

**Joint Crediting Mechanism Guidelines for Developing Proposed Methodology  
for Reducing Emissions from Deforestation and Forest Degradation, and the Role of  
Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon  
Stocks in Developing Countries (REDD-plus)**

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## **1. Scope and applicability**

1. Joint Crediting Mechanism Guidelines for Developing Proposed Methodology for Reducing Emissions from Deforestation and Forest Degradation, and the Role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks in Developing Countries (REDD-plus) (hereinafter referred to as “these Guidelines”) are intended to assist methodology proponents in preparing proposed methodologies for REDD-plus under the Joint Crediting Mechanism (hereinafter referred to as “JCM”).
2. These Guidelines are to be referred to by the Joint Committee in developing and assessing proposed methodologies. These Guidelines are also to be referred to throughout the entire project cycle of a JCM project for REDD-plus.
3. These Guidelines describe standards, which are requirements to be met, and guidance indicated by the terms “should” and “may” as defined in paragraph 7 below.
4. Submission and subsequent assessment of a proposed methodology are conducted in line with the procedure delineated in Joint Crediting Mechanism Project Cycle Procedure for REDD-plus.
5. These Guidelines aim to assist the development of methodologies to quantify emissions reductions from the five REDD-plus activities listed in the Cancun Agreements (UNFCCC, Decision 1/CP.16 paragraph 70), i.e. (a) reducing emissions from deforestation; (b) reducing emissions from forest degradation; (c) conservation of forest carbon stocks; (d) sustainable management of forests; and (e) enhancement of forest carbon stocks. All methodologies account for (a) reducing emissions from deforestation at a minimum.
6. These guidelines promote the national REDD-plus strategy and take into consideration the national or any relevant sub-national reference level and forest monitoring system established by the Kingdom of Cambodia.

## **2. Terms and definitions**

7. The following terms apply in this Guidelines:
  - (a) “Should” is used to indicate that among several possibilities, one course of action is recommended as particularly suitable;
  - (b) “May” is used to indicate what is permitted.
8. Terms in these guidelines are defined in JCM Glossary of Terms available on the JCM website.

## **3. Key concepts**

### **3.1. Project emission reductions to be credited in a JCM project for REDD-plus**

9. In a JCM project for REDD-plus, the project emission reductions to be credited are defined

as the sum of the annual emission reductions resulting from project activities adjusted using a discount factor for the risk of reversals during a monitoring period.

10. The annual emission reductions are a conservative estimate of the difference between the project reference level and project net emissions in each year.
11. Net emissions include net CO<sub>2</sub> emissions from carbon pools and GHG emissions from GHG sources.
12. The project reference level is an estimate of the anticipated annual net forest-related emissions in the project area during the monitoring period without the project being implemented. Guidelines for methodologies on setting out the procedures for establishing project reference levels are provided in paragraphs 30 to 35 in these Guidelines.
13. The project net emissions is the sum of actual net emissions from forest in the project area, GHG emissions from the project activities and net emissions displaced to outside of the project area by the project activities during the monitoring period. Guidelines for methodologies on setting out the procedures to estimate the project net emissions are provided in paragraphs 36 to 39 in these Guidelines.
14. Guidelines for methodologies to determine the discount factor for risk of reversals are provided in paragraphs 40 to 43 in these Guidelines.

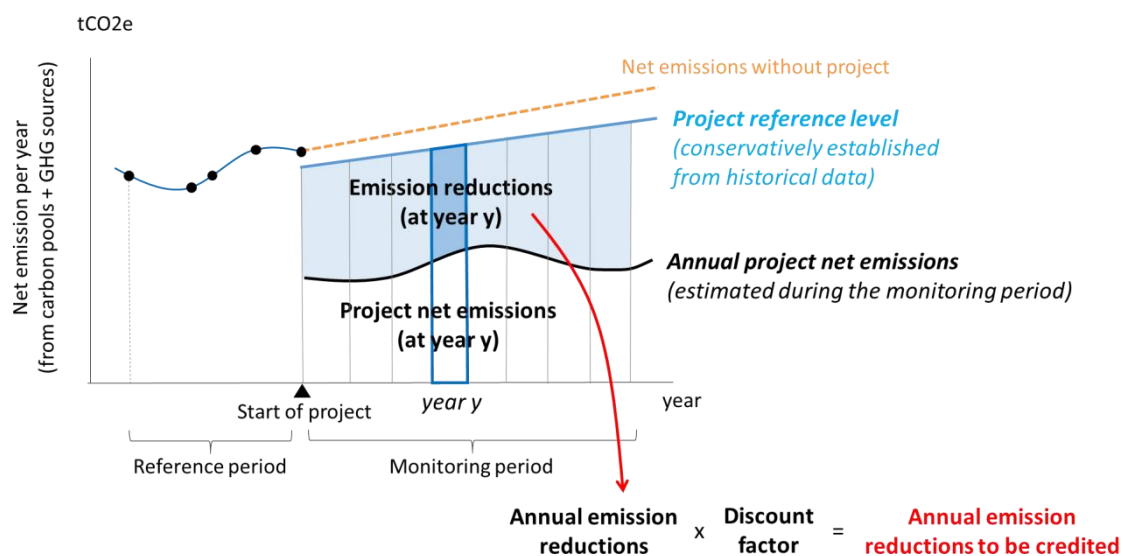


Figure: Relationship between the project reference level, annual project net emissions, annual emission reductions, and the annual emission reductions to be credited

### 3.2. Eligibility criteria

15. Eligibility criteria in proposed methodologies contain the following:
  - (a) Requirements for the project in order to be registered as a JCM project for REDD-plus.
  - (b) Requirements for the project to be able to apply the approved methodology.

## **4. Concept for REDD-plus in the JCM**

### **4.1. Forest Definition**

16. The definition of forest used for REDD-plus methodologies should follow the national definition of forest designated by the Kingdom of Cambodia, as specified in Annex I of these Guidelines. If there is a difference between the national definition of forest and the definition used in a proposed methodology, the reason for selecting the forest definition is explained.

### **4.2. Geographical Boundaries**

17. The project area and the reference area for the project are identified. A displacement belt and/or activity area are also identified, when necessary. The project area and the activity area are delineated taking into account forest management units and other administrative boundaries as well as local land management customs.
18. The project area is the area targeted for reducing net emissions from forest.
19. The reference area is the area used to establish the project reference level. The reference area is similar to the project area with respect to drivers of deforestation and/or forest degradation, landscape configuration and ecological condition, and socio-economic and cultural conditions.
20. The displacement belt is the area outside the project area where net emissions displaced by project activities are monitored. Guidelines for accounting for displaced emissions are provided in paragraph 37 below.
21. The activity area is the area where project activities are implemented to reduce net emissions in the project area and to reduce the risk of the displacement of emissions to other areas.
22. At the time of validation, at least 80 percent of forest in the project area is under the control of the project, and acquisition of the rights of use of the forest to the extent necessary for the project is demonstrated by the project participants with documentary evidence. By the time of the first verification event, the entire right is under the control of the project, and is demonstrated as such by the project participants with documentary evidence.

### **4.3. Carbon pools and GHG sources**

23. The carbon stocks to be considered include each of the following five carbon pools: above ground biomass, below-ground biomass, dead wood, litter and soil organic carbon.
24. GHG sources to be considered are sources such as biomass burning, enteric fermentations of livestock, rice cultivation, and nitrogen fertilization for CH<sub>4</sub> and N<sub>2</sub>O and fuel consumed by project activities for CO<sub>2</sub>.

#### 4.4. Estimation and accounting of net emissions<sup>1</sup>

25. Net CO<sub>2</sub> emissions from the carbon pools are defined as a result of gross emissions caused by decreases of the carbon stocks minus removals caused by increases of the carbon stocks.
26. The approach and procedures used for the national or any relevant sub-national reference level or forest monitoring system developed by the Kingdom of Cambodia are considered when estimating net emissions of the project. The guidelines in paragraphs 27 to 28 are followed when alternative or additional approaches and procedures are used. The methodology proponents communicate with the technical contact person for REDD-plus under the JCM to explain the proposed approach and procedures to develop the project reference level and estimate project net emissions, consider any comments and other feedback they receive, and keep records of the communications. The technical contact person for REDD-plus under the JCM is provided on the JCM website.
27. Field Manual for the National Forest Inventory of Cambodia and the most recent IPCC guidelines, such as *IPCC 2006 Guidelines for National GHG Inventories* or the *IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry*, are used when estimating net emissions.
28. The monitoring of net CO<sub>2</sub> emissions from the carbon pools should be conducted using a combination of remote sensing and ground-based survey. The best available technology, including novel satellite observation technologies, may be employed to build effective monitoring systems for net CO<sub>2</sub> emissions.
  - (a) Remote sensing: Forest/non-forest, land cover types and forest type should be classified through remote sensing analysis using satellite imageries whose spatial resolution is 30 meters or higher. For the classification of land cover and forest types, classification to reflect the amount of carbon stock per hectare is encouraged and the classification should reflect each country's forest designations. The accuracy of imagery analyses of forest/non-forest classification is 80 percent or higher.
  - (b) Ground-based survey of emission factors: Emission factors, or carbon stocks per

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<sup>1</sup> The following guides may be referred to for the estimation of net emissions:  
 Than, S., L. Vesa, S. Vanna, P. Hyvönen, K. T. Korhonen, G. Sola, M. Henry and M. van Rijn. 2017. "Field Manual for the National Forest Inventory of Cambodia. 2nd revision" Forestry Administration of the Ministry of Agriculture, Forestry and Fisheries, Food and Agriculture Organization of the United Nations, Phnom Penh, Cambodia.  
 Forestry and Forest Products Research Institute. 2012. "REDD-plus Cookbook: How to measure and monitor forest carbon" [www.ffpri.affrc.go.jp/redd-rc/ja/reference/cookbook.html](http://www.ffpri.affrc.go.jp/redd-rc/ja/reference/cookbook.html)  
 GOF-C-GOLD. 2015. "A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals associated with deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation" [http://www.gofcgold.wur.nl/redd/sourcebook/GOF-C-GOLD\\_Sourcebook.pdf](http://www.gofcgold.wur.nl/redd/sourcebook/GOF-C-GOLD_Sourcebook.pdf)

hectare, of each carbon pool in each class, should be obtained through on-the-ground measurements. If ground measurements are not used, a reasonable explanation is provided, and the IPCC's Emission Factor Database (EFDB), national forest inventories-or other internationally recognized data may be used as alternative data sources for the emission factors, with an explanation of the rationale for and validity of the data provided.

29. To establish the project reference level, carbon pools and GHG sources can be excluded if their exclusion leads to conservative estimates of emission reductions. To estimate project net emissions, net emissions from all carbon pools and GHG sources should be estimated. However, if the net emission from any carbon pool or any single GHG source due to project activities is estimated to amount to less than five percent of the total net emissions according to measured values or data from the IPCC's guidelines, Emission Factor Database (EFDB), national forest inventories or other internationally recognized sources, a simple but conservative procedure may be used to estimate the amount, and ex post monitoring is not necessary.

#### **4.5. Project reference level**

30. The project reference level is a projection of the sum of the annual net CO<sub>2</sub> emissions from the carbon pools and annual GHG emissions from forest in the project area in the absence of the project. Project reference levels of the net CO<sub>2</sub> emissions and/or GHG emissions should be established based on the net CO<sub>2</sub> emissions and/or GHG emissions from the reference area during the reference period.
31. Regardless of how many of the activities described in paragraph 5 are included in the scope of a project, a single project reference level is established for the project. The reference level can be established by integration of separate models for net CO<sub>2</sub> emissions and GHG emissions or by modeling the combined values directly.
32. The project reference level is consistent with the national forest reference level established by the Kingdom of Cambodia. The guidelines in paragraphs 33 to 34 are followed when alternative or additional approaches and procedures are used.
33. The reference period dates back at least 10 years from the start of the project. The methodology proponents may designate a maximum date back period of the historical data to be used for developing the reference levels that is appropriate for the methodology. The net CO<sub>2</sub> emission data from carbon pools and GHG emission data from GHG sources to establish the project reference level should be obtained for at least four points of times. This means that carbon stock data from at least five points in time are required when using the stock-change method to estimate net emissions.
34. Three approaches for establishing the project reference level are recognized:

- (a) Average of annual net CO<sub>2</sub> emissions and/or GHG emissions during the reference period;
  - (b) Single regression models of the historical trends of annual net CO<sub>2</sub> emissions and/or GHG emissions;
  - (c) Other sophisticated models, including multiple regression analysis of annual net CO<sub>2</sub> emissions and/or GHG emissions, taking into account possible changes in drivers of deforestation and/or forest degradation, such as changes in demography, agricultural, forestry and other land use activities, and national and/or sub-national circumstances such as land development policies and programs.
35. The project reference level is reassessed within five years to ensure that it adequately reflects the actual circumstances of the project area, such as drivers of deforestation and/or forest degradation, activities that lead to land-use changes, and changes of forest management methods. If the result of reassessment shows that the project reference level no longer adequately reflects actual circumstances, the project reference level is reestablished. If a national or relevant sub-national reference level is established after the project start date, the national or relevant sub-national reference level is considered when reestablishing the project reference level at the time of reassessment, and the validity of the new project reference level is explained. However, the newly established project reference level cannot be applied retroactively to evaluate net emissions reduction before the reassessment.

#### **4.6. Project net emissions**

36. Project net emissions include (a) the net CO<sub>2</sub> emissions from the carbon pools and GHG emissions from forest in the project area, (b) GHG emissions due to the project activities inside and outside the project area including safeguards activities, and (c) displaced emissions in each year during the monitoring period.
37. Displaced emissions are net emissions displaced from forest inside to outside the project area as a result of the project activities. Any decrease in carbon stocks and increase of GHG emissions from forest outside the project area that are reasonably attributable to the project activities are quantified and accounted as displaced emissions. Any increase in carbon stocks and decrease of GHG emissions compared to the situation without the project outside the project area due to the project activities are excluded from the accounting. The ways and means to identify and quantify displaced emissions are explained in the proposed methodologies.
38. The approach and procedures used in any national or sub-national forest monitoring system relevant to the project area established by the Kingdom of Cambodia are considered when establishing the monitoring system for project net emissions.

39. Monitoring is implemented at least just prior to verifications.

#### **4.7. Project emission reductions to be credited**

40. The methodology proponents demonstrate that the method to estimate annual emission reductions is conservative.
41. In order to effectively deal with the risk of reversals, the annual project emission reductions to be credited are calculated using a discount factor, considering internal risks (such as risks arising from inadequate project management, loss of financial viability, increased opportunity costs, and reduction of project longevity), external risks (such as risks caused by issues associated with land ownership and resource use rights, community engagement, and political matters) and natural risks (such as risks associated with unprecedented forest fires, pests and disease outbreaks, extreme weather patterns, and geological events). The default value of the discount factor is 20 percent. The proposed methodologies may use the default value and/or provide a procedure that the project participants can apply to develop a project specific discount factor to deal with the risk of reversals, with the justification for the procedure provided.
42. The discount factor is reassessed at the time of verification. If the result of reassessment shows that the discount factor no longer adequately reflects actual circumstances, the discount factor is reestablished. However, a newly established discount factor cannot be applied retroactively to calculate project emission reductions to be credited before the reassessment.
43. Annual project emission reductions to be credited are calculated for each year from the project reference level, the project net emissions and the discount factor. Their sum is the project emission reductions to be credited during a monitoring period.

#### **5. General Guidelines for developing methodologies**

44. Methodology proponents prepare the proposed methodology by providing parameters and default values in the Proposed Methodology Form and the Proposed Methodology Spreadsheet, attached to these Guidelines.
45. These Guidelines, the Proposed Methodology Form and the Proposed Methodology Spreadsheet may be obtained electronically from the JCM website.
46. The Proposed Methodology Form and the Proposed Methodology Spreadsheet are completed in English.
47. Methodology proponents provide supporting documents to justify key logical and quantitative assumptions regarding the choice of eligibility criteria, default values and procedures to establish the project reference level, project net emissions, discount factor and other related information on REDD-plus.



48. The Joint Committee develops the Proposed Methodology Form and the Proposed Methodology Spreadsheet and may revise them if necessary.
49. The Proposed Methodology Form is not altered, that is, is completed without modifying its format, font, headings. If sections of the Proposed Methodology Form are not applicable, it is made clear that the section is intentionally left blank by writing “N/A” in the appropriate cells.
50. The Proposed Methodology Spreadsheet enables calculation of project emission reductions to be credited automatically by the project participants through inputting values. The Proposed Methodology Spreadsheet consists of the following:
  - (a) An Input Sheet containing all the parameters to be monitored *ex post*, project-specific parameters to be fixed *ex ante* by the project participants (e.g. historical data) as well as the default factors which can be changed by the project participants. For each parameter, the methodology proponents fill in all the required fields, except for those of the inputted values;
  - (b) A Calculation Process Sheet containing all the default values which are set in the methodology and cannot be changed by the project participants, calculation process to derive project reference level and project net emissions, and the resulting project emission reductions to be credited.
51. The proposed methodology:
  - (a) Describes the procedures in a manner that is sufficiently explicit to enable the methodology to be used, applied to projects unambiguously, and reproduced by a third party;
  - (b) Is possible for projects following the methodology to be subjected to JCM validation and/or verification;
  - (c) Includes all algorithms, formulae, and step-by-step procedures needed to apply the methodology and validate the project, i.e. calculating project reference level, project net emissions and project emission reductions to be credited;
  - (d) Provides instructions for making any logical or quantitative assumptions that are not provided in the methodology and are made by the methodology user;
  - (e) Avoids the intentional increase of credits caused by perverse incentives (e.g. when an increase in output is triggered by incentive to increase credits).
52. The presentation of values in the Proposed Methodology Form and the Proposed Methodology Spreadsheet should be in international standard format (e.g. 1,000 representing one thousand and 1.0 representing one). The units used should be accompanied by their equivalent S.I. units/norms (thousand/million) as part of the requirement to ensure transparency and clarity.

## 6. Instructions for completing the Proposed Methodology Form for REDD-plus

Instructions for completing the Proposed Methodology Form are provided below. A hypothetical proposed methodology is inserted to enhance the clarity of these Guidelines. This methodology is purely indicative and does not imply that the methodology is to be adopted.

### Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Partner Country	the Kingdom of Cambodia
Name of the methodology proponents submitting this form	Company DEF
Title of the proposed methodology and version number	Reducing deforestation and forest degradation through forest fire prevention, forest management and land use improvement in Cambodia Version 1.0
List of documents to be attached to this form (please check):	<input checked="" type="checkbox"/> The attached draft JCM-PDD: <input type="checkbox"/> Additional information
Date of submission	1/10/2016

- Provide an unambiguous title for the proposed methodology. The title should reflect the types of REDD-plus activities to which the methodology is applicable and include the approach or activity(ies) for achieving net reduction of emissions.
- Provide a list of any additional documents to be attached to this form.
- Provide the date of submission in DD/MM/YYYY.

History of the proposed methodology

Version	Date	Contents revised
1.0	1/10/2016	First edition

- Provide the version number and date of submission in DD/MM/YYYY.
- If a previously submitted methodology has been revised, provide the date of revision in DD/MM/YYYY as well as a brief summary of the revision.

## A. Title of the methodology

Reducing deforestation and forest degradation through forest fire prevention, forest management and land use improvement in Cambodia Version 1.0

- Provide an unambiguous title for the proposed methodology and the version number of the proposed methodology. The title should reflect the types of REDD-plus activities to which the methodology is applicable and include the approach or activity(ies) for achieving net reduction of emissions.

## B. Terms and definitions

Terms	Definitions

- Provide definitions of key terms that are used in the proposed methodology.

## C. Summary of the methodology

Items	Summary
<i>Project activities (emission reduction measures)</i>	Conduct fire prevention measures; Develop and implement forest management plans; When there is risk of emissions displacement, invest in land use improvement activities, such as agricultural intensification, to reduce pressure on forests.
<i>Establishment of project reference level</i>	The project reference level is established as below the average of net emissions during the reference period through the following steps: - identifying the reference area, - mapping changes in the land use type and estimating forest carbon density in the reference area during the reference period, - calculating historical carbon stock change and CO <sub>2</sub> emissions
<i>Calculation of project net emissions</i>	Project net emissions are calculated on the basis of the monitored land-use change in the project area and emission factors over the monitoring period. Net CO <sub>2</sub> emissions in the project area and GHG emissions in the activity area are monitored and accounted. Displaced emissions in the displacement belt are monitored and estimated.
<i>Monitoring parameters and methods</i>	Change of forested area and replacement land use –monitored by remote sensing. Burned area – monitored by remote sensing. Forest carbon stock change – monitored through forest

	inventory Use of fuel for project activities – monitored using project records
Calculation of project emission reductions to be credited	Calculating the project emission reduction in a conservative manner. A default value of 20% is applied for the discount factor.

- Summarize the key elements of the proposed methodology, including brief descriptions of:
  - Project activities (i.e. emission reduction measures);
  - Establishment of the project reference level;
  - Estimation of project net emissions;
  - Key monitoring parameters and methods;
  - Determination of the discount factor for risk of reversals.

#### D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	The main drivers of deforestation and forest degradation are conversion for agriculture and forest fire.
Criterion 2	The project area does not include forest on peat soil. Peat is defined as organic soil with at least 65% organic matter and a minimum thickness of 50 cm.
Criterion 3	Illegal logging to supply regional, national or international markets is not taking place.
Criterion 4	Agricultural intensification activities do not involve large numbers of livestock and the application of inorganic fertilizers.
Criterion 5	The historic pattern of deforestation is mosaic.
Criterion 6	N/A
Criterion 7	N/A
Criterion 8	N/A
Criterion 9	N/A
Criterion 10	N/A

- Eligibility criteria are requirements for the project in order for it to be able to apply the approved methodology and registered as a REDD-plus project under the JCM.
- Eligibility criteria are those that can be examined objectively.
- Eligibility criteria include:
  - Characteristics to identify the measures applied to the methodology;
  - Conditions that are necessary in order to enable robust calculation of emission reductions by the methodology, e.g. the situation before the implementation of the activity;
- Eligibility criteria should be, to the extent possible, those that can be ascertained upon validation, i.e. eligibility criteria should avoid those which need to be monitored ex post.

*For example, actual performance of a measure should not be included as eligibility criteria, since it is not certain at validation whether the stated performance can be achieved. On the other hand, performance as defined by scientifically referenced figures can be included as eligibility criteria since it can be readily checked upon validation.*

## E. Geographical Boundaries

### Essential

Geographical boundary	Requirements
Project area	No additional requirements. (The project area does not have to be a single area of forest)
Reference area	The reference area includes the project area for the determination of the initial project reference level, but excludes the project area when the reference level is reassessed.

### Optional boundaries

Geographical boundary	Required (Y/N/TBD)	Additional requirements
activity area	Y	Non-forest area outside the project area.
Displacement belt	Y	Determined through mobility analysis based on a multi-criteria evaluation.

TBD: to be decided by the project proponent

- Describe any requirements additional to those described in paragraphs 17 to 22 of these guidelines for the establishment of the geographical boundaries.
- Identify whether an activity area and/or displacement belt are required in the methodology, or whether the project participants are left to decide (to be decided – TBD) whether the project design includes these areas.

## F. Carbon pools and GHG sources

The net emission sources to be considered include all the following Carbon pools and GHG sources.

Project reference level			
Carbon pools and GHG sources		Included (Y/N)	Explanation
Carbon pools	Above ground biomass	Y	This methodology applies to projects where carbon stock change in this pool may be significant.
	Below ground biomass	Y	This methodology applies to projects

			where carbon stock change in this pool may be significant.
	Dead wood	Y	This methodology applies to projects where carbon stock change in this pool may be significant.
	Litter	N	This methodology applies to projects where carbon stock change in this pool is not significant; Can be conservatively excluded.
	Soil organic carbon	N	This methodology applies to projects where carbon stock change in this pool is not significant; Can be conservatively excluded.
GHG sources	CH <sub>4</sub> in biomass burning		This methodology applies to projects where GHG emission from this source may be significant.
	N <sub>2</sub> O in biomass burning		This methodology applies to projects where GHG emission from this source may be significant.
	N/A		N/A
Project net emissions			
Carbon pools and GHG sources		Included (Y/N)	Explanation
Carbon pools	Above ground biomass	Y	This methodology applies to projects where carbon stock change in this pool may be significant.
	Below ground biomass	Y	This methodology applies to projects where carbon stock change in this pool may be significant.
	Dead wood	Y	This methodology applies to projects where carbon stock change in this pool may be significant.
	Litter	N	This methodology applies to projects where carbon stock change in this pool is not significant; Can be conservatively excluded.
	Soil organic carbon	N	This methodology applies to projects where carbon stock change in this pool is not significant; Can be conservatively excluded.
GHG sources	CH <sub>4</sub> in biomass burning		This methodology applies to projects where GHG emission from this source may be significant.
	N <sub>2</sub> O in biomass burning		This methodology applies to projects where GHG emission from this source may be significant.
	CO <sub>2</sub> in combustion of fossil fuels		This methodology applies to projects where GHG emission from this source may be significant.

- *Identify which of the five carbon pools are included in the establishment of the project*

*reference level and the estimation of project net emissions.*

- *Identify GHG sources that are reasonably attributable to the methodology.*

## G. Establishment of project reference level

### G.1. Establishment of project reference level

Approach for estimating project reference level	The project reference level is established by a conservative estimation of the average historical net CO <sub>2</sub> emissions and GHG emissions.
-------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------

The project reference level is established as follows:

1) Identifying the reference area and setting the reference period

The reference area is mapped and described and the reference period is set. The reference area is similar to the project area regarding the drivers of deforestation and/or forest degradation, landscape configuration, socio-economic and cultural conditions, and is more than ten times larger than the total size of the project area,. The reference period dates back at least 10 years from the start of the project.

2) Estimating past forested area in the reference area

Forest in the project area and the reference area is classified into types (or strata) reflecting the national land use classification system and differences in carbon density. The area of each land use type is mapped using remote sensing data with a minimum resolution of 30 meters. The classified maps of forest/non-forest and forest types have a minimum accuracy of 80%.

3) Estimating forest carbon density of each land use type

Default values, such as those in IPCC guidelines, are applied for carbon density of each land use type. When more than one default value exists, a default value is selected to provide a conservative estimate of net project emissions.

4) Calculating average carbon stock change during the reference period

The average carbon stock change during the reference period is calculated conservatively using Equation 2 and Equation 3 in G.2. below.

5) Calculating other GHG emissions in the reference scenario

CH<sub>4</sub> and N<sub>2</sub>O emissions from biomass burning during the monitoring period are projected using Equation 4 in G.2. below.

6) Establishing project reference level in a conservative manner

The project reference level is calculated using Equation 1 in G.2. below.

### G.2. Calculation of project reference level

The project reference level at year y during the proposed monitoring period is calculated as follows:

$$RL_y = \Delta CS_{ref,y} * 44/12 + L_{fire,ref,y} \quad \text{(Equation 1)}$$

$RL_y$  Project reference level at year y [tCO<sub>2</sub>e]

$\Delta CS_{ref,y}$  Projected carbon stock change in project area at year y [tC]

44/12 Conversion factor of molecular weight of carbon to CO<sub>2</sub>

$L_{fire,ref,y}$  Projected amount of CH<sub>4</sub> and N<sub>2</sub>O emissions from forest fires in project area at year y [tCO<sub>2</sub>e]

The projected carbon stock change of the project area at year  $y$  ( $\Delta CS_{ref,y}$ ) is conservatively established from the historical change of land use types in the initial forested area (forested area at the beginning of reference period) in the project area during the reference period and carbon density of each land use type. At least five points of carbon stock data during the reference period are collected to obtain at least four data of the carbon stock changes.  $\Delta CS_{ref,y}$  is conservatively established as the average of the carbon stock changes after the period with the largest decrease in carbon stock change per year is excluded from the calculation.

Carbon stock change at year  $y$  in the project area is projected using the following equation.

$$\Delta CS_{ref,y} = \frac{\sum (C_{yri} - C_{yri+1}) / \sum (yr_{i+1} - yr_i) * A_{PJ} / A_{RE}}{\Delta CS_{ref,y}} \quad \text{(Equation 2)}$$

$\Delta CS_{ref,y}$  Projected carbon stock change in project area at year  $y$  [tC]  
 $C_{yr}$  Carbon stock in initial forested area in reference area at year  $yr$  during the reference period [tC]  
 $yr_i$  Years during the reference period  
 $A_{RE}$  Initial forested area [ha]  
 $A_{PJ}$  Project area [ha]

Number “a” is excluded from  $i$  when  $(C_a - C_{a+1}) / (yr_{a+1} - yr_a) = \max((C_{yri} - C_{yri+1}) / (yr_{i+1} - yr_i))$  to establish the project reference level conservatively below the level of net CO<sub>2</sub> emissions without project.

$$C_{yr} = \sum C_{i,j,yr} = \sum (A_{i,yr} * EF_{i,j}) \quad \text{(Equation 3)}$$

$C_{yr}$  Carbon stock in initial forested area at year  $yr$  during the reference period [tC]  
 $C_{i,j,yr}$  Carbon stock in carbon pool  $j$  in stratum  $i$  at year  $yr$  [tC]  
 $A_{i,yr}$  Total area of stratum  $i$  in initial forested area at year  $yr$  [ha]  
 $EF_{i,j}$  The Emission Factors of carbon pool  $j$  of stratum  $i$  [tC ha<sup>-1</sup>]  
 $i$  A stratum of land use types  
 $j$  A specific carbon pool

Data for “EF<sub>*i,j*</sub>” can be sourced from 2006 IPCC guidelines.

CH<sub>4</sub> and N<sub>2</sub>O emissions from forest fires in the project area are projected using the following equation.

$$L_{fire\_ref,y} = \sum_{yr} L_{fire\_ref,yr} / n_{yr} * A_{PJ} / A_{RE} \quad \text{(Equation 4)}$$

$L_{fire\_ref,y}$  Projected amount of CH<sub>4</sub> and N<sub>2</sub>O emissions from fires in project area at year  $y$  [tCO<sub>2</sub>e]  
 $L_{fire\_ref,yr}$  Historical amount of CH<sub>4</sub> and N<sub>2</sub>O emissions from fires in initial forested area at year  $yr$  during the reference period [tCO<sub>2</sub>e]  
 $n_{yr}$  Number of monitored years during the reference period  
 $A_{RE}$  Initial forested area [ha]  
 $A_{PJ}$  Project area [ha]

$$L_{fire\_ref,y} = AB_{i,yr} * MB_i * C_f * G_{ef} * 10^{-3} * GWP \quad \text{(Equation 5)}$$

$L_{fire\_ref,yr}$  Amount of CH<sub>4</sub> and N<sub>2</sub>O emissions from fires in initial forested area at year  $yr$  during the reference period [tCO<sub>2</sub>e]  
 $AB_{i,yr}$  Area burnt in stratum  $i$  in initial forested area at year  $yr$  [ha]  
 $MB_i$  Mass of fuel available in initial forested area for combustion in stratum  $i$  [t ha<sup>-1</sup>]  
 $C_f$  Combustion factor for forest fire  
 $G_{ef}$  Emission factor for forest fire [g kg-dm burnt<sup>-1</sup>]  
 $GWP$  Global Warming Potential (25 for CH<sub>4</sub> and 298 for N<sub>2</sub>O)

Data of “MB<sub>*i*</sub>”, “C<sub>*f*</sub>” and “G<sub>*ef*</sub>” can be sourced from 2006 IPCC guidelines.

Carbon pools and GHG sources can be excluded, if their exclusion leads to conservative



estimates of the emission reductions.
---------------------------------------

- *Provide a qualitative explanation of the procedure to establish the project reference level referring to paragraphs 30 to 35 of these Guidelines.*
- *Provide the equations to establish the project reference level.*
- *Provide a description of how the approach and procedures used in the project are consistent with those for national or sub-national reference level including the project area .*
- *Elaborate the method to calculate the project reference level. Be specific and complete, so that the procedure can be carried out in an unambiguous way, replicated, and subjected to assessment and verification:*
  - *Use consistent variables, equation formats, subscripts, etc.;*
  - *Number all equations in the Proposed Methodology Form;*
  - *Define all variables, with units indicated;*
  - *Justify the conservativeness of the calculation method, e.g. discounting the result of calculation and applying conservative parameters.*
- *Elaborate all parameters, coefficients, and variables used in the calculation of the project reference level:*
  - *For those values that are provided in the methodology:*
    - *Clearly indicate the precise references from which these values are taken (e.g. official statistics, IPCC Guidelines, commercial and scientific literature).*
    - *Justify the conservativeness of the values provided.*
  - *For those values that are to be provided by the project participants, clearly indicate how the values are to be selected and justified, for example, by explaining:*
    - *What types of sources are suitable (official statistics, expert judgment, proprietary data, IPCC Guidelines, commercial and scientific literature, etc.);*
    - *The vintage of data that is suitable;*
    - *What spatial level of data is suitable (local, regional, national, international);*
    - *How conservativeness of the values is to be ensured.*
- *For all data to be used by the project participants, specify the procedures to be followed if the site-specific historical data are unavailable. For instance, the methodology could point to a preferred data source, and indicate a priority order for use of additional data and/or fall back data sources to preferred sources (e.g. private, international statistics, etc.).*
- *Note any parameters, coefficients, variables, etc. that are used to calculate the project reference level and that should be obtained by project proponent.*
- *Explain any parts of the calculation method that are not self-evident. Provide references as necessary. Explain implicit and explicit key assumptions in a transparent manner.*
- *For methodologies requiring sampling, clearly indicate the sampling method and the statistical treatment of the sampled data.*

## H. Calculation of project net emissions

Project net emissions at year  $y$  during the monitoring period are calculated on the basis of monitored carbon stock change, emissions from other GHG sources and displacement during the monitoring period as follows:

$$PE_y = \Delta CS_{PJ,y} * 44/12 + L_{fire\_PJ,y} + E_{energy,PJ,y} + DE_y \quad (\text{Equation 6})$$

$PE_y$	Project net emissions at year $y$ [tCO <sub>2</sub> e]
$\Delta CS_{PJ,y}$	Carbon stock change in the project area at year $y$ [tC]
$L_{fire\_PJ,y}$	Amount of non-CO <sub>2</sub> emissions from fires in the project area during year $y$ [tCO <sub>2</sub> e]
$E_{energy,PJ,y}$	Amount of CO <sub>2</sub> emissions from energy use during year $y$ [tCO <sub>2</sub> ]
$DE_y$	Displacement of emissions at year $y$ [tCO <sub>2</sub> e]
44/12	Conversion factor of molecular weight of carbon to CO <sub>2</sub>

(a) Carbon stock change in the project area at year  $y$  is estimated using the following equation.

$$\Delta CS_{PJ,y} = \Sigma (C_{ymi} - C_{ymi+1}) / \Sigma (ym_{i+1} - ym_i) \quad (\text{Equation 7})$$

$\Delta CS_{PJ,y}$	Carbon stock change in the project area at year $y$ [tC]
$C_{ym}$	Carbon stock at year $ym$ during the monitoring period [tC]
$ym1, ym2, \dots$	Year during the monitoring period

$$C_{ym} = \Sigma_{i,j} C_{i,j,ym} = \Sigma_{i,j} (A_{i,ym} * EF_{i,j}) \quad (\text{Equation 8})$$

$C_{ym}$	Carbon stock at year $ym$ during the monitoring period [tC]
$C_{i,j,ym}$	Carbon stock in carbon pool $j$ of stratum $i$ at year $ym$ [tC]
$A_{i,ym}$	Total area of stratum $i$ at year $ym$ [ha]
$EF_{i,j}$	The emission factor of carbon pool $j$ of stratum $i$ [tC ha <sup>-1</sup> ]
$i$	Stratum of land use types
$j$	A category of carbon pool

Data for “ $A_{i,ym}$ ” are generated by direct monitoring using remotely sensed imagery. Data for “ $EF_{i,j}$ ” are collected by direct monitoring using forest sampling. The number of sample plots is determined to provide estimates in the net change in carbon stocks to within 10 per cent of the true value of the mean at the 95 per cent confidence level.

For non-CO<sub>2</sub> emissions (CH<sub>4</sub> and N<sub>2</sub>O) from forest fires in the project area during year  $y$ , the equation below is used.

$$L_{fire\_PJ,y} = \Sigma_{yr} L_{fire\_PJ,y} / ny \quad (\text{Equation 9})$$

$L_{fire\_PJ,y}$	Amount of CH <sub>4</sub> and N <sub>2</sub> O emissions from fires in the project area during year $y$ [tCO <sub>2</sub> e]
$L_{fire\_PJ,y}$	Amount of CH <sub>4</sub> and N <sub>2</sub> O emissions from fires in the project area at year $y$ during the monitoring period [tCO <sub>2</sub> e]
$ny$	Number of monitored years during the monitoring period

$$L_{fire\_PJ,y} = AB_{i,ym} * MB_i * C_f * G_{ef} * 10^{-3} * GWP \quad (\text{Equation 10})$$

$L_{fire\_PJ,y}$	Amount of CH <sub>4</sub> and N <sub>2</sub> O emissions from fires in the project area at year $y$ during the monitoring period [tCO <sub>2</sub> e]
$AB_{i,ym}$	Area burnt in stratum $i$ in the project area at monitoring year $ym$ [ha]
$MB_i$	Mass of fuel available for combustion in stratum $i$ [t ha <sup>-1</sup> ]
$C_f$	Combustion factor for forest fire
$G_{ef}$	Emission factor for forest fire [g kg-dm burnt <sup>-1</sup> ]
$GWP$	Global Warming Potential (25 for CH <sub>4</sub> and 298 for N <sub>2</sub> O)

Data for “ $AB_{i,ym}$ ” is generated by direct monitoring using remotely sensed imagery.

Data for “ $MB_i$ ”, “ $C_f$ ” and “ $G_{ef}$ ” can be sourced from 2006 IPCC guidelines.

(b) For CO<sub>2</sub> emissions from combustion of fossil fuels for project activities such as from transport and machinery use at year  $y$ , the equation below is used.

$$E_{energy,PJ,y} = LC_y * CC * ODU * 44/12 \quad (\text{Equation 11})$$

$E_{energy,PJ,y}$  Amount of CO<sub>2</sub> emissions from energy use during year  $y$  [tCO<sub>2</sub>]  
 $LC_y$  Consumption of fuel at monitoring year  $y$  [TJ]  
 $CC$  Carbon content of fuel [kt-C TJ<sup>-1</sup>]  
 $ODU$  Oxidized during use factor  
 $44/12$  Conversion factor of molecular weight of carbon to CO<sub>2</sub>

Data of “ $LC_y$ ” is collected by direct monitoring.

Data of “ $CC$ ” and “ $ODU$ ” is sourced from 2006 IPCC guidelines.

Net emissions from any carbon pools and GHG sources whose amount is less than 5% of total emissions can be estimated using simple measures, such as by using reference data, rather than direct monitoring.

(c) Displacement of net emission is monitored in displacement belt outside the project area. The displacement belt is determined through mobility analysis based on a multi-criteria evaluation, for which factors such as maps of the historical deforestation and degradation patterns, distance from roads and data collected through a participatory workshop are used..

The displacement of net emissions are to be calculated as follows:

$$DE_y = DE_{CO_2,ym} + DE_{fire,ym} \quad (\text{Equation 12})$$

$DE_y$  Displacement of net emissions during year  $y$  [tCO<sub>2</sub>e]  
 $DE_{CO_2,ym}$  Displacement of CO<sub>2</sub> emissions during monitoring year  $ym$  [tCO<sub>2</sub>]  
 $DE_{fire,ym}$  Displacement of CH<sub>4</sub> and N<sub>2</sub>O emissions during year monitoring  $ym$  due to forest fires [tCO<sub>2</sub>e]

$$DE_{CO_2,ym} = (\Delta CS_{DB,ym} - \Delta CS_{DB,ref,y}) * 44/12 \quad (\text{Equation 13})$$

$DE_{CO_2,ym}$  Displacement of CO<sub>2</sub> emissions during monitoring year  $ym$  [tCO<sub>2</sub>]  
 $\Delta CS_{DB,ym}$  Carbon stock change in displacement belt at monitoring year  $ym$  [tC]  
 $\Delta CS_{DB,ref,y}$  Projected carbon stock change in displacement belt area at year  $y$  [tC]  
 $44/12$  Conversion factor of molecular weight of carbon to CO<sub>2</sub>

Carbon stock change at year  $y$  in the displacement belt is projected using the following equation.

$$\Delta CS_{DB,ref,y} = \sum (C_{yri} - C_{yri+1}) / \sum (yr_{i+1} - yr_i) * A_{DB} / A_{RE} \quad (\text{Equation 14})$$

$\Delta CS_{DB,ref,y}$  Projected carbon stock change in displacement belt area at year  $y$  [tC]  
 $C_{yr}$  Carbon stock in initial forested area in reference area at year  $yr$  during the reference period [tC]  
 $yr_i$  Years during the reference period  
 $A_{DB}$  Displacement belt [ha]  
 $A_{RE}$  Initial forested area in reference area [ha]

Number “ $a$ ” is excluded from  $i$  when  $(C_a - C_{a+1}) / (yr_{a+1} - yr_a) = \max((C_{yri} - C_{yri+1}) / (yr_{i+1} - yr_i))$ .

Displacement of CH<sub>4</sub> and N<sub>2</sub>O emissions during year  $y$  due to forest fires is calculated as follows:

$$DE_{fire,ym} = L_{fire,DB,ym} - L_{fire,DB,ref,y} \quad (\text{Equation 15})$$

$DE_{fire,y}$	Displacement of CH <sub>4</sub> and N <sub>2</sub> O emissions due to forest fires during monitoring year $ym$ [tCO <sub>2</sub> e]
$L_{fire\_DB,ym}$	CH <sub>4</sub> and N <sub>2</sub> O emissions due to forest fires in displacement belt at monitoring year $ym$ [tCO <sub>2</sub> e]
$L_{fire\_DB\_ref,y}$	Projected amount of emissions from CH <sub>4</sub> and N <sub>2</sub> O during year $y$ due to forest fires in displacement belt [tCO <sub>2</sub> e]

CH<sub>4</sub> and N<sub>2</sub>O emissions from forest fires in the displacement belt are projected as follows:

$$L_{fire\_DB\_ref,y} = \sum_{yr} L_{fire\_ref,y} / n_{yr} * A_{DB} / A_{RE} \quad (\text{Equation 16})$$

$L_{fire\_DB\_ref,y}$  Projected amount of emissions from CH<sub>4</sub> and N<sub>2</sub>O during year  $y$  due to forest fires in displacement belt [tCO<sub>2</sub>e]

$L_{fire\_ref,yr}$  Historical amount of CH<sub>4</sub> and N<sub>2</sub>O emissions from fires in initial forested area in reference area at year  $yr$  during the reference period [tCO<sub>2</sub>e]

$n_{yr}$  Number of monitored years during the reference period

$A_{DB}$  Displacement belt [ha]

$A_{RE}$  Initial forested area in reference area [ha]

$$L_{fire\_ref,y} = AB_{i,yr} * MB_i * C_f * G_{ef} * 10^{-3} * GWP \quad (\text{Equation 17})$$

$L_{fire\_ref,yr}$  Amount of CH<sub>4</sub> and N<sub>2</sub>O emissions from fires in initial forested area in reference area at year  $yr$  during the reference period [tCO<sub>2</sub>e]

$AB_{i,yr}$  Area burnt in stratum  $i$  in initial forested area in reference area at year  $yr$  [ha]

$MB_i$  Mass of fuel available in initial forested area in reference area for combustion in stratum  $i$  [t ha<sup>-1</sup>]

$C_f$  Combustion factor for forest fire

$G_{ef}$  Emission factor for forest fire [g kg-dm burnt<sup>-1</sup>]

$GWP$  Global Warming Potential (25 for CH<sub>4</sub> and 298 for N<sub>2</sub>O)

Data for “ $AB_{i,yr}$ ” is generated by direct monitoring using remotely sensed imagery.

Data for “ $MB_i$ ”, “ $C_f$ ” and “ $G_{ef}$ ” can be sourced from 2006 IPCC guidelines.

Equation 17 is same as Equation 5,

- Provide a qualitative explanation of the procedure to calculate the project net emissions referring to paragraph 36 to 39 of these Guidelines.
- Provide the equations to calculate the project net emissions.
- Provide a description of how the approach and procedures used in any national or sub-national forest monitoring system to the project area are considered.
- Where applicable, the method to calculate project net emissions should adhere to the instructions provided in the section on project reference level.
- Explain the method to estimate the displaced emissions, including the method to determine the displacement belt, if necessary.

## I. Calculation of project emission reductions to be credited

Project emission reductions at year  $y$  are calculated as the difference between the project reference level and the project net emissions.

Annual emission reductions are calculated using the equation below.

$$ER_y = RL_y - PE_y \quad \text{(Equation 13)}$$

$ER_y$     Project emission reductions at year  $y$  [tCO<sub>2</sub>e]  
 $RL_y$     Project reference level at year  $y$  [tCO<sub>2</sub>e]  
 $PE_y$     Project net emissions at year  $y$  [tCO<sub>2</sub>e]

Annual project emission reductions to be credited are calculated using Equation 14, which includes discounting for the risk of reversals.

A default value of 20% is applied for the discount factor.

$$ER_{cred,y} = ER_y * (1 - DF) \quad \text{(Equation 14)}$$

$ER_{cred,y}$     Project emission reductions to be credited at year  $y$  [tCO<sub>2</sub>e]  
 $ER_y$     Project emission reductions at year  $y$  [tCO<sub>2</sub>e]  
 $DF$     Discount factor, default as 0.3

Project emission reductions to be credited during a monitoring period  $p$  are calculated as follows:

$$ER_{cred,p} = \sum ER_{cred,y} \quad \text{(Equation 13)}$$

$ER_{cred,p}$     Project emission reductions to be credited during a monitoring period  $p$  [tCO<sub>2</sub>e]  
 $ER_{cred,y}$     Project emission reductions to be credited at year  $y$  during monitoring period  $p$  [tCO<sub>2</sub>e]

- *Provide a description of how estimation of the emission reduction is conservative.*
- *Elaborate the calculation method used to estimate, measure or calculate annual project emission reductions to be credited. In most cases, this will be simple equation with two terms: project reference level and project net emissions.*
- *When the 20% default value is not used for the discount factor, elaborate the procedure to identify the risk of reversals and set the discount factor.*

## J. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source
$EF_{i,j}$	The Emission Factors of carbon pool $j$ of stratum $i$	National forest inventory or 2006 IPCC Guidelines Vol.4 (Table 2.2, 2.3) or other internationally recognized data
$MB_i$	Average Mass of fuel available for combustion of stratum $i$ per hectare	2006 IPCC Guidelines
$C_f$	Combustion factor. Shown in value together with $MB_i$ .	2006 IPCC Guidelines Vol.4 (Table 2.6)
$G_{ef}$	Emission factor for forest fire	2006 IPCC Guidelines
GWP	Global Warming Potential	2006 IPCC Guidelines
CC	Carbon content of oil	2006 IPCC Guidelines
ODU	Oxidized during use factor	2006 IPCC Guidelines

- *Identify sources of default values, where default values are applied to the proposed methodology.*

## 7. Instructions for completing the Proposed Methodology Spreadsheet

Instructions for completing the Proposed Methodology Spreadsheet are provided below. The Input Sheet of the Proposed Methodology Spreadsheet should be completed. A hypothetical Input Sheet of the Proposed Methodology Spreadsheet is inserted to enhance the clarity of these Guidelines. This is purely indicative and does not imply that the Input Sheet of the Proposed Methodology Spreadsheet is adopted.

### Proposed methodology spread sheet (input sheet) [Attachment to Proposed Methodology Form]

Table 1: Parameters to be monitored ex post

(a) Monitoring point No.	(b) Parameters	(c) Description of data	(d) Estimated Values	(e) Units	(f) Monitoring option	(g) Source of data	(h) Measurement methods and procedures	(i) Monitoring frequency	(j) Other comments
(1)	$A_{i,y}$	Area of stratum (= land use type) $i$ at year $ym$ during monitoring period.	→ Table 1-a.	ha	Option C	USGS GLOVIS, Landsat imagery	Analyzing multispectral optical satellite imagery	Once every three years	Min. spatial resolution of 30 m
(2)	$AB_{i,y}$	Area burnt in stratum (= land use type) $i$ at year $ym$ during monitoring period.	→ Table 1-a.	ha	Option C	USGS GLOVIS, Landsat imagery	Analyzing multispectral optical satellite imagery	Once every three years	Min. spatial resolution of 30 m
(3)	$EF_{1,1}$	Emission factor (carbon stock per hectare) in above ground biomass in primary forest	200	tC ha <sup>-1</sup>	Option C	Forest sampling	Forest sampling	Once every three years	
(4)	$EF_{1,2}$	Emission factor (carbon stock per hectare) of dead wood, all types of forest	14	tC ha <sup>-1</sup>	Option C	Forest sampling	Forest sampling	Once every three years	
(5)	$LC_{ym}$	Project fuel consumption during year $ym$ during monitoring period.	→ Table 1-b.	TJ	Option B	USGS GLOVIS, Landsat imagery	Analyzing multispectral optical satellite imagery	Once a year	
(6)	$DE_{CO_2,ym}$	Displacement of net CO <sub>2</sub> emissions during year $ym$ during monitoring period.		Ha	Option C	USGS GLOVIS, Landsat imagery	Analyzing multispectral optical satellite imagery	Once every three years	Min. spatial resolution of 30 m
(7)	$DE_{fire,ym}$	Displacement of CH <sub>4</sub> and N <sub>2</sub> O emissions during year $ym$ during monitoring period.		Ha	Option C	USGS GLOVIS, Landsat imagery	Analyzing multispectral optical satellite imagery	Once every three years	Min. spatial resolution of 30 m

Table 1-a. Area of stratum  $i$  and area burnt in stratum  $i$  at year  $ym$  during monitoring period

Year during the monitoring period	(1) Forest area (ha): $A_{i,y}$			(2) Burnt area (ha): $AB_{i,y}$		
	Primary forest	Secondary forest	Cropland	Primary forest	Secondary forest	Cropland
	$A_{1,y}$	$A_{2,y}$	$A_{3,y}$	$AB_{1,y}$	$AB_{2,y}$	$AB_{3,y}$
ym1						
ym2						
ym3						
ym4						
ym5						
...						

Table 1-b. Project fuel consumption

Year	(3) Project fuel consumption (TJ):LC <sub>y</sub>
<i>y<sub>m1</sub></i>	
<i>y<sub>m2</sub></i>	
<i>y<sub>m3</sub></i>	
<i>y<sub>m4</sub></i>	
<i>y<sub>m5</sub></i>	
....	

Table 2: Project-specific parameters to be fixed ex ante

(a)	(b)	(c)	(d)	(e)	(f)
Parameters	Description of data	Estimated value	Units	Source of data	Other comments
$A_{RE}$	Size of reference area		ha		The reference area is decided by project proponents
$A_{PJ}$	Size of project area		ha		The project area is decided by project proponents
$A_{DB}$	Size of displacement belt		ha		The displacement belt is decided by project proponents through mobility analysis based on a multi-criteria evaluation
$A_{i,yr}$	Size of stratum (= land use type) <i>i</i> at year <i>yr</i> during the reference period.	→ Table 2-a.	ha	Satellite imagery	Min. spatial resolution of 30 m
$AB_{i,yr}$	Size burnt in stratum (= land use type) <i>i</i> at year <i>yr</i> during the reference period.	→ Table 2-a.	ha	Satellite imagery	Min. spatial resolution of 30 m

Table 2-a. Area of stratum *i* and area burnt in stratum *i* at year *y* during reference period

Year during the reference period	(1) Forest area (ha): $A_{i,yr}$			(2) Burnt area (ha): $AB_{i,yr}$		
	Primary forest	Secondary forest	Cropland	Primary forest	Secondary forest	Cropland
	$A_{1,y}$	$A_{2,y}$	$A_{4,y}$	$AB_{1,y}$	$AB_{2,y}$	$AB_{4,y}$
<i>yr1</i>						
<i>yr2</i>						
<i>yr3</i>						
<i>yr4</i>						
<i>yr5</i>						
...						

## [Monitoring option]

Option A	Based on public data which is measured by entities other than the project participants (Data used: publicly recognized data such as statistical data and specifications)
Option B	Based on the amount of transaction which is measured directly using measuring equipment (Data used: commercial evidence such as invoices)
Option C	Based on the actual measurement using measuring equipment (Data used: measured values)



The Calculation Process Sheet of the Proposed Methodology Spreadsheet should be completed. A hypothetical Calculation Process Sheet of the Proposed Methodology Spreadsheet is provided below enhance the clarity of these Guidelines. This is purely indicative and does not imply that the Calculation Process Sheet is adopted.

### JCM Proposed Methodology Spreadsheet (Calculation Process Sheet)

1. Calculations for project emission reductions to be credited	Pool / Sources	Value	Units	Parameter
Project emission reductions to be credited during the period $p$			tCO <sub>2</sub> e	$ER_p$
<b>2. Basic data of the project</b>				
Size of reference area	Carbon stock and biomass burning		ha	$A_{RE}$
Size of project area	Carbon stock and biomass burning		ha	$A_{PJ}$
Size of displacement belt	Carbon stock and biomass burning		ha	$A_{DB}$
Monitoring start date				Y1
Monitoring end date				
<b>3. Selected default values</b>				
Emission factor (carbon stock per hectare) in above ground biomass in primary forest	Above ground biomass	200	tC ha <sup>-1</sup>	$EF_{1,1}$
Emission factor (carbon stock per hectare) in above ground biomass in secondary forest	Above ground biomass	100	tC ha <sup>-1</sup>	$EF_{2,1}$
Emission factor (carbon stock per hectare) in above ground biomass in cropland	Above ground biomass	30	tC ha <sup>-1</sup>	$EF_{4,1}$
Ratio to below-ground biomass of all types of forest	Below-ground biomass	37.0	%	$RA_{toB}$
Emission factor (carbon stock per hectare) of dead wood, all types of forest	Dead wood	14	tC ha <sup>-1</sup>	$EF_{i,3}$
Mass of fuel available for combustion * Combustion factor in primary forest	Biomass burning	119.6 * 0.36	t ha <sup>-1</sup>	$MB_1 * Cf$
Mass of fuel available for combustion * Combustion factor in secondary forest	Biomass burning	42.2 * 0.55	t ha <sup>-1</sup>	$MB_2 * Cf$
Mass of fuel available for combustion * Combustion factor in cropland	Biomass burning	5.5 * 0.80	t ha <sup>-1</sup>	$MB_4 * Cf$
Emission factor for forest fires (CH <sub>4</sub> )	Biomass burning	6.8	g kg-dm burnt <sup>-1</sup>	$Gef-CH_4$
Emission factor for forest fires (N <sub>2</sub> O)	Biomass burning	0.2	g kg-dm burnt <sup>-1</sup>	$Gef-N_2O$
Global Warming Potential (CH <sub>4</sub> )	Biomass burning	25	-	GWP
Global Warming Potential (N <sub>2</sub> O)	Biomass burning	298	-	GWP

Carbon content of oil (Gasoline)	Combustion of fossil fuels from transport and machinery use	18.7	kt-C TJ <sup>-1</sup>	CC
Oxidized during use factor	Combustion of fossil fuels from transport and machinery use	1.0	-	ODU
<b>4. Calculations for project reference level</b>				
Project reference level at year y			tCO2e	RL <sub>pi,y</sub>
Year during reference period				
yr1				
yr2				
yr3				
yr4				
yr5				
Carbon stock change at year yr			tC	ΔCS <sub>ref,y</sub>
Carbon stock at Yr1			tC	
Primary forest	Carbon stock		ha	A <sub>1,yr1</sub>
Secondary forest	Carbon stock		ha	A <sub>2,yr1</sub>
Cropland	Carbon stock		ha	A <sub>3,yr1</sub>
Carbon stock at Yr2			tC	
Primary forest	Carbon stock		ha	A <sub>1,yr2</sub>
Secondary forest	Carbon stock		ha	A <sub>2,yr2</sub>
Cropland	Carbon stock		ha	A <sub>3,yr2</sub>
Carbon stock at year Yr3				
Primary forest	Carbon stock		ha	A <sub>1,yr3</sub>
Secondary forest	Carbon stock		ha	A <sub>2,yr3</sub>
Cropland	Carbon stock		ha	A <sub>3,yr3</sub>
...				
Non-CO <sub>2</sub> emissions from forest fires at year yr			tCO2e	L <sub>fire_ref,y</sub>
Non-CO <sub>2</sub> emission at year Yr1			tCO2e	
Area of burnt primary forest at yr1	Biomass burning		ha	
Area of burnt secondary forest at yr1	Biomass burning		ha	
Area of burnt cropland at yr1	Biomass burning		ha	
Non-CO <sub>2</sub> emission at year Yr2			tCO2e	
Area of burnt primary forest at yr2	Biomass burning		ha	
Area of burnt secondary forest at yr2	Biomass burning		ha	
Area of burnt cropland at yr2	Biomass burning		ha	

Non-CO <sub>2</sub> emission at year Yr3				
Area of burnt primary forest at yr3	Biomass burning		ha	
Area of burnt secondary forest at yr3	Biomass burning		ha	
Area of burnt cropland at yr3	Biomass burning		ha	
<b>5. Calculations of the project net emissions</b>				
Project net emissions during year y			tCO <sub>2</sub> e	PE <sub>y</sub>
Year during first monitoring period				
ym1				
ym2				
ym3				
Carbon stock changes at year ym			tC	$\Delta CS_{PJ,y}$
Carbon stock at year ym1			tC	
Area of primary forest at year ym1	Carbon stock		ha	
Area of secondary forest at year ym1	Carbon stock	0	ha	
Area of cropland at year ym1	Carbon stock	0	ha	
Carbon stock at year ym2			tC	
Area of primary forest at year ym2	Carbon stock		ha	
Area of secondary forest at year ym2	Carbon stock		ha	
Area of cropland at year ym2	Carbon stock		ha	
Carbon stock at year ym3			tC	
Area of primary forest at year ym3	Carbon stock		ha	
Area of secondary forest at year ym3	Carbon stock		ha	
Area of cropland at year ym3	Carbon stock		ha	
Non-CO <sub>2</sub> emissions from forest fires at year ym			tCO <sub>2</sub> e	$L_{fire,PJ,y}$
Non-CO <sub>2</sub> emission at year Yr1			tCO <sub>2</sub> e	
Area of burnt primary forest at year y1	Biomass burning		ha	
Area of burnt secondary forest at year y1	Biomass burning		ha	
Area of burnt cropland at year y1	Biomass burning	0	ha	
Non-CO <sub>2</sub> emission at year Yr2			tCO <sub>2</sub> e	
Area of burnt primary forest at year y2	Biomass burning		ha	
Area of burnt secondary forest at year y2	Biomass burning		ha	
Area of burnt cropland at year y2	Biomass burning		ha	
Non-CO <sub>2</sub> emission at year Yr3			tCO <sub>2</sub> e	
Area of burnt primary forest at year y3	Biomass burning		ha	

	Area of burnt secondary forest at year y3	Biomass burning		ha	
	Area of burnt cropland at year y3	Biomass burning		ha	
	CO <sub>2</sub> emissions from transport and machinery use during year y			tC	$E_{energy,PJ,y}$
	Consumption of oil during year y			TJ	$LC_y$
	Carbon content of oil (Gasoline)	Combustion of fossil fuels from transport and machinery use		kt-C TJ <sup>-1</sup>	CC
	Oxidized during use factor	Combustion of fossil fuels from transport and machinery use		-	ODU
	Displacement of net emissions during the period y			tCO <sub>2</sub> e	$DE_y$
	Displacement of CO <sub>2</sub> emissions during monitoring year ym	Carbon stock		tCO <sub>2</sub>	$DE_{CO2,ym}$
	Displacement of CH <sub>4</sub> and N <sub>2</sub> O emissions during year monitoring ym due to forest fires	Biomass burning		tCO <sub>2</sub> e	$DE_{fire,ym}$
<b>5. Calculation of discount factor</b>					
	Discount factor			20	%

[List of Default Values]

Emission Factors of carbon pool <i>j</i> of stratum <i>i</i>				
Carbon stock in above ground biomass of stratum <i>i</i>				
	Primary forest	200	tC ha <sup>-1</sup>	$EF_{1,1}$
	Secondary forest	100	tC ha <sup>-1</sup>	$EF_{2,1}$
	Cropland	30	tC ha <sup>-1</sup>	$EF_{4,1}$
	Ratio to below-ground biomass, all types of forest.	37.0	%	$RA_{toB}$
	Emission factor of carbon stock in dead wood, all types of forest	14	tC ha <sup>-1</sup>	$EF_{i,3}$

Average mass of fuel available for combustion per hectare				
	Primary forest	119.6 * 0.36	t ha <sup>-1</sup>	$MB_1 * Cf$
	Secondary forest	42.2 * 0.55	t ha <sup>-1</sup>	$MB_2 * Cf$
	Cropland (rice residues)	5.5 * 0.80	t ha <sup>-1</sup>	$MB_4 * Cf$
Emission factor for forest fire				
	CH <sub>4</sub>	6.8	g kg-dm burnt <sup>-1</sup>	$Gef-CH_4$
	N <sub>2</sub> O	0.2	g kg-dm burnt <sup>-1</sup>	$Gef-N_2O$
Global Warming Potential				
	CH <sub>4</sub>	25	-	GWP
	N <sub>2</sub> O	298	-	GWP

	Carbon content of oil (Gasoline)	18.7	Kt-C TJ <sup>-1</sup>	CC
	Oxidized during use factor	1.0	-	ODU
	Discount factor	20	%	DF

- *The Input Sheet of the Proposed Methodology Spreadsheet consists of a table of parameters to be monitored ex post, and parameters to be fixed ex ante, which, combined, should provide a complete listing of the data that needs to be collected for the application of the methodology. The tables may include data that is collected from other sources (e.g. official statistics, expert judgment, proprietary data, IPCC Guidelines, commercial and scientific literature, etc.), measured, or sampled. Parameters that are calculated with equations provided in the methodology should not be included in this section.*

*For the “Parameters to be monitored ex post”(table 1), the following items are filled:*

- *Parameter: the variable used in equations in the proposed methodology;*
- *Description of data: a clear and unambiguous description of the parameter;*
- *Estimated value: this field is for the project participants to fill in to calculate emission reductions, and may be left blank in the proposed methodology.*
- *Unit: The International System Unit (SI units – refer to <[http://www.bipm.fr/enus/3\\_SI/si.html](http://www.bipm.fr/enus/3_SI/si.html)>)*
- *Monitoring option: please select option(s) from below. If appropriate, please provide the order of priority and the conditions when the options are chosen.*
  - *Option A: Based on public data which is measured by entities other than the project participants (Data used: publicly recognized data such as statistical data and specifications)*
  - *Option B: Based on the amount of transaction which is measured directly using measuring equipments (Data used: commercial evidence such as invoices)*
  - *Option C: Based on the actual measurement using measuring equipments (Data used: measured values)*
- *Source of data: A description which data sources should be used to determine this parameter. Clearly indicate how the values are to be selected and justified, for example, by explaining:*
  - *What types of sources are suitable (official statistics, expert judgment, proprietary data, IPCC, commercial and scientific literature, etc.);*
  - *What spatial level of data is suitable (local, regional, national, international).*
- *Measurement methods and procedures: For option B and C, a description of the measurement procedures or reference to appropriate standards. Provide also QA/QC procedures.*
- *Monitoring frequency: A description of the frequency of monitoring (e.g. continuously, annually, etc).*
- *Other Comments: Other input not covered by the items above.*

- *The table “Parameters to be fixed ex ante”(table 2), should also adhere to the instruction provided above. Data that is determined only once and remains fixed should be considered under “J. Data and parameters fixed ex ante”.*

**Annex I. National definition of forest for REDD-plus under the JCM of the Kingdom of Cambodia**

For a REDD-plus project under the JCM in Cambodia, forest refers to a unit of an ecosystem in the form of wetland and dry land covered by natural or planted vegetation with a height from 5 meters on an area of at least 0.5 hectares, and canopy crown cover of more than 10%. Areas also include forest regrowth and areas under afforestation or reforestation. Rubber, oil palm plantations and perennial crops are excluded from this definition.