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MINISTRY OF
POWER
सत्यमेव जयते

Ministry of Environment, Forest and Climate Change

METHODOLOGY

BM FR05.001

Afforestation and reforestation of degraded mangrove habitats

INDIAN Carb•n MARKET

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Version 1.0

Sectoral scope(s): Forestry

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1. Introduction

1. This methodology is adopted and refers to the latest approved version of the UNFCCC Clean Development Mechanism Methodology AR-AM0014 (as valid from 04 October 2013).

2. It shall be the responsibility of the non-obligated entity and Accredited Carbon Verification Agency (ACVA) to note of any subsequent changes or revisions in the above-mentioned methodology while developing projects and performing validation and/or verification activity respectively

3. This methodology allows afforestation and reforestation of wetland that constitutes degraded mangrove habitat. The methodology allows use of mangrove species and non-mangrove species but in case of more than 10 per cent area being covered by planting of non-mangrove species it prohibits changes in the hydrology of the project area. The methodology restricts the extent of soil disturbance in the project to be no more than 10 per cent. Project activities applying this methodology may choose to exclude or include accounting of any of the carbon pools of dead wood and soil organic carbon, but cannot include the litter carbon pool.

2. Definitions

4. The definitions contained in the following documents shall apply:[1]

   (a) "Detailed Procedure for Offset Mechanism under CCTS";

   (b) "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories"

5. For the purpose of this methodology, the following specific definitions also apply:

   (a) **Degraded mangrove habitat -** refers to wetlands where, in their natural state, mangrove vegetation can grow and have soil or sediment that is usually water-logged with water that is saline or brackish, and that were subjected to impacts resulting in decrease of forest cover below that reported by the host Party.

   (b) **Soil disturbance -** refers to any activity that results in a decrease in soil organic carbon (SOC), for example ploughing, ripping, scarification, digging of pits and trenches, stump removal, etc.

3. Scope & Applicability

3.1. Scope

6. This methodology applies to afforestation and reforestation project activities implemented in degraded mangrove habitats.

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[1] These documents are available online at the following URLs:

(a) <http://www.ipcc nggip.iges.or.jp/public/gpglulucf/gpglulucf.html>.

3.2. Applicability

7. This methodology is applicable under the following conditions:

   (a) The land subject to the project activity is degraded mangrove habitat;

   (b) More than 90 per cent of the project area under the project scenario is planted with mangrove species. If more than 10 per cent of the project area is planted with non-mangrove species then the project activity does not lead to alteration of hydrology of the project area and hydrology of connected up-gradient and down-gradient wetland area;

   (c) Soil disturbance attributable to the A/R Indian Carbon Market (ICM) project activity does not cover more than 10 per cent of area.[2]

8. A project activity applying this methodology shall also comply with the applicability conditions of the tools contained within the methodology and applied by the project activity.

3.3. Methodology Approval Date

9. The date of adoption of this document shall be effective from 27 March 2025.

3.4. Applicability of approved tools

10. This methodology also refers to the latest approved versions of the following adopted ICM tools:

   (i) "BM-T-AR-0001: "Combined tool to identify the baseline scenario and demonstrate additionality in A/R ICM project activities" (hereinafter referred to as BM-T-AR-001);

   (ii) "BM-T-AR-004: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R ICM project activities" (hereinafter referred to as BM-T-AR-004);

   (iii) "BM-T-AR-003: Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R ICM project activities" (hereinafter referred to as BM-T-AR-003);

   (iv) "BM-T-AR-002: Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R ICM project activity" (hereinafter referred to as BM-T-AR-002);

   (v) "BM-T-AR-005: Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R ICM project activity" (hereinafter referred to as BM-T-AR-005).

4. Methodology: Baseline and Monitoring Component

4.1. Selection of carbon pools and greenhouse gases accounted

11. The carbon pools selected for accounting of carbon stock changes are shown in table 1.

[2] For example, digging pits of size 0.50 m × 0.50 m (length × width) at a spacing of 3 m × 3 m is equal to a coverage of 2.78 per cent; continuous ploughing of land is equal to a coverage of 100 per cent.

Table 1. Carbon pools selected for accounting of carbon stock changes

Carbon pool	Whether selected	Justification/Explanation
Above-ground biomass	Yes	This is the major carbon pool subjected to project activity
Below-ground biomass	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
Litter	No	Litter biomass is subjected to high turnover and displacement due to tidal currents. It is a conservative choice to exclude the pool from accounting because the project activity will not decrease the rate of accumulation of litter
Dead wood and Soil organic carbon	Optional	Carbon stock in these pools may increase due to implementation of the project activity

12. The emission sources and associated greenhouse gases (GHGs) selected for accounting are shown in table 2.

Table 2. Emission sources and GHGs selected for accounting

Sources	Gas	Whether Selected	Justification/Explanation
Burning of woody biomass	CO_2	No	CO_2 emissions due to burning of biomass are accounted as a change in carbon stock
	CH_4	Yes	Burning of woody biomass for the purpose of site preparation, or as part of forest management, is allowed under this methodology
	N_2O	Yes	Burning of woody biomass for the purpose of site preparation, or as part of forest management, is allowed under this methodology

4.2. Identification of the baseline scenario and demonstration of additionality

13. The non-obligated entity shall identify the baseline and demonstrate that the project activity is additional by using BM-T-AR-0001.

4.3. Stratification

14. If biomass distribution over the project area is not homogeneous, stratification should be carried out to improve the precision of biomass estimation. Different stratifications may be appropriate for the baseline and project scenarios in order to achieve optimal precision of estimation of net GHG removals by sinks. In particular:

(a) For baseline net GHG removals by sinks, it is usually sufficient to stratify the area according to major vegetation types and their crown cover and/or land use types;

(b) For actual net GHG removals by sinks the stratification for ex ante estimations is based on the project planting/management plan and the stratification for ex post estimations is based on the actual implementation of the project

planting/management plan. If natural or anthropogenic impacts (e.g. local fires) or other factors (e.g. soil type) significantly alter the pattern of biomass distribution in the project area, then the ex post stratification is revised accordingly.

4.4. Baseline net GHG removals by sinks

15. The baseline net GHG removals by sinks shall be calculated as follows:

$$\Delta C_{BSL,t} = \Delta C_{TREE\_BSL,t} + \Delta C_{SHRUB\_BSL,t} + \Delta C_{DW\_BSL,t} \quad \text{Equation (1)}$$

Where:

$\Delta C_{BSL,t}$	=	Baseline net GHG removals by sinks in year *t*; t CO_2-e
$\Delta C_{TREE\_BSL,t}$	=	Change in carbon stock in baseline tree biomass within the project boundary in year *t*, as estimated in BM-T-AR-0004"; t CO_2-e
$\Delta C_{SHRUB\_BSL,t}$	=	Change in carbon stock in baseline shrub biomass within the project boundary, in year *t*, as estimated in BM-T-AR-0004; t CO_2-e
$\Delta C_{DW\_BSL,t}$	=	Change in carbon stock in baseline dead wood biomass within the project boundary, in year *t*, as estimated in BM-T-AR-0003"; t CO_2-e

4.5. Actual net GHG removals by sinks

16. GHG emissions resulting from removal of herbaceous vegetation, combustion of fossil fuel, fertilizer application, use of wood, decomposition of litter and fine roots of N-fixing trees, construction of access roads within the project boundary, and transportation attributable to the project activity shall be considered insignificant and therefore accounted as zero.

17. The actual net GHG removals by sinks shall be calculated as follows:

$$\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t} \quad \text{Equation (2)}$$

Where:

$\Delta C_{ACTUAL,t}$	=	Actual net GHG removals by sinks, in year *t*; t CO_2-e
$\Delta C_{P,t}$	=	Change in the carbon stocks in project, occurring in the selected carbon pools, in year *t*; t CO_2-e
$GHG_{E,t}$	=	Increase in non-CO_2 GHG emissions within the project boundary as a result of the implementation of the A/R ICM project activity, in year *t*, as estimated in BM-T-AR-0002; t CO_2-e

18. Change in the carbon stocks in project, occurring in the selected carbon pools in year *t* shall be calculated as follows:

$$\Delta C_{P,t} = \Delta C_{TREE\_PROJ,t} + \Delta C_{SHRUB\_PROJ,t} + \Delta C_{DW\_PROJ,t} + \Delta SOC_{PROJ,t} \quad \text{Equation (3)}$$

Where:

$\Delta C_{P,t}$	=	Change in the carbon stocks in project, occurring in the selected carbon pools, in year *t*; t CO_2-e
$\Delta C_{TREE\_PROJ,t}$	=	Change in carbon stock in tree biomass in project in year *t*, as estimated in BM-T-AR-0004; t CO_2-e
$\Delta C_{SHRUB\_PROJ,t}$	=	Change in carbon stock in shrub biomass in project in year *t*, as estimated in BM-T-AR-0004; t CO_2-e
$\Delta C_{DW\_PROJ,t}$	=	Change in carbon stock in dead wood in project in year *t*, as estimated in BM-T-AR-0003; t CO_2-e
$\Delta SOC_{PROJ,t}$	=	Change in carbon stock in the soil organic carbon (SOC) pool within the project boundary, in year *t*; t CO_2-e

19. The change in carbon stock in the SOC pool within the project boundary, in year *t*, shall be estimated as follows:

$$\Delta SOC_{PROJ,t} = \frac{44}{12} \times \sum_{t=1}^{t} A_{PLANT,t} \times dSOC_t \times 1\ year \qquad \text{Equation (4)}$$

Where:

$\Delta SOC_{PROJ,t}$	=	Change in SOC stock within the project boundary, in year *t*; t CO_2-e
$A_{PLANT,t}$	=	Area planted in year *t*; ha
$dSOC_t$	=	The rate of change in SOC stocks within the project boundary, in year *t*; t C ha^{-1} $yr^{-}1$. The following default value of is used, unless transparent and verifiable information can be provided to justify a different value: (i) $dSOC_t$= 0.50 t C ha^{-1} yr^{-1} for *t* = t_{PLANT} to *t* = t_{PLANT} + 20 years, where t_{PLANT} is the year in which planting takes place; (ii) $dSOC_t$ = 0 t C ha^{-1} yr^{-1} for *t* > t_{PLANT} +20.

4.6. Leakage

20. Leakage shall be estimated as follows:

$$LK_t = LK_{AGRIC,t} \qquad \text{Equation (5)}$$

Where:

LK_t	=	GHG emissions due to leakage, in year *t*; t CO_2-e
$LK_{AGRIC,t}$	=	Leakage due to the displacement of agricultural activities in year *t*, as estimated in BM-T-AR-0005; t CO_2-e

4.7. Net anthropogenic GHG removals by sinks

21. The net anthropogenic GHG removals by sinks shall be calculated as follows:

$$\Delta C_{AR,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t \quad \text{Equation (6)}$$

Where:

$\Delta C_{AR,t}$	=	Net anthropogenic GHG removals by sinks, in year *t*; t CO_2-e
$\Delta C_{ACTUAL,t}$	=	Actual net GHG removals by sinks, in year *t*; t CO_2-e
$\Delta C_{BSL,t}$	=	Baseline net GHG removals by sinks, in year *t*; t CO_2-e
LK_t	=	GHG emissions due to leakage, in year *t*; t CO_2-e

4.8. Calculation of CCCs

22. The tCCCs and lCCCs for a verification period T = $t_2 - t_1$, (where t_1 and t_2 are the years of the start and the end, respectively, of the verification period) shall be calculated as follows[3]:

$$tCCC_{t_2} = \sum_{1}^{t_2} \Delta C_{AR,t} \quad \text{Equation (7)}$$

$$lCCC_{t_2} = \sum_{t_1+1}^{t_2} \Delta C_{AR,t} \quad \text{Equation (8)}$$

Where:

$tCCC_{t_2}$	=	Number of units of temporary Carbon Credit Certificates issuable in year t_2
$lCCC_{t_2}$	=	Number of units of long-term Carbon Credit Certificates issuable in year t_2
$\Delta C_{AR,t}$	=	Net anthropogenic GHG removals by sinks, in year *t*; t CO_2-e
t_1, t_2	=	The years of the start and the end, respectively, of the verification period

23. If $lCCC_{t2} < 0$ then $lCCC_{t2}$ presents the number of *lCCCs* that shall be replaced because of a reversal of net anthropogenic greenhouse gas removals by sinks since the previous certification.

[3] Temporary CCCs or tCCCs expire at the end of the commitment period following the one during which these were issued. Long-term CCCs or lCCCs expire at the end of its crediting period. tCCCs are issued for the net anthropogenic greenhouse gas removals by sinks achieved by the project activity since the project start date; lCCCs are issued for the net anthropogenic greenhouse gas removals by sinks achieved by the project activity during each verification period.

5. Monitoring Procedure

5.1. Monitoring plan

24. The monitoring plan shall provide for collection of all relevant data necessary for:

    (a) Verification that the applicability conditions listed under paragraphs 3 and 4 have been met;

    (b) Verification of changes in carbon stocks in the pools selected;

    (c) Verification of project emissions and leakage emissions.

25. The data collected shall be archived for a period of at least two years after the end of the last crediting period of the project activity.

5.2. Monitoring of project implementation

26. Information shall be provided, and recorded in the project design document (PDD), to establish that the commonly accepted principles and practices of forest inventory and forest management in the host country are implemented. If such principles and practices are not known or available, standard operating procedures (SOPs) and quality control/quality assurance (QA/QC) procedures for inventory operations, including field data collection and data management, shall be identified, recorded and applied. Use or adaptation of SOPs available from published handbooks, or from the "IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry 2003", is recommended.

5.3. Precision requirements

27. For this methodology, the precision requirements are those listed in BM-T-AR-0004.

5.4. Data requirements under the methodology

28. Description of data and parameters can be found in the tools used in this methodology.

29. Data and parameters obtained from measurement shall be monitored as required in the tools.

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Revision/Changes in the Document

Version	*Date*	*Description*
1.0	27 March 2025	Initial Adoption