

VCS Module

VMD0041

Estimation of baseline carbon stock changes
and greenhouse gas emissions in ARR project
activities (BL-ARR)

Version 1.1

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Sectoral Scope 14

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Revision to include tidal wetland restoration and conservation activities (version 1.1 of this module)
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1 SOURCES

This module is one of numerous modules that constitute VCS methodology VM0007 REDD+ Methodology Framework (REDD+ MF).

This module is based on the following methodologies:

- CDM methodology AR-ACM0003 *Afforestation and reforestation of lands except wetlands*
- VM0033 *Methodology for tidal wetland and seagrass restoration*

This module uses the latest versions of the following methodology and module:

- CDM methodology AR-ACM0003 *Afforestation and reforestation of lands except wetlands*, and associated tools.
- CDM tool AR-Tool12 *Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities*
- CDM tool AR-Tool14 *Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*
- VMD0042 *Estimation of baseline soil carbon stock changes and greenhouse gas emissions in peatland rewetting and conservation project activities (BL-PEAT)*
- VMD0050 *Estimation of baseline carbon stock changes and greenhouse gas emissions in tidal wetland restoration and conservation project activities (BL-TW)*

2 SUMMARY DESCRIPTION OF THE MODULE

This module provides procedures for the estimation of GHG emissions and removals under the baseline scenario ($\Delta C_{BSL-ARR}$) in ARR and RWE-ARR¹ project activities. Stand-alone RWE project activities do not use this module.

GHG emissions and removals under the ARR baseline scenario on terrestrial mineral soils are estimated using the procedures provided in AR-ACM0003 *Afforestation and reforestation of lands except wetlands* and associated tools. RWE-ARR project activities estimate GHG emissions and removals in the biomass carbon pools (including biomass burning) using AR-ACM0003 and (where relevant) procedures for herbaceous biomass in this module. Net GHG emissions in the SOC pool are not estimated in this module, but using Modules BL-PEAT or BL-TW, as they are regarded as the WRC component.

In all cases, the resulting calculation is expressed as “Net GHG removals under the ARR baseline scenario”.

¹ RWE project activities that account for (re)establishment of herbaceous vegetation (not covered under the definition of ARR and in AR-ACM0003) are also treated as RWE-ARR.

3 DEFINITIONS AND ACRONYMS

Definitions

In addition to the definitions set out in the VCS Program document *Program Definitions* and the VCS methodology VM0007 *REDD+MF*, the following definitions apply to this methodology:

Mineral Soil

A soil that does not meet the definition of an organic soil

Organic Soil

Soil with a surface layer of material that has a sufficient depth and percentage of organic carbon to meet an internationally accepted threshold (e.g., host-country, FAO or IPCC) of organic soil. Where used in this methodology, the term peat is used to refer to organic soil.

Terrestrial

On land; in the context of this methodology: not on a wetland

Acronyms

ARR	Afforestation, Reforestation and Revegetation
CDM	Clean Development Mechanism
GHG	Greenhouse Gas
RWE	Restoration of Wetland Ecosystems
VCS	Verified Carbon Standard
WRC	Wetlands Restoration and Conservation

For definitions of VCS AFOLU project categories refer to the *VCS Standard*.

4 APPLICABILITY CONDITIONS

This module is applicable under the following conditions:

- The applicability conditions set out in *AR-ACM0003 Afforestation and reforestation of lands except wetlands* must be met.²
- Applicability conditions included in *AR-ACM0003 Afforestation and reforestation of lands except wetlands* and corresponding tools that exclude project activities on wetlands can be disregarded for the purpose of their use in this module, as accounting procedures for the peat soil are provided in Modules *BL-PEAT* and *BL-TW*.
- Where the ARR project activity is implemented on peatland, the peatland must be degraded in the baseline scenario as identified by the presence of drainage infrastructure (ditches, canals) and associated lowered water tables below the surface. In the case of

² In case there is a conflict between the CDM methodology and the VCS rules, the VCS rules must be followed, as set out in *VCS AFOLU guidance, Additional guidance for VCS Afforestation, Reforestation and Revegetation projects using CDM Afforestation/Reforestation Methodologies*, available on the VCS website.

forested peatland, degradation may be identified by the removal or degradation of the tree cover before the project start date.

- Where the ARR project activity is implemented on tidal wetlands, the wetland must be degraded, as defined in *REDD+ MF*.

5 PROCEDURES

GHG emissions and removals under the ARR baseline scenario on terrestrial mineral soils are estimated using the procedures provided in *AR-ACM0003 Afforestation and reforestation of lands except wetlands* and associated tools.

RWE-ARR project activities must estimate the GHG emissions and removals under the project scenario using:

- For non-soil pools (such as aboveground biomass and wood products) and biomass burning: *AR-ACM0003* and associated tools (where the estimation of carbon stock changes in the soil components and below-ground biomass must not be included) and procedures for herbaceous vegetation in RWE-ARR project activities provided below.
- For the soil pools: procedures provided in Modules *BL-PEAT* or *BL-TW*.

Net GHG removals under the ARR baseline scenario are estimated as follows:

$$\Delta C_{BSL-ARR} = \sum_{t=1}^{t^*} \Delta C_{BSL,t} + \Delta C_{BSL-herb} \quad (1)$$

Where:

$DC_{BSL-ARR}$	Net GHG removals under the ARR baseline scenario up to time t^* (t CO ₂ e)
$\Delta C_{BSL,t}$	Baseline net GHG removals by sinks in year t (from <i>AR-ACM0003</i>) (t CO ₂ e)
$\Delta C_{BSL-herb}$	Net GHG removals under the ARR baseline scenario in herbaceous vegetation up to time t^* (t CO ₂ e)
t	1,2,3 ... t^* time since project start (years)

Procedures for the estimation of uncertainty for ARR project activities are provided in *AR-ACM0003*.

Long-term average in case of harvesting

For strata where ARR project activities in the baseline scenario include harvesting, the long-term average GHG benefit must be calculated as specified in Module *M-ARR*.

Herbaceous vegetation

Where a carbon stock increase in herbaceous vegetation is quantified in the project scenario, carbon stock changes must also be quantified in the baseline scenario; where a carbon stock

decline is quantified in the baseline scenario, carbon stock changes must also be quantified in the project scenario.

Net carbon stock change in herbaceous vegetation in the baseline scenario is estimated using a carbon stock change approach as follows:

$$\Delta C_{BSL-herb} = \sum_{i=1}^{M_{BSL}} \sum_{t=1}^{t^*} \Delta C_{BSL-herb,i,t} \quad (2)$$

$$\Delta C_{BSL-herb,i,t} = (C_{BSL-herb,i,t} - C_{BSL-herb,i,(t-T)}) / T \quad (3)$$

Where:

$\Delta C_{BSL-herb}$ Net GHG removals under the ARR baseline scenario in herbaceous vegetation up to time t^* (t CO₂e)

$\Delta C_{BSL-herb,i,t}$ Net carbon stock change in herbaceous vegetation carbon pools in the baseline scenario in stratum i in year t ; t CO₂ yr⁻¹

$C_{BSL-herb,i,t}$ Carbon stock in herbaceous vegetation in the baseline scenario in stratum i in year t ; t CO₂

i 1, 2, 3 ... M_{BSL} strata in the baseline scenario

t 1, 2, 3 ... t^* years elapsed since the project start date

T Time elapsed between two successive estimations ($T = t_2 - t_1$)

For tidal wetlands, a default factor for $C_{BSL-herb,i,t}$ may be applied as provided in Section 6.

The sampling method of herbaceous vegetation is provided in Module *M-ARR*.

6 DATA AND PARAMETERS

6.1 Data and Parameters Available at Validation

Data / Parameter	$\Delta C_{BSL,t}$
Data unit	t CO ₂ e
Description	Baseline net GHG removals by sinks in year t
Equations	1
Source of data	<i>AR-ACM0003 Afforestation and reforestation of lands except wetlands</i>
Value applied	N/A
Justification of choice of data or description of	<i>AR-ACM0003</i> is approved by the UNFCCC's CDM.

measurement methods and procedures applied	
Purpose of Data	Calculation of baseline emissions
Comments	This parameter is quantified based on the quantification of parameters $C_{TREE_BSL,t}$, $C_{SHRUB_BSL,t}$, $C_{DW_BSL,t}$ and $C_{LI_BSL,t}$ as provided in CDM tool <i>AR-Tool12</i> and CDM tool <i>AR-Tool14</i> .

Data / Parameter	$C_{BSL-herb,i,t}$
Data unit	t CO ₂ e
Description	Carbon stock in herbaceous vegetation in the baseline scenario in stratum i in year t
Equations	3
Source of data	Default value or from own measurements (using Module <i>M-ARR</i>)
Value applied	For tidal wetlands, 11 t CO ₂ ha ⁻¹ may be applied for strata with 100 percent herbaceous cover. For areas with a vegetation cover <100 percent, a 1:1 relationship between vegetation cover and carbon stock must be applied.
Justification of choice of data or description of measurement methods and procedures applied	Calculated from peak aboveground biomass data from 20 sites, as summarized in Mitsch and Gosselink 2007. The median of these studies is 1.3 kg dry matter m ⁻² . This was converted to the default factor value as follows: $1.3 \times 0.45 \times 0.5 \times 44/12$. The factor 0.45 converts organic matter mass to carbon mass; the factor 0.5 is a factor that averages annual peak biomass (factor = 1) and annual minimum biomass (factor = 0, assuming ephemeral aboveground biomass and complete litter decomposition).
Purpose of Data	Calculation of baseline emissions
Comments	N/A

6.2 Data and Parameters Monitored

None.

7 REFERENCES

Mitsch, W.J., and J.G. Gosselink. 2007. *Wetlands*. 4th ed. John Wiley & Sons, Inc., Hoboken, NJ.

DOCUMENT HISTORY

Version	Date	Comment
v1.0	9 March 2015	Initial version
v1.1	8 Sep 2020	The scope of the module was expanded to include RWE-ARR activities and to remove procedures for quantification of SOC, which have been moved to BL-PEAT and BL-TW as appropriate.