusted r^2 of ≥ 0.75; otherwise "Option 1.2 historical average" must be used.

$$WoPR_{i,t} = a + b * t \quad (2)$$

Where:

$WoPR_{i,t}$	Deforestation by the baseline agent of the planned deforestation in the absence of the project in stratum *i* in year *t*; ha (Under Option 1.1 the rate will differ by year in the baseline period)

[1] Official records may include permits for concessions or permits to deforest for agricultural/commercial purposes

a	Estimated intercept of the regression line; ha
b	Slope of the linear regression; ha yr^{-1}
t	1, 2, 3, … t^* years elapsed since the projected start of the REDD project activity

Option 1.2: Baseline deforestation based on historic deforestation average

Under this approach, the baseline annual deforestation by the baseline deforestation agent is assumed to be equal to the average deforested area, during the 5 years prior to the project start date.

Survey the deforestation agent and, if available, examine official records[2] to determine the total area deforested by the deforestation agent each year over the previous five years within the country.

$$WoPR_{i,t} = \sum_{ag=1}^{ag} \frac{HistHa_{i,ag}}{5} \quad (3)$$

Where:

$WoPR_{i,t}$	Deforestation by the baseline agent of the planned deforestation in the absence of the project in stratum *i* in year *t*; (Under Option 1.2 the same area of deforestation will be applied for each year of the baseline period)
$HistHa_{i,ag}$	The number of hectares of forest cleared by the baseline agent of the planned deforestation in the five years prior to project implementation in stratum *i* by agent *ag* within the country; ha
i	1, 2, 3, … *M* strata
ag	1, 2, 3, ... *ag* agents of deforestation
t	1, 2, 3, … t^* years elapsed since the projected start of the REDD project activity

Where there is no history of deforestation and no verifiable plans for controlled lands and future-controlled lands then *WoPR* must be set to planned baseline rate for the project ($D\%_{planned} * A_{planned}$ from the planned deforestation baseline module).

STEP 2: Estimate new projection of forest clearance by the baseline agent of deforestation with project implementation if no leakage is occurring

Subtract the total project area of planned baseline deforestation from the historic area of deforestation to calculate the new area.

$$NewR_{i,t} = WoPR_{i,t} - \left(D\%_{planned,i,t} * A_{planned,i}\right) \quad (4)$$

Where:

$NewR_{i,t}$	New calculated forest clearance in stratum *i* at time *t* by the baseline agent of the planned deforestation where no leakage is occurring; ha

[2] Official records may include permits for concessions or permits to deforest for agricultural/commercial purposes

$WoPR_{i,t}$	Deforestation by the baseline agent of the planned deforestation in stratum *i* in year *t* in the absence of the project; ha
$D\%_{planned,i,t}$	Projected annual proportion of land that will be deforested in stratum *i* at year *t;* %
$A_{planned,i,}$	Total area of planned deforestation over the baseline period for stratum *i*; ha
i	1, 2, 3, … *M* strata
t	1, 2, 3, … t^* years elapsed since the projected start of the REDD project activity

STEP 3: Monitor all areas deforested by baseline agent of deforestation through the years in which planned deforestation was forecast to occur

All areas deforested by the baseline agent of deforestation must be monitored. Areas of deforestation may be anywhere in the host country. There is no requirement to track international leakage.

$$LKA_{planned,i,t} = A_{defLK,i,t} - NewR_{i,t} \quad (5)$$

Where:

$LKA_{planned,i,t}$	The area of activity shifting leakage in stratum *i* at time *t*; ha
$NewR_{i,t}$	New calculated forest clearance by the baseline agent of the planned deforestation in stratum *i* at time *t* where no leakage is occurring; ha
$A_{defLK,i,t}$	The total area of deforestation by the baseline agent of the planned deforestation in stratum *i* at time, *t*; ha
i	1, 2, 3, … *M* strata
t	1, 2, 3, … t^* years elapsed since the start of the REDD project activity

If $NewR_{i,t}$ exceeds $A_{defLK,i,t}$ then $LKA_{planned,i,t}$ must be set as zero as positive leakage is not considered under the VCS.

STEP 4: Monitor greenhouse gas emissions outside the project boundary by baseline agent of deforestation

Where a specific agent of deforestation has been identified fertilizer use and biomass burning shall be monitored. Conservatively any emissions shall be counted as leakage regardless of whether the source was or was not included in baseline calculations:

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

Where:

$GHG_{LK,E,i,t}$	Greenhouse gas emissions as a result of leakage of avoided deforestation activities 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 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

Where the baseline agent of deforestation is unwilling to share information on areas burned and quantity of fertilizer used the values shall be estimated based on common practice as defined by participatory rural appraisal (PRA).

PART 2: WHERE ONLY A CLASS OF DEFORESTATION AGENTS CAN BE IDENTIFIED

Where only a class of agents can be identified leakage can be most closely linked to the market demand for the commodity that would have been produced within the project area in the absence of the project.

STEP 1: Identify commodity produced by baseline class of agent

For many classes of agents it is likely that a single commodity will be associated (e.g. oil palm producers or cattle ranchers) and thus this commodity shall be used for the leakage analysis.

For other classes of agents the most likely commodity shall be assessed. This assessment shall include justification including information on commodity suitability and the commodities currently being produced by others in the same class of agent. If justifiable different commodities may be assigned to different strata.

STEP 2: Assess proportion of available areas that are forested

Determine areas in the country currently potentially available for production of the commodity(ies) specified in STEP 1. The determination shall reference to soil type, elevation, precipitation and access to markets for the specified commodity(ies). Determine the proportion of this available area that is currently forested (PF_c).

STEP 3: Evaluate project area relative to other forested areas for commodity production in the country

3.1 Assess productivity of project area for commodity production

3.2 Assess productivity of alternative areas in the country for commodity production

Assessment of productivity shall include soil type, elevation and precipitation. Experts in the production of the specific commodity shall be consulted (e.g. Government Ministry of Agriculture).

STEP 4: Assess proportional leakage factor

If average productivity of alternative lands is the same ±15% as the relevant strata in the project area then:

$LK_{CP\text{-}ME,c,i}$ = 0.4

If average productivity of alternative lands is >15% **less** than the relevant strata in the project area then:

$LK_{CP\text{-}ME,c,i}$ = 0.7

If average productivity of alternative lands is >15% **more** than the relevant strata in the project area then:

$LK_{CP\text{-}ME,c,i}$ = 0.2

STEP 5: Calculate estimated leakage

$$\Delta C_{LK-AS,planned} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \sum_{c=1}^{C} \left(\left(\Delta C_{BSL,planned} \right) * PF_c * LK_{CP-ME,c,i} \right) \quad (7)$$

Where:

$\Delta C_{LK\text{-}AS,planned}$	Net CO_2 emissions due to activity shifting leakage for projects preventing planned deforestation; t CO_2-e
$\Delta C_{BSL,planned}$	Net CO_2 emissions in the baseline from planned deforestation in the project area; t CO_2-e
PFc	Proportion of available area for production of commodity *c* that is currently forested; dimensionless
$LK_{CP\text{-}ME,c,i}$	Leakage factor for displacement of class of planned deforestation agents; dimensionless
c	1, 2, 3, ... *C* commodities
i	1, 2, 3, … *M* strata
t	1, 2, 3, … *t** years elapsed since the start of the REDD project activity

PART 3: THE SPECIAL CASE OF PEATLANDS

In countries with peatland and where the planned deforestation baseline land use is for a commodity that can be produced on drained peatland, the specific agent shall be identified and leakage to peatland shall, wherever possible, be prevented.

Thus, for example, in countries where oil palm is grown on drained peatland, a planned deforestation project may not have a baseline of oil palm production by a class of agent. In this case the specific agent must be identified and tracked through time to ensure that leakage to peatland does not occur.

It would be good practice to have a contract with the baseline agent to ensure that the rate of planting on drained peatland does not increase after the project start date.

Where leakage to peatlands does occur, the leakage emissions are conservatively estimated as five times[3] the average carbon stock of the project multiplied by the area of leakage. Emissions from peatland drainage occur every year that the peat is drained, typically several decades– conservatively all emissions calculated here are taken upfront.

$$LK_{peat,t} = A_{LK-peat,t} * \left(\sum_{i=1}^{M} \Delta C_{BSL,i} \Big/ M \right) * 5 \quad (8)$$

Where:

$LK_{peat,t}$	Net greenhouse gas emissions due to leakage to peatlands as a result of implementation of a planned deforestation project at time *t*; t CO_2-e
$A_{LK-peat,t}$	Area of leakage to peatland at time *t*; ha
$\Delta C_{BSL,i}$	Net carbon stock changes in all pools in baseline stratum *i*; t CO_2-e ha^{-1}
i	1, 2, 3, … *M* strata
M	The total number of strata
t	1, 2, 3, … *t** years elapsed since the start of the REDD project activity

The area of leakage to peatland is equal to the increase in deforestation of peatland by the specific agent relative to business-as-usual. So if historic data shows X hectares of peatland deforestation by the focal agent each year over the past five years then any deforestation in excess of those X hectares each year after project implementation shall be counted as leakage.

5 PARAMETERS

5.1. Data and Parameters Not Monitored

Data Unit / Parameter:	$HistHa_i$
Data unit:	Ha
Used in equations:	2
Description:	Average annual area of deforestation by the baseline agent of deforestation in stratum *i* for the 5 years prior to project implementation

[3] This value is based on the following assumptions and data from the VCS approved "Methodology for Conservation Projects that Avoid Planned Land-Use Conversion in Peat Swamp Forests": drainage of tropical peatswamp areas emits about 0.9 t CO2 per cm drained per year, typical drainage depth on conversion to non-forest use is 50 cm, emissions per year are 45 t CO2/ha; average biomass of peatswamp forest is about 440 t CO2/ha; and assume peat remains drained for 50 years; factor = 50*45/440 (= 5).

Source of data:	Analysis of Remote Sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation.
Justification of choice of data or description of measurement methods and procedures applied:	-
Any comment:	Must be re-evaluated whenever the baseline is revised

Data Unit / Parameter:	PF_c
Data unit:	Dimensionless
Used in equations:	7
Description:	Proportion of available area for production of commodity *c* that is currently forested
Source of data:	GIS analysis plus consultation with experts
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	Must be re-evaluated whenever the baseline is revised

5.1. Data and Parameters Monitored

Data Unit / Parameter:	$A_{LK\text{-}peat,i}$
Data unit:	ha
Used in equations:	8
Description:	Area of leakage to peatland at time *t*
Source of data:	GPS coordinates and/or Remote Sensing data and/or legal parcel records
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Must be examined at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC procedures to be applied:	

Any comment:	$A_{LK\text{-}peat}$ is equal to the increase in deforestation of peatland by the specific agent relative to business-as-usual. So if historic data shows X hectares of peatland deforestation by the focal agent each year over the past five years than any deforestation in excess of those X hectares each year after project implementation shall be counted as leakage. *Ex-ante* evidence shall be presented to justify a projection of zero leakage to peatland. Such evidence can include contracts with the displaced agent of deforestation or evidence of the unsuitability of peatland for the projected land use.

Data Unit / Parameter:	$A_{planned,i}$
Data unit:	ha
Used in equations:	4
Description:	Total area of planned deforestation over the entire project lifetime for stratum *i*
Source of data:	GPS coordinates and/or Remote Sensing data and/or legal parcel records
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Must be examined at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event.
QA/QC procedures to be applied:	
Any comment:	*Ex-ante*, $A_{planned,i}$ shall be determined as described in BL-PL

Data Unit / Parameter:	$A_{defLK,i,t}$
Data unit:	ha
Used in equations:	5
Description:	The total area of deforestation by the baseline agent or class of agent of the planned deforestation in stratum *i* at time *t*
Source of data:	Analysis of Remote Sensing data and/or legal records and/or survey information for lands owned or controlled or previously owned or controlled by the baseline agent of deforestation,

Description of measurement methods and procedures to be applied:	This parameter is updated at baseline renewal when aboveground biomass is re-inventoried as per module CP-AB (at least every 10 years).
Frequency of monitoring/recording:	Must be reexamined at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC procedures to be applied:	
Any comment:	Legal records will include government permits to deforest including concession licenses *Ex-ante*, project proponents shall determine and justify the likelihood of leakage based on characteristics of the baseline agent or class of agent

5.2. Parameters Originating in Other Modules

6. Data Unit / Parameter:	$\Delta C_{BSL,i}$
Data unit:	t CO_2-e ha^{-1}
Used in equations:	1
Description:	Net carbon stock changes in all pools in the baseline stratum *i*
Module parameter originates in:	BL-PL
Any comment:	

Data Unit / Parameter:	$D\%_{planned,i,t}$
Data unit:	%
Used in equations:	4
Description:	Projected annual proportion of land that will be deforested in stratum *i* at year *t*
Module parameter originates in:	BL-PL
Any comment:	

Data Unit / Parameter:	$E_{BiomassBurn,i,t}$
Data unit:	t CO_2-e
Used in equations:	6
Description:	Direct N_2O emission as a result of nitrogen application in stratum *i* in year *t*
Module parameter originates in:	E-NA

Any comment:	*Corresponding information shall be included in the VCS PD*

DOCUMENT HISTORY

Version	Date	Comment
v1.0	3 Dec 2010	Initial version released
v1.1	20 Nov 2012	The module was revised to include avoided planned degradation as an allowable activity: • Added the text “hereafter in this module, “deforestation” refers to both deforestation and planned degradation” • Added a parameter for net CO_2 emissions in the baseline from planned deforestation in the project area in equation 7.