

FOR CDM-ARWG-A01

Draft A/R Large-scale Methodology

AR-ACM00XX: Afforestation and reforestation of lands except wetlands

Version 01.0.0

Sectoral scope(s): 14

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COVER NOTE

1. Procedural background

1. This methodology results from consolidation of 11 other A/R CDM methodologies. The A/R Working Group (A/R WG) at its previous (36th) meeting had recommended a similar consolidation of the small-scale A/R CDM methodologies which was approved by the Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM) at its 68th meeting. This work is part of the core support activities included in the A/R WG work plan approved in the CDM MAP 2012.

2. Purpose

2. Consolidation of the A/R CDM methodologies is intended to facilitate usability and accessibility of the methodological standards.

3. Key issues and proposed solutions

3. The consolidation is accompanied by re-structuring of the standards with a modular design. The two-tier modular design consists of a higher level framework document (“the methodology”) containing the overall methodological approach and methodological steps which draw upon the lower-level detailed algorithms contained in the second tier documents (“the tools”). Each tool addresses a particular aspect of the methodology, for example additionality, changes in carbon pools, project emissions, leakage emissions, etc. Project participants may choose not to apply some of these tools if such a choice is more appropriate/cost-effective for their project activity.
4. The consolidation also harmonises the methodology with the CDM Project Standard (PS) by avoiding repetition of the requirements that are already contained in the PS.
5. The consolidation also brings together the relevant methodology-related decisions of the Board which at present are contained in numerous stand-alone documents. This will reduce the number of stand-alone documents and improve accessibility and consistency of the A/R CDM standards.
6. The modular design of the consolidated methodology facilitates the task of revision, amendment, improvement and maintenance of the methodical standards. For example, an improvement taking place in a tool becomes accessible to all the methodologies that use this tool and there is no need for revising/amending all the methodologies.

4. Impacts

7. Consolidation and modularization of the methodology will make the methodological standards more accessible to the interested user. It will, however, not affect adversely the projects that are already registered.

5. Proposed work and timelines

8. The present draft consolidated methodology has been considered and agreed by the A/R WG to be recommended for approval. Approval of the draft consolidated methodology will complete the present task.

6. Recommendations to the Board

9. The A/R WG recommends that the Board approve the draft consolidated methodology.

7. References

10. Approval of the draft consolidated methodology will result in withdrawal of the following existing A/R CDM methodologies:
 - (a) "AR-AM0002: Restoration of degraded lands through afforestation/reforestation;"
 - (b) "AR-AM0004: Reforestation or afforestation of land currently under agricultural use;"
 - (c) "AR-AM0005: Afforestation and reforestation project activities implemented for industrial and/or commercial uses;"
 - (d) "AR-AM0007: Afforestation and Reforestation of Land Currently Under Agricultural or Pastoral Use;"
 - (e) "AR-AM0009: Afforestation or reforestation on degraded land allowing for silvopastoral activities;"
 - (f) "AR-AM0010: Afforestation and reforestation project activities implemented on unmanaged grassland in reserve/protected areas;"
 - (g) "AR-AM0011: Afforestation and reforestation of land subject to polyculture farming;"
 - (h) "AR-AM0012: Afforestation or reforestation of degraded or abandoned agricultural lands;"
 - (i) "AR-AM0013: Afforestation and reforestation of lands other than wetlands;"
 - (j) "AR-ACM0001: Afforestation and reforestation of degraded land;"
 - (k) "AR-ACM0002: Afforestation or reforestation of degraded land without displacement of pre-project activities."

TABLE OF CONTENTS	Page
1. INTRODUCTION	5
2. SCOPE, APPLICABILITY, AND ENTRY INTO FORCE	5
2.1. Scope	5
2.2. Applicability	5
2.3. Entry into force	5
3. NORMATIVE REFERENCES	6
4. DEFINITIONS	6
5. BASELINE AND MONITORING METHODOLOGY	7
5.1. Selection of carbon pools and greenhouse gases accounted	7
5.2. Identification of the baseline scenario and demonstration of additionality	7
5.3. Stratification	8
5.4. Baseline net GHG removals by sinks	8
5.5. Actual net GHG removals by sinks	8
5.6. Leakage	10
5.7. Net anthropogenic GHG removals by sinks	10
5.8. Calculation of tCERs and ICERs	10
6. MONITORING PROCEDURE.....	11
6.1. Monitoring plan.....	11
6.2. Monitoring of project implementation.....	11
6.3. Precision requirements.....	11
6.4. Data requirements under the methodology	11
APPENDIX 1. CROPLAND IN WHICH SOIL DISTURBANCE IS RESTRICTED	13
APPENDIX 2. GRASSLAND IN WHICH SOIL DISTURBANCE IS RESTRICTED	16

1. Introduction

1. This methodology allows afforestation and reforestation of any land that does not fall into the category of wetland. Where the land in its baseline land-use has soil organic carbon (SOC) content that is expected to be higher than that under the land-use of “forestry”, the methodology restricts the extent of soil disturbance in the project to be no more than 10%. The higher SOC content in the baseline may result either because of the nature of the soils (e.g. the soils are organic soils) or because of anthropogenic activities (e.g. soils are not tilled and external organic matter is added as inputs). Apart from this restriction on the extent of soil disturbance in certain types of soils and land-use practices, the methodology has a broad scope of application¹. Project activities applying this methodology may choose to exclude or include accounting of any of the three carbon pools of dead wood, litter, and soil organic carbon.

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology excludes from its scope the land that falls into the category of wetland.

2.2. Applicability

3. This methodology is applicable under the following conditions:
 - (a) The land subject to the project activity does not fall in wetland category;
 - (b) Soil disturbance attributable to the A/R CDM project activity does not cover more than 10% of area² in each of the following types of land, when these lands are included within the project boundary:
 - (i) Land containing organic soils;
 - (ii) Land which, in the baseline, is subjected to land-use and management practices and receives inputs listed in appendices 1 and 2 to this methodology.
4. 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.

2.3. Entry into force

5. The date of entry into force of the draft methodology is the date of the publication of the EB 70 meeting report on 23 November 2012.

¹ For example, the land to be afforested or reforested does not have to be degraded land.

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%; continuous ploughing of land is equal to a coverage of 100%.

3. Normative references

6. The following documents are indispensable for application of this methodology:³
- (a) Clean development mechanism project standard;
 - (b) A/R methodological tools:
 - (i) “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities;”
 - (ii) “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities;”
 - (iii) “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities;”
 - (iv) “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities;”
 - (v) “Estimation of non-CO₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity;”
 - (vi) “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity;”

4. Definitions

7. The definitions contained in the following documents shall apply:⁴
- (a) Glossary of CDM terms;
 - (b) Modalities and procedures for afforestation and reforestation project activities under the clean development mechanism (A/R CDM modalities and procedures) as contained in the annex to decision 5/CMP.1;
 - (c) IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry, 2003.
8. For the purpose of this methodology, “soil disturbance” is 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 These documents are available online at: <http://cdm.unfccc.int/Reference/index.html>

⁴ These documents are available online at the following URLs:

(a) <<http://cdm.unfccc.int/Reference/index.html>>;

(b) <<http://cdm.unfccc.int/Reference/COPMOP/index.html>>;

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

5. Baseline and monitoring methodology

5.1. Selection of carbon pools and greenhouse gases accounted

9. The carbon pools selected for accounting of carbon stock changes are shown in Table 1.

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
Dead wood Litter and Soil organic carbon	Optional	Carbon stock in these pools may increase due to implementation of the project activity

10. 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 ₂ O	Yes	Burning of woody biomass for the purpose of site preparation, or as part of forest management, is allowed under this methodology

5.2. Identification of the baseline scenario and demonstration of additionality

11. The “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities” shall be applied for the purpose of identification of the baseline scenario and demonstration of additionality.

5.3. Stratification

12. 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.

5.4. Baseline net GHG removals by sinks

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

$$\Delta C_{BSL,t} = \Delta C_{TREE_BSL,t} + \Delta C_{SHRUB_BSL,t} + \Delta C_{DW_BSL,t} + \Delta C_{LI_BSL,t} \quad \text{Equation (1)}$$

Where:

- $\Delta C_{BSL,t}$ = Baseline net GHG removals by sinks in year t ; t CO₂-e
- $\Delta C_{TREE_BSL,t}$ = Change in carbon stock in baseline tree biomass within the project boundary in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO₂-e
- $\Delta C_{SHRUB_BSL,t}$ = Change in carbon stock in baseline shrub biomass within the project boundary, in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO₂-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 the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO₂-e
- $\Delta C_{LI_BSL,t}$ = Change in carbon stock in baseline litter biomass within the project boundary, in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO₂-e

5.5. Actual net GHG removals by sinks

14. 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.

15. 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 CO₂-e
- $\Delta C_{P,t}$ = Change in the carbon stocks in project, occurring in the selected carbon pools, in year t ; t CO₂-e
- $GHG_{E,t}$ = Increase in non-CO₂ GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year t , as estimated in the tool “Estimation of non-CO₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity”; t CO₂-e

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

$$\Delta C_{P,t} = \Delta C_{TREE_PROJ,t} + \Delta C_{SHRUB_PROJ,t} + \Delta C_{DW_PROJ,t} + \Delta C_{LI_PROJ,t} + \Delta SOC_{AL,t} \quad \text{Equation (3)}$$

Where:

- $\Delta C_{P,t}$ = Change in the carbon stocks in project, occurring in the selected carbon pools, in year t ; t CO₂-e
- $\Delta C_{TREE_PROJ,t}$ = Change in carbon stock in tree biomass in project in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO₂-e
- $\Delta C_{SHRUB_PROJ,t}$ = Change in carbon stock in shrub biomass in project in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO₂-e
- $\Delta C_{DW_PROJ,t}$ = Change in carbon stock in dead wood in project in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO₂-e
- $\Delta C_{LI_PROJ,t}$ = Change in carbon stock in litter in project in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO₂-e

$\Delta SOC_{AL,t}$ = Change in carbon stock in SOC in project, in year t , in areas of land meeting the applicability conditions of the tool “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”, as estimated in the same tool; t CO₂-e

5.6. Leakage

17. Leakage shall be estimated as follows:

$$LK_t = LK_{AGRIC,t} \quad \text{Equation (4)}$$

Where:

LK_t = GHG emissions due to leakage, in year t ; t CO₂-e

$LK_{AGRIC,t}$ = Leakage due to the displacement of agricultural activities in year t , as estimated in the tool “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity”; t CO₂-e

5.7. Net anthropogenic GHG removals by sinks

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

$$\Delta C_{AR-CDM,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t \quad \text{Equation (5)}$$

Where:

$\Delta C_{AR-CDM,t}$ = Net anthropogenic GHG removals by sinks, in year t ; t CO₂-e

$\Delta C_{ACTUAL,t}$ = Actual net GHG removals by sinks, in year t ; t CO₂-e

$\Delta C_{BSL,t}$ = Baseline net GHG removals by sinks, in year t ; t CO₂-e

LK_t = GHG emissions due to leakage, in year t ; t CO₂-e

5.8. Calculation of tCERs and ICERs

19. The tCERs and ICERs 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:

$$tCER_{t_2} = \sum_1^{t_2} \Delta C_{AR-CDM,t} \quad \text{Equation (6)}$$

$$ICER_{t_2} = \sum_{t_1+1}^{t_2} \Delta C_{AR-CDM,t} \quad \text{Equation (7)}$$

Where:

- $tCER_{t_2}$ = Number of units of temporary Certified Emission Reductions issuable in year t_2
- $ICER_{t_2}$ = Number of units of long-term Certified Emission Reductions issuable in year t_2
- $\Delta C_{AR-CDM,t}$ = Net anthropogenic GHG removals by sinks, in year t ; t CO₂e
- t_1, t_2 = The years of the start and the end, respectively, of the verification period

20. If $ICER_{t_2} < 0$ then $ICER_{t_2}$ represents the number of $ICERs$ that shall be replaced because of a reversal of net anthropogenic greenhouse gas removals by sinks since the previous certification.

6. Monitoring procedure

6.1. Monitoring plan

21. The monitoring plan shall provide for collection of all relevant data necessary for:
- Verification that the applicability conditions listed under paragraphs 3 and 4 have been met;
 - Verification of changes in carbon stocks in the pools selected; and
 - Verification of project emissions and leakage emissions.
22. 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.

6.2. Monitoring of project implementation

23. 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.

6.3. Precision requirements

24. For this methodology, the precision requirements are those listed in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities."

6.4. Data requirements under the methodology

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

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

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Appendix 1. Cropland in which soil disturbance is restricted

1. Cropland which is subjected, in the baseline, to the land-use, land management practices, and inputs listed in the following table attracts the restriction on the extent of soil disturbance as described in paragraph 3 (b) of this methodology.

Table 1. Cropland in which soil disturbance is restricted⁵

Region	Land use	Management	Inputs
Boreal	Long-term cultivated cropland	Full tillage	High with manure
		Reduced tillage	High with manure
		No-till	High without manure
	High with manure		
	Short-term or set aside cropland	Full tillage	High with manure
		Reduced tillage	High with manure
No-till		High without manure	
		High with manure	
Temperate, cold, dry	Long-term cultivated cropland	Full tillage	High with manure
		Reduced tillage	High with manure
		No-till	High with manure
	Short-term or set aside cropland	Full tillage	High with manure
		Reduced tillage	High with manure
		No-till	Medium
High without manure			

⁵ Adapted from 2006 IPCC Guidelines for National Greenhouse Gas Inventories. See table 5.5 on page 5.17 for a more complete description of the terms used in the table.

Region	Land use	Management	Inputs
Temperate, cold, moist	Long-term cultivated cropland	Reduced tillage	High with manure
		No-till	High with manure
	Short-term or set aside cropland	Full tillage	High with manure
		Reduced tillage	High with manure
		No-till	High without manure
			High with manure
Temperate, warm, dry	Long-term cultivated cropland	Full tillage	High with manure
		Reduced tillage	High with manure
		No-till	High with manure
	Short-term or set aside cropland	Full tillage	High with manure
		Reduced tillage	High with manure
		No-till	Medium
			High without manure
Temperate, warm, moist	Long-term cultivated cropland	Reduced tillage	High with manure
		No-till	High with manure
	Short-term or set aside cropland	Full tillage	High with manure
		Reduced tillage	High with manure
		No-till	High without manure
			High with manure
Tropical, dry	Short-term or set aside cropland	Full tillage	High with manure
		Reduced tillage	Medium
			High without manure
	No-till	High with manure	
		All	
Tropical, moist	Short-term or set aside cropland	Full tillage	High with manure
		Reduced tillage	High without manure

Region	Land use	Management	Inputs
			High with manure
		No-till	High without manure
			High with manure
Tropical, montane	Long-term cultivated cropland	No-till	High with manure
	Short-term or set aside cropland	Full tillage	High with manure
		Reduced tillage	High without manure
			High with manure
		No-till	Medium
	High without manure		
Tropical, wet	Short-term or set aside cropland	Full tillage	High with manure
		Reduced tillage	High without manure
			High with manure
		No-till	High without manure
			High with manure

Appendix 2. Grassland in which soil disturbance is restricted

- Grassland which is subjected, in the baseline, to the land management practices and inputs listed in the following table attracts the restriction on the extent of soil disturbance as described in paragraph 3 (b) of the methodology.

Table 1. Grassland in which soil disturbance is restricted⁶

Temperature / Moisture Regime	Management	Inputs
Boreal	Improved	All
	Non-degraded	All
	Moderately degraded	High
Temperate, cold, dry	Improved	All
	Non-degraded	All
	Moderately degraded	High
Temperate, cold, moist	Improved	All
	Non-degraded	All
	Moderately degraded	High
Temperate, warm, dry	Improved	All
	Non-degraded	All
	Moderately degraded	High
Temperate, warm, moist	Improved	All
	Non-degraded	All
	Moderately degraded	High
Tropical, dry	Improved	All
	Non-degraded	All
Tropical, moist	Improved	All
	Non-degraded	All
	Moderately degraded	High
Tropical, montane	Improved	All
	Non-degraded	All
	Moderately degraded	High
Tropical, wet	Improved	All
	Non-degraded	High
	Moderately degraded	High

⁶ Adapted from "2006 IPCC Guidelines for National Greenhouse Gas Inventories". See table 6.2 on page 6.16 for a more complete description of the terms used in the table.

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