WR Methodological Module

Estimation of baseline carbon stock changes and greenhouse gas emissions from wetland restoration with hydrologic management (BL-WR-HM)

I. SCOPE, APPLICABILITY AND PARAMETERS

Scope

This module allows for estimating carbon stock changes and GHG emissions related to Wetland Restoration (WR) in the baseline case when the project activity will include hydrologic management. Examples of eligible hydrologic management project activities include:

a. Diversion of river water (e.g., Mississippi River or other) into wetlands;
b. Introduction of nonpoint source runoff (e.g., agricultural, stormwater) into wetlands;
c. Discharge of treated municipal effluent into wetlands (e.g., wetland assimilation).
d. Outfall management to maximize sheetflow and minimize impounded or stagnant conditions.

Applicability

The module is applicable for estimating baseline carbon stock changes and GHG emissions related to wetland restoration (WR) through hydrologic management, or through the combination of hydrologic management with assisted natural regeneration, seeding, or tree planting. The following conditions must be met to apply this module.

- Project activities meet the applicability conditions in the WR-MF listed under All Activity Types, and Wetland Restoration with Hydrologic Management.
- Projected wetland loss is not included in the baseline scenario.
- Project activities that increase emissions beyond the baseline scenario must be accounted for.
- All hydrologic management activities shall be demonstrated to be conducted in compliance with applicable environmental regulations and required permits.

Parameters

This module provides procedures to determine the following parameter:

Parameter	SI Unit	Description
$\Delta C_{bsl,WR\text{-}HM}$	t CO_2-e	Cumulative total carbon stock changes and greenhouse gas emissions for the baseline scenario when the project activity will

		include hydrologic management

II. PROCEDURE

- Step 1: Identification of baseline scenario
- Step 2: Project boundary
- Step 3: Baseline stratification
- Step 4: Baseline net GHG removals for fixed baselines
- Step 5: Monitoring requirements for baseline renewal

Part 1. Identification of the baseline scenario

Baseline determination is defined from Paragraph 22 of the CDM A/R Modalities and Procedures as "existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary" where the land would remain degraded in the absence of the project activity. Project proponent must demonstrate that the land would remain degraded in the absence of the project activity by applying the tool T-DEG. This may be accomplished by using multiple sources of data, such as from peer-reviewed literature, archives, maps or satellite images of the land use/cover prior to project activity, field surveys, governmental reports, expert judgment[1] and interviews with land owners or professionals affiliated with wetland management of the area. Project proponent must demonstrate that the candidate baseline scenario does not alter historical wetland patterns by analyzing the historical and existing wetland over the most recent 10-year period prior to the project start date, or longer if necessary, to demonstrate baseline historical wetland patterns.

Part 2. Project boundary

The WR baseline scenario is the carbon stock present immediately prior to site preparation, or the most likely carbon stock in the absence of project implementation as determined in step 1. The "project boundary" geographically delineates the WR project activity under the control of the Project proponent (PP) as defined in the WR-MF. It shall be demonstrated that each discrete parcel of land to be included in the boundary is eligible for a WR ACR project activity.

The pools that will be included or excluded from accounting are provided in **WR**-MF. **WR**-MF shall be followed in determining the GHG assessment boundary, along with the guidance in the ACR *Forest Carbon Project Standard,* Chapter 2.

Hydrologic management has the potential to increase GHG emissions therefore baseline and project emissions must be accounted for. Emissions may be estimated based on site/project

[1] Justification should be supplied for all values derived from expert judgment.

specific data, an acceptable proxy, reference sample plots or field monitoring of similar sites, peer-reviewed literature, approved local or national parameters, or the most recent default emission factors provided by IPCC (e.g. IPCC 1997, 2003, 2006). Project proponent using extrapolated values must make conservative estimates to determine the baseline and proposed project activity GHG emissions. Sources deemed significant and selected for accounting in the baseline scenario shall also be accounted for in the project scenario.

Exclusion of carbon pools and emission sources is allowed subject to considerations of conservativeness and significance testing. This may be accomplished by using multiple sources of data, such as from peer-reviewed literature, field surveys, governmental reports, and expert judgment[2]. Pools or sources may always be excluded if conservative, i.e. exclusion will tend to underestimate net GHG emission reductions/removal enhancements. Pools or sources can be neglected (i.e., counted as zero) if application of the tool T-SIG indicates that the source is insignificant, provided that all sources, sinks and pools determined to be insignificant and excluded from accounting represent less than 3% of the *ex ante* calculation of emission reductions/removal enhancements (per ACR *Forest Carbon Project Standard*). If monitoring of baseline and project emissions determine that an emission source(s) initially included in the GHG assessment boundary is insignificant using the tool T-SIG, monitoring may cease.

Part 3. Baseline stratification

When estimating baseline carbon stocks, several strata can be assessed, including but not limited to:

a. Management regime
b. Vegetation type and species
c. Age class
d. Trend in land loss conversion
e. Water quality (e.g. salinity, nutrient inputs, distance from source, etc.)
f. Hydrology
g. Elevation and subsidence rates
h. Site index and anticipated growth rates

If the project activity area is not homogeneous, stratification should be carried out to improve the accuracy and precision of carbon stock estimates. Different stratifications may be required for the baseline and project scenarios, especially if there will be a change in hydrology, in order to achieve optimal accuracy and precision of the estimates of net GHG removal by sinks. For estimation of baseline net GHG removals by sinks, or estimation of actual net GHG removals by sinks, strata should be defined based on parameters that affect GHG removals or emissions and/or that are key entry variables for the methods used to measure changes in biomass

[2] Justification should be supplied for all values derived from expert judgment.

stocks.

- **For baseline net GHG removals by sinks.** It will usually be sufficient to stratify according to major vegetation types since baseline removals for degraded (or degrading) wetlands can be expected to be small in comparison to project removals;

- **For actual net GHG removals by sinks.** The stratification for *ex-ante* estimations shall be based on the project monitoring plan. The stratification for *ex post* estimations shall be based on the actual implementation of the project monitoring plan. If natural or anthropogenic impacts (e.g., hurricanes) or other factors (e.g. altered hydrology) add variability to the growth pattern of the project area, then the *ex-post* stratification shall be revised accordingly.

Project proponent may use remotely sensed data acquired close to the time of project commencement and/or the occurrence of natural or anthropogenic impacts for *ex-ante* and *ex-post* stratification.

Part 4. Baseline net removals for fixed baselines

The WR wetland baseline scenario is the carbon stock present immediately prior to site preparation or the most likely carbon stock in the absence of project implementation. Therefore, the baseline net GHG removals by sinks is the sum of the changes in carbon stocks in the selected carbon pools within the project boundary just prior to site preparation or that would have occurred in the absence of the project activity.

Under the applicability conditions of this methodology:

- Changes in the carbon stock of aboveground and belowground biomass of non-tree vegetation may be conservatively assumed to be zero for all strata in the baseline scenario;

- Changes in the carbon stock of dead wood and litter/surface debris carbon pools are conservatively omitted. Therefore, the sum of the changes in the carbon stocks of dead wood and litter carbon pools is zero for all strata in the baseline scenario;

- For wetland GHG emissions, the sum of emissions will either be set as zero or quantified based on the conclusions of Step 2. Project proponent using extrapolated values must make conservative estimates.

The baseline net GHG removals by sinks shall be estimated using the equations in this section. When applying these equations for the *ex-ante* calculation of baseline net GHG removals by sinks, Project proponent shall provide estimates of the values of those parameters that are not

available before the start of the crediting period and commencement of monitoring activities. Project proponent should retain a conservative approach in making these estimates.

4.1 Baseline carbon stocks[3]

The net carbon stock changes in the baseline are equal to the baseline living tree biomass stock plus the soil organic carbon stock minus the baseline greenhouse gas emissions. The baseline net GHG removals by sinks will be determined as:

$$\Delta C_{bsl,WR\text{-}HM} = (\Delta C_{TREE\_BSL} + \Delta C_{SOC\_BSL}) - \Delta GHG_{E\_BSL} \quad (1)$$

where:

$\Delta C_{bsl\text{-}WR\text{-}HM}$ Cumulative total of the carbon stock changes and greenhouse gas emissions for the baseline scenario up to time *t;* t CO_2-e

ΔC_{TREE_BSL} Cumulative total of the carbon stock changes of living tree biomass for the baseline scenario up to time *t;* t CO_2-e

ΔC_{SOC_BSL} Cumulative total of the carbon stock changes of soils for the baseline scenario up to time *t;* t CO_2-e

ΔGHG_{E_BSL} Cumulative total of the change in carbon emissions for the baseline scenario *t;* t CO_2-e

For calculation of carbon stock sequestered in living tree biomass see the module "Estimation of carbon stocks in tree biomass" (CP-TB). For calculation of carbon stocks sequestered in soils see the module "Estimation of carbon stocks in the soil organic carbon pool" (CP-S). For calculation of carbon emissions see the module "Estimation of emission source" (E-E).

Part 5. Monitoring requirements for baseline renewal

A crediting period for a project is a predetermined length of time for which the baseline scenario is applicable. This period of time is used for carbon quantification of offsets generated relative to its baseline.

Crediting periods can be renewed when Project proponent[4]:

- Re-submit the GHG Project Plan in compliance with then-current GHG Program standards and criteria;
- Re-evaluate the project baseline;

[3] Stock estimates shall occur for the pools defined through the framework module WR-MF

[4] American Carbon Registry, 2010. American Carbon Registry Forest Carbon Project Standard, version 2.1. Winrock International, Little Rock, Arkansas. http://www.americancarbonregistry.org/carbon-accounting/forest-carbon-project-standard-v2.0. Last Accessed: June 6, 2010. 63 pages.

- Demonstrate additionality against then-current regulations and performance standard data.
- Use GHG program-approved baseline methods, emission factors, tools, and methodologies in effect at the time of crediting period renewal;
- Undergo verification by an approved verifier.

PARAMETERS ORIGINATING IN OTHER MODULES

Data /parameter:	ΔC_{TREE_BSL}
Data unit:	t CO_2-e
Used in equations:	1
Description:	Cumulative total of the carbon stock changes of living tree biomass in the baseline scenario
Module parameter originates in:	CP-TB
Any comment:	

Data /parameter:	ΔGHG_{E_BSL}
Data unit:	t CO_2-e
Used in equations:	1
Description:	Cumulative total of the change in carbon emissions of the baseline scenario
Module parameter originates in:	E-E
Any comment:	

Data /parameter:	ΔC_{SOC_BSL}
Data unit:	t CO_2-e
Used in equations:	1
Description:	Cumulative total of the carbon stock changes of soils for the baseline scenario

Module parameter originates in:	CP-S
Any comment:	