VCS ARR Methodology

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TerraCarbon®

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CLIMATE ASSOCIATES

Quantification procedures based on AR-ACM0003 and CDM A/R Tools, with the following key innovations and additions:

- **Performance benchmark** - standardized approach for additionality and crediting baselines
- **Census-based quantification approach**
- **Standardized accounting of leakage**

- Accounting of harvested wood products
- Explicit guidance on treatment of long-term average (where management involves even-aged harvesting)
- Explicit guidance on *de minimis* calculation

Applicability conditions

- Project activity qualifies as ARR
- Project activity involves no deliberate manipulation of hydrology (if on organic soils)
- Project activity does not take place on tidal wetlands (*VM0033 to cover mangrove restoration*)

Quantification approach	Applicability conditions	Crediting baseline	Additionality	Appropriate ARR activities
Area-based – uses project area, A_t, as the scaling parameter. Applies plot-based sampling.	The ARR activity can be clearly delineated spatially, and area calculated using GIS.	Performance benchmark	Performance benchmark	ARR activities that produce a change in LU/LC (e.g. plantations, facilitated natural regeneration, enrichment plantings)
Census-based – uses a complete census of individual planting units (e.g., tree, shrub, bamboo clump), N_t, as the scaling parameter.	Individual planting units are clearly defined (e.g., tree, shrub, bamboo clump) and identifiable in the field (unique ID and GPS location). No change in land use. A complete census of all planting units is maintained. No removal of pre-existing woody biomass (e.g., trees or shrubs).	Project method where baseline scenario = absence of planting units	Project method – demonstration of implementation barriers	Best suited to dispersed planting activities that do not result in a change in LU/LC (e.g. agroforestry, urban forestry, shelterbelts, planting in rural homesteads). Constrained project boundary allows “stacking” with other methodologies (e.g. ALM to cover SOC)

Project boundary

Pool/source	Included?
Above- and belowground woody biomass (trees and shrubs)	**Yes**
Above- and belowground non-woody biomass	Optional
Dead wood	Optional
Litter	Optional (excluded with census-based quantif)
Soil organic carbon	Optional (excluded with census-based quantif)
Harvested wood products	Optional
N2O emissions from N fertilizer	**Conditional on project activity**
CH4 and N2O emissions from burning tree biomass	**Conditional on project activity**
CO2, CH4 and N2O emissions from burning fossil fuels	No

8.5 Net GHG Emission Reductions and Removals

Area-based quantification

$$NGR = \Delta C_{WP} * (1 - PB_t) * (1 - LDF) * (1 - UNC) \quad \textbf{(38)}$$

Where:

NGR	Net GHG removals from the project activity up to year *T*; t CO_2e
ΔC_{WP}	Net GHG removals in the project scenario up to year *T*; t CO_2e
PB_t	Performance benchmark up to year T; percent
LDF	Leakage Discount Factor; percent
UNC	Uncertainty; percent

Census-based quantification

Net GHG removals using census-based quantification are calculated with removals in the baseline scenario implicitly set equal to zero.

$$NGR = \Delta C_{WP} * (1 - LDF) * (1 - UNC) \quad \textbf{(39)}$$

Where:

NGR	Net GHG removals from the project activity up to year *T*; t CO_2e
ΔC_{WP}	Net GHG removals in the project scenario up to year *T*; t CO_2e
LDF	Leakage Discount Factor; percent
UNC	Uncertainty; percent

Performance benchmark

= observed rate of increase in vegetative stocks in matched control plots, as compared with the project area

Step1 - Delineate eligible control area (via GIS overlays)

Factor	Data source/matching approach	Rationale
Political boundary	National boundary (subnational if distinct subnational policies administering incentives for tree planting)	Similar policy environment
Outside any registered VCS AFOLU project	Absence of any registered AFOLU projects consulting VCS Project Database	Absence of carbon finance = control
Agroecological zone	FAO-GAEZ	Similar climate, soil, topography
Initial proximity to nearest pre-existing forest cover	LU/LC classification within +/-5 years of base year Exclude any areas with distances greater than those for the project area	Similar extent of proximal seed sources
Initial land use/land cover	LU/LC classification within +/-5 years of base year	Similar initial non forest land cover and pre-existing land management/ anthropogenic disturbance regime
Land tenure	Published or official government sources Minimally public/private	Similar actors

Step 2 - Select approach to quantify *EVS* (estimated vegetative stocking):

a) Direct visual assessment of percent cover (e.g. using i-Tree Canopy tool)

b) Remote sensing metric with significant, positive linear correlation with aboveground biomass (e.g. NDFI, Lidar-derived canopy height)

Step 3 - Allocate and evaluate random virtual control plots

a) Select control plots from within matched area (SRS or StrRS)

b) Evaluate initial (t=-5) *EVS* values. Discard any plots with initial *EVS* exceeding +/-10% of the project area *EVS* at t=0.

c) Re-evaluate *EVS* at t=0 and calculate increase in *EVS*.

56 m radius polygon around each control point (= 1.0 ha)

Visual assessment of % canopy cover

Methodology requires assessment of 50 random points within each plot – see iTrees canopy tool (replicable/auditable)


5/2013

Step 4 – Derive performance benchmark

4. Derive performance benchmark

The performance benchmark is then calculated as:

$$PB_t = t * \frac{1}{t_{eval} - t = -5} * \frac{1}{n} * \sum_{i=1}^{n} \Delta EVS_{control,i,t\_eval} * \frac{1}{\Delta EVS_{wp,t}} \quad \text{(A2)}$$

Where:

PB_t	Performance benchmark applicable from year *t* through year *t+4*; percent
$\Delta EVS_{control,i,t\_eval}$	Increase in estimated vegetative stocking, *EVS*, in control plot *i*, in the interval from *t=-5* to t_{eval} (year of last evaluation event)
$\Delta EVS_{wp,i,t}$	Increase in average estimated vegetative stocking, *EVS*, in the project area, in the interval from *t=0* to *t*
i	Control plot 1, 2, 3 ... *n*
t	Time; years since project start
t_{eval}	Year of last evaluation event (every 5 years)

Control plot	EVS_i,t=-5	EVS_i,t=0	EVS_i,t=5		ΔEVS_control,i, t=0	ΔEVS_control,i, t=5
1	20%	15%	10%		0%	0%
2	25%	30%	25%		5%	0%
3	20%	30%	35%		10%	15%
4	10%	20%	15%		10%	5%
5	25%	35%	30%		10%	5%
6	10%	20%	25%		10%	15%
7	5%	15%	25%		10%	20%
8	5%	0%	5%		0%	0%
9	10%	5%	10%		0%	0%
10	15%	25%	25%		10%	10%
11	5%	15%	10%		10%	5%
12	25%	30%	40%		5%	15%
13	20%	20%	30%		0%	10%
14	5%	15%	15%		10%	10%
15	10%	10%	20%		0%	10%
16	5%	0%	0%		0%	0%
17	20%	15%	10%		0%	0%
18	20%	20%	15%		0%	0%
19	15%	10%	15%		0%	0%
20	25%	30%	35%		5%	10%
	$EVS_{wp,t=0}$	*$EVS_{wp,t=5}$*	*$EVS_{wp,t=10}$*	ΔEVS_control,t	5%	7%
EVS_wp,t	15%	75%	100%	ΔEVS_wp,t	60%	85%
				PB_t	8%	8%

Leakage

Leakage

Leakage: “Any increase in GHG emissions that occurs outside the project boundary (but within the same country), and is measurable and attributable to the project activities” (VCS Methodology Requirements, v4.0).

Existing CDM AR Leakage tool only captures activity shifting leakage.

Goals: Develop standardized and simplified approach that captures both activity shifting and market effects.

Proposed Leakage Tool

Standardized approach to estimate leakage based on project specific conditions

Output is a leakage discount rate (LDR) that is applied annually to the net GHG benefits

Reviewed by experts and informed by AFOLU sector study in the US (EPA, 2005) that provided insight on extent of leakage from AR and time effects

Leakage Discount Rate

Net GHG Benefits from Project =

*Net GHG Removals from Project * (1-PB)*(1-LDR)*(1-UNC)*

Leakage discount rate (LDR) =

Standardized leakage discount rate x Carbon stock adjustment factor x Accounting period adjustment factor

Step 1: Standardized leakage discount rate

Leakage rates that are scaled to the amount of production that is displaced.

Projects on less productive land will have lower displacement effects and lower leakage.

Relative productivity = Project area productivity/national productivity

Scenario	Criteria	SLDR
High	Relative productivity greater than 0.75	20%
Medium	Relative productivity greater than 0.50 but less than or equal to 0.75	15%
Low	Relative productivity greater than 0.25 but less than or equal to 0.50	10%
Very Low	Relative productivity less than or equal to 0.25	5%
No Leakage	No productive activities in the 2 years before the project start date	0

Step 2: Carbon stock adjustment factor

Factors in the carbon stocks on lands that received displaced production

Projects that displace production to lands with higher carbon stocks will apply a higher LDR and vice versa

Relative carbon stocks = Project area carbon stocks/national carbon stocks in forests

Scenario	Criteria	CSAF
Very High	Relative carbon stock in project area is less than 0.80	1.50
High	Relative carbon stock in project area is between 0.80 and 1.00	1.25
Medium	Relative carbon stock in project area is between 1.00 and 1.20	1.00
Low	Relative carbon stock in project area is greater than 1.20	0.80

Step 3: Accounting period adjustment factor

Leakage, estimated as a percentage of net GHG benefits from the project, varies over different time scales and will be higher over shorter time scales (<50 yrs) where fewer GHG benefits from the project have been generated.

Accounting period adjustment factors for crediting periods 20-50 years informed by modeled leakage estimates over varying time scales (EPA, 2005).

Scenario	Criteria	APAF
High	Crediting period is between 20 and 29 years	1.75
Medium	Crediting period is between 30 and 39 years	1.50
Low	Crediting period is between 40 and 49 years	1.25
No Adjustment	Crediting period is equal to or greater than 50 years	1.00

Step 4: Leakage discount rate

Leakage discount rate (LDR) =

Standardized leakage discount rate x Carbon stock adjustment factor x Accounting period adjustment factor

Leakage tool summary

Includes activity shifting and market effects

Simple to apply

Reflects variability in potential leakage based on differing project conditions

Reflects inherent uncertainty in quantifying leakage

Based on limited research to date, but conservatively applied and can be refined over time based on new research