

AR-TOOL15

A/R Methodological tool

**Estimation of the increase in GHG
emissions attributable to displacement of
pre-project agricultural activities in A/R
CDM project activity**

Version 02.0



United Nations
Framework Convention on
Climate Change

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1. Introduction

1. This tool provides a step-by-step method for estimating increase in GHG emissions resulting from displacement of pre-project agricultural activities from the project boundary of an afforestation or reforestation (A/R) project activity under the clean development mechanism (CDM). The tool estimates the increase in emissions on the basis of changes in carbon stocks in the affected carbon pools in the land receiving the displaced activities.

2. Scope, applicability, and entry into force

2.1. Scope

2. The tool applies to all types of A/R CDM project activities and programmes of activities.

2.2. Applicability

3. This tool is not applicable if the displacement of agricultural activities is expected to cause, directly or indirectly, any drainage of wetlands or peat lands.

2.3. Entry into force

4. The date of entry into force of the revision is the date of the publication of the EB 75 meeting report on 4 October 2013.

3. Normative references

5. The following documents are indispensable for the application of this tool:
 - (a) Glossary of CDM terms;
 - (b) The A/R methodological tool: "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities";
 - (c) The A/R methodological "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities".

4. Definitions

6. The definitions contained in the Glossary of CDM terms shall apply.
7. For the purpose of this tool, the following specific definitions shall apply:
 - (a) **Agricultural activities** - refers to crop cultivation activities and grazing activities occurring on land;
 - (b) **Crop cultivation activities** - refers to human induced activities, occurring on land, that are aimed at vegetation control for producing food, forage, fiber, oilseed crops, etc., including harvesting of the produce;
 - (c) **Grazing activities** - refers to human induced activities, occurring on land, that are aimed at livestock production;

- (d) **Displacement of agricultural activities** - refers to shifting of the agricultural activities from areas of land within the project boundary to areas of land outside the project boundary;
- (e) **Leakage emission** - refers to the increase in GHG emissions resulting from displacement of pre-project activities.

5. Parameter

8. This tool provides procedures to determine the following parameter:

Table 1. Parameter determined by the tool

Parameter	SI Unit	Description
$LK_{AGRIC,t}$	t CO ₂ e	Leakage emission due to the displacement of agricultural activities in year t

6. Estimation of leakage emission

9. Leakage emission attributable to the displacement of agricultural activities due to implementation of an A/R CDM project activity is estimated as the decrease in carbon stocks in the affected carbon pools of the land receiving the displaced activity.

Note 1. Displacement of an agricultural activity by itself does not result in leakage emission. Leakage emission occurs when the displacement leads to an increase in GHG emissions relative to the GHG emissions attributable to the activity as it exists within the project boundary.

Note 2. Increase in GHG emission occurring outside the project boundary attributable to the secondary effects of the A/R CDM project activity (e.g. changes in demand, supply or price of goods) is considered insignificant for the purpose of this tool and hence accounted as zero.

10. Leakage emission attributable to the displacement of grazing activities under the following conditions is considered insignificant and hence accounted as zero:

- (a) Animals are displaced to existing grazing land and the total number of animals in the receiving grazing land (displaced and existing) does not exceed the carrying capacity of the grazing land;
- (b) Animals are displaced to existing non-grazing grassland and the total number of animals displaced does not exceed the carrying capacity of the receiving grassland;
- (c) Animals are displaced to cropland that has been abandoned within the last five years;
- (d) Animals are displaced to forested lands, and no clearance of trees, or decrease in crown cover of trees and shrubs, occurs due to the displaced animals;
- (e) Animals are displaced to zero-grazing system.

11. In all other cases, the lands within the project boundary from which the pre-project agricultural activities are to be displaced outside the project boundary are delineated and their area is estimated. Leakage emission resulting from displacement of the activities is estimated as follows:

$$LK_{AGRIC,t} = \frac{44}{12} \times (\Delta C_{BIOMASS,t} + \Delta SOC_{LUC,t}) \quad \text{Equation (1)}$$

$$\Delta C_{BIOMASS,t} = [1.1 \times b_{TREE} \times (1 + R_{TREE}) + b_{SHRUB} \times (1 + R_S)] \times CF \times A_{DISP,t} \quad \text{Equation (2)}$$

$$\Delta SOC_{LUC,t} = SOC_{REF} \times (f_{LUP} \times f_{MGP} \times f_{INP} - f_{LUD} \times f_{MGD} \times f_{IND}) \times A_{DISP,t} \quad \text{Equation (3)}$$

Where:

- $LK_{AGRIC,t}$ = Leakage emission resulting from displacement of agricultural activities in year t ; t CO₂e
- $\Delta C_{BIOMASS,t}$ = Decrease in carbon stock in the carbon pools of the land receiving the activity displaced in year t ; t d.m.

Note. The factor of 1.1 is used to account for the carbon stock in the dead wood and litter pools as a fixed percentage of the carbon stock in living trees.

- CF = Carbon fraction of woody biomass; dimensionless.
A default value of 0.47 is used unless transparent and verifiable information can be provided to justify a different value.

- $A_{DISP,t}$ = Area of land from which agricultural activity is being displaced in year t ; ha

- b_{TREE} = Mean above-ground tree biomass in land receiving the displaced activity; t d.m. ha⁻¹

The value of this parameter is obtained by applying one of the applicable methods from the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities” to the land receiving the displaced activity.

Where the land receiving the displaced activity is unidentified, value of b_{TREE} is set equal to the applicable value of mean above-ground biomass in forest in the region or country where the A/R CDM project activity is located, as obtained from Table 3A.1.4 of the *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry* (IPCC GPG-LULUCF 2003) unless transparent and verifiable information can be provided to justify a different value.

R_{TREE}	= Root-shoot ratio for trees in the land receiving the displaced activity; dimensionless. A default value of 0.25 is used unless transparent and verifiable information can be provided to justify a different value.
b_{SHRUB}	= Mean above-ground shrub biomass in land receiving the displaced activity; t d.m. ha ⁻¹ . The value of this parameter is obtained by applying one of the applicable methods from the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities” to the land receiving the displaced activity.
R_s	= Root-shoot ratio for shrubs in the land receiving the displaced activity; dimensionless. The default value of 0.40 is used unless transparent and verifiable information can be provided to justify a different value.
$\Delta SOC_{LUC,t}$	= Change in soil organic carbon (SOC) stock due to land-use change in the land receiving the displaced activity in year t ; tC ha ⁻¹ . The value of this parameter may be set to zero if: (a) The only displaced activity being received in the land is grazing activity; or (b) The value of the parameter as estimated from Equation (3) is less than zero (i.e. negative).
SOC_{REF}	= SOC stock corresponding to the reference condition in native lands by climate region and soil type applicable to the land receiving the displaced activity; t C ha ⁻¹ . The value of this parameter is taken from Table 3 of the “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”.
$f_{LUP}, f_{MGP}, f_{INP}$	= Relative SOC stock change factors for land-use, management practices, and inputs respectively, applicable to the receiving land before the displaced activity is received; dimensionless. The value of these parameters is taken from Tables 4, 5, and 6 of the “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”.
$f_{LUD}, f_{MGD}, f_{IND}$	= Relative SOC stock change factors for land-use, management practices, and inputs respectively, applicable to the receiving land after the displaced activity has been received; dimensionless. The value of these parameters is taken from Tables 4, 5, and 6 of the “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”.
t	= 1, 2, 3, ...years elapsed since the start of the A/R CDM project activity

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12. Where pre-project activities are shifted to different types of receiving lands in a year, Equations (1), (2) and (3) shall be applied to each type of land separately and the estimated leakage emissions shall be added to obtain the value of the parameter $LK_{AGRIC,t}$

7. Data and parameters used in the tool

13. This section describes the requirements for the data and parameters used in this tool. The requirements contained in the data description tables should be treated as an integral part of the tool. The requirements contained in the tools which are referred to in this tool shall also apply.

7.1. Data and parameters not monitored

14. The values, sources, and requirements for data and parameters which are not subject to monitoring are provided in the text of the tool along with the equations in which these are used.

7.2. Data and parameters monitored

15. The requirements for data and parameters subject to monitoring are provided in the table below.

Data / Parameter table 1. Area of land

Data / Parameter:	$A_{DISP,t}$
Data unit:	Ha
Description:	Area of land from which agricultural activity is being displaced in year t
Source of data:	Field measurement
Measurement procedures (if any):	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Monitoring frequency:	At every verification
QA/QC procedures:	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
02.0	4 October 2013	<p>EB 75, Annex 28</p> <p>This revision:</p> <ul style="list-style-type: none">• Incorporates related decisions from the Board;• Delinks leakage emission from the project carbon stocks;• Estimates leakage from actual carbon stocks in the receiving lands;• Reformats the methodology using the current template and thus enhances readability and consistency.
01	04 December 2009	<p>EB 51, Annex 15</p> <p>Initial adoption.</p>

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