JCM Proposed Methodology Form for REDD-plus and Afforestation/Reforestation

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Partner Country	Republic of the Philippines
Name of the methodology proponents submitting this form	Marubeni Corporation
Title of the proposed methodology, and version number	Enhancing carbon removals through afforestation/reforestation, Version 1.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD ☐Additional information
Date of completion	27/2/2026

History of the proposed methodology

Version	Date	Contents revised
1.0	27/2/2026	First version

A. Title of the methodology

Enhancing carbon removals through afforestation/reforestation, Version 1.0

B. Terms and definitions

Terms	Definitions
Forest	Land spanning more than 0.5 hectares with trees higher than 5 meters and with a canopy cover of more than 10 percent, or trees that are able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.
Non-forest	An area which does not meet the definition of forest.
Afforestation/Reforestation	Activities to convert from non-forest to forest through planting, sowing and human-assisted natural regeneration of woody vegetation.
Soil disturbance	Human activities (e.g. tilling, cultivating) that release organic carbon from the soil into the atmosphere.
Wetland	Wetlands include land that is covered or saturated by water for all or part of the year.

C. Summary of the methodology

Items	Summary
Project activities (emission reduction or removal enhancement measures)	Activities to enhance carbon removal in tree biomass by converting non-forest to forest through direct planting and assisted natural regeneration.
Establishment of project reference level	The project reference level is determined by estimating the carbon stock in biomass that is present in the project area prior to the start of the project. It is adjusted to take uncertainties into consideration.
Calculation of project net emissions or removals	Project net removals are calculated by estimating net carbon stock change of tree biomass of planted or naturally

	regenerated trees over the monitoring period, from the project start or the last verification to the current verification. GHG emissions in the project area resulting from the implementation of project activity are monitored and accounted for. Displaced emissions and uncertainties are deducted to calculate net removals.
Monitoring parameters and methods	- Project area (Area converted from non-forest to forest) [ha]: monitored by remote sensing. - Average tree biomass per hectare in the project scenario in year *t* [tdm/ha]: estimated using direct measurement of trees - Average tree biomass per hectare in the project area before the start of the project [tdm/ha]: estimated using direct measurement of trees - Average nontree biomass per hectare in the project area before the project starts [tdm/ha]: estimated using direct measurement of nontrees (shrubland, grassland) - Amount of synthetic fertilizer applied [kg]: monitored using project records. - Amount of organic fertilizer applied [kg] monitored using project records. - Project area burnt [ha]: monitored using remote sensing. - Amount of fossil fuel used: monitored using project records. - Ratio of the wood collection, agricultural, or livestock activity expected to be displaced during the crediting period, potentially impacting tree biomass outside the project area [0 to 1]: This is determined by credible estimations or a representative survey. - Land within a project area where the wood collection or agricultural activity is taking place [ha]: determined by credible estimations or a representative survey. - Number of livestock expected to be displaced during the crediting period, potentially affecting tree biomass outside the project area [head]: This is determined by credible estimations or a representative survey. - Grazing capacity of the area where the livestock will be displaced to [ha/head]: This is determined by credible estimations or a representative survey.

Calculation of project emission reductions or removals to be credited	Project emission reductions or removals are calculated in a conservative manner. A default buffer rate of at least 15%, as defined in the *JCM Guidelines for Developing Proposed Methodology for REDD-plus and afforestation/reforestation*, is applied to account for the reversal risk.

D. Eligibility criteria

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

Criterion 1	Project area is neither forest nor wetland.
Criterion 2	The most likely scenario without the project does not show an increase in biomass in the project area. This criterion is demonstrated through observations showing that biomass in the project area has not increased during the past 10 years prior to the start of the project.
Criterion 3	Project area has not been cleared of forest within the 10-years period prior to the start date of the project.
Criterion 4	Project activity is not mandated by law nor legal requirements.
Criterion 5	Project activity does not involve site preparation techniques (e.g. digging, stump removal) that cause soil disturbance.
Criterion 6	The project activity is to enhance carbon removals through plantation and/or assisted natural regeneration whose species are approved by the government of the Philippines to plant.
Criterion 7	Project applies silvicultural systems of conservation forests. Legal or illegal logging to supply commercial timber to regional, national or international timber markets is not carried out in the project area during the project period.

E. Geographical Boundaries

Geographical boundary	Required (Y/N/TBD)	Additional requirements / Remarks
Project area	Y	None
Reference area	N	This methodology does not require to set the reference area.
Activity area	N	None
Displacement belt	N	None

TBD: to be decided by the project proponent

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	Aboveground tree biomass	N	This pool would not have increased in the absence of the project. Conservatively excluded.
	Belowground tree biomass	N	This pool would not have increased in the absence of the project. Conservatively excluded.
	Aboveground nontree biomass	N	This pool would not have increased in the absence of the project. Conservatively excluded.
	Belowground nontree biomass	N	This pool would not have increased in the absence of the project. Conservatively excluded.
	Dead wood	N	This pool would have decreased in the absence of the project. Conservatively excluded.
	Litter	N	This pool would have decreased in the absence of the project. Conservatively excluded.
	Soil organic carbon	N	Soil disturbance is avoided in this methodology.
GHG sources	N/A		N/A
Project net emissions or removals			
Carbon pools and GHG sources		Included (Y/N)	Explanation
Carbon pools	Aboveground tree biomass	Y	Major carbon pool
	Belowground tree biomass	Y	Major carbon pool

	Aboveground nontree biomass	N	Carbon stock may not increase due to the project activity. Conservatively excluded.
	Belowground nontree biomass	N	Carbon stock may not increase due to the project activity. Conservatively excluded.
	Dead wood	N	Carbon stock may increase due to the project activity. Conservatively excluded.
	Litter	N	Carbon stock may increase due to the project activity. Conservatively excluded.
	Soil organic carbon	N	Carbon stock may increase due to the project activity. Conservatively excluded.
GHG sources	N_2O emissions from fertilizer application		Where nitrogen fertilizer is applied, N_2O emissions should be included.
	CH_4 and N_2O emissions from burning of biomass (natural cause)		Where natural biomass burning occurs, CH_4 and N_2O emissions may constitute significant sources of emissions. Decreases in carbon stock due to burning are accounted for as changes in tree biomass.
	CO_2 emissions from fossil fuel burning		Where fossil fuels are consumed by machines used for forest management and reforestation, such as site preparation, CO_2 emissions are included.

G. Establishment and calculation of project reference level

G.1. Establishment of project reference level

Approach for estimation of project reference level

Project reference level is established based on the historical data of carbon stock in the project

area where trees are planted during the project period. Since the 'Eligibility Criterion 2' of this methodology requires that there is no increase of biomass in the project area without project activity, the project reference level is assumed to be zero.
Carbon removals in the carbon pools of dead wood, litter and soil organic carbon may increase with the project activity and may be constant without the project activity. To ensure the conservativeness of the net carbon removal, these carbon removals are not accounted in either reference level or project net carbon removal. Project reference level is established based on the historical data of carbon stock in the project area where trees are planted during the project period. Since the 'Eligibility Criterion 2' of this methodology requires that there is no increase of biomass in the project area without project activity, the project reference level is assumed to be zero.
Carbon removals in the carbon pools of dead wood, litter and soil organic carbon may increase with the project activity and may be constant without the project activity. To ensure the conservativeness of the net carbon removal, these carbon removals are not accounted in either reference level or project net carbon removal.

G.2. Calculation of project reference level

Since the 'Eligibility Criterion 2' of this methodology assumes no increase of biomass without project activity, the project reference level is zero.

H. Calculation of project net emissions or removals

Project net removals are calculated as follows.

$$CR_{PJ,t} = \sum_{k=1}^{K} \Delta C_{TREE_{PJ},t,k} - C_{LOST,t} - GHG_{BURN,t} - GHG_{FERT,t} - GHG_{FUEL,t} - DE_{TOTAL}$$

(Equation 1)

Where:
$CR_{PJ,t}$= Project net removals in year *t* [tCO_2eq]
$\Delta C_{TREE_{PJ},t,k}$= Carbon stock change in year *t* during k_{th} monitoring interval [tCO_2eq]
$C_{LOST,t}$= Loss of carbon stock due to site preparation for tree planting in shrubland and grassland in year *t* [tCO_2eq]
$GHG_{BURN,t}$= GHG emissions from biomass burning in year *t* [tCO_2eq]
$GHG_{FERT,t}$= GHG emissions from fertilizer consumption in year *t* [tCO_2eq]
$GHG_{FUEL,t}$= GHG emission from fossil fuel use in year *t* [tCO_2eq]

DE_{TOTAL}= Displaced emissions [tCO_2eq]

Displaced emissions are deducted in the first year of the project period (t=1).

t= Years during the crediting period 1,2,3…T

k= Number of monitoring tree biomass during the project 1,2,3..K.

< Carbon stock change in tree biomass >

Carbon stock change in tree biomass is estimated using the stock difference method which estimates the difference in carbon stocks at two points in time. Carbon stock at a given point in time is estimated using the stratified random sampling method. The number of sample plots required for estimation of biomass stocks is calculated using the A/R Methodology Tool "Calculation of the number of sample plots for measurements within A/R CDM project activities". For the ex-ante estimation of carbon stock change in tree biomass, annual change is estimated based on growth models conservatively representing the project activity.

Carbon stock change in tree biomass in year *t* is calculated as follows. Where monitoring intervals are longer than one-year, yearly amount of project net removals are calculated through annualization, dividing project net removals in the monitoring interval by the number of years of the monitoring interval.

$$\Delta C_{TREE_{PJ},t,k} = [\sum_{i=1}^{M} C_{TREE_{PJ},t,k,i} \times (1 - Unc_{PJ,t}) - \sum_{i=1}^{M} C_{TREE_{PJ},t-xk,i} \times (1 - Unc_{PJ,t-xk})] \div x_k$$

(Equation 2)

Where:

$C_{TREE_{PJ},t,i}$= Carbon stock in tree biomass in stratum *i* in year *t* [tCO_2eq]

x_k= Number of years of the monitoring interval in the k_{th} monitoring

$Unc_{PJ,t}$ =Uncertainty in cumulative removals through year *t* [0 to 1]

Carbon stock in tree biomass in year *t* is a sum of carbon stock in aboveground biomass and belowground biomass.

$$C_{TREE_{PJ},t,i} = C_{ABG_{PJ},t,i} + C_{BLG_{PJ},t,i} \quad \text{(Equation 3)}$$

Where:

$C_{ABG_{PJ},t,i}$ = Carbon stock in aboveground biomass in year *t* in stratum *i* [tCO_2eq]

$C_{BLG_{PJ},t,i}$ = Carbon stock in belowground biomass in year *t* in stratum *i* [tCO_2eq]

Carbon stock in aboveground biomass is converted from tree biomass.

$$C_{ABG_{PJ},t,i} = \frac{44}{12} \times CF_{TREE} \times B_{ABG,t,i} \times A_i \quad \text{(Equation 4)}$$

Where:

$\frac{44}{12}$ = Ratio of molecular weight of carbon dioxide to carbon

CF_{TREE} = Carbon fraction of tree biomass on dry weight basis [t C/tdm]

$B_{ABG,t,i}$ = Aboveground tree biomass per hectare in year *t* in stratum *i* [tdm/ha]

A_i = Project area of stratum *i* [ha]

Aboveground tree biomass per hectare is assessed using the allometric equation appropriate for the tree species.

Carbon stock in belowground biomass is estimated from aboveground biomass.

$$C_{BLG_{PJ},t} = C_{ABG_{PJ},t} \times R_{TREE} \quad \text{(Equation 5)}$$

Where:

R_{TREE} = Root to shoot ratio of tree [0 to 1]

< Loss of carbon stock>

Loss of carbon stock due to site preparation for tree planting in shrubland and grassland is calculated as follows:

$$C_{LOST,t} = \sum_{i=1}^{M} (C_{TREE_{LOST},t,i} + C_{NONTREE_{LOST},t,i}) \times \left(1 + Unc_{LOST,t}\right) \quad \text{(Equation 6)}$$

Where:

$C_{LOST,t}$ = Loss of carbon stock from cuttings of herbaceous plants in grassland in year *t* [tCO_2eq]

$C_{TREE\_LOST,t,i}$ = Carbon stock loss in tree biomass in stratum *i* in year *t* [tCO_2eq]

$C_{NONTREE\_LOST,t,i}$ = Carbon stock loss in nontree biomass in stratum *i* in year *t* [tCO_2eq]

i = Stratum 1,2,3,…M

$Unc_{LOST,t}$= Carbon stock loss uncertainty in year *t* [0 to 1]

< Loss of carbon stock in tree biomass >

Carbon stock in tree biomass is estimated using a stratified random sampling method. The number of sample plots required for estimation of biomass stocks is calculated using the A/R Methodology Tool "Calculation of the number of sample plots for measurements within A/R CDM project activities".

$$C_{TREE\_LOST,t,i} = C_{ABG\_LOST,t,i} + C_{BLG\_LOST,t,i} \quad \text{(Equation 7)}$$

Where:

$C_{TREE\_LOST,t,i}$ = Total carbon stock loss in tree biomass in stratum *i* in year *t* [tCO_2eq]
$C_{ABG\_LOST,t,i}$ = Carbon stock loss in aboveground biomass in stratum *i* in year *t* [tCO_2eq]
$C_{BLG\_LOST,t,i}$ = Carbon stock loss in belowground biomass in stratum *i* in year *t* [tCO_2eq]

$$C_{ABG\_LOST,t,i} = \frac{44}{12} \times CF_{TREE} \times B_{ABG_{LOST},t,i} \times A_{LOST,t,i} \quad \text{(Equation 8)}$$

Where:

$\frac{44}{12}$ = Ratio of molecular weight of carbon dioxide to carbon

CF_{TREE} = Carbon fraction of tree biomass [tC]
$B_{ABG\_LOST,t,i}$ = Loss of aboveground tree biomass per hectare in stratum *i* in year *t* [tdm/ha]
$A_{LOST,t,i}$ = Area of stratum *i* where carbon stocks are lost in year *t* [ha]

Aboveground tree biomass per hectare is assessed using the allometric equation appropriate for the tree species. Allometric equations are sourced from peer-reviewed literature or other scientific evidence and should be specific to the species, genus or family within the ecoregion or Holdridge life zone in the region where the project is located. For project activities involving facilitated natural regeneration or with more than two species in a single stand, equation(s) are selected from the following as available, listed in descending order of preference: i) Equations specific to the forest type within the same ecoregion (defined at the biome level) or Holdridge life-zone as the region in which the project is located, or ii) Global equations specific to the forest type.

$$C_{BLG\_LOST,t,i} = C_{ABG\_LOST,t,i} \times R_{TREE} \quad \text{(Equation 9)}$$

Where:

R_{TREE} = Root to shoot ratio of tree [0 to 1]

< **Loss of carbon stock in nontree biomass**>

Carbon stock in nontree biomass is estimated using a stratified random sampling method or estimated by using project-specific, regional, national or IPCC default values for each vegetation type.

$$C_{NONTREE\_LOST,t,i} = \frac{44}{12} \times CF_{NONTREE} \times B_{NONTREE\_LOST,t,i} \times A_{LOST,t,i} \quad \text{(Equation 10)}$$

Where:

$CF_{NONTREE}$ = Carbon fraction of nontree biomass [tC]
$B_{NONTREE\_LOST,t,i}$ = Nontree biomass loss per hectare in stratum i in year t [tdm/ha]

< Carbon stock loss uncertainty >

The carbon stock loss uncertainty is calculated by propagating the errors associated with the estimates of included pools as follows

$$Unc_{LOST,t} = MIN\left(1, MAX\left(0, \frac{\sqrt{\sum_{p=1}^{n}(U_p \times C_p)^2}}{\sum_{p=1}^{n} C_p} - 0.1\right)\right) \quad \text{(Equation 11)}$$

Where:

$Unc_{LOST,t}$= Carbon stock loss uncertainty at year *t* [0 to 1]

U_p= Uncertainty (expressed as 90 percent confidence interval as a fraction of the mean) in carbon stock estimate of pool *p* [0 to 1]

C_p = Carbon stock estimate of pool *p* [tCO_2eq]

$p =$ Type of carbon pools (tree biomass or nontree biomass)

< GHG emissions from biomass burning >

$$GHG_{BURN,t} = \sum_{i=1}^{M}(B_{ABG\_BURN,t,i} \times A_{BURN,t,i} \times COMF) \times (GWP_{CH4} \times EF_{CH4} + GWP_{N2O} \times EF_{N2O}) \quad \text{(Equation 12)}$$

Where:

$GHG_{BURN,t}$ = Project emissions due to biomass burning in year *t* [t CO_2eq]

$A_{BURN,t,i}$ = Area burned year *t* in stratum *i* [ha]

GWP_{CH4} = Global warming potential for CH_4

EF_{CH4}= Emission factor for CH_4 [t/tdm. burned]

GWP_{N2O} = Global warming potential for N_2O

EF_{N2O}= Emission factor for N_2O [t/tdm. burned]

$B_{ABG\_BURN,t,i}$ = Average aboveground biomass stock per hectare subject to burning in year *t* in stratum *i* [tdm./ha]

$COMF$ = Combustion factor [0 to 1]

< N_2O emissions from fertilizer applications >

N_2O emissions from fertilizer applications are calculated as follows.

$$GHG_{FERT,t} = GHG_{Direct-N,t} + GHG_{Indirect-N,t} \quad \text{(Equation 13)}$$

Where:

$GHG_{Direct-N,t}$ = Direct N_2O emissions from fertilizer use in year *t* [tCO_2eq]

$GHG_{Indirect-N,t}$ = Indirect N_2O emissions from fertilizer use in year *t* [tCO_2eq]

$$GHG_{Direct-N,t} = \left(F_{Synth,t} + F_{Org,t}\right) \times EF_{Direct-N} \times \frac{44}{28} \times GWP_{N20} \quad \text{(Equation 14)}$$

Where:

$F_{Synth,t}$ = Synthetic N fertilizer used in year *t* [tN]

$F_{Org,t}$ = Organic N fertilizer used in year *t* [tN]

$EF_{Direct-N}$ = Emission factor for N_2O emission from N inputs by fertilizers

$\frac{44}{28}$ = Ratio of molecular weight of N_2O to N

GWP_{N20} = Global warming potential for N_2O

$$F_{Synth,t} = M_{Synth,t} \times NC_{Synth,t} \quad \text{(Equation 15)}$$

Where:

$F_{Synth,t}$ = Synthetic N fertilizer used in year *t* [tN]

$M_{Synth,t}$ = Mass of synthetic fertilizer used in year *t* [t]

$NC_{Synth,t}$ = N content of synthetic fertilizer used in year *t* [tN/t]

$$F_{Org,t} = M_{Org,t} \times NC_{Org,t} \quad \text{(Equation 16)}$$

Where:

$F_{Org,t}$ = Organic N fertilizer used in year *t* [tN]

$M_{Org,t}$ = Mass of organic fertilizer used in year *t* [t]

$NC_{Org,t}$ = N content of organic fertilizer used in year *t* [tN/t]

$$GHG_{Indirect-N,t} = Nfert_{volat,t} + Nfert_{leach,t} \quad \text{(Equation 17)}$$

Where:

$Nfert_{volat,t}$= Indirect N_2O emissions produced from atmospheric deposition of N volatilized due to fertilizer use in year *t* [tCO_2eq]

$Nfert_{leach,t}$= Indirect N_2O emissions from leaching and runoff of N due to fertilizer use in year t [tCO_2eq]

$$Nfert_{volat,t} = [(F_{Synth,t} \times Frac_{GASF}) + (F_{Org,t} \times Frac_{GASM})] \times EF_{NVolat} \times \frac{44}{28} \times GWP_{N20}$$

(Equation 18)

Where:

$Frac_{GASF}$= Fraction of all synthetic N added to soils that volatilizes as NH_3 and NOx
$Frac_{GASM}$= Fraction of all organic N added to soils that volatilizes as NH_3 and NOx
EF_{NVolat}= Emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces

$$Nfert_{leach,t} = [(F_{Synth,t} + F_{Org,t}) \times Frac_{Leach})] \times EF_{NLeach} \times \frac{44}{28} \times GWP_{N20} \quad \text{(Equation 19)}$$

Where:
$Frac_{Leach}$= Fraction of synthetic or organic N added to soils that is lost through leaching and runoff, in regions where leaching and runoff occurs
EF_{NLeach}= Emission factor for N_2O emissions from leaching and runoff

< GHG emission from fossil fuel use >

$$GHG_{FUEL,t} = \sum_j FC_{j,t} \times NCV_j \times EF_j \quad \text{(Equation 20)}$$

Where:
$FC_{j,t} =$ Quantity of fossil fuel use type *i* in year *t* [t]
$NCV_j =$ Net Calorific Value of fossil fuel use type *j* [TJ/t]
$EF_j =$ GHG emission from fossil fuel burning type *j* [tCO_2eq/TJ]

< Displaced emissions >

Displaced emissions occur due to a shift of activities from inside of the project area to outside of the project area. These shifts of activities can cause multiple categories of displaced emissions. In the context of this methodology, displaced emissions from a. collection of wood, b. agriculture, and c. livestock are considered. Displaced emissions through change in market is not considered under this methodology since no commercial timber production has been conducted in the project area. The land within a project area from which the activities are to be displaced outside the project area is delineated and its area is estimated. Potential displaced emissions within its crediting period are estimated ex-ante and deducted in the first year (t=1) of the project period.

Total displaced emissions

$$DE_{TOTAL} = DE_{wood} + DE_{agri} + DE_{livestock} \quad \text{(Equation 21)}$$

Displaced emissions from wood collection

$$DE_{wood} = A_{wood} \times Activity\ shift_{wood} \times CO_{2stock\_wood} \quad \text{(Equation 22)}$$

Displaced emissions from agriculture

$$DE_{agri} = A_{agri} \times Activity\ shift_{agri} \times CO_{2stock\_agri} \quad \text{(Equation 23)}$$

Displaced emissions from livestock

$DE_{livestock} = Displaced\ heads \times Grazing\ capacity \times CO_{2stock\_livestock}$ (Equation 24)

Where:

DE_{wood} = Displaced emissions from collection of wood in the project area [tCO_2eq]

A_{wood} = Land within a project area where the activity would have taken place in the reference scenario [ha]

$Activity\ shift_{wood}$ = Ratio of the wood collection activity that will be displaced during the crediting period and will have impact on the tree biomass outside the project area [0 to 1]. This factor is determined by credible estimations or a representative survey.

CO_{2stock_wood} = Average stock of tree biomass on the area where the wood collection activity will be displaced to [tCO_2eq/ha]. If it is not known where the activity will be displaced to, the CO_2-stock is the average stock of 'tree biomass' of a natural forest in the region or in the Philippines.

DE_{agri} = Displaced emissions from agriculture in the project area [tCO_2eq]

A_{agri} = Land within a project area where the activity is taking place [ha]

$Activity\ shift_{agri}$ = Ratio of the agricultural activity that will be displaced during the crediting period and will have impact on the tree biomass outside the project area [0 to 1]. This factor is determined by credible estimations or a representative survey.

CO_{2stock_agri} = Average stock of tree biomass on the area where the agricultural activity will be displaced to [tCO_2eq/ha]. If it is not known where the activity will be displaced to, the CO_2-stock is the average stock of 'tree biomass' of a natural forest in the region or in the Philippines.

$DE_{livestock}$ = Displaced emissions from livestock in the project area [tCO_2eq]

$Displaced\ heads$ = Number of heads that will be displaced during the crediting period and will have impact on the tree biomass outside the project area [head]. This factor is determined by credible estimations or a representative survey.

$Grazing\ capacity$ = Grazing capacity of the area where the livestock will be displaced to [ha/head]

$CO_{2stock\_livestock}$ = Average stock of 'tree biomass' on the area where the livestock activity will be displaced to [tCO_2eq/ha]. If it is not known where the activity will be displaced to, the CO_2-stock is the average stock of 'tree biomass' of a natural forest in the region or in the Philippines.

< **Uncertainty in cumulative removals in year *t*>**

$Unc_{PJ,t}$ is calculated by propagating the errors associated with the estimates of included pools as follows:

$$Unc_{PJ,t} = MIN\ (1, MAX\left(0, \frac{\sqrt{\sum_{p=1}^{n}\left(U_{p,t=0} \times C_{p,t=0}\right)^2 + \sum_{p=1}^{n}\left(U_{p,t} \times C_{p,t}\right)^2 - 2\rho \sum_{p=1}^{n}(U_{p,t=0} \times C_{p,t=0} \times U_{p,t} \times C_{p,t})}}{\Delta C_{biomass,t}} - 0.1\right))$$

(Equation 25)

Where:

$Unc_{PJ,t}$= Uncertainty in cumulative removals through year *t* [0 to 1]

$U_{p,t}$= Uncertainty (expressed as the 90% confidence interval as a fraction of the mean) in carbon stock of pool *p* in year *t* [0 to 1]

$C_{p,t}$ = Carbon stock of pool *p* (tree biomass and nontree biomass) in year *t* [tCO_2eq]

p= Type of carbon pools, tree biomass and nontree biomass

ρ= Correlation coefficient between carbon stocks at *t*=0 and *t* (used only for permanent plots; ρ= 0 for independent plots)

$\Delta C_{biomass,t}$= Change in carbon stock in biomass carbon pools in year *t* [tCO_2eq]

I. Calculation of project emissions reductions or removals to be credited

$$C_{credit,t} = CR_{PJ,t} - C_{REF} \quad \text{(Equation 26)}$$

Where:

$C_{credit,t}$ = Amount of carbon credits to be issued in year *t* [tCO_2eq]

$CR_{PJ,t}$ = Project net removals in year *t* [tCO_2eq]

C_{REF} = Reference net GHG removals (=0) in year *t* [tCO_2eq]

Project net removals to be credited are subject to a default buffer rate of at least 15 %, as defined in the *JCM Guidelines for Developing Proposed Methodology for REDD-plus and afforestation/reforestation*, to account for reversal risk.

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

CF_{TREE}	Carbon fraction of tree biomass [tC/tdm]	*2006 IPCC Guidelines*
R_{TREE}	Root to shoot ratio of tree [0 to 1]	Peer-reviewed literature or other scientific evidence including *2006 IPCC Guidelines*
$CF_{NONTREE}$	Carbon fraction of nontree biomass [tC]	*2006 IPCC Guidelines*
NCV_j	Net Calorific Value of fossil fuel use type *j* [TJ/Gg]	*2006 IPCC Guidelines Table 1.2 of Ch. 1 Vol. 2*
EF_j	GHG emission from fossil fuel burning type *j* [tCO_2eq/TJ]	*2006 IPCC Guidelines Table 3.2.1 of Ch. 3 and Table 2.5 of Ch.2, Vol. 2*
$EF_{Direct-N}$	Emission factor for N_2O emission from N inputs by fertilizers	*2006 IPCC Guidelines Table 11.1 of Ch. 11 Vol. 4*
EF_{NVolat}	Emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces [0.01]	*2006 IPCC Guidelines Table 11.3 of Ch. 11 Vol. 4*
EF_{NLeach}	Emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces	*2006 IPCC Guidelines Table 11.3 of Ch. 11 Vol. 4*
$Frac_{GASF}$	Fraction of all synthetic N added to soils that volatilizes as NH_3 and NOx	*2006 IPCC Guidelines Table 11.3 of Ch. 11 Vol. 4*
$Frac_{GASM}$	Fraction of all organic N added to soils that volatilizes as NH3 and NOx	*2006 IPCC Guidelines Table 11.3 of Ch. 11 Vol. 4*
$Frac_{Leach}$	Fraction of synthetic or organic N added to soils that is lost through leaching and runoff, in regions where leaching and runoff occurs	*2006 IPCC Guidelines Table 11.3 of Ch. 11 Vol. 4*
GWP_{N20}	Global warming potential for N_2O	*IPCC Fifth Assessment Report (AR5)*
EF_{N2O}	Emission factor for N_2O [t/tdm]	*2006 IPCC Guidelines Table 2.5, Ch. 2, Vol. 4*
GWP_{CH4}	Global warming potential for CH_4	*IPCC Fifth Assessment Report (AR5)*
EF_{CH4}	Emission factor for CH_4 [t/tdm]	*2006 IPCC Guidelines Table 2.5, Ch. 2, Vol. 4*
$COMF$	Combustion factor	*2006 IPCC Guidelines Table 2.6, Ch. 2, Vol. 4*