



Verified Carbon Standard

MODULE FOR ESTIMATING LEAKAGE FROM ARR ACTIVITIES ASSESSMENT REPORT



Document Prepared by Aster Global Environmental Solutions Inc.

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Summary

Aster Global Environmental Solutions, Inc., (Aster Global) was commissioned by Verra to perform the assessment of VMD0054: Module for Estimating Leakage from ARR Activities in accordance with the VCS Program Guide, the Methodology Development and Review Process, and the Methodology Requirements.

The module states “Project activities applying the methodology VM0047 Afforestation, Reforestation and Revegetation must use this module to estimate leakage.”¹

The purpose and scope of the module assessment was to evaluate whether the document was prepared in line with the VCS program requirements. Aster Global's assessment included a detailed review of adherence to the VCS Methodology Development and Review Process, the VCS Program Guide, and the VCS Methodology Requirements, with regard to applicability conditions, emissions, leakage, monitoring, data and parameters, and adherence to the principles of the VCS rules and requirements (relevance, completeness, consistency, accuracy, transparency and conservativeness). Aster Global's assessment also included a detailed analysis of the module, literature reviews, technical reviews and

¹ VMD0054 Module for Estimating Leakage from ARR Activities, v1.0, 28 September 2023, Page 5

responses to all non-conformity reports (NCRs), clarifications (CLs), and opportunities for improvement (OFIs) based on the VCS rules and requirements.

The assessment team identified 41 findings (CLs and OFIs). All were addressed satisfactorily in line with the VCS program requirements. These CLs and OFIs provided necessary clarity to ensure the module was in compliance with the VCS rules and requirements. All findings were appropriately addressed and are depicted in Appendix A.

Aster Global confirms all module assessment activities, including objectives, scope and criteria, level of assurance and the module's adherence to the VCS Program, as documented in this report, are complete. Aster Global concludes without any qualifications or limiting conditions that VMD0054: Module for Estimating Leakage from ARR Activities meets the requirements of VCS Rules and Requirements. Aster Global recommends that Verra approve the module.

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1 INTRODUCTION

1.1 Objective

This module assessment was performed to evaluate the likelihood that use of the module would result in accurate calculations and appropriate criteria for GHG emissions (ISO 14064-3:2019) within the leakage accounting area. This report summarizes the findings of the module assessment contained within the Verified Carbon Standard (VCS) methodology development and approval process. Verra, referred to as the “Module Developer,” has commissioned Aster Global Environmental Solutions, Inc. (Aster Global), referred to as the “Assessment Team,” to perform an assessment of VMD0054 Module for Estimating Leakage from ARR Activities, referred to as the “Module” or VMD0054 herein.

This report presents the findings of a qualified assessment team of auditors and experts in methodologies for GHG emissions or who have assessed the module for compliance under the applicable rules of the VCS Program. Section 2 below presents the assessment approach, Section 3 below summarizes the assessment process and conclusions, and Appendix A provides details and resolutions of all individual findings from the assessment process.

1.2 Summary Description of the Module

The module has been developed concurrently and in association with the Methodology for Afforestation, Reforestation and Revegetation Projects. The module states “Project activities applying the methodology VM0047 Afforestation, Reforestation and Revegetation must use this module to estimate leakage.”² It will replace any previous VCS or CDM tools for estimating leakage in conjunction with any ARR projects utilizing VM0047 within Verra.

2 ASSESSMENT APPROACH

2.1 Method and Criteria

This assessment is based on standard auditing techniques in line with VCS requirements to assess the correctness of the information provided. In accordance with the VCS rules, a separate module assessment must be completed with any related methodology assessment. The assessment of the module encompassed one applicability condition, procedures for determining leakage, quantification of net GHG emissions, monitoring, and data and parameters.

² Ibid, Page 5

The Verra documents used to assess the Module were:

- Program Guide (v4.3, 17 January 2023)
- Program Definitions (v4.3, 21 December 2023)
- Methodology Requirements (v4.3, 17 January 2023)
- Methodology Development and Review Process (v4.2, 17 January 2023)
- Methodology Template (v4.2, 21 December 2022)
- Methodology Assessment Report Template (v4.1, 21 December 2022)
- Validation and Verification Manual (v3.2, 19 October 2016)

Note that the most recent VCS Program documents from 29 August 2023 are not listed above. Per Verra, it was acceptable to report the previous versions used throughout the module assessment process, as this current report had already been drafted and review completed prior to the program updates. Further, the new methodology requirements were applicable to methodologies/modules that had not yet solicited public comments.

2.2 Document Review

All documents reviewed in the module assessment are in listed in Appendix B.

2.3 Interviews

Interviews were conducted online using Microsoft Teams via typical assessment channels, including the opening meeting, methodology/module walkthroughs, meetings to discuss findings, in addition to email exchanges, phone calls, and the closing meeting. Details and attendees of each meeting are included below:

Opening Meeting to discuss action items		10 June 2022
<i>Methodology Assessment Team</i>	<i>Methodology Development Team</i>	
Mansfield Fisher – Aster Global	Abel Marcarini – Verra	
Matthew Perkowski – Aster Global	Cecilia Simon – Verra	
Janice McMahon – Aster Global	Diego Navarrete – Verra	
Shawn McMahon – Aster Global	David Shoch – Terra Carbon	
Cindy McClure – Aster Global	Scott Settelmyer – Terra Carbon	
Meeting to discuss Leakage Module		20 July 2022
<i>Methodology Assessment Team</i>	<i>Methodology Development Team</i>	
Mansfield Fisher – Aster Global	Abel Marcarini – Verra	

Matthew Campbell – Aster Global

Scott Settelmyer – Terra Carbon

Sandesh Shrestha – Aster Global

Caitlin Sellers – Aster Global

Meetings to discuss Round 1 Findings
04, 06 & 12 January 2023
Methodology Assessment Team
Methodology Development Team

Justin Ziegler – Aster Global

David Shoch – Terra Carbon

Matthew Campbell – Aster Global

Spencer Plumb - Verra

Sandesh Shrestha – Aster Global

Scott Settelmyer – Terra Carbon

Caitlin Sellers – Aster Global

2.4 Assessment Team

The names, roles, and summary of qualifications/expertise/experience relevant to the methodology assessment team follow:

Name	Role	Summary of qualifications, expertise, relevant methodology experience
Shawn McMahon	Lead Assessor and Verra-approved IFM Expert	Vice-President, Lead Assessor, VCS WRC Non-Peatlands Expert. Approved to conduct third-party carbon sequestration validations and verifications under VCS (WRC, REDD, IFM and ARR expert). Specializes in third-party carbon offset validations and verifications, carbon sequestration project development, development and implementation of management plans for enhancement of carbon stocks, development of carbon and environmental asset tracking programs, and team management.
Barbara Toole O'Neil	Verra-approved Standardized Methods Expert / Assessment Team Member	Since 2010 she has completed assessments of 14 new methodologies. Her work responsibilities have addressed a wide range of environmental issues from preparing inventories or offset project documents to assessing methodologies submitted to the Verified Carbon Standard (VCS) (forestry to energy efficiency); , validating/ verifying inventories and carbon offset projects, corporate social responsibility auditing, developing governance for sustainability non-profits, to writing a social standard to assess the impact of environmental projects (carbon, water, forestry, agriculture) on the quality of life for women in emerging third world countries.

Caitlin Sellers	Assessment Team Member	Ms. Sellers has been involved in environmental, forest, wetland and wildlife projects for over 15 years and has specialized in forest carbon project auditing for 9 years. She is directly involved in validation and verification of forest carbon offsets and methodologies.
Mansfield Fisher	Assessment Team Member	Mr. Fisher received his in MS in Forestry and MS in Economics from North Carolina State University in 2020. Previously, Mr. Fisher worked for The Nature Conservancy working on restoration of the longleaf pine habitats in coastal North Carolina. Mr. Fisher has extensive knowledge in econometric modeling related to land use conversion.
Sandesh Shrestha	Assessment Team Member / GIS & Remote Sensing Specialist	Mr. Shrestha received his MS in Forestry from University of Maine in 2019. Mr. Shrestha has experience working in multiple projects in the United States and in Nepal. Prior to joining the Aster Global team, he worked as a Geospatial Research Associate with Kentucky State University where he focused on the acquisition, compilation, and processing of geospatial data using satellite imagery, LiDAR, and UAV drones for creating ecosystem assessments, land use/cover change, and watershed modelling. Mr. Shrestha is a published author of numerous research projects in the United States and Nepal related to hydrology, remote sensing applications, LULC change, climate change impact, community perception and vulnerability studies. Mr. Shrestha is a professional member of the Society of American Foresters and Nepal Forester's Association.
Matthew Campbell	Assessment Team Member	Mr. Campbell received his MS in Environmental Studies and Graduate Certificate in Geographic Information Sciences (GIS) from University of North Carolina Wilmington in 2016. Previously, Mr. Campbell has worked as a crew lead and field coordinator for forestry crews working on a long-term climate change forestry research project in Sierra Nevada mixed-conifer forests through the University of Nevada Reno.
Justin Ziegler	Assessment Team Member / Forest Biometrician	Dr. Ziegler received his Bachelor of Science in Forest Resources from the University of Idaho, and Master of Science and PhD both in Forest Sciences from Colorado State University. Dr. Ziegler has experience teaching at the university setting and as a practicing forester, in sampling design, biometry, data analyses and computational modeling. He has 15 publications in forest and fire science, including areas of natural resource inventories, growth-and-yield

		modeling, and forest carbon measurements. He is certified as a Professional Forester with the Society of American Foresters and as a Certified Wildland Fire Ecologist and Wildland Fuels Scientist with the Association for Fire Ecology.
Janice McMahon	QA/QC / President	Specializes in natural resource management projects including carbon sequestration feasibility assessments, development and implementation of management plans for enhancement of ecosystem services, assessment of GHG emissions and reductions, development of environmental asset tracking programs, GHG validations and verifications, endangered/ threatened species assessments, habitat management plans, and integrated ecosystem services plans. Responsible for leading the Forestry, Carbon, and GHG Services Division, which includes client and team coordination, proposal preparation and review, marketing presentations, maintenance of Aster Global's ANSI accreditation and management System, and quality assurance and quality control for projects in the United States as well as the international market.

2.5 Resolution of Findings

The process of module assessment involved 4 formal rounds of evaluation by the assessment team and resulted in a final module version in conformance to VCS rules. Findings related to corrective action, clarification requests or other findings were resolved during communication between the assessment team and the methodology development team. More specifically, where noted by the assessment team, the methodology development team implemented corrective actions by amending module text and requirements and providing written clarification responses. Types of findings were characterized in the following manner:

Non-Conformance Reports (NCRs) are generally issued as a response to material discrepancies in a part of the module. However, no NCRs were issued during the assessment process.

Clarifications (CL) were issued when language within the methodology needed extra clarification to avoid ambiguity/confusion for the reader or minor errors in equations needed correction.

Opportunities for Improvement (OFI) were issued to the methodology developer when an opportunity for improvement was identified but was not required to be addressed to confirm to VCS rules.

During the course of the methodology assessment, 41 findings (CLs and OFIs) were identified. Of those, Aster Global ensured *reasonable* assurance was provided to close all findings. Details on how each finding was closed can be found in Appendix A. Throughout the assessment, all CLs were eventually satisfactorily addressed to the standards and requirements of Aster Global

and/or VCS. The CLs provided necessary clarity to ensure the methodology complied with the requirements of VCS. Detailed summaries of each finding, including the issue raised, responses and final conclusions are provided in Appendix A.

A brief summary of some findings listed includes methodology requirements, performance benchmark, additionality, definitions, and equations:

Finding #5: The parameter r_j sourced a growth rate based on FAOSTAT “world” values instead of those relevant to developing countries. The developer changed the text of the methodology to “globally” to ensure the values were appropriately applied and made further text changes to ensure consistency.

Finding #9: The ratio of above to belowground biomass stocks was a default value of 125%. The assessor asked why this would be considered appropriate for all situations and vegetation types. The developer revised the value to align with IPCC values unless verifiable evidence could justify a different value. The assessor confirmed the clarifications and changes were appropriate to close out the finding.

Finding #19: The assessment team noted the template used was not the most recently approved version from Verra, resulting in field mismatches, etc., and contained inconsistent terminology between tool and module. The developer eventually corrected the version and changed all references to “module” to ensure consistency, which the assessment team confirmed correct.

3 ASSESSMENT FINDINGS

The final version of module VMD0054 was found to be in compliance with the principles set out in the VCS Standard and other VCS rules and requirements. The new module provides ARR project leakage quantification methodologies, while adhering to the principles of VCS (relevance, completeness, consistency, accuracy, transparency, and conservativeness).

Applicable VCS-approved CDM and IPCC tools are appropriately cited for determining quantification components within the Data and Parameters section. The assessment addressed specific issues that arose in the module, which are pertinent to the above-mentioned principles set forth by the VCS Standard.

3.1 Relationship to Approved or Pending Methodologies

Methodology	Title	GHG Program	Key differences with new proposed one	Assessor Comments
AR-ACM003	Clean Development Mechanism (CDM) AR-Tool 15, version 2.0, Estimation of the increase in GHG	CDM	Does not incorporate market leakage effects, can only be revised with	As this effort is to bring an ARR methodology within the VCS program, the

	emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity		approval of CDM Executive Board	creation of a new VCS leakage module ensures consistency and alignment with VCS principles.
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3.2 Stakeholder Comments

The module was listed for public stakeholder consultation from 17 December 2021 to 28 January 2022 and then later for key commenters to have an additional opportunity to comment. A total of 31 public comments were received during this consultation process. Due to total number of comments, a separate appendix has been prepared (Appendix C). The Assessment Team and Verra both reviewed the public comments and the methodology development team's responses. The assessment team confirmed closure of all public comments. All comments, the developer's response to each comment, any resultant changes to the methodology, and an explanation of appropriateness are included in the Appendix C. This review ensured that the developer has adequately addressed all stakeholder comments.

3.3 Structure and Clarity of Module

Through the methodology development and review process, the assessment team ensured the module was written in a clear, logical, concise and precise manner in accordance with the Methodology Development and Review Process (v4.2, 17 January 2023).

- The developer has followed the instructions in the module template and ensured that the module's various criteria and procedures are documented in the appropriate sections of the template. This was confirmed through a detailed review of the template requirements within the assessment team's Findings process. Several Findings were issued related to the module's consistency with the template, and all Findings were resolved to ensure VCS requirements were achieved.
- The terminology used in the module is consistent with that used in the VCS Program, and GHG accounting generally. The assessment team issued Findings related to VCS definitions, and all Findings were resolved to ensure terminology was consistent.
- The key words must, should and may have been used appropriately and consistently to denote firm requirements, (non-mandatory) recommendations and permissible or allowable options, respectively. This was confirmed through the assessments team's overall read, interpretation, and review process. The developer did change terms as a result of the Findings from the assessment team to be more compatible with VCS rules.
- The criteria and procedures are written in a manner that can be understood and applied readily and consistently by project proponents. Applicable Findings were resolved to ensure this was achieved.

- The criteria and procedures are written in a manner that allows projects to be unambiguously audited. Several Findings were issued to ensure the module can be consistently and robustly applied to a broad spectrum of project types. The Findings were resolved sufficiently.

Overall, it is the Assessment Team’s opinion that the structure of the module document meets the methodological requirements of the VCS Program.

3.4 Definitions

The key terms defined in the module are presented clearly and appropriately in the Definitions sections at the beginning of the document by the methodology developers for ease of use. The assessment process ensured definitions of key terms are presented concisely and can assist the reader in comprehension for effective implementation of the methodology.

3.5 Applicability Conditions

During the methodology assessment process, the assessment team ensured the applicability condition was appropriate for the activities targeted by the methodology. Quantification procedures required by the methodology adequately target the relevant applicability condition. The applicability condition appropriately specifies relevant requirements to individual projects. The assessment determined the applicability condition contained within the methodology is appropriate, adequate and in compliance with the VCS Program.

Further, the assessment team determined the applicability condition provides sufficient clarity to projects determining if their activities are or are not eligible under the methodology. The applicability condition addresses environmental integrity and practical considerations, where relevant.

The following summarizes the applicability condition as written, changes made during the revision of the methodology, and the final evaluation of those changes during the assessment. The single general applicability condition follows:

“This module applies to estimating leakage emissions from ARR activities. Projects using this module must meet all applicability conditions of the methodology VM0047 Afforestation, Reforestation and Revegetation.”³

Assessment: This applicability condition provides the broad application of the methodology to ARR activities utilizing the VCS methodology VM0047, where the additional conditions of the Methodology for Afforestation, Reforestation and Revegetation have been met. The applicability condition is written in a clear and concise manner, ensuring a project activity adheres to the condition and that conformance can be demonstrated at the time of project validation.

³ Ibid

3.6 Project Boundary

This section is not applicable to the module, as the project boundary is established under the Methodology for Afforestation, Reforestation and Revegetation.

3.7 Baseline Scenario

This section is not applicable to the module, as the baseline scenario is established under the Methodology for Afforestation, Reforestation and Revegetation.

3.8 Additionality

This section is not applicable to the module, as additionality is established under the Methodology for Afforestation, Reforestation and Revegetation.

3.9 Quantification of GHG Emission Reductions and Removals

3.9.1 Baseline Emissions

This section is not applicable to the module, as the quantification of baseline emissions is established under the Methodology for Afforestation, Reforestation and Revegetation.

3.9.2 Project Emissions

This section is not applicable to the module, as the quantification of project emissions is established under the Methodology for Afforestation, Reforestation and Revegetation.

3.9.3 Leakage

The module contains the following five steps for calculating Leakage:

Step 1: Determine foregone production in project area

Step 2: Determine the impact of leakage mitigation activities

Step 3: Determine the amount of new land that is brought into production

Step 4: Determine the change on carbon stocks in the new lands brought into production

Step 5: Determine leakage emissions

In step 1, foregone production is calculated for commodities that were produced in the project area during the historical reference period. The amount of foregone production in the project area is quantified in equation 2, which is the difference between baseline production for each commodity produced in the project area and the monitored production of that same commodity in the project area.

The impact of leakage mitigation activities is determined in step 2. “Leakage mitigation is equal to the difference in production between the project and baseline scenarios of the leakage mitigation area.”⁴ The impact of mitigation activities is the amount of foregone production that may result in leakage, which is quantified in equation 5 of the leakage module.

The amount of new land brought into production is determined in step 3, followed by the determination of change in carbon stocks in new lands brought into production in step 4. Finally, equation 10 is applied in step 5 to determine the leakage emissions from new land that is brought into production, as follows:

$$LK_t = AL_t \times CS \times \frac{44}{12}$$

Each step contains various parts, equations and defined terms that the assessment team vetted through review and discussion with the module development team. The assessment team determined the steps to calculating leakage were appropriate and sufficient for ARR project activities. Further, these procedures conform to the VCS rules for ARR.

3.9.4 Net GHG Emission Reductions and Removals

This section is not applicable to the module, as the net GHG emission reductions and removals is established under the Methodology for Afforestation, Reforestation and Revegetation.

3.10 Monitoring, Data and Parameters

The following are the data, parameters and procedures available at validation. Through review of all data/parameters at validation, the assessment team confirms with *reasonable* assurance that they are appropriate for the project activities covered by the leakage module. The assessment team concludes the data/parameters and procedures applied are in line with VCS rules.

Data/Parameter	Assessment Team Findings
$p_{j,h}$	This is production in the project area for commodity j in year h of the historical reference period. The purpose of the parameter is quantification of foregone production. The data unit, source, value applied, and description of measurement methods and procedures applied are consistent with VCS rules.
H	This is number of years within historical reference period used to determine baseline production within the project area. The purpose of the parameter is quantification of foregone production. The data unit, source, value applied, and description of measurement methods and procedures applied are consistent with VCS rules.

⁴ Ibid, Page 7

$op_{j,h}$	This is production units of commodity j in the leakage mitigation area in year h of the historical reference period. The purpose of the parameter is quantification of leakage mitigation for foregone production. The data unit, source, value applied, and description of measurement methods and procedures applied are consistent with VCS rules.
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The following are the data, parameters and procedures to be monitored for leakage. Through review of all data/parameters to be monitored, the assessment team confirms with *reasonable* assurance they are appropriate for the project activities covered by the module and will ensure GHG emission reductions and removals are monitored and reported appropriately. The assessment team concludes the data/parameters and procedures for monitoring are in line with VCS rules.

Data/Parameter	Assessment Team Findings
$MP_{j,t}$	This is monitored production in the project area for commodity j in year t . The purpose of the parameter is quantification of foregone production. The data unit, source, and frequency of monitoring are consistent with VCS rules.
r_j	This is the annual growth rate of yield for commodity j . The purpose of the parameter is quantification of baseline commodity production in the project area and the leakage mitigation area. The data unit, source, measurement methods and procedures to be applied, and frequency of monitoring are consistent with VCS rules.
$OMP_{j,t}$	This is monitored production in the leakage mitigation area for commodity j in year t . The purpose of the parameter is quantification of leakage mitigation. The data unit, source, and frequency of monitoring are consistent with VCS rules.
IS	This is the share of leakage resulting in increased supply outside the project area. The purpose of the parameter is quantification of area of new land brought into production. The data unit, source, measurement methods and procedures to be applied, and frequency of monitoring are consistent with VCS rules.
NL_j	This is the share of increased supply from new land brought into production for commodity j . The purpose of the parameter is quantification of area of new land brought into production. The data unit, source, and frequency of monitoring are consistent with VCS rules.
$y_{j,t}$	This parameter is production units per hectare per year. The purpose of the parameter is quantification of area of new land brought into production. The data unit, source, measurement methods and procedures to be applied, and frequency of monitoring are consistent with VCS rules.
$\Delta C_{biomass}$	This parameter is the change in forest biomass carbon stocks equal to the regional average stock where the project is located. The purpose of the parameter is quantification of leakage emissions. The data unit, source, measurement

	methods and procedures to be applied, and frequency of monitoring are consistent with VCS rules.
SOC_{REF}	This parameter is soil organic carbon (SOC) stock corresponding to the reference condition in native ecosystems by climate region and soil type applicable to the land receiving the displaced activity. The purpose of the parameter is quantification of change in carbon stocks on new lands brought into production. The data unit, source, measurement methods and procedures to be applied, and frequency of monitoring are consistent with VCS rules.
f_{LU}, f_{MG}, f_{IN}	This parameter is relative SOC stock change factors applicable to the displaced production over 20 years for land use, management practices and inputs respectively. The data unit, source, and frequency of monitoring are consistent with VCS rules.

3.11 Uncertainty

The module contains no assessments of uncertainties. The assessment team determined that no parameters presented significant risk that the uncertainty for estimation emissions reductions could exceed 10 percent of the estimated value. Therefore, no assessment of uncertainty occurred within the assessment of the leakage module.

3.12 Verifiable

After completion of the full assessment of the module, the assessment team confirms with *reasonable* assurance that the module is sufficiently clear and specific to require project developers to transparently report project results that can pass validation and verification audits with high confidence.

4 ASSESSMENT CONCLUSION

Aster Global Environmental Solutions, Inc., has completed the assessment of the VCS module VMD0054: Module for Estimating Leakage from ARR Activities (Version 1.0, dated 28 September 2023). The assessment team confirms the module adheres to the criteria established for this assessment, which are documented and complete. Aster Global concludes without any qualifications or limiting conditions that the module document meets the requirements of the VCS Program Guide, VCS Methodology Requirements, and the VCS Methodology Development and Review Process. Therefore, Aster Global recommends that Verra approve the module (Module for Estimating Leakage from ARR Activities, v1.0, 28 September 2023) as prepared by Verra.

5 EVIDENCE OF FULFILMENT OF VVB ELIGIBILITY REQUIREMENTS

As stated in the VCS Methodology Development and Review Process, “The criteria for eligible validation/verification bodies are set out in Section 5 of the VCS Program Guide.”⁵

Further, the Program Guide Section 5 states “Validation/verification bodies are also eligible to conduct methodology assessments (validation) of methodologies under the methodology development and review process. The validation/verification body shall hold accreditation for validation for the sectoral scope(s) applicable to the methodology. Where the methodology falls under more than one sectoral scope, the validation/verification body shall hold accreditation for validation for all relevant sectoral scopes. Validation/verification bodies shall ensure the assessment team includes experts with subject-matter expertise in all areas relevant to the proposed project activity. Validation/verification bodies may contract external experts where needed to meet this requirement.”⁶

Aster Global fulfils the eligibility requirements in the following ways:

- Aster Global is accredited by the ANSI National Accreditation Board (ANAB) under the following:

Rank	ISO/IEC 17029:2019 expires 08 March 2027 Certificate Here
Environmental Information	ISO 14065: 2020
Greenhouse Gas	ISO 14064-3:2019
Project Level Verification of Assertion related to GHG emissions reductions and removals	
Group 01	GHG emission reductions from fuel combustion
Project Level Verification/Validation of Assertion related to GHG emissions reductions and removals	
Group 03	Land Use and Forestry, subgroup ART TREES
Group 05	Livestock
Group 06	Waste Handling and Disposal
Organization Level Verification of assertions related to GHG emissions and removals	
Group 01	General, subgroup CORSIA
Group 02	Manufacturing
Group 03	Power Generation
Group 05	Mining and Mineral Production
Group 06	Metals

⁵ VCS Methodology Development and Review Process, v4.3, 29 August 2023, Page 1

⁶ VCS Program Guide, V4.4, 29 August 2023, Page 1

Group 07	Chemical Production
Group 08	Oil and gas extraction, production and refining, including petrochemicals
Group 09	Waste

- Aster Global utilized Shawn McMahon (WRC non-peatlands, IFM, ALM, and REDD expert) and Barbara Toole O’Neil (Standardized Methods expert) as VCS-approved experts who participated in the comprehensive review. Aster Global also utilized an internal soil scientist, remote sensing expert, and forest biometricians with experience in relevant aspects of the methodology assessment.
- To date, Aster Global has completed greater than 18 VCS methodology validations under AFOLU and is currently assessing 3 additional VCS methodologies.

6 SIGNATURE

Signed for and on behalf of:

Name of entity: Aster Global Environmental Solutions, Inc.

Signature:



Name of signatory: Shawn McMahon

Date: 25 September 2023

7 APPENDIX A - FINDINGS

Item Number	1
Parameter (Description)	pj
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	<p>The assessment team discussed this parameter in a call with the Project Proponent. The Project Proponent stated that the intent of this parameter is to be broad, as it refers to the number of production units of commodities specific to a project, allowing flexibility for Project Proponents based on the commodities used. While the assessment team believes this approach is appropriate, the broad nature of the parameter and the broad allowable sources of data need more information to provide project proponents with more details on what source of data is allowable and clarification regarding which sources of data should be prioritized.</p> <p>Full closure of this item is pending resolution of findings pertaining to parameter H.</p>
Round NCR/CL/OFI	1
Round 1 Response from Methodology Developer	CL: Please update information for this parameter to provided additional clarification regarding allowable sources of data and their prioritization in use.
Aster Global Findings - Round 2	Have clarified priority of data sources in Step 1 and in parameter table
Round NCR/CL/OFI	2
Round 2 Response from Methodology Developer	CL: Please ensure consistent use of subscripts for parameters.
Aster Global Findings - Round 3	Revised subscripts to p j,h in parameter table to match equation 1
Aster Global Findings - Round 3	The assessment team confirmed revisions have been made to address this finding.

Item Number	2
Parameter (Description)	H
Requirement Met (Y, N or Pending)	Y

Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	<p>This parameter refers to the number of years within the historical reference period to determine within the project area, with a value between 3-5 to be chosen by the Project Proponent. It is unclear to the assessment team why the values between 3-5 were chosen.</p> <p>Additionally, it is unclear to the assessment team how Project Proponents are to determine the length of the historical reference period.</p>
Round 1 NCR/CL/OFI	<p>1</p> <p>CL: Please clarify how the number of years within the historical reference period (3-5) was determined, and provide verifiable evidence to substantiate.</p> <p>CL: Please clarify how the Project Proponent determines the length of the historical reference period and if there are any requirements for doing so.</p>
Round 1 Response from Methodology Developer	Have revised so that historical reference period is the greater of the three year period prior to project start (or project instance start) or one complete crop rotation if applicable.
Aster Global Findings - Round 2	The referenced equations using this parameter are incomplete.
Round 2 NCR/CL/OFI	<p>2</p> <p>CL: Please ensure complete referencing of equations within Data and Parameters.</p>
Round 2 Response from Methodology Developer	revised to refer to equations 1 and 3.
Aster Global Findings - Round 3	The assessment team confirmed revisions have been made to address this finding.

Item Number	3
Parameter (Description)	opj
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	See finding pertaining to parameter pj. Additionally, The parameter opj was not noted in Equation 2.
Round 1 NCR/CL/OFI	<p>1</p> <p>CL: See finding pertaining to parameter pj. CL: Please clarify where parameter opj is located.</p>
Round 1 Response from Methodology Developer	Have clarified that parameter opj is located in equation 3. Have not added revised language pertaining to pj as only acceptable sources of data are grower records or data derived from RS methods (neither is prioritized over the other)
Aster Global Findings - Round 2	opj is referred to as opjh in the relevant equations

Round NCR/CL/OFI	2	CL: Please ensure consistent use of subscripts for parameters.
Round 2 Response from Methodology Developer		Revised subscripts to o j,h in parameter table to match equation 1
Aster Global Findings - Round 3		The assessment team confirmed revisions have been made to address this finding.

Item Number	4	
Parameter (Description)	MP _{j,t}	
Requirement Met (Y, N or Pending)	Y	
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx	
Aster Global Initial Findings	See finding pertaining to parameter pj. Additionally, The parameter opj was not noted in Equation 2.	
Round NCR/CL/OFI	1	CL: See finding pertaining to parameter pj.
Round 1 Response from Methodology Developer	Have not added revised language pertaining to pj as only acceptable sources of data are grower records or data derived from RS methods. (neither is prioritized over the other). Parameter opj is not referenced in this parameter table.	
Aster Global Findings - Round 2	MP _{tt} is referred to as MP _{jt} in the relevant equations	
Round NCR/CL/OFI	2	CL: Please ensure consistent use of subscripts for parameters.
Round 2 Response from Methodology Developer	corrected to MP _{jt}	
Aster Global Findings - Round 3	The assessment team confirmed revisions have been made to address this finding.	

Item Number	5	
Parameter (Description)	r _j	
Requirement Met (Y, N or Pending)	Y	
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx	

<p>Aster Global Initial Findings</p>	<p>This parameter, presented as a percent, is the annual growth rate of commodity yields for a given commodity. Regional data from published studies or government statistics for the commodity should be used if available. Alternatively, data from FAOSTAT can be used. The assessment team determined that both the use of regional data, and in its absence, use of FAOSTAT are appropriate. If neither data source, is available, a default value of 2.5% can be used. The assessment team reviewed the rationale behind the establishment of this default value, listed in Appendix 2 of the module. Two articles are referenced (Fuglie Nin-Pratt, 2012 and Alexandratos and Bruinsma, 2012).</p> <p>Appendix 2 states "Analysis from the IFPRI indicates that the average agricultural growth rates in developing countries over the past 40 years have remained less than 2.5 percent for each decade with values ranging from 2.08 percent to 2.42 percent (Fuglie and Nin-Pratt, 2012)." While the assessment team substantiates that the use of 2.5% is a conservative and appropriate value, the assessment team reviewed Fuglie and Nin-Pratt, 2012 and found that the referenced values (2.08-2.42 percent) are for the "World" category, not developing countries.</p>
<p>Round 1 NCR/CL/OFI</p>	<p>1 CL: Please clarify how the text in Appendix 2 referencing the agricultural growth rates for "developing countries" is appropriate, when the values referenced from the Fuglie and Nin-Pratt, 2012 article are sourced from the "World" category.</p>
<p>Round 1 Response from Methodology Developer</p>	<p>Have corrected text to reference agricultural growth rates from "developing countries" to "globally"</p>
<p>Aster Global Findings - Round 2</p>	<p>rj has inconsistent definitions between equations.</p> <p>If using FAOSTAT to determine the annual growth rate of commodity yields, it is unclear what the beginning time point a user must select to derive a rate. The accompanying footnote contains readability issues; as a result, it was unclear to the assessment team how to follow the procedure to look up values on all referenced productivity data. The description in 5.1.1 of rj contains much more information on its calculation than in Data and Parameters; these procedures are unclear (i.e., is rj calculated as the annualized growth rate between yields at each time point, or as the average year over year change, expressed as a ratio). The description 5.1.1 also contains additional information on disaggregation of data used to calculate rj but this is not included in Data and Parameters.</p>
<p>Round 2 NCR/CL/OFI</p>	<p>2 CL: Please ensure consistent use of definitions for parameters. CL: Please add additional guidance to ensure consistent procedures for determining parameter when using FAOSTAT. OFI: Please clarify in Data and Parameters for rj, how the parameter value is calculated if using FAOSTAT data. CL: Please add additional guidance of determination of rj regarding disaggregation of government data.</p>
<p>Round 2 Response from Methodology Developer</p>	<p>have revised for consistent use of definitions, have added procedures and calculation if using FAOSTAT, and have added text re: disaggregation of govt data</p>

Aster Global Findings - Round 3	Assessment team has confirmed that Module developer now uses the same description of r_j throughout Module. Additionally, the module developer has added additional text in Data and Parameters for Parameter r_j in both the 'Source of data' and 'Description of measurement methods and procedures to be applied.'. This finding is closed.
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Item Number	6
Parameter (Description)	OMP _{j,t}
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	See finding pertaining to parameter p_j . Additionally, The parameter op_j was not noted in Equation 2.
Round 1 NCR/CL/OFI	1 CL: See finding pertaining to parameter p_j .
Round 1 Response from Methodology Developer	Have not added revised language pertaining to p_j as only acceptable sources of data are grower records or data derived from RS methods (neither is prioritized over the other). Parameter op_j is not referenced in this parameter table.
Aster Global Findings - Round 2	OMP _{tt} is referred to as OMP _{jt} in the relevant equations
Round 2 NCR/CL/OFI	2 CL: Please ensure consistent use of subscripts for parameters.
Round 2 Response from Methodology Developer	corrected to OP _{jt}
Aster Global Findings - Round 3	The assessment team confirmed revisions have been made to address this finding.

Item Number	7
Parameter (Description)	IS
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	Appendix 2 includes a justification for the default value of 75%, however, the assessment team does not have access to the analysis used to justify this default value.

Round NCR/CL/OFI	1	CL: Please provide the analysis conducted to justify the default value of 75%.
Round 1 Response from Methodology Developer		See attached analysis prepared by Zoey and reviewed by Greg Latta.
Aster Global Findings - Round 2		The file "Supporting Analysis for Share of Leakage.docx" provides evidence for a conservative value of 0.75. This finding is closed.
Round NCR/CL/OFI	2	
Round 2 Response from Methodology Developer		
Aster Global Findings - Round 3		
Round NCR/CL/OFI	3	
Round 3 Response from Methodology Developer		
Aster Global Findings - Round 4		No "Source of data" is included for this parameter.
Round NCR/CL/OFI	4	CL: Please ensure completeness of Data and Parameters.
Round 4 Response from Methodology Developer		have corrected
Aster Global Findings		The Source of Data for parameter IS now complete. This finding is closed.

Item Number	8
Parameter (Description)	y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	<p>The assessment team determined that using national productivity data from published studies or government statistics if available or FAOSTAT if not, is appropriate.</p> <p>However, in the "Description of measurement methods and procedures to be applied" box, it is stated that data from the year closest to the year for which leakage emissions are being calculated SHOULD be used. Based on this language, it is unclear to the assessment team if project proponents will have the option to not use the data from the closest year.</p>
Round NCR/CL/OFI	1
Round 1 Response from Methodology Developer	CL: Please clarify if project proponents can decide whether or not to use the data from the closest year for which leakage emissions are being calculated. Have changed to MUST be used

Aster Global Findings - Round 2	y is referred to as y _{jt} in the relevant equations
Round NCR/CL/OFI	2
Round 2 Response from Methodology Developer	revised to reference y _{j,t} in the parameter table
Aster Global Findings - Round 3	The assessment team confirmed revisions have been made to address this finding.

Item Number	9
Parameter	ΔCBiomass
(Description)	
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	
Round NCR/CL/OFI	1
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	It is unclear what the two comparisons are to derive the delta component of the parameter. It is unclear why it is assumed that forest biomass is 125% of aboveground biomass stocks. For example, IPCC GPG LULUCF suggests using Cairns equations to estimate belowground biomass (Table 4.A.4), and failing that, states it is good practice to then defer to Table 3A1.8 which lists ratios of aboveground to belowground biomass ratios between 0.20 and 3.95 across different vegetation types. Further, its unclear if forest biomass stocks refers only to aboveground woody biomass or addtl components (e.g. non-woody biomass and litter). In the Source of Data, it is allowed to use Table 3A.1.4 in IPCC GPG LULUCF; however, this tool is based on the CDM AR-Tool15 which considers the values in Table 3A.1.4 in IPCC GPG LULUCF to be representative of tree aboveground biomass only.
Round NCR/CL/OFI	2
	CL: Please explain how it is determined that underground biomass stocks are 25% of aboveground forest biomass. CL: Please provide clear language defining what pools constitute forest biomass. In particular, address why this Leakage tool interprets values in Table 3A.1.4 as representative of all aboveground forest biomass pools in incongruence with AR-Tool15.

Round 2 Response from Methodology Developer	Have revised from default value of 0.25 to instead require use of Table 4.A.4 of the IPCC GPG 2003 unless verifiable evidence can justify a different value. Have also added further text in the procedures and parameter table to clarify that this value should also include estimates of carbon stored in dead wood and litter pools (by applying a conservative factor of 1.1 to tree biomass if only tree biomass data is available)
Aster Global Findings - Round 3	Cairns equations are now used to determine root to shoot ratio of aboveground biomass stocks. Table 3A.1.4 is now only presented as standing live woody biomass stocks. Third, an additional calculation step was added to estimate litter and dead wood as a proportion of above-and belowground woody biomass stocks. These changes are appropriate.

Item Number	10
Parameter (Description)	fLU, fMG, fIN
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	
Round 1 NCR/CL/OFI	1
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	The referenced equations using this parameter are incorrect.
Round 2 NCR/CL/OFI	2
Round 2 Response from Methodology Developer	Have corrected parameter table to reference eq 9
Aster Global Findings - Round 3	The correct equation is listed for this parameter. This finding is closed.

Item Number	11
Parameter (Description)	Eq. 1
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx

Aster Global Initial Findings	
Round NCR/CL/OFI	1
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	t is undefined in "where"
Round NCR/CL/OFI	2
Round 2 Response from Methodology Developer	Have defined t
Aster Global Findings - Round 3	Assessment team has confirmed that Module developer has defined t. Finding is closed.

Item Number	12
Parameter (Description)	Eq. 4
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	
Round NCR/CL/OFI	1
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	t is undefined in "where"
Round NCR/CL/OFI	2
Round 2 Response from Methodology Developer	Have defined t
Aster Global Findings - Round 3	Assessment team has confirmed that Module developer has defined t. Finding is closed.

Item Number	13
Parameter (Description)	Eq 5.
Requirement Met (Y, N or Pending)	Y

Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	
Round 1 NCR/CL/OFI	
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	The accompanying text "And where the minimum value of $I_{(j,t)}$ is zero." describes a calculation outside of the equation
Round 2 NCR/CL/OFI	OFI: Consider incorporating the accompanying text into the equation.
Round 2 Response from Methodology Developer	have moved text into definitions of I and revised equation
Aster Global Findings - Round 3	Assessment team has confirmed that Module developer has incorporated the opportunity for improvement. Finding is closed.

Item Number	14
Parameter (Description)	Eq. 6
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	
Round 1 NCR/CL/OFI	
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	The definition of $y_{j,t}$ substantially differs from the definition of y_{jt} in Data and Parameters
Round 2 NCR/CL/OFI	CL: Please ensure consistency of parameter definitions.
Round 2 Response from Methodology Developer	definitions are now consistent
Aster Global Findings - Round 3	Assessment team has confirmed that Module developer has consistently described y_{jt} . Finding is closed.

Item Number	15
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Parameter (Description)	Eq. 7
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	
Round 1 NCR/CL/OFI	1
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	Eq 7 does not make clear what the subscript j refers to.
Round 2 NCR/CL/OFI	2
Round 2 Response from Methodology Developer	have corrected to refer to commodity j
Aster Global Findings - Round 3	Assessment team has confirmed that Module developer has made appropriate changes to close the finding.

Item Number	16
Parameter (Description)	Eq 8.
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	
Round 1 NCR/CL/OFI	1
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	It is not clear as written whether $\Delta C_{biomass}$ should be in units of biomass per ha or units of carbon mass per ha It is not clear why CS has no units in its description
Round 2 NCR/CL/OFI	2
Round 2 Response from Methodology Developer	CL: Please ensure differentiation biomass stocks from carbon stocks. CL: Please ensure consistency of parameter definitions. CL: Please ensure consistent definitions of units have changed to tree biomass stocks in equation and parameter table and included units of CS in the equation

Aster Global Findings - Round 3	The assessment team notes that the leakage Module has changed $\Delta C_{biomass}$ from carbon stored in forest biomass to carbon stock in tree biomass. The assessment team asks the Module developer to consider whether this narrowed definition may have non-conservative implications for determining leakage.
Round 3 NCR/CL/OFI	CL: Please clarify in line with assessor findings.
Round 3 Response from Methodology Developer	have reverted to "forest biomass"; have clarified pools and included additional text and procedures in the parameter table to apply a factor of 1.1 (per CDM AR-Tool 15) to data that represents biomass only to account for carbon stored in dead wood and litter pools if data referenced includes biomass only.
Aster Global Findings - Round 4	The assessment team notes that the leakage Module has reverted $\Delta C_{biomass}$ from carbon stored in forest biomass to carbon stock in tree biomass, back to carbon stored in forests. The leakage module uses a default 0.50 ratio of carbon to biomass. However, CDM AR-Tool 15, version 2.0, of which informed the development of this module, as well as the ARR Methodology currently under development use a value of 0.47.
Round 4 NCR/CL/OFI	CL: Please clarify how it is appropriate to use 0.50 as a carbon-in-biomass proportion.
Round 4 Response from Methodology Developer	have changed to 0.47 to match values applied by new ARR meth
Aster Global Findings	The assessment team confirms 0.47 has replaced 0.50 as the carbon fraction. The example calculations in the Module have also been updated to incorporate this change. This finding is closed.

Item Number	17
Parameter (Description)	Eq 9.
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	
Round 1 NCR/CL/OFI	
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	ΔSOC has a different definition than in Eq 9 It is unclear why the source of data is located in the Equation's definition of fLU , fMG , and fIN . It is unclear why delta SOC has no units in its description
Round 2 NCR/CL/OFI	CL: Please ensure sources of data are not listed in "where" CL: Please ensure consistency of parameter definitions. CL: Please ensure consistent definitions of units

Round 2 Response from Methodology Developer	Have removed sources of data from where. Have revised for consistency in definitions and units.
Aster Global Findings - Round 3	Assessment team has confirmed that Module developer has made appropriate changes to close the finding.

Item Number	18
Parameter (Description)	Eq. 10
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	ARR Leakage Tool_Rev_29April2022_clean.docx
Aster Global Initial Findings	
Round 1 NCR/CL/OFI	1
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	t is undefined in "where" The definition of CS in this equation is different than the definition of CS in Eq 8
Round 2 NCR/CL/OFI	2 CL: Please define t in "where" CL: Please ensure consistency of parameter definitions.
Round 2 Response from Methodology Developer	have revised definition of CS and added definition of t
Aster Global Findings - Round 3	Assessment team has confirmed that Module developer has defined t. However, the revision for CS' definition in Eq 10 created a grammatical issue: "Change in carbon stock in change in carbon stocks on new lands brought into production (t C ha ⁻¹)".
Round 3 NCR/CL/OFI	3 CL: Please correct the definition of CS in Eq 10.
Round 3 Response from Methodology Developer	Have corrected definition of CS to remove duplicate words
Aster Global Findings - Round 4	CS' definition is corrected. This finding is closed.

Item Number	19
Parameter (Description)	TITLE PAGE: Complete all items in the box on the title page using Arial or Century Gothic 10.5 point, black, regular (non-italic) font. This box must appear on the title page of the final document. Methodologies may also feature the project title and preparers' name, logo and contact information more prominently on the title page, using the format below (Arial or Century Gothic 24 point and Arial or Century Gothic 12 point, black, regular font).

Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Title Page
Aster Global Initial Findings	<p>Title page has fonts in a dark gray font.</p> <p>Contact info is in 13-point font size; however, that is the same as the template displays, so either size is appropriate.</p> <p>Some early paragraphs are justified, while most later ones are left aligned.</p>
Round 1 NCR/CL/OFI	<p>1 CL: Please revise color of font to black per the template requirements.</p> <p>Please justify all paragraphs to aid in readability and consistency throughout the document.</p>
Round 1 Response from Methodology Developer	Have corrected font color on title page and left justified all paragraphs for consistency.
Aster Global Findings - Round 2	Template is not the same as the most recent version (v4.1), resulting in differences, e.g. field mismatches between draft and template, different font sizes and font sets.
Round 2 NCR/CL/OFI	2 CL: Please update template.
Round 2 Response from Methodology Developer	Template has been updated
Aster Global Findings - Round 3	<p>Template is not the same as the most recent version (v4.1), resulting in differences, e.g. field mismatches between draft and template, different font sizes and font sets. For illustration, see the title page in the template v4.1.</p> <p>Further, there is interchangeable terminology throughout of module versus tool, which are two distinct VCS-defined purposes. See header of Section 2 and included text, for example.</p>
Round 3 NCR/CL/OFI	3 CL: Please update template and ensure the use of tool is removed throughout the document.
Round 3 Response from Methodology Developer	Have replaced "tool" with "module" throughout where appropriate
Aster Global Findings - Round 4	<p>The module now consistently terms itself as a module.</p> <p>Template is not the same as the most recent version (v4.1), resulting in differences, e.g. field mismatches between draft and template, different font sizes and font sets. For illustration, see the title page in the template v4.1.</p>
Round 4 NCR/CL/OFI	4 CL: Please update template.
Round 4 Response from Methodology Developer	will be completed by verra

Aster Global Findings	Verra has completed a technical review and while the formatting does not align with the template, it is consistent with recently published modules. Item closed.
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Item Number	20
Parameter (Description)	Report Body: Unless applying a merited deviation, please complete all sections using Arial or Franklin Gothic Book 10.5 point, black, regular (non-italic) font.
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Entire Module
Aster Global Initial Findings	Section 1, 3 & 7 are Arial (Body), while the remaining sections are Franklin Gothic Book.
Round 1 NCR/CL/OFI	CL: Please revise whichever sections to make fonts consistent.
Round 1 Response from Methodology Developer	Have corrected to use Franklin Gothic Book throughout
Aster Global Findings - Round 2	Equation numbers are not aligned. Font color alternates between grey and black. Elements in equation "where" section are not consistently aligned.
Round 2 NCR/CL/OFI	CL: Please revise color of font to black per the template requirements. CL: Please justify all paragraphs to aid in readability and consistency throughout the document. Ensure all paragraphs, equations, and equations numbers are correctly aligned.
Round 2 Response from Methodology Developer	Fonts have been revised and equations aligned
Aster Global Findings - Round 3	The module developer has made sufficient proofing and typesetting changes to close the finding.

Item Number	21
Parameter (Description)	Relationship to Approved or Pending Methodologies
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Table 1

Aster Global Initial Findings		<p>Table 1 in the overall Methodology for Afforestation, Reforestation and Revegetation Projects already contains similar overall methodologies.</p> <p>Table 1 in the Leakage Module should not mirror that table but include similar or equivalent leakage tools/modules in VCS or CDM that already exist (e.g., AR-Tool 15), and explain whether an existing module could be reasonably revised to meet the objective of this proposed new module. It appears the intent of Table 1 is not currently met.</p>
Round NCR/CL/OFI	1	CL: Please address the comment, and ensure Table 1 of the leakage module incorporates the required explanations, or provide input from Verra on the intent of this table to justify the explanation of what is already written.
Round 1 Response from Methodology Developer		Have corrected to reference the CDM AR Leakage Tool
Aster Global Findings - Round 2		The table has been appropriately updated to reference the CDM AR Tool 15, which is used as part of AR-ACM003. Item closed.

Item Number		22
Parameter (Description)		Contents
Requirement Met (Y, N or Pending)		Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)		Contents
Aster Global Initial Findings		The table of contents page has some minor formatting issues.
Round NCR/CL/OFI	1	CL: Please ensure the TOC is updated prior to sending a revised leakage module document.
Round 1 Response from Methodology Developer		Will do on submission
Aster Global Findings - Round 2		Table of contents does not reference correct pages. Appendix labels use a dash to separate appendix number from title of appendix but template uses colon.
Round NCR/CL/OFI	2	CL: Please ensure the TOC is updated prior to sending a revised leakage module document.
Round 2 Response from Methodology Developer		Have changed dash to colon and updated TOC
Aster Global Findings - Round 3		The appendix labels have been corrected, and the page numbers in the ToC corrected. However, the ToC does not contain the revised appendix labels.
Round NCR/CL/OFI	3	CL: Update the ToC during final revision.
Round 3 Response from Methodology Developer		will be completed by verria

Aster Global Findings - Round 4	The assessment team notes that the ToC still does not reference the correct pages. The onus will be on Verra to ensure an appropriate ToC in the final module. Item closed.
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Item Number	23
Parameter (Description)	VCS Methodology: VCS Version 4.0 Header
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Header
Aster Global Initial Findings	<p>The VCS header logo is used. It's unclear if the intent of the embedded header text to the far right is to be changed by a Module Developer. However, since no explicit requirement is described in the template, a Finding was not issued on that item.</p> <p>The Final title/number of the tool should be confirmed before final assessment, as it is now currently in draft (Tool XXX) form.</p>
Round 1 NCR/CL/OFI	1
Round 1 Response from Methodology Developer	
Aster Global Findings - Round 2	
Round 2 NCR/CL/OFI	2
Round 2 Response from Methodology Developer	
Aster Global Findings - Round 3	
Round 3 NCR/CL/OFI	3
Round 3 Response from Methodology Developer	
Aster Global Findings - Round 4	The assessment team confirmed the title/number have been included in the provided version of the module. Item closed.

Item Number	24
Parameter (Description)	1 Sources This methodology uses the latest versions of the following <modules/tools>:
Requirement Met (Y, N or Pending)	Y

Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Sources
Aster Global Initial Findings	The Sources are listed. The section number did not appear to carry over.
Round 1 NCR/CL/OFI	1 CL: Please ensure the section is numbered.
Round 1 Response from Methodology Developer	Section is numbered (1)
Aster Global Findings - Round 2	Sources require existing methodologies on which this tool is based, but the ARR Methodology is not listed.
Round 2 NCR/CL/OFI	2 OFI: Consider listing the associated ARR methodology.
Round 2 Response from Methodology Developer	Have added placeholder; will add relevant VM number once assigned
Aster Global Findings - Round 3	The assessment team notes that a placeholder for the ARR Methodology under Review has been added in Section 1. This finding remains open until the placeholder has been finalized.
Round 3 NCR/CL/OFI	3 CL: List the associated ARR methodology when finalized.
Round 3 Response from Methodology Developer	
Aster Global Findings - Round 4	This item is addressed in the most recent version provided to the assessment team.

Item Number	25
Parameter (Description)	2 Summary Description Provide a brief summary description of the module, including the main/any procedural steps. The summary should be kept concise.
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Summary Description
Aster Global Initial Findings	The summary description is sufficient, but the section number did not appear to carry over.
Round 1 NCR/CL/OFI	1 CL: Please ensure the section is numbered.
Round 1 Response from Methodology Developer	Section is numbered (2)
Aster Global Findings - Round 2	Summary description is sufficient and section number is corrected. Finding is closed.

Item Number	26
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Parameter (Description)	3 Definitions Using the format in the example below, provide, in alphabetical order, definitions of key terms and acronyms that are used in the methodology. Ensure all defined terms are used in the methodology. Do not include terms already defined under the VCS Program.
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Section 3, Definitions
Aster Global Initial Findings	The Definitions section appears unfinished, only containing two entries. The section number did not appear to carry over.
Round NCR/CL/OFI 1	CL: Please clarify if the Definitions section is complete, as written. If not, please ensure it includes all key terms and acronyms used in the module. Please ensure the section is numbered.
Round 1 Response from Methodology Developer	Definitions are completed (acronyms and definition for subsistence commodity added). Section is numbered (3)
Aster Global Findings - Round 2	All pertinent definitions are now listed. Finding is closed.

Item Number	27
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Round NCR/CL/OFI	1	<p>CL: Please ensure the section is numbered.</p> <p>OFI: Please consider revising the paragraph under the Applicability Conditions to be more consistent with the template, i.e.:</p> <p>"This module applies to... This module is applicable under the following conditions: • <Condition> • <Condition> • ... This module is not applicable under the following conditions: • <Condition> • ..."</p>
Round 1 Response from Methodology Developer		Section is numbered (4). Have revised wording of paragraph as suggested (bullet point to be added after accepting changes).
Aster Global Findings - Round 2		This section is appropriately numbered. The OFI has been addressed, with the module developer opting to utilize the template format. Item closed.

Item Number	28
Parameter (Description)	<p>5 PROCEDURES</p> <p>Describe, in detail, the procedures established by the module. Follow the instructions provided in any relevant sections of the VCS Methodology Template (e.g., project boundary, baseline scenario, additionality and quantification of GHG emission reductions and removals).</p>
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Procedures
Aster Global Initial Findings	<p>The section number did not appear to carry over.</p> <p>The procedures are described, pending other Findings related to content.</p>
Round NCR/CL/OFI	1
Round 1 Response from Methodology Developer	Section is numbered
Aster Global Findings - Round 2	Step 5.1.1 contains the following text: "Where historical production records for the project area do not exist, use regional (sub-national) average values derived from published census data. If these are not available, use regional or national average values derived from published census data". The two statements appear partially duplicative.
Round NCR/CL/OFI	2
Round 2 Response from Methodology Developer	Have revised to clarify
Aster Global Findings - Round 3	The assessment team confirmed that revision have been made to improve clarity.

Item Number	29
Parameter (Description)	6 DATA AND PARAMETERS
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Data and Parameters
Aster Global Initial Findings	The section number did not appear to carry over.
Round NCR/CL/OFI	1 CL: Please ensure the section is numbered.
Round 1 Response from Methodology Developer	Section is numbered
Aster Global Findings - Round 2	This section is appropriately numbered. Item closed.

Item Number	30
Parameter (Description)	7 REFERENCES: Include any references relevant to the methodology.
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	References
Aster Global Initial Findings	The section number did not appear to carry over.
Round NCR/CL/OFI	1 CL: Please ensure the section is numbered.
Round 1 Response from Methodology Developer	Section is numbered
Aster Global Findings - Round 2	References section contains references not contained in-text.
Round NCR/CL/OFI	2 CL: Please ensure completeness of references with no uncited references.
Round 2 Response from Methodology Developer	Removed Gibbs and Murray references
Aster Global Findings - Round 3	The assessment team confirmed that references that appear in Section 7 but not in-text have been removed. However, references (e.g. IPCC 2003, 2019) occur in-text but are not located in Section 7.
Round NCR/CL/OFI	3 CL: Please ensure completeness of references with no uncited references.

Round 3 Response from Methodology Developer	Have added IPCC 2003 and 2019 references to section 7
Aster Global Findings - Round 4	Module developer has added Penman et al. 2003 and Buendia et al. 2019 to 7 REFERENCES. However, when these respective sources are referenced elsewhere in the documented, the in-text citation are "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories" and "IPCC GPG-LULUCF 2003".
Round 4 NCR/CL/OFI	4 CL: Please ensure the in-text citations match the same Author-Year as is listed in 7 References.
Round 4 Response from Methodology Developer	have corrected referemces so that sconsistently refers to the relevant IPCC report
Aster Global Findings	The Reference section now correctly references in-text citations. This finding is closed.

Item Number	31
Parameter (Description)	APPENDIX X: <TITLE OF APPENDIX> Use appendices for supporting information. Delete this appendix (title and instructions) where no appendix is required.
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Appendix B of Main Methodology
Aster Global Initial Findings	APPENDIX B: TESTING THE SIGNIFICANCE OF CARBON POOLS AND GHG EMISSIONS is included in the overall methodology, but it would be beneficial to also include here, where relevant.
Round 1 NCR/CL/OFI	1 OFI: Consider including the same appendix (Appendix B) from the overall methodology that includes methods for estimating significance, for ease of readership and document navigation.
Round 1 Response from Methodology Developer	Done. Referenced now in section 5.2.6
Aster Global Findings - Round 2	Exclusion of Appendix B creates a dependency of the tool on the ARR Methodology.
Round 2 NCR/CL/OFI	2 OFI: Consider including the same appendix (Appendix B) from the overall methodology that includes methods for estimating significance, for reasons of methodological independence of the tool.
Round 2 Response from Methodology Developer	Have elected not to include App b in tool as tool is currently intended only for use with ARR projects and Verra does not intend to develop any other ARR methodologies
Aster Global Findings - Round 3	Module developer has declined to include appendix B and provided sufficient reasoning for their decision. This finding is closed.

8 APPENDIX B – DOCUMENTS RECEIVED

Name	Received
VCS ARR Methodology 3May2022 CLEAN (1).pdf	6/10/2022
Versions before public consultation	6/10/2022
ARR Leakage Tool_Rev_31March2022.docx	6/10/2022
VCS ARR Methodology (1).docx	6/10/2022
ARR Leakage Tool (1).docx	6/10/2022
VCS ARR Methodology 3May2022 CLEAN (1).docx	6/10/2022
ARR Leakage Tool_Rev_31March2022.pdf	6/10/2022
VCS ARR Methodology APPENDIX 11May2022 CLEAN (2).pdf	6/10/2022
ARR Methodology and Leakage Tool Public Consultation comments DTS and SS responses_08 June 2022.xlsx	7/20/2022
ARR_performance benchmark demo 21Jun2022.xlsx	7/21/2022
Versions Before Public Consultation	7/21/2022
ARR Leakage Tool (1).docx	7/21/2022
VCS ARR Methodology (1).docx	7/21/2022
ARR Leakage Tool_Rev_29April2022_clean.docx	8/3/2022
VCS ARR Methodology 12Aug2022 rev.docx	8/15/2022
VCS ARR Methodology APPENDIX 12Aug2022 CLEAN.docx	8/15/2022
VCS ARR Methodology APPENDIX 12Aug2022.docx	8/15/2022
RE_22036.00_-_Performance_Benchmark_Example	8/29/2022
ARR_PB_over_time.csv	8/29/2022
WLS_ARR_over_time_20220818.R	8/29/2022
ARR_performance benchmark demo 17Aug2022.xlsx	9/7/2022
VCS ARR Methodology 12Aug2022 rev CLEAN.docx	9/28/2022
Verra ARR	12/22/2022
expert consult	12/22/2022
leakage tool	12/22/2022
SOC loss	12/22/2022
Calhoun demo.xls	12/22/2022
Mobley_ML2015 Surficial_gains_and_subsoil_losses_of_so.pdf	12/22/2022
Open Notebook.onetoc2	12/22/2022
Richter et al 1999.pdf	12/22/2022
VCS ARR Methodology APPENDIX Oct2022rev.docx	12/22/2022
ARR Expert Consultation Report.docx	12/22/2022
Smith et al demo.xls	12/22/2022
FCI WG Baselines_Additionality and Jurisdictional_Landscape Approaches Background Paper - updated with key takeaways .docx	12/22/2022
Forest Carbon Innovations TOR 2020 6 25.docx	12/22/2022
Key takeaways from FCI WG meeting #9.docx	12/22/2022

VCS ARR Methodology Oct2022rev.docx	12/22/2022
Meeting #9 - ARR & agroforestry.pdf	12/22/2022
Open Notebook.onetoc2	12/22/2022
VCSAF_ARR_MethodologyReview_20220126.pdf	12/22/2022
Blanco-Canqui and Wortmann - 2020 - Does occasional tillage undo the ecosystem service.pdf	12/22/2022
VCS ARR Methodology rev1Oct CLEAN_gl_dts.docx	12/22/2022
VCS ARR Methodology rev1Oct CLEAN_SCP DTS.docx	12/22/2022
Conant et al. - 2007 - Impacts of periodic tillage on soil C stocks A sy.pdf	12/22/2022
Crawford et al. - 2014 - Changes in the soil quality attributes of continuo.pdf	12/22/2022
Cooper et al 2016.pdf	12/22/2022
Dynarski et al. - 2020 - Dynamic Stability of Soil Carbon Reassessing the .pdf	12/22/2022
Kettler et al. - 2000 - Soil Quality Assessment after Weed-Control Tillage.pdf	12/22/2022
Kirkegaard et al. - 2020 - Strategic tillage of a long-term, no-till soil has.pdf	12/22/2022
Open Notebook.onetoc2	12/22/2022
22036.00 Leakage Module Preliminary Round 1 Findings_with_Public_Comments_SS.xlsx	12/22/2022
VandenBygaart and Kay - 2004 - Persistence of Soil Organic Carbon after Plowing a.html	12/22/2022
Appendix 1 - Leakage Example_20 December.xlsx	12/22/2022
ARR Leakage Tool_Rev_20 December.docx	12/22/2022
Open Notebook.onetoc2	12/22/2022
Wortmann et al. - 2010 - One-Time Tillage of No-Till Crop Land Five Years P.html	12/22/2022
Supporting Analysis for Share of Leakage .docx	12/22/2022
weighting demo.xlsx	12/27/2022
22036.00_Verra ARR Methodology Assessment_Round 1 Findings_Revised TC responses.xlsx	1/4/2023
SOC recovery tillage.xlsx	1/4/2023
expert consult	1/25/2023
leakage tool	1/25/2023
SOC loss	1/25/2023
Blanco-Canqui and Wortmann - 2020 - Does occasional tillage undo the ecosystem service.pdf	1/25/2023
SOC recovery tillage.xlsx	1/25/2023
Conant et al. - 2007 - Impacts of periodic tillage on soil C stocks A sy.pdf	1/25/2023
Cooper et al 2016.pdf	1/25/2023
Crawford et al. - 2014 - Changes in the soil quality attributes of continuo.pdf	1/25/2023
Dynarski et al. - 2020 - Dynamic Stability of Soil Carbon Reassessing the .pdf	1/25/2023
Kettler et al. - 2000 - Soil Quality Assessment after Weed-Control Tillage.pdf	1/25/2023
VandenBygaart and Kay - 2004 - Persistence of Soil Organic Carbon after Plowing a.html	1/25/2023
Wortmann et al. - 2010 - One-Time Tillage of No-Till Crop Land Five Years P.html	1/25/2023
Kirkegaard et al. - 2020 - Strategic tillage of a long-term, no-till soil has.pdf	1/25/2023
ARR Leakage Tool_Rev_20 December.docx	1/25/2023

Supporting Analysis for Share of Leakage .docx	1/25/2023
Forest Carbon Innovations TOR 2020 6 25.docx	1/25/2023
Key takeaways from FCI WG meeting #9.docx	1/25/2023
Meeting #9 - ARR & agroforestry.pdf	1/25/2023
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VCS ARR Methodology rev1Oct CLEAN_gl_dts.docx	1/25/2023
VCSAF_ARR_MethodologyReview_20220126.pdf	1/25/2023
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Calhoun demo.xls	1/25/2023
Smith et al demo.xls	1/25/2023
22036.00_Verra ARR Methodology Assessment_Round 1 Findings_Revised TC responses add Jan23.xlsx	1/25/2023
VCS ARR Methodology Jan2023rev.docx	1/25/2023
22036.00 Leakage Module Preliminary Round 1 Findings_with_Public_Comments_SS.xlsx	1/25/2023
VCS ARR Methodology APPENDIX Jan2023rev.docx	2/15/2023
VCS ARR Methodology APPENDIX 11May2022 CLEAN (2).docx	2/27/2023
VCS ARR Methodology APPENDIX Jan2023rev CLEAN.docx	2/28/2023
Appendix 1 - Leakage Example_20 December.xlsx	3/2/2023
VCS ARR Methodology Jan2023rev CLEAN.docx	3/8/2023
Round 2	3/13/2023
Round 2 Versions_Unformatted_Originals	3/13/2023
lieurance2018.pdf	3/13/2023
Past_as_prologue_An_innovation-diffusion_approach_.pdf	3/13/2023
22036.00_Verra ARR Methodology Assessment_Round 2 Findings TC response.xlsx	3/13/2023
VCS ARR Methodology APPENDIX round 2 rev_formatted.docx	3/13/2023
VCS ARR Methodology round 2 rev.docx	3/13/2023
VCS ARR Methodology round 2 rev_formatted.docx	3/13/2023
VCS ARR Methodology APPENDIX round 2 rev.docx	3/13/2023
Round 2 Revision	3/21/2023
ARR Leakage Tool_Marked and Unformatted_20 March.docx	3/21/2023
ARR Leakage Module_Formatted_20 March.docx	3/22/2023
22036.00_Verra ARR Methodology Assessment_Round 2 Findings TC_SP response_.xlsx	3/27/2023
22036.00 Leakage Module Round 2 Findings_TC responses.xlsx	4/13/2023
22036.00 Leakage Module Round 3 Findings Final 20230404_TC.xlsx	4/27/2023
22036.00_Verra ARR Methodology Assessment_Round 3_draft_20230423_TC responses.xlsx	4/27/2023

ARR Leakage Module_TC_Marked_April 9.docx	4/27/2023
VCS ARR Methodology round 3 rev.docx	4/27/2023
VCS ARR Methodology APPENDIX round 3 rev.docx	4/27/2023
nfu-rsx-gyp (2023-04-25 14 19 GMT-4).mp4	4/27/2023
VCS ARR Methodology round 3 rev 5May2023.docx	5/8/2023
ARR Leakage Module_Marked_May 12.docx	5/15/2023
ARR Leakage Module_Marked_May 15.docx	5/17/2023
22036.00 Leakage Module Round 4 Findings Final 20230515_TC.xlsx	5/17/2023
22036.00 Leakage Module Round 4 Findings Final 20230515 TC responses.xlsx	6/12/2023
ARR Leakage Module round 4 rev_SP_20230612.docx	6/12/2023
VCS ARR Methodology APPENDIX round 4 rev.docx	6/12/2023
VCS ARR Methodology round 4 rev_SP20230609.docx	6/12/2023
VCS ARR Methodology round 4 rev_SP20230609 DTS.docx	6/16/2023
VCS ARR Methodology round 4 rev_SP20230609 DTS20230619.docx	6/22/2023
ARR_Leakage Module_VVB_FinalReview.docx	8/16/2023
ARR_Methodology_VVB_FinalReview_20230816.docx	8/23/2023
22036.00_Verra ARR Methodology Assessment_Round 4_20230522 TC responses 20230612.xlsx	8/28/2023
ARR_Methodology_VVB_FinalReview_20230829.docx	8/30/2023
ARR Table 1_ Annotated .docx	8/30/2023
ARR_Methodology_VVB_FinalReview_20230830.docx	9/1/2023
ARR_Methodology_VVB_FinalReview_20230906.docx	9/7/2023
22036.00 ARR Meth Docs List.xlsx	9/12/2023
query (5).iqy	9/12/2023
ARR_Methodology_VVB_FinalReview_20230915.docx	9/22/2023
VMD0054_ARR_Leakage Module_VVB Review_Final_20230922.docx	9/22/2023
ARR_Methodology_VVB_FinalReview_20230915.docx	9/25/2023
VM0047_ARR_Methodology_VVB Review_Final.pdf	9/25/2023
VMD0054_ARR_Leakage Module_VVB Review_Final.pdf	9/25/2023

9 APPENDIX C – PUBLIC COMMENT

Item Number	32
Section	
Commenter	Caio Gallego
Comment Number	1
Public Comment	The development of the tool for leakage accounting by Verra is proposing to bring a more standardized and simplified approach to CDM methodology. Thus, it is understood that the tool will not only capture the displacement leakage from activities, but will also include market effects. We understand that the tool is still being refined, but, so far, it is plausible to attribute greater detail on how market effects may imply more or less leakage from the project. Furthermore, while the tool is not ready, should the project proponent apply the CDM method?
Response from Methodology Developer	Yes, project proponents may use the CDM method. Based on Section 9.4 of the VCS Methodology Approval Process, once the new VCS leakage tool is ready, the CDM tool may be used for a grace period established by Verra (up to 12 months). Beyond the end of the grace period, projects must only use the new VCS leakage tool.
Aster Global Round 1 Findings	The commenter requested additional detail on quantifying market leakage from the tool and asked about usage of the CDM tool. The developer addressed the CDM tool but did not demonstrate how due account was taken of the request for more market leakage detail.
Round NCR/CL/OFI	1 CL: Please demonstrate how you assessed the request for additional detail on market leakage in the tool.
Round 1 Response from Methodology Developer	The new tool provides detail on the procedures and parameters (and underlying rationale) to quantify all leakage; no distinction is made between market vs. activity based leakage. No further change to the tool are necessary.
Aster Global Findings - Round 2	The Methodology Developer stated no elaboration of how market effects may imply more or less leakage because market-based leakage is implicitly included in the tool, though not explicitly distinguished.

Item Number	33
Section	
Commenter	Caio Gallego
Comment Number	2
Public Comment	The proposed methodology makes no reference to the guidelines applicable to grouped projects in the first instance. Even though there are no significant differences in the use of the methodology, we emphasize the fact that, at the very least, a guideline should be included on how to use it in grouped projects. Still, the new proposal does not contemplate how the leakage calculation will be performed in the scope of grouped projects, for example: should it be done for each project area and an average should be calculated? Furthermore, when new areas are included in the project, should the calculation be reviewed? We would like to emphasize the need to include a guideline to use the tool for leakage calculation in grouped projects.

Response from Methodology Developer	The leakage tool will be revised. The new approach will be based on the amount of production that is displaced in the project area, and will not require any special guidance to incorporate new areas (project instances) that are added to a grouped project
Aster Global Round 1 Findings	Since grouped projects will bring in new lands many years post the project start date, it is unclear how simply quantifying displacement based on the set 5-year baseline takes due account of the comment.
Round 1 NCR/CL/OFI	CL: Please demonstrate how quantifying displacement is sufficient for grouped projects, per the comment.
Round 1 Response from Methodology Developer	See attached example with two instances, have revised tool so that historical reference period for displaced production is tied to the project instance start date, and so that monitoring of leakage continues for 5 years after the date of the last instance.
Aster Global Findings - Round 2	Revisions to the text now clarify how grouped instances alter the calculation of leakage

Item Number	34
Section	5.1.1
Commenter	Leon-Jacques Theron
Comment Number	3
Public Comment	<p>What is the reasoning for using a national average (rather than a sub-national regional average)? Using a national average rather than a regional average may not make much sense in countries with highly heterogeneous ecosystems, climates, forest management practices, etc. Unless you have actors with the flexibility to displace their activities at a national scale (e.g., medium-to-large corporations or individuals with access to sufficient capital for such activities), it may not make sense to compare local productivity to national productivity. Where resources are scarce and mobility/flexibility is limited, those whose activities are displaced from the project area may be more likely to move to the closest highest productivity land available in the immediate surroundings of the project area. Using a national average relies on the assumption that activities displaced from the project area could move to any other part of the country, which may not be a valid assumption under conditions of heterogeneous land characteristics and limited access to capital as mentioned above. As far as market leakage, a national scale may make sense, but this will be contextdependent and should be reviewed on a case-by-case basis; it will depend on the specific product as well as supply chains and actors and how well articulated a given region's production is with the national market. I think this will differ greatly between countries depending on their wealth and the state of their economies. Furthermore, what if the baseline activity is activities such as firewood extraction or charcoal production that are illegal and for which no national production data exists? Also, if for example the baseline activity is subsistence-driven, comparing it to a national average inflated with commercial production could artificially lower the risk of leakage.</p>

Response from Methodology Developer	The tool will be revised to reference regional productivity data when available. Baselines for AR projects will not include instances where firewood, charcoals, or other timber products are displaced. Instances where subsistence activities are displaced by reforestation for carbon are fairly uncommon. When regional or national production data does not exist, historical production yields in the project area (prior to the start date) will be used in the calculation of new land that will be brought into production.
Aster Global Round 1 Findings	The commenter noted possible issues with using national averages, displacement of illegal activities not captured in national data, and capturing subsistence-driven leakage. The assessor took due account by responding to each comment and specifying sub-national/regional or remote sensing data will now be required, but some items remain unclear. It is unclear how baselines for ARR projects will not include illegal activities, as this is not specified in the methodology by an applicability/eligibility condition or within Section 6 describing the baseline scenario. Further, though subsistence activities may be uncommon, it is unclear how the ability to utilize multiple data points will reduce the risk of artificially lower leakage.
Round 1 NCR/CL/OFI	CL: Please address the comment.
Round 1 Response from Methodology Developer	Have revised tool so that subsistence uses (also now defined in the tool) must use assume same productivity in new lands that was observed in the historical reference period in the project area. With respect to charcoal or fuelwood (legal or illegal), the tool already requires use of project area productivity data where no regional or national data exists (e.g. section 5.3.5).
Aster Global Findings - Round 2	Given the multitude of sources include project area productivity (and barring that official government statistics, and barring that, published studies), the assessment team finds sufficient sources of data are available.

Item Number	35
Section	5.1.1
Commenter	Florian Reimer
Comment Number	8
Public Comment	6. Leakage Module: 5.1.1 lacks a definition of the unit of "productivity". In t product / ha ? In USD revenue / ha ? A new system might produce <ton of product, but higher income / ha.
Response from Methodology Developer	Tool has been revised; yields are referenced and clearly defined as units of production per hectare. commodities produced per unit area in the project area prior to the project activity compared to national averages"
Aster Global Round 1 Findings	The commenter requested more definition around productivity, and the developer revised the tool to clearly define productivity. However, the assessor did not locate this definition within the revised version of the tool we were provided.
Round 1 NCR/CL/OFI	CL: Please demonstrate where productivity is clearly defined within the revised tool.

Round 1 Response from Methodology Developer	The new tool does not refer to productivity specifically; but it does refer yields on lands brought into production; when used in formula (6), the parameter y is clearly defined as $[y](j,t)$ = Yield on new land brought into production for commodity j in year t (units of production/ha)
Aster Global Findings - Round 2	The unit definitions associated with commodity yield (units of production per ha) are clear and consistently used throughout the Tool.

Item Number	36
Section	
Commenter	Dan Harburg
Comment Number	10
Public Comment	2. Regionally-focused leakage calculations We suggest that alternative calculations should be considered, perhaps as alternatives to the proposed leakage calculation method, when best data is available at a subnational scale to estimate leakage (similar to the approved Verra methodology VM0015). A regional approach assumes that supply chains occur in clusters - e.g. slaughterhouses will buy within a given range, such as a 300km radius, so the displacement of activities to supply beef will also happen within this buffer area. We are currently working with a number of academics on a regionally-focused approach leveraging a panel analysis and difference-in-differences method to obtain a more regional estimate of leakage. This type of land spillover has been estimated in recent research ⁷ , and it's a more robust method than the approach proposed in this methodology.
Response from Methodology Developer	Regional data on productivity and carbon stocks will be included in the revised tool
Aster Global Round 1 Findings	If robust research exists in certain areas, it is unclear how the leakage tool will ensure the project uses the most robust data, in contrast to being able to choose from multiple sources, if available.
Round 1 NCR/CL/OFI	1 CL: Please address the comment.
Round 1 Response from Methodology Developer	Have revised to clarify that data from official government agency sources should be used if available, and that published literature may be used in the absence of such data.
Aster Global Findings - Round 2	The revision to the tool now permits use of published literature in lieu of government statistics for parameters except in cases such as p_j where government statistics are to be preferred over published literature. Due to this revision, this public comment is addressed.

Item Number	37
Section	
Commenter	James Mulligan
Comment Number	20
Public Comment	The leakage values in the EPA study: Reflect only domestic leakage within the US; they do not capture international leakage, which is what matters in the voluntary market context.
Response from Methodology Developer	Will revise tool and no longer reference the EPA study

Aster Global Round 1 Findings	It is unclear how removing the EPA study addresses the original comments and how simply removing the EPA study provides the necessary provisions to capture international leakage.
Round NCR/CL/OFI 1	CL: Please explicitly state how the replacement approach addresses the commenter's concerns.
Round 1 Response from Methodology Developer	International leakage that occurs outside the project host country is not required to be included per the VCS Standard; the tool assumes displaced production is replaced in the same region as the project
Aster Global Findings - Round 2	The assessment team concurs that the VCS Standard states international leakage does not need to be assessed.

Item Number	38
Section	
Commenter	James Mulligan
Comment Number	21
Public Comment	Reflect dynamics that are unique to the US land sector, which are quite different than in most of the developing world where most of these projects will be located. For example, in the EPA study's baseline, area in agricultural land is actually declining as productivity in our industrialized agricultural sector continues to increase. This is not what's happening globally, of course, where we're losing forest to grow more food. As another example, there's a lot of land sitting in CRP, not in cultivation, that is available for reforestation given a carbon price stimulus. That allows the model to reforest without displacing agriculture and without having a leakage effect. This is pretty unique to the US.
Response from Methodology Developer	Will revise tool and no longer reference the EPA study
Aster Global Round 1 Findings	The commenter noted the difference between US and international agricultural land conversion trends. The developer noted the tool would be revised but did not state necessarily how the revision would address the comment.
Round NCR/CL/OFI 1	CL: Please clarify, in a general sense, how the revised tool ensures great differences in US versus international agricultural land demands are addressed.
Round 1 Response from Methodology Developer	no difference in approach; production-based now; values for market replacement and new land brought into production conservatively set based on global analysis
Aster Global Findings - Round 2	The assessment team finds that revisions made to the Tool have addressed the original comment.

Item Number	39
Section	
Commenter	James Mulligan
Comment Number	22
Public Comment	Reflect the application of a carbon price, which limits indirect land use change (leakage). Of course this is not how voluntary markets operate, and this is a lesson we're getting out of the Latta modeling.
Response from Methodology Developer	Will revise tool and no longer reference the EPA study

Aster Global Round 1 Findings	The developer noted the original use of the EPA tool reflected a US carbon price, which would limit international land use change quantification. It is unclear how the developer's response addresses the commenter's concern about carbon pricing.
Round NCR/CL/OFI 1	CL: Please explain if and how the differences in voluntary market carbon pricing have been captured in the revised tool.
Round 1 Response from Methodology Developer	Carbon pricing is not included in the tool; commodity production replacement rates could fall if there are increasing carbon incentives to keep forests standing, or rise if carbon incentives decrease. In any case, the analysis of production replacement rates for various global commodities shows that our assumption of 75% replacement rate is demonstrably conservative.
Aster Global Findings - Round 2	The Methodology Developer has not explicitly made any changes to incorporate voluntary market carbon pricing and has replaced use of the EPA study with a 75% replacement rate that is argued to be sufficiently conservative.

Item Number	40
Section	Revised Leakage Tool
Commenter	Mombak
Comment Number	1
Public Comment	<p>Issue identified: The protocol is unclear on whether intensification will no longer be needed at some future point. This creates risks for project developers if long-term impacts of leakage discounts on credit generation are not well understood, particularly for projects that are 30 years or more. Also, the possibility of compensating assumes that the leakage is expected to be acute in the short term due to the low capacity of agents to invest in technology, but can we consider the long-term leakage impact to be zero/insignificant? We argue that it should be, so long as the project solves this with investments and after a few years leaves the farmer able to maintain a high level of productivity.</p> <p>Our recommended change: Consider a fade-out period of investment in intensification based on continued high productivity beyond the period of investment by the project developer. For instance, if the yield (kg/ha) or the cumulative rate of annual gains (%) remains above the regional average for a set period of time (perhaps beyond investments have been made to increase productivity), then the leakage mitigation is assumed to continue beyond the investment period.</p>
Response from Methodology Developer	<p>Agree that a sustained period of productivity gain should be sufficient to mitigate the impact of the project activity (or said differently, productivity declines after a period of time would likely have also effected the baseline activity and are thus not an impact that should be attributed to the project activity).</p> <p>Suggest a period of 10 yrs for estimating leakage impacts (could then be available as leakage mitigation area for new projects)</p>

Aster Global Round 1 Findings	The commenter wanted the developer to consider how intensification may no longer be needed in the future and that they should consider a phase out of leakage impacts. The developer noted they agree this approach could be warranted, but it is unclear what "Suggest a period of 10 yrs. for estimating leakage [sic] impacts (could then be available as leakage [sic] mitigation area for new projects)" means in relation to if the tool was or will be revised to include the suggested changes.
Round 1 NCR/CL/OFI	1 CL: Please address the finding.
Round 1 Response from Methodology Developer	Have specified (in section 2) that the period for assessing and calculating leakage is 5 years during which the effects of displacement can be expected to occur.
Aster Global Findings - Round 2	The methodology developer has made revisions to set the period of leakage calculations for 5 years.

Item Number	41
Section	Revised Leakage Tool
Commenter	Mombak
Comment Number	5
Public Comment	<p>Issue identified: The example in the appendix 1 of the ARR leakage method indicates a stocking rate of 0.33 animal/hectare in the project area versus an average of 1.7 in our region of interest. Realistic numbers for stocking rate in degraded pasture (e.g. ~0.8UA/ha in Amazon) and average regional stocking rate would increase leakage estimate up to four times. This results in twice the estimated leakage calculated in the previously proposed module from Feb/2022. High leakage penalties may discourage carbon projects in general based on the size of this penalty.</p> <p>Our recommendation change: We suggest balancing this with an adjustment factor, such as the fraction of forest (f) that was included in the initial version of this ARR leakage module (also in the CDM protocol for reference). We believe that this factor more accurately represents the available forest areas in a region where leakage may occur and affects the choosing location of projects. In addition, areas with less vegetation and more restrictions on deforestation are more prone to agricultural intensification.</p>
Response from Methodology Developer	<p>Leakage equations are based on the amount of displaced production; and will result in higher leakage values for areas with higher productivity.</p> <p>Fraction of forest should be discussed w/Verra; conservative to assume it is 100%, also b/c some grazing areas could be displaced to grasslands/cerrado which should not be excluded; if it is incorporated, then need to decide the area for this calculation (if not national, then regional definition becomes critical; also need to consider if/how to exclude protected areas that are effectively protected).</p> <p>Could also consider in future revisions.</p>

Aster Global Round 1 Findings	<p>The commenter was concerned that project's could incur high leakage penalties and suggested a balanced adjustment factor. The developer took due account of the comment but suggested the fraction of a forest suggestion should be discussed with Verra. It is unclear if this discussion happened, and if so, what the result was.</p>
Round NCR/CL/OFI 1	<p>CL: Please address the finding.</p>
Round 1 Response from Methodology Developer	<p>No adjustment for fraction of forest has been made. Assuming zero emissions on conversion of non-forested land (e.g. grassland) would not be conservative. Assuming 100% of new land being brought into production is forest (highest carbon stocks) is conservative.</p>
Aster Global Findings - Round 2	<p>The Methodology Developer has not made any revisions or made it known if they communicated with Verra regarding the fraction of a forest suggestion, leaving the value of 100% in place.</p>