T-VER-P-TOOL-01-03

Calculation of carbon stocks and change in carbon stocks in dead wood and litter in forest project activities

Version 01

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1. Introduction

This document is a tool for estimating carbon stocks and change in carbon stocks in dead wood and litter in forest project activities, which can be used to estimate carbon stock in both baseline and project scenarios.

2. Relevant Definitions

Details appear in Annex 1

3. Characteristics of Relevant Activities and Conditions

This tool is suitable for estimating carbon stock and change in carbon stock in dead wood and/or litter in the baseline and project scenarios, only by using the default-factor based method. In the event that the project does not move dead wood and/or litter by any human activity Humans outside the project boundary.

4. Estimation of carbon stock and change in carbon stock in dead wood and litter

Carbon stock and change in carbon stock in dead woods and litter are estimated on the basis of conservative default-factor based method. The calculation details are as follows.

4.1 Estimation of carbon stock in dead wood

It can be estimated using the values given by the dead wood generated in the project must not be removed throughout the project period to estimate the carbon stock of dead woods based on the tree biomass and the conservation constant which can be estimated as per the equation shown below.

$$C_{Dw,i,t} = C_{Tree,i,t} \times DF_{DW}$$

When:

$C_{Dw,i,t}$ = Carbon stock in dead wood i in Year t (tons of CO_2 equivalent)

$C_{Tree,i,t}$ = Carbon stock in tree biomass in year t (tons of carbon dioxide equivalent) was estimating using *T-VER-P-TOOL-01-02 Calculation for carbon stocks and*

change in carbon stocks of trees in forest project activities

DF_{DW} = Conservative constants for expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass (percentage)

i = Stratum *1, 2, 3, …*

Constant in estimating carbon stock in dead wood are shown as Annex2.

4.2 Estimating change in carbon stock in dead wood

The rate of change in carbon stock in the dead wood at that time was estimated using the linear change equation shown below.

$$dC_{DW,(t_1 t_2)} = \frac{C_{DW,t_2} - C_{DW,t_1}}{T}$$

When:

$dC_{DW,(t_1 t_2)}$ = The rate of change in the carbon stock in dead wood within the project scope at the time between Year at t_1 and Year at t_2 (tons of carbon dioxide equivalent per Year)

C_{DW,t_2} = Carbon stock of dead wood within project scope at time point in Year t_2

(tons of carbon dioxide equivalent)

C_{DW,t_1} = Carbon stock of dead wood within project scope at time point in Year t_1

(tons of carbon dioxide equivalent)

T = The elapsed time between two consecutive estimations ($T=t_2 - t_1$) (Year)

Therefore, the change in the carbon stock of dead woods is calculated using the following equation:

$$\Delta C_{DW,t} = dC_{DW,(t_1 t_2)} \times 1 \text{ Year for } t_1 \leq t \leq t_2$$

When:

$\Delta C_{DW,t}$ = Changes in the carbon stock in dead woods in project area, in Year at t (tons of carbon dioxide equivalent)

$dC_{DW,(t_1 t_2)}$ = The rate of change in the carbon stock in the dead woods within the project scope at the time between year at t_1 and Year at t_2 (tons of carbon dioxide equivalent per year)

4.3 Estimation of carbon stock in litter

Carbon stock in litter can be estimated using the values generated from litter in the project. It must not be removed from the project scope. Carbon stock estimation of litter is estimated based on tree biomass and conservation constants, which can be cestimated from the equation.

$$C_{LI,i,t} = C_{Tree,i,t} \times DF_{LI}$$

When:

$C_{LI,i,t}$ = Carbon stock of litter in stratum i at time in Year t (tons of carbon dioxide equivalent).

$C_{Tree,i,t}$ = Carbon stock in tree biomass in the i layer at year time t (tons of carbon dioxide equivalent) was assessed using *T-VER-P-TOOL-01-02 Calculation for carbon stocks and change in carbon stocks of trees in forest project activities*

DF_{LI} = The conservation constant for expressing carbon stock in litter as a percentage of carbon stock in tree biomass (percentage).

i = Stratum *1, 2, 3, …*

The constants for estimating carbon stock in litter are shown in Annex 3.

4.4 Estimating change in carbon stock in litter

The rate of change in litter at that time was estimated using the linear change equation.

$$dC_{LI,(t_1 t_2)} = \frac{C_{LI,t_2} - C_{LI,t_1}}{T}$$

When:

$dC_{LI,(t_1 t_2)}$ = The rate of change in the carbon stock in litter within the project scope at the time between Year at t1 and Year at t_2

(Tons of carbon dioxide equivalents per year)

C_{LI,t_2} = Carbon stock in litter within the project scope at the time point in Year t_2

(tons of carbon dioxide equivalent)

C_{LI,t_1} = Carbon stock in litter within the project scope at the time point in Year at t_1

(tons of carbon dioxide equivalent)

T = Elapsed time between two consecutive estimations ($T=t_2 - t_1$) (Year)

Therefore, changing the carbon stock of litter is estimated using the following equation:

$$\Delta C_{LI,t} = dC_{LI,(t_1 t_2)} \times 1 \text{ Year for } t_1 \leq t \leq t_2$$

When:

$\Delta C_{LI,t}$ = Changes carbon stock in litter within the project scope in the Year at t

(tons of carbon dioxide equivalent)

$dC_{LI,(t_1 t_2)}$ = The rate of change in the carbon stock in litter within the project scope for the period between Year at t_1 and Year at t_2 (Tons of carbon dioxide equivalents per year).

5. Relevant Parameters

5.1 Parameter not required monitoring

Parameter	DF_{DW}

Unit	Percentage
Meaning	The conservation constant expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass.
Source of Information	Annex2 Reference: AR-TOOL12: A/R Methodological tool: Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities (Version 03.1)
Remark	

Parameter	DF_{LI}
Unit	Percentage
Meaning	The conservation constant expressing carbon stock in litter as a percentage of carbon stock in tree biomass.
Source of Information	Annex3 Reference: AR-TOOL12: A/R Methodological tool: Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities (Version 03.1)
Remark	

5.2 Parameter required monitoring

Parameter	T
Unit	Year
Meaning	The time elapsed between two consecutive estimation of the carbon stock of dead wood or litter
Source of Information	Calculation equation
Frequency for monitoring	Following a cycle of follow-up estimations for certification
Remark	If carbon stock is estimated twice in succession at different time points in Year t2 and Year t1 For example, in the 1st year April is evaluated, but in the 2nd year, the September is evaluated, T is the fractional value.

6. References

1. AR-TOOL12 A/R Methodological tool: Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities Version 03.1
2. Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (AR-TOOL14 Version 04.2)
3. T-VER tool: T-VER-TOOL-FOR/AGR-03 Calculation for Carbon Stock in Dead Wood and Litter (No. 2)

Annex

Annex 1 Relevant definitions

Dead wood	The fallen trees or and the perennials die
Litter	The parts of a tree that fall to the ground include branches, stems, leaves, flowers, and fruits

Annex 2 Constant value for carbon stock in dead wood

Height above sea level (m)	Quantity of rainfall (mm per year)	Constant value (DF_{LI})
<2000	<1000	0.02
<2000	1000-1600	0.01
<2000	>1600	0.06
>2000	All heights	0.07

Source: AR-TOOL12: A/R Methodological tool: Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities (Version 03.1)

Annex 3 Constant value for carbon stock calculation in plant residues

Height above sea level (m)	Quantity of rainfall (mm per year)	Constant value (DF_{LI})
<2000	<1000	0.04
<2000	1000-1600	0.01
<2000	>1600	0.01
>2000	All heights	0.01

Source: AR-TOOL12: A/R Methodological tool: Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities (Version 03.1)

Document information

Version	Amendment	Entry into force	Description
01	--	1 March 2023	-