

# SECOND ASSESSMENT REPORT FOR THE “TOOL FOR MEASURING ABOVEGROUND LIVE FOREST BIOMASS USING REMOTE SENSING”



Document Prepared By Zane Haxtema

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<b>Prepared By</b>	SCS Global Services (SCS)
	<b>Contact</b>
	2000 Powell Street, Suite 600, Emeryville, CA 94608, USA  <a href="http://www.scsglobalservices.com">http://www.scsglobalservices.com</a>  Email: <a href="mailto:cpollet-young@scsglobalservices.com">cpollet-young@scsglobalservices.com</a>  Telephone: +1 (510) 452-8000
	<b>Approved By</b>
<b>Work Carried Out By</b>	Lead assessor: Zane Haxtema  Technical reviewer: Francis Eaton
<b>Summary:</b>	
<p>This report describes the second assessment of the “TOOL FOR MEASURING ABOVEGROUND LIVE FOREST BIOMASS USING REMOTE SENSING” (the “tool”), which provides procedures for the quantification of aboveground biomass. The purpose of the assessment was to assess the conformance of the tool to the VCS rules and current best practices for quantification of GHG emission reductions and removals. The criteria for the assessment was the VCS Version 3. The assessment was performed through a desk review of the tool and other relevant documents. A total of 55 findings was issued during the course of the assessment. No uncertainties are associated with the assessment. In summary, the version of the tool entitled “DRAFT 3.4” conforms fully to the assessment criteria.</p>	

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## 1 INTRODUCTION

### 1.1 Objective

The purpose of the audit activity was to conduct a second assessment of the tool element “SECOND ASSESSMENT REPORT FOR THE “TOOL FOR MEASURING ABOVEGROUND LIVE FOREST BIOMASS USING REMOTE SENSING” (“the tool”) in accordance with the guidance documents listed in Section 1.2 of this report.

### 1.2 Summary Description of the Tool

The tool provides procedures for the quantification of aboveground biomass for use with methodologies that cover AFOLU project activities. A more detailed description of the tool may be found in Section 2 of the tool.

## 2 ASSESSMENT APPROACH

### 2.1 Method and Criteria

Per Section 7.1 of the Methodology Approval Process, the scope of the assessment included all aspects of the assessment scope for new methodologies that are relevant to the tool. In the judgment of the assessment team, these included the following:

- Stakeholder consultation: Assessment of whether the developer has taken due account of all stakeholder comments.
- Structure and clarity of tool: Assessment of whether the tool is written in a clear, logical, concise and precise manner.
- Definitions: Assessment of whether the key terms in the tool are defined clearly and appropriately, and are consistently used in the tool.
- Applicability conditions: Assessment of whether the proposed tool’s applicability conditions are appropriate, adequate and in compliance with the VCS rules.
- Baseline, project and/or leakage emissions: Assessment of whether the approach for quantification of aboveground biomass, for the ultimate purpose of calculating baseline, project and/or leakage emissions, is appropriate, adequate and in compliance with the VCS rules.
- Data and parameters: Assessment of whether the specification for monitored and not monitored data and parameters is appropriate, adequate and in compliance with the VCS rules.

The tool was assessed for conformance against the VCS Version 3, including the following documents:

- VCS Standard, Version 3.4
- Agriculture, Forestry and Other Land Use Projects (AFOLU) Requirements, Version 3.4
- Methodology Approval Process, Version 3.5

- Program Definitions, Version 3.5
- Validation and Verification Manual, Version 3.0
- VCS Module Template, Version 3.3

The primary method used for this assessment was document review, as described in Section 2.2 of this report. In addition, the assessor took into consideration the comments received during the public comment period from 24 April 2014 until 24 May 2014.

## 2.2 Document Review

The assessment activity included a detailed review of the tool against the assessment criteria. In addition, the proposed tool was assessed for logical coherence, internal consistency, completeness, and consistency with current best practices for quantification of emission reduction and removals.

Review of the tool was complemented by a review of the published literature relevant to the development of the tool. The following documents were reviewed in order to ensure the conformance of the tool with the assessment criteria:

Chave, J. et al., 2009. Towards a worldwide wood economics spectrum. *Ecology letters*, 12(4), pp.351–66.

Ståhl, G. et al., 2011. Model-based inference for biomass estimation in a LiDAR sample survey in Hedmark County, Norway. *Canadian Journal of Forest Research*, 41(1), pp.96–107.

Weisbin, C.R., Lincoln, W. & Saatchi, S., 2014. A Systems Engineering Approach to Estimating Uncertainty in Above-Ground Biomass (AGB) Derived from Remote-Sensing Data. *Systems Engineering*, 17(3), pp.361–373.

Zanne, A.E. et al., 2009. Data from: Towards a worldwide wood economics spectrum. *Ecology Letters*. Available at: <http://dx.doi.org/10.5061/dryad.234>.

## 2.3 Interviews

No interviews were held as part of the assessment process.

## 2.4 Assessment Team

Zane Haxtema led the assessment and performed all aspects of the work, including review and report writing.

Zane Haxtema holds a M.S. in Forest Resources from Oregon State University (Corvallis, Oregon, USA). Mr. Haxtema is well versed in a wide variety of methodological approaches for carbon accounting, having served as a lead auditor on a wide variety of projects under the Climate Action Reserve, the Air Resources Board, the Verified Carbon Standard and the Climate, Community and Biodiversity Standards. He is a VCSA-approved AFOLU expert for the IFM project type.

Francis Eaton was the “appropriately qualified, independent technical reviewer” requested by Section 5.1.2 of the Validation and Verification Manual. As such, he performed an independent technical review of the assessment report before its release to the VCSA.

Francis Eaton holds a Masters of Forest Science from the Yale School of Forestry and Environmental Studies and received his B.S. in Forestry from Northern Arizona University. The focus throughout his studies was forest management with emphases on sampling design and statistical analysis. He spent three years working collecting field data and completing data analysis on forest restoration projects with the Ecological Restoration Institute. His work experience also includes complete biophysical inventories and estimation of timber volume for two 3000 acre properties, as a forest consultant in northern New Mexico. Mr. Eaton is well versed in sampling designs and auditing field campaigns as a teaching fellow for masters-level management plan courses. Mr. Eaton currently works as a Verification Forester for SCS and has completed forest carbon projects under the Verified Carbon Standard (VCS), the Climate Action Reserve (CAR), and the Climate, Community, and Biodiversity Alliance (CCBA). Moreover, Mr. Eaton is accredited by the California Air Resources Board as Lead Offset Verifier and is also certified by the Board in the US Forest Project and Urban Forest Protocols. He is also certified as Lead Verifier under the Climate Action Reserve.

## 2.5 Resolution of Findings

Potential material discrepancies identified during the assessment process were resolved through the issuance of findings. The types of findings issued by SCS were characterized as follows:

**Non-Conformity Reports (NCRs)** were issued in response to material discrepancies in the proposed revision. A material discrepancy could be defined as one of the following:

- An instance of nonconformance to the assessment criteria;
- An instance where the language of the tool required clarification in order to avoid ambiguity;
- An instance where the proposed tool lacked internal consistency; or
- An instance where formulae in the proposed revision were not consistent with mathematical convention.

An adequate response for each issued NCR, including evidence of corrective action, was required before a positive assessment opinion could be reached.

**New Information Requests (NIRs)** were issued to the client when more information was needed to determine whether a material discrepancy existed. Issuance of an NIR did not necessarily signify the presence of a material discrepancy. However, an adequate response to all issued NIRs was required before an assessment opinion could be reached.

**Opportunities for Improvement (OFIs)** were issued to the client when an opportunity for improvement in the proposed revision was identified. Such opportunities for improvement did not constitute material discrepancies. OFIs were considered resolved on issuance, and therefore a response to issued OFIs was not required before an assessment opinion could be reached.

In total, 55 findings were issued during the assessment. All issued findings are described in Appendix A below.

The main points of discussion raised during the assessment process were as follows:

1. Compliance of the tool with requirements of the VCS Module Template
2. Compliance of the tool with best practices for measurement and quantification of uncertainty
3. The developer's responses to comments issued during the public comment period

With respect to points 1 and 2 above, the tool was modified in response to issues raised during the assessment process in order to conform to the VCS rules and best practices for measurement and quantification of uncertainty. With respect to point 3 above, a demonstration was provided, for each public comment submitted, of either a) the updates made to the tool in response to the comment or b) the determination of insignificance or irrelevance of the comment.

### 3 ASSESSMENT FINDINGS

#### 3.1 Relationship to Approved or Pending Methodologies

This section is not applicable, as adherence to Section 5.2 of the Methodology Approval Process was not within the scope of the assessment, as defined in Section 2.1 above.

#### 3.2 Stakeholder Comments

The tool has been satisfactorily revised to address all stakeholder comments. An explanation of whether and how the developer has taken due account of all comments received during the public stakeholder consultation is contained within Appendix B below.

#### 3.3 Structure and Clarity of Tool

The tool is written in a clear, logical, concise and precise manner. Procedures and criteria are logically presented and easily understood. The tool contains a high level of internal consistency. Equations are mathematically sound and parameters are presented consistently throughout the text of the tool (e.g., there are no inconsistencies between the symbolization of the parameters in Section 6.1 and the symbolization in the rest of the tool. Furthermore, this report affirms that:

- **The developer has followed the instructions in the template and ensured that the tool's various criteria and procedures are documented in the appropriate sections of the template.** Conformance to the VCS Module Template was reviewed in detail throughout the assessment, as demonstrated in the findings set out in Appendix A.
- **The terminology used in the tool is consistent with that used in the VCS Program, and GHG accounting generally.** All definitions are consistent with those in the VCS program definitions, ISO 14064-2:2006, or other VCS guidance documents (e.g., the AFOLU Requirements).
- **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 convention is very intentionally followed throughout the tool.
- **The criteria and procedures are written in a manner that can be understood and applied readily and consistently by project proponents.** Familiarity with the subject matter will likely be

necessary for competent application of the tool; however, this familiarity can be readily gained through university courses or other training. The assessment team agrees that it is outside the scope of the tool to provide all of the knowledge needed to competently implement the procedures set out in the tool, as that knowledge is readily available elsewhere. Otherwise, the criteria and procedures are quite clearly presented, and should be readily accessible to users with the necessary competencies.

- **The criteria and procedures are written in a manner that allows projects to be unambiguously audited against them.** All criteria and procedures have been critically reviewed to ensure that they can be consistently understood and that conformance with said criteria and procedures can be unambiguously assessed.

In conclusion, the tool is structurally sound and of adequate clarity.

### 3.4 Definitions

The assessment team concludes, overall, that the definitions for terms used by the tool are appropriate and in conformance with the VCS rules. A further justification of the conformance of the definitions with the requirements of the VCS Module Template follows.

- **Definitions of key terms and acronyms used in the tool are provided in alphabetical order.** The assessment team confirmed that the definitions are in alphabetical order
- **All defined terms are used, and consistently defined, throughout the tool.** No terms exist within Section 3 of the tool that are not used within the tool. Usage of defined terms is consistent throughout the tool. The definitions provided are clear and consistent.
- **Terms already defined under the VCS are not included.** Section 3 of the tool does not include any terms defined in the VCS Program Definitions or ISO 14064-2:2006 (as referenced therein).

### 3.5 Applicability Conditions

The assessment team concludes, overall, that the applicability conditions are appropriate and in conformance with the VCS rules.

#### 3.5.1 Assessment of Conditions as a Whole

An assessment of the applicability conditions, as a whole, follows.

Criterion	Assessment findings
Are the applicability conditions appropriately specified?	<b>Yes;</b> as described for each condition in Section 3.5.2 below, all conditions are specified with appropriate clarity and precision
Are the applicability conditions appropriate for the project activities targeted by the tool and the quantification procedures set out within the tool?	<b>Yes;</b> as follows:  1) Applicability conditions place no restriction on project activities, other than requiring that project activities fall within

	<p>AFOLU sectoral scope, which is appropriate since tool can be used for monitoring for an array of project activities taking place on forestland and tool does not contain any requirements that are specific to any one project activity</p> <p>2) As described in more detail in Section 3.5.2 below, applicability conditions restrict applicability to circumstances appropriate to quantification procedures set out within tool by, for example, requiring that area of interest qualifies as forest (important as procedures within tool are specifically targeted at estimation of aboveground biomass in forests) and requiring that tool is used to estimate aboveground biomass at a specific point in time for which remotely sensed imagery is available (important as tool does not fulfil any other purpose)</p>
<p>Are the applicability conditions as a whole sufficiently clear for determining which project activities are eligible under the tool, and which are not?</p>	<p><b>Not applicable</b>, since (as described immediately above) tool does not provide specification regarding project activities</p>
<p>How do the applicability conditions address environmental integrity and practical considerations?</p>	<p>1) Applicability conditions <b>do not</b> address environmental integrity, which is appropriate, as consideration of environmental integrity is outside tool's scope</p> <p>2) Practical considerations pertaining to measurement of aboveground biomass are addressed soundly in applicability conditions, as described above</p>

### 3.5.2 Assessment of Each Applicability Condition

An identification and discussion of each conditions follows.

No.*	Overall comments	Explanation of whether...	
		The applicability condition is written in a sufficiently clear and precise manner	Conformance with the applicability condition can be demonstrated at the time of project validation
1	Appropriately describes “the project activity(s) and/or circumstances under which the module applies”, as required by VCS Module Template	Condition is written with adequate clarity and precision; “AFOLU methodologies” has a clear meaning under VCS Program and “AFLB” is clearly defined in Section 3; condition clarifies that tool is only applicable when used side-by-side with a methodology that requires estimation of above-ground live biomass	It can be clearly demonstrated, at time of project validation, that a project is using tool in conjunction with an AFOLU methodology that requires estimation of biomass
2	Limits scope of applicability to forestland, which is appropriate given lack of procedures for estimation of non-tree biomass	Condition is written with adequate clarity and precision, as “AOI” is clearly defined in Section 3 and “forest” is defined in VCS Program Definitions	While definitions of “forest” vary, it should be possible to demonstrate that AOI meets an applicable definition of “forest” at project validation and any time period thereafter (noting that portions of AOI may be forest at validation but may become non-forest thereafter, but that tool does not specifically require that a constant AOI is maintained over time)
3	Ensures that biomass for a given time period is estimated using remotely sensed data acquired during that time period, which is essential for drawing inference to that period	Condition is written with adequate clarity and precision, as “remotely sensed data” should be a clearly understood term and “accessible for the time period desired”, while not being as precisely stated as possible, is reasonably clear in indicating that remotely sensed data must have been	Where remotely sensed data are used for reporting at validation, it should be possible for conformance to be readily demonstrated at time of validation

No.*	Overall comments	Explanation of whether...	
		The applicability condition is written in a sufficiently clear and precise manner	Conformance with the applicability condition can be demonstrated at the time of project validation
		acquired during time frame of interest	
4	No specific comments	Condition is written with adequate clarity and precision, as terms “Predictive model (PM)”, “RS metrics” and “ALFB” are clearly defined or described and definition of “parametric” is well understood in statistical literature	Where ALFB are estimated for reporting at validation, a model will likewise have been selected, and so it should be possible for conformance to be readily demonstrated at time of validation
5	Provides clarification that tool does not provide specific procedures for monitoring or change detection	This condition is a condition to determine whether tool can be used be a methodology, and is written with adequate clarity and precision, as it is clearly indicated that tool cannot be used in contexts where a specific procedure for monitoring is required	As condition determines whether a methodology can use tool, and as any methodology applied should be identified prior to validation, it should be possible for conformance to be readily demonstrated at time of validation

\* As numbered according to the order of listing within Section 4 of the tool.

### 3.6 Project Boundary

This section is not applicable, as the tool does not provide procedures to identify the project boundary.

### 3.7 Baseline Scenario

This section is not applicable, as the tool does not provide procedures to identify the baseline scenario.

### 3.8 Additionality

This section is not applicable, as the tool does not provide procedures to determine and/or demonstrate additionality.

### 3.9 Quantification of GHG Emission Reductions and Removals

The tool does not contain procedures to specifically quantify baseline emissions, project emissions, leakage emissions and net GHG emission reductions and removals. Rather, the tool contains procedures

for estimation of aboveground biomass that can be used in the quantification of any of the categories of emissions listed above.

The assessment team’s findings regarding the conformance of the procedures within the tool will, therefore, be located within this Section 3.9.

The assessment team concludes, overall, that the procedures for calculating aboveground biomass are in conformance with the VCS rules.

An assessment of the criteria and procedures for calculating aboveground biomass, as a whole, follows.

Criterion	Assessment findings
Are procedures for calculating aboveground biomass appropriate for the project activities covered by the tool?	<b>Yes</b> ; procedures comply with all VCS rules for the category of project activities covered by the tool, as further described below
Are all algorithms, equations and formulas used appropriate and without error?	<b>Yes</b> ; assessment team carefully reviewed procedures and confirmed that all equations are appropriate and without mathematical errors; equations are consistent with best practices for GHG accounting and statistical/mathematical practice
Do procedures for calculating aboveground biomass cover all GHG sources, sinks and reservoirs (and carbon pools) included in the project boundary?	Not applicable (procedures cover only aboveground biomass, as set out in Section 5.1.2.2 of tool)
Are all models or default factors used appropriate and in conformance with VCS requirements on same?	<b>Yes</b> , as follows: <ul style="list-style-type: none"> <li>• Wood density factors prescribed comply with Section 4.5.6 of VCS Standard, as described more fully under procedure “Determination of wood density value” below</li> <li>• While tool does not require use of any specific allometric equation (and thus was not assessed against criteria of Section 4.1.6 of VCS Standard), guidance for selection of allometric equations is in conformance with VCS requirements, as described more fully under procedure</li> </ul>

Criterion	Assessment findings
	"Determination of allometric equation" below

Further identification and discussion of the procedures for calculating aboveground biomass is provided below. The guidance in Section 5.1 of the tool will not be addressed, as it provides a summary of the procedures found in Sections 5.1.1 through 5.1.4, as opposed to providing the procedures themselves.

Procedure	Sec.	Assessment findings
Stratification	5.1.1	<ul style="list-style-type: none"> <li>• Tool clearly states that stratification is not required, but provides guidance (with intentional use of term "should") for considerations where stratification is elected</li> <li>• Guidance provided is generally appropriate for AFOLU projects and is certainly appropriate for project activities covered by tool</li> </ul>
Sampling with remotely sensed data	5.1.2.1	<ul style="list-style-type: none"> <li>• First paragraph contains useful information regarding considerations for planning sampling effort</li> <li>• Second paragraph clarifies relationship between "RSSU" and "RS data", sets out sampling methods that may be used for RSSU sample design (all sampling methods listed are statistically valid for use in this context), and correctly states that (all other things being equal) larger RSSU size will result in lower estimator error</li> <li>• Third paragraph clarifies relationship between "RSP" and "RSSU" and sets out further criteria regarding RSPs</li> <li>• Remainder of Section 5.1.2.1 sets out procedures for estimation of sample size needed to attain a certain desired margin of error:               <ul style="list-style-type: none"> <li>○ General approach follows standard processes for a priori sample size determination that are well established in natural resources sampling literature, and Equation 2 is a well-known representation of relationship between variance, desired margin of error and number of samples needed (i.e., sample size)</li> <li>○ Assessment team was able to trace Equations 3 and 4 to referenced equations from Weisbin et al. (2014)</li> <li>○ Guidance for use of a priori inventory data or pilot studies is appropriate</li> <li>○ Guidance for quantification of variables used in Equations 2-4 appears reasonable; while</li> </ul> </li> </ul>

Procedure	Sec.	Assessment findings
		<p>quantification of these variables will inherently be uncertain (perhaps highly so) in absence of site-specific inventory data, default values and accompanying guidance appear appropriate (but note that default values were not assessed against Section 4.1.7 of VCS Standard, as they are not directly used in “calculation of net GHG emission reductions and/or removals” and thus, per definition of “default factor” in VCS Standard, are not considered default factors</p> <ul style="list-style-type: none"> <li>Final paragraphs contain requirements for RSSU sampling design; all such requirements are fully consistent with best statistical practice.</li> <li>Guidance provided is technically sound and appropriate for project activities covered by tool</li> </ul>
Design of “in-situ” (i.e., field) measurement plots	5.1.2.2	<ul style="list-style-type: none"> <li>First paragraph describes relationship between SPs and RSSUs and establishes requirement for independence of different levels of sampling (which is appropriate for statistical analysis procedures set out in tool)</li> <li>Second paragraph describes circumstances under which a single predictive model can be used, in contrast to circumstances under which multiple predictive models are required</li> <li>Third and fourth paragraphs set out requirements for minimum number of SPs and minimum size of SPs, respectively, that seem broadly appropriate (keeping in mind that user of tool will be incentivized to increase number of SPs and/or increase size of SPs because that will result in lower uncertainty and a lower confidence deduction)</li> <li>Numbered points in fifth paragraph set out generic QA/QC requirements (assessment team confirmed these are appropriate to project activities) and clarifies that procedures only address quantification of aboveground biomass pool</li> <li>Guidance provided is technically sound and appropriate for project activities covered by tool</li> </ul>
Positional accuracy of in-situ plot location	5.1.2.2	<ul style="list-style-type: none"> <li>Requirement that positional accuracy be no more than 10 meters is generally appropriate for project activities covered by tool (see documentation of resolution of NIR 2014.34, in Appendix A, for further details)</li> </ul>

Procedure	Sec.	Assessment findings
Determination of wood density value	5.1.2.2.1	<ul style="list-style-type: none"> <li>• Global Wood Density Database, from Zanne et al. (2009), complies with all requirements of Section 4.5.6 (as referenced through Section 4.1.7(1)) of VCS Standard, as follows (only items 2, 5, 6, 7, 8 and 9 are relevant here):</li> <li>• Data are collected from secondary sources and are available from a recognized credible source and have been reviewed for publication by an appropriate peer review group (i.e., study by Chave et al. (2009) that was published in a reputable, peer reviewed journal, Ecology Letters, as confirmed through review of “Author Guidelines” [<a href="http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1461-0248/homepage/ForAuthors.html#tips1">http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1461-0248/homepage/ForAuthors.html#tips1</a>; accessed 28 January 2015], and was conducted by authors that can be assumed to be experts in their respective fields)</li> <li>• Data are made publically available, and are thus made available to VCSA</li> <li>• Data are global in scope, and therefore are appropriate to any geographic location</li> <li>• Professional judgment has not been applied; all data are based upon empirically determined values</li> <li>• While ensuring custody arrangements for database is outside scope of tool, it appears that database can be accessed from a stable URL and so users should be able to access it going forward</li> <li>• Therefore, assessment team confirms this procedure is compliant with assessment criteria and appropriate for project activities covered by tool</li> </ul>
Determination of allometric equation	5.1.2.2.1	<ul style="list-style-type: none"> <li>• While tool does not require any specific equations, it appropriately requires that any guidance found within any methodology(ies) used in conjunction with the tool must be followed</li> <li>• In absence of guidance, tool directs user to “allometric equations for forests similar to those found in the AOI found in GPG-LULUCF Annex 4A.2 Table 4.A.1 (Intergovernmental Panel on Climate Change 2003), or... Chave et al (2014)”</li> <li>• Approach for specification of allometric equations does not conflict with IPCC 2006 Guidelines for National GHG Inventories, and therefore approach conforms to Section 4.5.1 of AFOLU Requirements, which states that “The IPCC 2006 Guidelines for National GHG Inventories or the IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry shall be used as guidance for</li> </ul>

Procedure	Sec.	Assessment findings
		<p>quantifying increases or decreases in carbon stocks and GHG emissions”</p> <ul style="list-style-type: none"> <li>• Assessment team notes that tool does <i>not</i> include procedures for verifying equations via destructive sampling, as recommended as good practice guidance by Section 4.3.3.5.1 of IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry “when allometric equations developed from a biome-wide database, such as those in Annex 4A.2, Tables 4.A.1 and 4.A.2, are used”; therefore, tool does not follow guidance provided by IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry</li> <li>• However, assessment team understands Section 4.5.1 of AFOLU Requirements to mean that either IPCC 2006 Guidelines for National GHG Inventories or IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry must be used as guidance (therefore compliance with IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry is not inherently required); AFOLU Requirements contains no other requirements that would suggest that guidance of IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry must be followed in this case, and IPCC 2006 Guidelines for National GHG Inventories does not contain any guidance regarding validation or verification of allometric equations; therefore, approach undertaken does not present a non-conformance to AFOLU Requirements</li> <li>• Furthermore, because tool does not specify any particular allometric equation to be used, any allometric equation used will be assessed against criteria in Section 4.1.6(2)-(6) of VCS Standard (as referenced by Section 3.1.4 of VCS Standard) at time of validation or verification, which will ensure adequate quality of data</li> <li>• In addition, Picard et al. (2012) and Chave (2005) contain useful material regarding selection and development of allometric equations</li> <li>• Therefore, assessment team confirms this procedure is compliant with assessment criteria and appropriate for project activities covered by tool</li> </ul>
Model development	5.1.3.1	<ul style="list-style-type: none"> <li>• Procedure describes cross-validation process and sets out criteria to ensure appropriate implementation process;</li> </ul>

Procedure	Sec.	Assessment findings
		guidance provided is technically sound and appropriate for project activities covered by tool
Reporting precision	5.1.3.2	<ul style="list-style-type: none"> <li>• Procedure consists of a series of equations for reporting basic information regarding model precision; these values are not used directly in quantification, but are required to be reported by tool; assessment team agrees that reporting this information will assist in independent assessment of modeling results</li> <li>• Equations 8 through 12 are mathematically correct and appropriate for intended purpose (and for project activities covered by tool)</li> </ul>
Quantification of estimate, and uncertainty of estimate, of aboveground biomass	5.1.3.3	<ul style="list-style-type: none"> <li>• Procedure consists of a series of equations for quantification of estimate, and uncertainty of estimate, of aboveground biomass</li> <li>• Assessment team traced Equations 13 through 17 to Ståhl (2011) and can confirm that they reflect equations in that credibly, peer-reviewed source; Equation 18 contains standard procedure for calculation of weighted-average uncertainty in a given stratum on a per-hectare basis (user of methodology would have to know how to then combine errors across strata, if stratification was used, to determine a project-level estimate, but this knowledge can be readily gained through review of forest sampling literature)</li> <li>• Equations 13 through 18 are mathematically correct and appropriate for intended purpose (and for project activities covered by tool)</li> </ul>
Discounting	5.1.4	<ul style="list-style-type: none"> <li>• Tool contains some basic guidance on discounting (in case that methodology applied in conjunction with tool contains more specific procedures for discounting, it should be easy enough to connect said guidance with guidance set out in tool)</li> </ul>

### 3.9.1 Baseline Emissions

This section is not applicable, as the tool does not provide specific procedures to calculate baseline emissions.

### 3.9.2 Project Emissions

This section is not applicable, as the tool does not provide specific procedures to calculate project emissions.

**3.9.3 Leakage**

This section is not applicable, as the tool does not provide specific procedures to calculate leakage emissions.

**3.9.4 Net GHG Emission Reductions and Removals**

This section is not applicable, as the tool does not provide specific procedures to calculate net GHG emission reductions or removals.

**3.10 Monitoring**

The tool does not provide specific procedures for monitoring, and, therefore, many reporting requirements of Section 3.10 of the VCS Methodology Assessment Report Template are not applicable. However, the assessment team concludes that the specification of data/parameters available at validation is appropriate for the project activities covered by the methodology and compliant with the VCS rules. (No specification is provided for data/parameters monitored.)

An identification of each data/parameter available at validation, and an assessment (as requested) of how each piece of information provided in the parameter table is appropriate, is provided below.

Data / Parameter	<b>E</b>
Data unit	Data unit is consistent with unit used elsewhere in tool (i.e., all quantification is for biomass in units of tonnes/ha)
Source of data	Assessment team agrees this is an arbitrary value that can be set by project proponent
Value applied:	Suggested value is reasonable
Justification of choice of data or description of measurement methods and procedures applied	Tool provides sufficient guidance to "measure" value for parameter
Purpose of Data	One of four categories set out in VCS Module Template was chosen; while no categories clearly fit purpose of data as used in tool, developer was required to choose from one of four categories, and this choice seemed reasonable

Data / Parameter	<b>total</b>
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Data unit	Data unit is correct as a t-value is, by definition, unitless
Source of data	While source of data is not stated as clearly as it could be, information on this parameter can be found in any introductory statistics textbook
Value applied:	Assessment team agrees that value applied is dependent on confidence level
Justification of choice of data or description of measurement methods and procedures applied	Value used is adequately justified, both within Section 6.1 and elsewhere in tool
Purpose of Data	One of four categories set out in VCS Module Template was chosen; while no categories clearly fit purpose of data as used in tool, developer was required to choose from one of four categories, and this choice seemed reasonable

Data / Parameter	$r$
Data unit	Per Weisbin et al. (2014), parameter must be a distance unit; in order for Equation 4 to work correctly parameter must be in same units as parameter "d", so pixels is an appropriate unit
Source of data	Tool clarifies that default value may be used and that Section 5.1.2.1 can be sought for alternative sources
Value applied:	Suggested value is reasonable
Justification of choice of data or description of measurement methods and procedures applied	Value used is adequately justified, both within Section 6.1 and elsewhere in tool
Purpose of Data	One of four categories set out in VCS Module Template was chosen; while no categories clearly fit purpose of data as used in tool, developer was required to choose from one of four categories, and this choice seemed reasonable

Data / Parameter	$d$
Data unit	Per Weisbin et al. (2014), parameter must be a distance unit; in order for Equation 4 to work correctly parameter must be in same units as parameter "c", so pixels is an appropriate unit
Source of data	Assessment team agrees that this value is calculated
Value applied:	Assessment team agrees it is not possible to identify a single value applied
Justification of choice of data or description of measurement methods and procedures applied	Assessment team agrees this is not applicable, as value is not truly "measured" and neither is it established in tool
Purpose of Data	One of four categories set out in VCS Module Template was chosen; while no categories clearly fit purpose of data as used in tool, developer was required to choose from one of four categories, and this choice seemed reasonable

Data / Parameter	$e$
Data unit	As set out in Weisbin et al. (2014), parameter is equal to a ratio and is thus unitless
Source of data	Assessment team confirmed value is found in Weisbin et al. (2014)
Value applied:	Ratio of (1/3) was confirmed to have been sourced from Weisbin et al. (2014)
Justification of choice of data or description of measurement methods and procedures applied	Reference to data sources are appropriately provided

Purpose of Data	One of four categories set out in VCS Module Template was chosen; while no categories clearly fit purpose of data as used in tool, developer was required to choose from one of four categories, and this choice seemed reasonable
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Data / Parameter	$\eta$
Data unit	Variable is described as number of pixels in RSSU, so data unit is appropriate
Source of data	Assessment team agrees that this value is calculated
Value applied:	Suggested value is reasonable
Justification of choice of data or description of measurement methods and procedures applied	Value used is adequately justified, both within Section 6.1 and elsewhere in tool
Purpose of Data	One of four categories set out in VCS Module Template was chosen; while no categories clearly fit purpose of data as used in tool, developer was required to choose from one of four categories, and this choice seemed reasonable

Data / Parameter	$ALFB_p$
Data unit	Data unit is consistent with unit used elsewhere in tool (i.e., all quantification is for biomass in units of tonnes/ha)
Source of data	Assessment team agrees that a previous study would be an appropriate data source for this parameter
Value applied:	Assessment team agrees it is not possible to identify a single value applied

Justification of choice of data or description of measurement methods and procedures applied	Provides an appropriate procedure (suitable to complexity and importance of task at hand) for "measuring" this parameter
Purpose of Data	One of four categories set out in VCS Module Template was chosen; while no categories clearly fit purpose of data as used in tool, developer was required to choose from one of four categories, and this choice seemed reasonable

Data / Parameter	K
Data unit	Data unit is appropriate, as parameter tracks number of rounds of cross-validation
Source of data	Data source is appropriately defined, based upon definition of parameter
Value applied:	Assessment team agrees that, per tool requirements, at least 10 round must employed
Justification of choice of data or description of measurement methods and procedures applied	Value used is adequately justified, both within Section 6.1 and elsewhere in tool
Purpose of Data	One of four categories set out in VCS Module Template was chosen; while no categories clearly fit purpose of data as used in tool, developer was required to choose from one of four categories, and this choice seemed reasonable

Data / Parameter	Y'
Data unit	Data unit is consistent with unit used elsewhere in tool (i.e., all quantification is for biomass in units of tonnes/ha)
Source of data	Assessment team agrees that predictive model and RS metrics are sources of data for this parameter

Value applied:	Assessment team agrees it is not possible to identify a single value applied
Justification of choice of data or description of measurement methods and procedures applied	Provides a high-level procedure for measurement of this parameter
Purpose of Data	One of four categories set out in VCS Module Template was chosen; while no categories clearly fit purpose of data as used in tool, developer was required to choose from one of four categories, and this choice seemed reasonable

#### 4 ASSESSMENT CONCLUSION

In conclusion, the assessment team affirms, without qualification or limitation, that the tool (version entitled “DRAFT 3.4”; date of issue 27 January 2015) is in full compliance with the assessment criteria as described in Section 1.2 of this report.

#### 5 REPORT RECONCILIATION

This section is not applicable.

#### 6 EVIDENCE OF FULFILMENT OF VVB ELIGIBILITY REQUIREMENTS

The following evidence of fulfilment of SCS’ eligibility requirements is presented in accordance with Section 4.2 of the Tool Approval Process.

SCS has completed ten project validations under sectoral scope 14 (AFOLU). A summary of the first ten project validations performed by SCS is as follows:

Project and Project ID	Date validation report issued	Date project registered	Name of GHG program under which project registered
INFAPRO Rehabilitation of logged-over dipterocarp forest in Sabah, Malaysia (672)	31-Aug-2011	2-Sep-2011	Verified Carbon Standard
Natural High Forest Rehabilitation Project on degraded land of Kibale National Park (673)	6-Sep-2011	6-Sep-2011	Verified Carbon Standard

Project and Project ID	Date validation report issued	Date project registered	Name of GHG program under which project registered
Protection of a Tasmanian Native Forest (Project 3: Peter Downie) (587)	18-Mar-2011	7-Apr-2011	Verified Carbon Standard
Redd Forests Grouped Project: Protection of Tasmanian Native Forest (641)	13-May-2011	1-Jul-2011	Verified Carbon Standard
Protection of a Tasmanian native forest – Project 1 – REDD Forests Pilot (605)	18-Mar-2011	3-May-2011	Verified Carbon Standard
Boden Creek Ecological Preserve Forest Carbon Project (647)	24-Jun-2011	18-Jul-2011	Verified Carbon Standard
Peri-urban bamboo planting around South African townships (Project ID confidential)	8-Aug-2011	8-Dec-2011	Verified Carbon Standard
Tree planting in South African townships (Project ID confidential)	2-Sep-2011	8-Dec-2011	Verified Carbon Standard
Rimba Raya Biodiversity Reserve Project (674)	31-Aug-2011	7-Sep-2011	Verified Carbon Standard
Reforestation Across the Lower Mississippi Valley (774)	20-Apr-2011	14-Feb-2012	Verified Carbon Standard

Note that the above is not necessarily an exhaustive list of all validations performed by SCS.

**7 SIGNATURE**

Signed for and on behalf of:

Name of entity: SCS Global Services



Signature:

Name of signatory: Christie Pollet-Young

Date: 2 February 2015

## APPENDIX A

The following tables include all findings issued during the course of the assessment. It should be noted that all language under “Developer’s Response” is a verbatim transcription of responses provided by the tool developer.

**NCR 2014.1 dated 10-17-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 3; Program Definitions, V3.5

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 3

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 3 of the VCS Module Template states the following: "Do not include terms already defined under the VCS." Section 3 of the tool contains definitions for a number of terms that are formally defined under the VCS in the Program Definitions, which is not allowed by the VCS Module Template. Examples of such terms follow:

Afforestation, Reforestation and Revegetation (ARR)

Agricultural Land Management (ALM)

Agriculture, Forestry and Other Land Use (AFOLU)

**Developer’s Response:** Removed all terms defined in the VCS program definitions: [http://www.v-c-s.org/sites/v-c-s.org/files/Program%20Definitions%20v3.0,%20Standardized%20Methods,%20Public%20Consultation.p](http://www.v-c-s.org/sites/v-c-s.org/files/Program%20Definitions%20v3.0,%20Standardized%20Methods,%20Public%20Consultation.pdf)

[df](http://www.v-c-s.org/sites/v-c-s.org/files/Program%20Definitions%20v3.0,%20Standardized%20Methods,%20Public%20Consultation.pdf)

**Auditor Response:** Through review of Section 3 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that definitions for terms already defined under the VCS have been removed. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer’s response adequately addresses the finding.

**NCR 2014.2 dated 10-17-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 3; Program Definitions, V3.5

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 6.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 6.1 of the VCS Module Template requires the tool developer to "Complete the table below for all data and parameters that will be determined or available at validation and remain fixed throughout the project crediting period (copy the table for each data/parameter)." The following non-conformities have been identified regarding the completion of the table for each parameter.

1. Under "Justification of choice of data or description of measurement methods and procedures applied", the table requires inclusion of the following information: "Justify the choice of data source, providing references where applicable. Where values will be based on measurement, include a description of the appropriate measurement methods and procedures that must be applied (eg, what standards or protocols must be followed). Where the data/parameter value is established in the methodology (eg, a default factor established from primary sources) provide justification for the method used, using an appendix where necessary." This information is not provided for any of the parameters listed in the tool.
2. Under "Equations", the table requires identification of "the equation(s) that use this data/parameter". This information is not provided for any of the parameters listed in the tool.
3. Under "Purpose of Data", the tool developer is required to "Indicate one of the following:
  - Determination of baseline scenario (for AFOLU methodologies, where relevant)
  - Calculation of baseline emissions
  - Calculation of project emissions
  - Calculation of leakage"

For all of the parameters, the "Purpose of Data" is not selected from among the choice identified in the VCS Module Template.

- Developer's Response:**
1. Justification/description has been added for all parameters.
  2. All equations have been numbered and cross-referenced in the table.
  3. All 'Purpose of data' rows have been filled per VCS specification

**Auditor Response:** Through review of Section 6.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the required information has been provided for all data and parameters currently contained within that section. However, the "Data unit" for parameter E is described as "Percentage" and the "Value applied" is indicated to be "10%". This is not consistent with the description of the parameter below Equation 2, which states that "The default value of E is 10% of the mean stratum or AOI biomass stock (t ha-1)" (and thus indicates that the unit of measure for parameter E is tonnes per hectare). Therefore, the non-conformity has not been fully resolved.

**Developer's Response 2:** The definition of E in the text has been modified to reflect the definition in section 6.1

**Auditor Response 2:** Through review of the updated tool entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm that information is consistently provided regarding the parameter E. Therefore, the non-conformity has been resolved. However, note the recently issued NCR 2014.49.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.3 dated 10-17-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The term shall is reserved for VCS program documents and is generally not appropriate for modules."

Section 4 of the tool contains the word "shall" in the following text: "The project proponent shall demonstrate that biomass estimation methods available under the specific methodology for which the use of this tool is to be applied are not appropriate either due to accessibility constraints, security concerns, cost limitations, and/or demonstrate that the certainty of estimates produced by this tool meet or exceed those estimated using the methods detailed within the methodology."

**Developer's Response:** All instances of the word 'shall' have been rephrased to use unrestricted terms.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that all instances of usage of the term "shall" have been removed. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.4 dated 10-17-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 4 of the VCS Module Template requires that "Applicability conditions must be specified clearly, and in a manner that allows easy determination of whether the module can be used by a methodology or other module". This indicates that the applicability conditions are intended to determine whether the tool can be used by a methodology or other module. A number of applicability conditions are written, instead, to determine whether the tool can be used for a particular project.

For example, the opening paragraph of Section 4 states "The tool is applicable in forest carbon offset project development where large forested areas must be surveyed and the cost to conduct field plot sampling such that desired precision in carbon densities is achieved is prohibitively high". The circumstance described in this text is specific to individual projects. The same is the case with the requirement that "The project proponent shall demonstrate that biomass estimation methods available under the specific methodology for which the use of this tool is to be applied are not appropriate either due to accessibility constraints, security concerns, cost limitations, and/or demonstrate that the certainty of estimates produced by this tool meet or exceed those estimated using the methods detailed within the methodology", which contains a specific request for a demonstration that must be made by a project proponent.

While it is understood that the applicability conditions in Section 4 are consistent with applicability conditions as they have historically been written in VCS methodologies (in that they are focused on items that individual projects or project proponents must comply with), the clear requirement of the VCS Module Template is for a set of applicability conditions that are geared towards a determination of whether a certain methodology or different module or tool can use the tool.

**Developer's Response:** The language has been changed in this section to give specific guidance on the applicability of this tool. The author suggests also that while the template guidance clearly required applicability conditions for specific methodologies, it also requires project conditions under which the tool is applicable

**Auditor Response:** Through review of Section 4 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the applicability conditions have been re-written from the standpoint of whether the tool is can be used by a given methodology, or is applicable to a particular project activity, rather than the standpoint of whether the tool is applicable to a particular project. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.5 dated 10-17-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 4 of the VCS Module Template requires that "Applicability conditions must be specified clearly, and in a manner that allows easy determination of whether the module can be used by a methodology or other module". The following factors that preclude "easy determination of whether the module can be used by a methodology or other module" have been identified:

1. In the first paragraph of Section 4, the following terms are not defined and, when not defined, are inherently relative and excessively subject to interpretation: "large forested areas" and "prohibitively high".
2. With respect to the phrase "desired precision", it is not clear which entity is authorized to determine what level of precision is desired.
3. The intended meaning of the term "surveyed" is not clear. All other reference to "survey" in the tool pertain to LiDAR or remote sensing; it appears that the term in Section 4 may be intended to refer to the context of forest inventory sampling, but it is not completely clear.

**Developer's Response:** 1. The subjective nature of the terms used is recognized and the terms have been removed.

2. There is no objective standard that can be used here as project costs and credit return expectation varies due to location and project developer. The language has been modified to better contextualize the statement.

3. No use of the term 'survey' was found in section 4. The use of the term survey is used appropriately throughout.

Survey: 'an act of measuring and examining an area of land' -- Merriam Webster Dictionary

**Auditor Response:** Through review of Section 4 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that all instances of usage of unclear or relative terminology, as quoted in the text of the finding, have been removed. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.6 dated 10-17-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The term "area-normalized" is used twice in the tool, in Sections 4 and 5.1. The meaning of the term is not clear. A google search of "area-normalized" indicates that the term has various meanings in a variety of scientific disciplines. It is likely that use of this term, if not defined, will lead to confusion on the part of at least some intended users.

**Developer's Response:** A Definition(Section3) has been added for 'area-normalized'

**Auditor Response:** Through review of Section 3 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that a definition has been added for the term "area-normalized". The term is sufficiently clear as to facilitate understanding of the usage of this term elsewhere in the tool. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.7 dated 10-17-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 4 of the VCS Module Template requires that "Applicability conditions must be specified clearly, and in a manner that allows easy determination of whether the module can be used by a methodology or other module". One of the applicability conditions in Section 4 of the tool reads as follows: "The tool can be applied if... The project proponent shall demonstrate that biomass estimation methods available under the specific methodology for which the use of this tool is to be applied are not appropriate either due to accessibility constraints, security concerns, cost limitations, and/or demonstrate that the certainty of estimates produced by this tool meet or exceed those estimated using the methods detailed within the methodology." This condition has not been constructed using proper grammar, and the meaning of the condition, if read literally, and as written, is unclear. Thus, the specification of the condition does not allow easy determination of whether the module can be used by a methodology or other module.

**Developer's Response:** The applicability condition referenced has been removed as it has been deemed unnecessary.

**Auditor Response:** Through review of Section 4 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the condition in question has been removed. Therefore, this finding is no longer applicable, and will be withdrawn.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.8 dated 10-17-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." It is required that the cover page of the methodology element must indicate whether it is a module or tool under "Type". The cover page states indicates the type as "Tool", but it is stated in Section 4 that "This module is not applicable under the following conditions." Thus, the type is not consistently specified.

**Developer's Response:** All instances of the word 'module' have been replaced with the word 'tool' except for in the header. As in other approved VCS tools, the location in this document where 'MODULE/TOOL' appear in the template header, the VCS control # will be used once approved.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the all usages of the term "module" have been removed other than in the header of the document. The assessment team agrees that, since the "MODULE/TOOL" text is written into the header of the VCS Module Template and will be replaced with a VCS-specific identifier upon approval, it is not necessary for this text to be altered. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.9 dated 10-17-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 4 of the VCS Module Template requires that "Applicability conditions must be specified clearly, and in a manner that allows easy determination of whether the module can be used by a methodology or other module". The tool states that "This module is not applicable under the following conditions... This tool is intended for the generation of ALFB density using sampling approach. However, it can be readily used for wall-to-wall mapping of ALFB when the Remote Sensing Sample Unit (RSSU) covers the entire AOI (stratum if stratification used)." It is not clear what condition is being stated, in the above text, under which the tool is not applicable.

**Developer's Response:** The problematic language has been removed from bulleted list of un-applicable conditions and added to the introductory paragraph of the section.

**Auditor Response:** Through review of Section 4 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the condition in question has been removed from its prior location and placed in an introductory paragraph to that section, in which context it is quite clearly stated. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NIR 2014.10 dated 10-25-2014****Standard Reference:** Methodology Approval Process V3.5, Section 3.5.5**Document Reference:** N/A

**Finding:** The Methodology Approval Process requires the following: "At the end of the public comment period, the VCSA provides all and any comments received to the developer. The developer shall take due account of such comments, which means it will need to either update the methodology or demonstrate the insignificance or irrelevance of the comment. It shall demonstrate to each of the validation/verification bodies what action it has taken, as set out in Section 3.4.2)." (The reference to Section 3.4.2 may be in error, as Section 3.4.2 does not appear to pertain directly to submitted public comments.) Please demonstrate the action taken in response to each of the public comments submitted.

**Developer's Response:** Please find a sheet in this workbook called 'Public Comment' in which comments are addressed.

**Auditor Response:** As noted in the Developer's Response, a worksheet has been provided in which public comments have been addressed. However, it is not clear how the following comments have been addressed or demonstrated to be insignificant:

"Moreover, you should include a paragraph on error propagation, as proposed in Pearson et al. 2005, to assess uncertainties on field-based AGB estimates." (Mr. Ervan)

"1) First off, the text needs a good edit: there are a number of English language typos, grammatical issues, sentences that are really run-on phrases." (Mr. Schlesinger)

"14) There are no or no useful QA/QCs recommended to follow in this tool, though the term QAQC is in Part 6 listing of Data and Parameters. It only says to use "Utilize industry standard techniques for measurement". This is insufficient because there are many ways to calculate many of the parameters. For example, one can use a clinometer, laser rangefinder, hysometer, or use LIDAR, all of which would be industry standards but would give four different estimates of tree height. The purpose of the QAQC is to give clear advice on how and what to do to avoid discrepancies in estimation." (Mr. Schlesinger)

"What is meant by requiring that remotely sensed data must be available "for the time period required"?" (Mr. Strebel; the tool continues to require, as an applicability condition, that "The remotely sensed data necessary to estimate ALFB is accessible for the time period desired" and it is unclear how his comment has been addressed)

In addition, many of the reported responses to the comments made by Mr. Ervan and Mr. Schlesinger are limited to "section has been removed" or "Text has been modified per the suggestion". The indication that "section has been removed" does not provide any clarity regarding whether the underlying issue set out in the comment has been addressed. Neither of the indications quoted above constitute a demonstration of the actions taken in response to the comments submitted by these authors. In the absence of such a demonstration, it is not possible to assess whether each comment has been appropriately addressed.

**Developer's Response 2:** The specific items listed have been addressed in the public comment sheet. All instances in which removal of the section was used as explanation for resolution have been appended with specific clarifying statements referring to the comment.

**Auditor Response 2:** Through review of the revised public comment sheet, the assessment team can confirm that an adequate demonstration has been made as to how all comments have been either addressed or demonstrated to be insignificant/irrelevant. Therefore, the information request has been satisfied.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.11 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 4 of the VCS Module Template requires that "Applicability conditions must be specified clearly, and in a manner that allows easy determination of whether the module can be used by a methodology or other module". The tool states that "This module is not applicable under the following conditions... Predictive model must be parametric". It is not clear what condition is being stated, in the above text, under which the tool is not applicable.

**Developer's Response:** Requirement for parametric model was moved to the previous (applicable under...) and the phrasing was changed.

**Auditor Response:** Through review of Section 4 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the condition in question has been removed from its prior location and placed in a different context where its meaning is clearer. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.12 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 5; VCS Methodology Template, V3.3, Section 8.1

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.3.2

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 5 of the VCS Module Template requires the following: "Follow the instructions provided in any relevant sections of the VCS Methodology Template (eg, project boundary, baseline scenario, additionality and quantification of GHG emission reductions and removals)." Section 8.1 of the VCS Methodology Template requires the following: "Use the example format below (copy and paste) for specifying equations and defining the associated parameters and variables, including the unit of measure. Ensure all equations are numbered using captions to specify the equation number and enable cross-referencing." Section 8.1 of the VCS Methodology Template contains specific guidance for procedures for quantification of baseline emissions, and the assessment team understands that the methods set out in the tool are generic and can be used in the quantification of baseline emissions, project emissions or leakage emissions. However, Sections 8.2 (project emissions) and 8.3 (leakage emissions) refer to Section 8.1, and so the guidance provided by Section 8.1 of the VCS Methodology Template is applicable, and mandatory, in any case.

The following discrepancies exist in all equations provided in the tool:

1. The unit of measure is not provided in the format set out in Section 8.1 of the VCS Methodology Template.
2. Equations are not numbered using captions to specify the equation number.
3. The various indexes used (e.g., i, as used in Section 5.1.3.2) are not always clearly defined in the tool.

**Developer's Response:** 1. Equation units have all been included.

2. Equations have all been numbered

3. There is no clear guidance in the VCS documentation regarding indices. The indices i, j, k, l and t are used consistently to refer to RSSU, stratum, validation plot, cross validation rounds, and RSP respectively throughout.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that required changes have been made, equations have been numbered and index notation is consistently applied. However, the assessment team notes that the unit for the various data and parameters pertaining to variances is consistently given in units of tonnes per hectare. While this is the correct unit for the standard deviation (assuming input data are in tonnes per hectare), it is not the correct unit for the variance. Therefore, not all units of measure have been correctly specified, and the non-conformity has not been fully resolved.

**Developer's Response 2:** All instances in which variance terms are defined have been modified to be consistent with variance notation in AR-TOOL14 Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (No. 4.1). Retrieved from <http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v2.1.0.pdf>

**Auditor Response 2:** Through review of the updated tool, entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm that the unit of measure for the variance in Equation 18 have been correctly specified. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.13 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

Although Section 5.1.3.2 refers to strata as being assigned the subscript j (as opposed to the subscript i) in equations, there are numerous references within the tool to "stratum i". This discrepancy may lead to a lack of consistent application by intended users.

**Developer's Response:** Notation for the index of stratum have been changed to 'j' throughout.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that notation has been corrected in the manner described in the Developer's Response. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.14 dated 10-25-2014**

**Standard Reference:** VCS Standard V3.4, Section 4.1.4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.4

**Finding:** The VCS Standard requires the following: "Where applicable, methodology elements shall provide a means to estimate a 90 or 95 percent confidence interval. Where a methodology applies a 90 percent confidence interval and the width of the confidence interval exceeds 20 percent of the estimated value or where a methodology applies a 95 percent confidence interval and the width of the confidence interval exceeds 30 percent of the estimated value, an appropriate confidence deduction shall be applied." The tool does provide a means to estimate a confidence interval. However, the tool then only states that "Discounting should be applied where uncertainty is greater than the permissible threshold for the following steps in this methodology". The term "should", as specified in the introductory text in the VCS Module Template, "should is to be used to indicate a (non-mandatory) recommendation". Thus, the usage of the word "should" results in a failure to adequately enforce the requirement of the VCS Standard to apply a confidence deduction where required by the VCS Standard.

**Developer's Response:** All locations in the document where the term 'should' was used were evaluated based on the guidance and changed to 'must' where necessary.

**Auditor Response:** Through review of Sections 5.1.3.2 and 5.1.4 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the updated tool now explicitly requires accounting for uncertainty in the manner required by Section 4.1.4 of the VCS Standard. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.15 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSMB\_VT\_v2 2 7

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool contains numerous references to "cross validation", but the tool does not contain instructions on how to undertake the cross validation procedure or a reference to where said instruction may be obtained. This omission may lead to a lack of consistent application by intended users.

**Developer's Response:** A reference to the seminal paper articulating cross validation has been added.

**Auditor Response:** Through review of Section 5.1 of the updated tool, entitled "VCS\_RSMB\_VT\_v3.1.2", the assessment team can confirm a reference to the publication by Picard and Cook (1984) has been added. Through review of the publication by Picard and Cook (1984), the assessment team can confirm that the cross-validation is articulated within that paper with sufficient clarity that, in conjunction with the guidance provided in the tool, an educated user will have sufficient background to appropriately apply the technique within the context in which its application is required by the tool. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.16 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSMB\_VT\_v2 2 7

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool defines "Remote Sensing Sampling Unit (RSSU)", in Section 3, as "Intersecting area of a given stratum i or AOI and area covered by RS data". The tool then contains multiple references, in Section 5.1.3.2, to RSSUs "intersecting stratum j" (or similar language).

"Intersect" is defined by Merriam-Webster (<http://www.merriam-webster.com/dictionary/intersect>; accessed 24 October 2014) as "to pierce or divide by passing through or across". As each RSSU, by definition, is the product of intersection of area of a given stratum and area covered by RS data, any given RSSU does not, strictly speaking, divide any given stratum. By referring to RSSUs as "intersecting stratum j" (or similar language), the tool risks confusing users and leading to a lack of consistent application.

**Developer's Response:** This should be clarified by the additional graphic included in the definition section for the RSSU. There may be multiple RSSU's in each stratum.

**Auditor Response:** Through review of Section 3 of the updated tool, entitled "VCS\_RSMB\_VT\_v3.1.2", the assessment team can confirm that the definition of "RSSU" has been modified to remove the reference to "intersecting area" and clarify that an RSSU is "A distinct, contiguous area of a given stratum or AOI area covered by RS data". The assessment team agrees that the revised definition is much clearer, and that the included figure adds additional clarity. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.17 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3; Program Definitions, V3.5

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool contains numerous references to the term "methodology", and some of these references (examples of which are below) are inconsistent with the usage of the term as defined in the Program Definitions. Use of the term "methodology" in a manner inconsistent with the Program Definitions is likely to result in confusion on the part of intended users.

1. "The use of RS (LiDAR, RADAR, hyperspectral/hyperspatial imagery) in combination with a relatively small number field plots and can be used to achieve a statistically valid sample under this methodology" (page 3)
2. "This tool does not present a methodology for stratification" (page 6)
3. "The RS predictor methodology employed in this tool follows the model-dependent estimator (MDE) (Stahl et al. 2011) and is based on a data collection design that insures correct and unbiased estimate of carbon density or total carbon" (page 6)

**Developer's Response:** 1. changed to 'tool'  
2. changed to 'method'  
3. changed to 'method'

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that all potential confusing instances of usage of the term "methodology" that are inconsistent with the usage of that term under the VCS Program have been removed. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NIR 2014.18 dated 10-25-2014****Standard Reference:** VCS Standard V3.4, Sections 2.4.1 and 4.1.4**Document Reference:** VCS\_RSBM\_VT\_v2 2 7

**Finding:** Edge effect occurs when items near the physical edge of a sampling frame receive probabilities of selection that are different from those located farther to the interior of the sampling frame. This phenomenon is a commonly understood problem in forest sampling, but may also be present in the sampling methods described in the tool. For example, the tool indicates, in Section 5.1.2.1.1, that "Simple random sampling, systematic sampling, or stratified random sampling can be employed in designing RSSU". However, if RSSUs are deliberately selected such that they are completely contained within the stratum or area of interest, areas close to the edge of the stratum or area of interest will receive a lower probability of selection than areas closer to the interior. If edge effect is not explicitly addressed in the sampling methods, it can be predicted, theoretically, that some level of bias will result. The same problem is present with respect to location of sample units. It is not readily apparent that the tool has a mechanism for addressing the problem of edge effect and ensuring "correct and unbiased estimate of carbon density or total carbon" (as claimed in Section 5.1 of the tool). Please clarify the methods used to ensure unbiasedness, or provide a justification for how the tool reduces "bias and uncertainties as far as is practical", as required under the principle of "accuracy" (as set out in Section 2.4.1 of the VCS Standard, as referenced via Section 4.1.4 of the VCS Standard), or how conservativeness serves as a moderator to accuracy (in accordance with the gray guidance text in Section 2.4.1 of the VCS Standard), in light of the edge effect problem described above.

**Developer's Response:** There is no direction in the tool to deliberately select RSSU's such that they are completely contained within the stratum. The guidance states that random, systematic or stratified random sampling should be used for both RS and in-situ sampling. Thus there is no sampling bias that would lead to an edge effect. Some verbiage has been added to clarify what the sampling frame from which randomized or systematic samples should be taken.

**Auditor Response:** The addition of language to the tool pertaining to the sampling frame, along with the addition of Figure 1 (which provides clarity regarding the distinction between RSSU, RSP and strata), have been helpful in clarifying the situation regarding edge effect. In addition, the inclusion of criteria requiring a 1,000 m buffer around the perimeter of the AOI to be included within the sampling frame ensure that areas along the edge of the AOI have a known probability of selection. Therefore, the information request has been satisfied.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.19 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSMB\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 4 of the VCS Module Template requires that "Applicability conditions must be specified clearly, and in a manner that allows easy determination of whether the module can be used by a methodology or other module". The tool states that "This module is not applicable under the following conditions... This tool is not intended for use in detection of change in ALFB density over time. However, the tool presents a method that can be repeated over time to measure changes of ALFB." The language quoted above appears to be self-contradictory, as "detection of change in ALFB density" and "measure changes of ALFB" appear to be, fundamentally, equivalent activities. As stated, the condition does not clearly identify those conditions under which the tool is not applicable, and thus does not allow easy determination of whether the tool can be used by a methodology or other tool/module.

**Developer's Response:** Language in the applicability condition has been modified per the suggestion.

**Auditor Response:** Through review of Section 4 of the updated tool, entitled "VCS\_RSMB\_VT\_v3.1.2", the assessment team can confirm that clarifying language has been added. In particular, the tool now states that "This tool is not applicable under the following conditions... The overarching methodology requires specific method for determining change in biomass density over time", which more clearly describes the conditions under which the tool is not applicable. In addition, it is clarified that the tool "does not provide methods for temporal change in ALFB density" (but the assessment team agrees that such does not preclude the tool from being used in this manner). Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.20 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 2

**Document Reference:** VCS\_RSMB\_VT\_v2 2 7, Section 2

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 2 of the VCS Module Template requires "a brief summary description of the module, including the main/any procedural steps". The main procedural steps are not described in Section 2 of the tool.

**Developer's Response:** Added main procedural steps for the tool.

**Auditor Response:** Through review of Section 2 of the updated tool, entitled "VCS\_RSMB\_VT\_v3.1.2", the assessment team can confirm that an indication of the main procedural steps has been added. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.21 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool states, under Section 5.1.1, that "Stratification of the AOI may improve prediction of AFLB densities from RS data within like land cover types. It is not essential to stratify the AOI if the proponent: a) accepts increased uncertainty in the estimate, or b) employs a method that can achieve sufficient accuracy without the use of stratification." The quoted language may preclude consistent application by intended users, due to the following inconsistencies and instances of lack of clarity:

1. The first sentence indicates, through use of the term "may", that stratification is purely optional. The second sentence suggests that stratification may not be optional under some circumstances. Specifically, it is implied that stratification is necessary if the proponent either does not accept increased uncertainty in the estimate or does not employ a method that can achieve sufficient accuracy without the use of stratification. The indication that stratification is optional, followed by the suggestion that stratification may be necessary, may lead to confusion and inconsistent application by intended users.

2. The tool refers to "sufficient accuracy", but does not provide criteria for use in determining whether a given accuracy level is "sufficient".

**Developer's Response:** 1. Language has been changed to clarify the role of stratification in the tool.

2. This issue was resolved in responding to NCR 2014.5

**Auditor Response:** Through review of Section 5.1.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the text in question has been modified to remove any indication, express or implied, that stratification is required by the tool. While the phrase "sufficient accuracy" remains within the tool, the assessment team agrees that the usage does not conflict with the requirements of the VCS Module Template, as the term is used in a context that (as clarified by the updated tool) is completely non-binding in nature, and therefore there are no concerns with the looser language leading to inconsistent application by intended users. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.22 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool states, under Section 5.1.1, that "The same RS data may be used in stratification and biomass estimation, however sampling data used for calibration of the stratification methodology and sampling data use biomass estimation must be independent and distinct." The quoted language exhibits lack of clarity in the following instances, which may preclude consistent application by intended users.

1. The term "sampling data" is not defined, or used, elsewhere in the tool. It is unclear what is meant by this term.
2. The phrase "sampling data use biomass estimation" exhibits incorrect grammar.
3. It is unclear what is meant by "calibration of the stratification methodology".
4. If "sampling data" is equivalent to "RS data", the indication that "the same RS data may be used in stratification and biomass estimation" appears directly contradictory to the requirement that "sampling data used for calibration of the stratification methodology and sampling data use biomass estimation must be independent and distinct", as it is not possible for the same dataset to be used for two purposes while simultaneously holding different components of said dataset "independent and distinct".

**Developer's Response:** 1.The term 'sampling data' has been prefaced where relevant with 'in-situ' referring to ground based sampling.

2. Changed to 'in-situ sampling data (SP) used in biomass estimation'

3. Language has been clarified.

4. See (1) above.

**Auditor Response:** Through review of Section 5.1.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the language in question has been made clear, and it is particularly clarified that sampling data are derived from sample plots (as opposed to from remote sensing). Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.23 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool states, under Section 5.1.1, that "Forest stratification must be conducted in accordance with overarching guidance on land cover classification from VCS, CDM, or other emissions reduction methodologies [sic] being employed concurrently". The quoted language exhibits lack of clarity in the following instances, which may preclude consistent application by intended users.

1. Footnote 1 includes a reference to Section 8.1.2 of VCS Methodology VM0006 (Terra Global Capital 2013), which implies that VCS-approved methodology VM0006 contains "overarching guidance on land cover classification from VCS". The term "methodology" is defined in the Program Definitions as "A specific set of criteria and procedures, which apply to specific project activities, for identifying the project boundary, determining the baseline scenario, demonstrating additionality, quantifying net GHG emission reductions and/or removals, and specifying the monitoring procedures". In accordance with this definition, VCS-approved methodology VM0006 contains "A specific set of criteria and procedures, which apply to specific project activities", but cannot be stated to contain "overarching guidance on land cover classification" (or any other task, for that matter).
2. The phrase "Forest stratification must be conducted..." implies that stratification is mandatory. This is contradictory to other language earlier in Section 5.1.1.
3. The reference to "overarching guidance on land cover classification from... CDM" is overly vague. The library of guidance from the Clean Development Mechanism program is large, existing over a suite of program documents, tools and methodologies. Given the lack of reference to a specific document or set of requirements, the language in question cannot be considered "precise".
4. The reference to "emissions reduction methodologies" is similarly imprecise. The term "emissions reduction methodology" is not defined as a category under the VCS Program, and is not defined within the tool. It is not clear how this language is to be interpreted in the context of projects that generate emission removals, as opposed to emission reductions.

**Developer's Response:** The paragraph has been modified substantially to remove suggestions regarding specific methodologies.

**Auditor Response:** Through review of Section 5.1.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the text in question has been substantially modified, as follows:

1. References to the VM0006 methodology containing "overarching guidance on land cover classification from the VCS" have been removed.
2. Language implying that stratification is a mandatory activity has been removed.
3. The vague (and unnecessary) reference to the CDM has been removed.
4. The term "emissions reduction methodologies" has been removed and replaced with the clearer term "overarching (VCS or otherwise) methodology".

Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.24 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The cover page of the VCS Module Template requires the following: "For AFOLU modules, indicate the applicable project category (ALM, ARR, IFM, REDD, WRC, ACoGS) and specific project type (eg, ICM, LtPF, APDD, RWE,AUC)". The tool exhibits the following non-conformities with respect to this requirement.

1. The "applicable project category" for project type RWE is not clearly stated.
2. The "applicable project category" for project type APD is not clearly stated.
3. The tool implies that LtPF is a project type under the WRC project category, which is incorrect.
4. The tool lists specific project types under the REDD, WRC and IFM project categories, but those categories are not clearly associated with the project types, as noted above. This creates lack of clarity regarding whether or not the tool is applicable to other project types within the respective project categories (e.g., whether or not the tool is applicable to the AUDD project type under the REDD project category).
5. The tool omits listing of some project categories (e.g., ALM) and some project types within categories (e.g., REDD-AUDD), implying that the tool is not applicable to all AFOLU project categories. However, the tool also states, in Section 2, that "This tool is intended for use with all approved VCS methodologies within the scope of Agriculture, Forestry, and Land Use". Thus, the specification of the applicable project categories and types is inconsistently stated.

**Developer's Response:** Text has been modified per the finding.

**Auditor Response:** Through review of the cover page of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the text in question has been modified to the following: "AFOLU - REDD, IFM, ARR, WRC". In addition, review of Section 2 of the updated tool confirms that the text in question has been modified to the following: "This tool is intended for use with approved VCS methodologies within the scope of Agriculture, Forestry, and Land Use involving estimation of Aboveground Live Forest Biomass. This tool is therefore limited to project categories within the scope of AFOLU where forest is present and estimation of ALFB is required." The assessment team agrees that the project categories REDD, IFM, ARR and WRC cumulatively encompass all project activities in which forest is present and estimation of AFLB (as defined in the tool) is required. Therefore, the assessment team agrees that the tool is no longer internally inconsistent regarding the project categories included in the scope of the tool. In addition, is there is evidently no "specific project type" to which the tool is applicable, the assessment team agrees that the requirement to include the "specific project type" is not relevant. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.25 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool states, under Section 5.1, that "The level 2 samples must be a representative sample in order to reduce the risk of bias", but provides no criteria against which representativeness of the sample must be assessed. The tool also states, in the same section, that "Sampling plots... must represent to the greatest extent possible, the full range and variability of biomass density within the stratum or AOI", but provides no criteria for assessment of whether a given set of sampling plots represents "to the greatest extent possible, the full range and variability of biomass density within the stratum or AOI".

The lack of criteria highlighted above may preclude consistent application by intended users.

**Developer's Response:** The section uses some general terms that are given precise meaning in subsequent procedural steps. This section is intended to use more general terms to give the reader an overall intuition of important aspects of the methodology. The detailed procedural steps that follow give specific criteria derived from the desired confidence in the final estimate precluding inconsistent application by intended users.

**Auditor Response:** Through review of Section 5.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the text "a representative sample" has been replaced with the more descriptive text "selected randomly with replacement or systematically". The assessment team agrees that these terms are sufficiently well-described and understood in the field of forest sampling, and additional criteria regarding sampling is provided in Section 5.1.2.1.1.

However, no change has been made to the requirement in the tool that sampling plots "must represent to the greatest extent possible, the full range and variability of biomass density within the stratum or AOI."

The assessment team's concerns with this language have been noted previously. In addition, it should be noted that this requirement to have sampling plots represent "to the greatest extent possible, the full range and variability of biomass density within the stratum or AOI" may conflict with the requirement to select sample plots "randomly with replacement or systematically", as a randomly selected sample may, in many cases, arguably not represent "to the greatest extent possible, the full range and variability of biomass density within the stratum or AOI".

As no change has been made to the requirement that sampling plots "must represent to the greatest extent possible, the full range and variability of biomass density within the stratum or AOI", the non-conformity has not been resolved,

**Developer's Response 2:** The text 'must represent to the greatest extent possible, the full range and variability of biomass density within the stratum or AOI' has been removed from the tool.

**Auditor Response 2:** Through review of the updated tool, entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm that the unit of measure for the variance in Equation 18 have been correctly specified. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NIR 2014.26 dated 10-25-2014**

**Standard Reference:** VCS Standard V3.4, Sections 2.4.1 and 4.1.4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1

**Finding:** The VCS Standard requires, under the principle of "accuracy" (as set out in Section 2.4.1 of the VCS Standard, as referenced via Section 4.1.4 of the VCS Standard), that bias and uncertainties be reduced "as far as is practical" (allowing that "the hypothetical nature of baselines, the high cost of monitoring of some types of GHG emissions and removals, and other limitations make accuracy difficult to attain in many cases... conservativeness may serve as a moderator to accuracy in order to maintain the credibility of project and program GHG quantification").

The tool specifically does not require, in Section 5.1, that level 2 samples be collected using a statistically valid sampling design, stating that "the primary objective of SPs is to facilitate predictive model (PM) development, not to be used as an unbiased estimation tool such as in forest inventory sampling". However, the tool also states that "The RS predictor methodology employed in this tool follows the model-dependent estimator (MDE) (Stahl et al. 2011) and is based on a data collection design that insures correct and unbiased estimate of carbon density or total carbon."

Please provide a justification for how a statistically valid sampling design for selecting level 2 samples is not required for design-unbiased estimation of Aboveground Live Forest Biomass using the procedure set out in the tool, and how the resulting estimation of Aboveground Live Forest Biomass is consistent with the principles set out in Section 2.4.1 of the VCS Standard. Please provide any referenced literature in order to allow the assessment team to independently assess any of the claims made.

**Developer's Response:** Level 2 (SP) sampling is not to develop a statistically accurate estimate of ALFB for the stratum or AOI. Level 2 sampling is used to calibrate the predictive model (PM) relating RS metrics to ALFB. The PM is essentially an allometric relationship between RS metrics and ALFB. The location of SP's must be chosen randomly or systematically to eliminate bias, the number of plots is justified via citation.

**Auditor Response:** Upon further review of the information provided, and the publication by Stahl et al. (2011), the assessment team agrees that the estimators described in the tool do not depend upon level 2 sampling being carried out in a statistically sound manner. Stahl et al. (2011) specifically state that "Sample S2 is assumed to be acquired in a manner appropriate for estimating the parameters in the vector a. According to the assumptions of regression analysis, this can be done in many different ways, ranging from purposive to random sampling (e.g., Royall 1970; Royall and Herson 1973)" (page 99). However, the assessment team also agrees that the adjustments to Section 5.1 of the tool, and the requirement that level 2 sampling be carried out "randomly with replacement or systematically" is helpful in lending further credibility to the approach set out in the tool.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.27 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool contains the following language under Section 5.1:

"The level 1 and level 2 sampling must be independent. That is to say, the RS survey must not be designed to use existing plots. RS data collection should be planned to cover sufficient area within each stratum (or AOI) to achieve desired precision in the estimate. Predictive model relationships between level 1 and level 2 data are established using a subset of the sampled area and tested using the remainder of the sampled area using a cross validation procedure to provide both accuracy and precision, which must be clearly documented. The number of SPs is limited to calibration and validation of predictive model only and is not used to independently estimate ALFB at the stratum or AOI scale. In the case of wall-to-wall mapping of the AOI, the PM can be directly used to estimate the mean and variance of ALFB of AOI without the need for stratification or statistical sampling approach. "

This language is unclear in the following instances, which may preclude consistent application by intended users:

1. The tool states that "the level 1 and level 2 sampling must be independent" but then states that "the RS survey must not be designed to use existing plots". While specifically designing the remote sensing survey to use existing plots would constitute a clear instance of violation of the requirement for independence, the definition of independence implied in this language is narrower than the commonly understood definition of independence. For example, if information about the location of RSSUs is used to determine the location of the SPs, that would also violate the requirement for independence of sampling, but it would be allowed under the narrower definition of "independent" implied by the tool.
2. The tool states that "The level 1 and level 2 sampling must be independent", but also states in the above language that "Sampling plots should be located within the RSSUs". This language appears to be self-contradictory.
3. The tool states that "Predictive model relationships between level 1 and level 2 data are established using a subset of the sampled area and tested using the remainder of the sampled area", but it is not clear what is meant by "sampled area".
4. The tool states "The number of SPs is limited to calibration and validation of predictive model only and is not used to independently estimate ALFB at the stratum or AOI scale." It is not clear how information on "the number of SPs" can be used for "calibration and validation of predictive model". It is also not completely clear what activity is precluded by the requirement to not "independently estimate ALFB at the stratum or AOI scale".
5. The tool states that "In the case of wall-to-wall mapping of the AOI, the PM can be directly used to estimate the mean and variance of ALFB of AOI without the need for stratification or statistical sampling approach." This language is entirely unclear. The indication that stratification is not needed in the case of "wall-to-wall mapping of the AOI" appears contradictory to the requirement for stratification in Section 5.1.1, which indicates that "Stratification if employed, must result in a wall-to-wall (tessellation) map of like land cover types covering the AOI"; the implication of the latter requirement is that stratification directly results in wall-to-wall mapping of the AOI (it is unclear how "wall-to-wall (tessellation) map of like land cover types covering the AOI" is different from "wall-to-wall mapping of the AOI"). In addition, it is not clarified exactly which procedures set out in the tool are not required in the case of "wall-to-wall mapping".

**Developer's Response:** 1. Language has been modified per the comment.  
 2. Resolved by modification made per (1)  
 3. Sampled area is clarified using terms from the Definitions section  
 4. "the number" changed to "the use".  
 5. "wall-to-wall" in the quoted text refers to wall-to-wall carbon density mapping. The text has been changed to reflect this. As stated in the text, the use of the term 'wall-to-wall' in section 5.1.1 refers to a tessellation of the AOI into like-landcover types. Wall to wall mapping can be conducted using the unadulterated tool only when the RS data covers the entire AOI. In this case, all procedures in the tool are used.

**Auditor Response:** Through review of Section 5.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the language in question has been considerably clarified and strengthened. Additional information has been provided regarding the relationships between the level 1 and level 2 samples, and reference to sample area are clearly linked to the defined terms in Section 3. With respect to item 5 in the text of the finding, some revisions have been made to the language such that the guidance of the tool can no longer be read as self-contradictory. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.28 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "All sections must be completed using Arial 10pt, black, regular (non-italic) font." The figure captions in the tool do not comply with the font requirements of the VCS Module Template, as they are provided using Arial 9pt, blue font.

**Developer's Response:** Caption font has been altered to meet the standard.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that all instances of non-compliant font usage in figure captions have been corrected. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.29 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.2.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool contains the following language under Section 5.1.2.1.1:

"Simple random sampling, systematic sampling, or stratified random sampling can be employed in designing RSSU. The size of RSSU must be much larger than the SPs to meet the required precision. In general, ALFB estimation based solely on RSSU is assumed to have larger errors than estimation based only on SPs. The use of larger sample units reduces the estimator error. For example, most common LiDAR estimators have about 10% error relative to SP estimates at the 1-ha scale, thus to reduce the error to about 1%, the area of LiDAR samples must be at least 100 times larger.

RSPs are inherently clustered due to the swathing or field-of-view configuration of airborne or space-borne sensors. ALFB estimation using the RSSU must include the spatial correlation among cluster points. The size of RSSU must be larger than the spatial correlation length of RSSU estimator error. The number of samples for each stratum or AOI depends on the size of RSSU. The number of samples and the size of samples to achieve the required precision are inversely related: the smaller the sample size, the larger the number of samples.

RSSUs for each stratum or for the AOI must be of a minimum size to allow unbiased estimation of mean for each stratum. The area of RSSU coverage in terms of number of hectares (n) for each stratum or of the AOI can be calculated from the following:"

This language is unclear in the following instances, which may preclude consistent application by intended users:

1. The tool states that "The size of RSSU must be much larger than the SPs to meet the required precision", but does not provide specific criteria for what is meant by "much larger". In addition, it is not clear if the quoted text refers to the size of a single RSSU, relative to the size of a single SP, or if the quoted text refers to the cumulative size of all RSSUs, relative to the cumulative size of all SPs.
2. The tool states that "For example, most common LiDAR estimators have about 10% error relative to SP estimates at the 1-ha scale, thus to reduce the error to about 1%, the area of LiDAR samples must be at least 100 times larger." It is unclear if the usage of the term "must" refers simply to the general relationship between LiDAR sample coverage and sample plot coverage, or if it refers to a specific requirement of the tool.
3. The tool states that "The size of RSSU must be larger than the spatial correlation length of RSSU estimator error", but does not provide criteria and procedures for determining "the spatial correlation length of RSSU estimator error".
4. The tool states that "RSSUs for each stratum or for the AOI must be of a minimum size to allow unbiased estimation of mean for each stratum", but does not provide criteria for determination of the "minimum size" that is necessary.

**Developer's Response:** 1. Once again, relative terms are used here to give an intuition of the relationships. The size of the RSSU when applying this tool is determined using equation (2)

2. The sentence is intended as exemplary ('For example..') The tool does not specify LiDAR as a necessary platform. The use of the term 'must' refers to mathematical relationship between the area of LiDAR samples in the example and the target error percentage.

3. The spatial correlation length is equivalent to the range from the semivariogram (r) which is used in equation 4. Description of the term and a reference to be used in its derivation is found in the first full paragraph on page 12 beginning 'The semivariogram analysis defining the correlation coefficient...'

4. Equation 2 is used to calculate the size of the RSSU. "The area of RSSU coverage in terms of number of RSPs (hectares, n) for each stratum or of the AOI can be calculated from the following: "

**Auditor Response:** Through review of Section 5.12.1.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that additional clarity has been added to the language in question. The assessment team's findings regarding the response to the various items raised in the text of the finding is as follows.

1. The issue has been resolved through deletion of the sentence in question. The assessment team agrees that the sentence in question was not a necessary component of the tool.
2. While it make sense that the sentence in question was intended as exemplary, it is not clear (from review of the tool alone) that the statement that "to reduce the error to about 1%, the area of LiDAR samples must be at least 100 times larger" was intended as applying only to the example given. The language in question could very easily be interpreted as containing some sort of requirement for application of the tool, particularly given usage of the term "must" (which, per the VCS Module Template, "is to be used to indicate a firm requirement"). While the statement that "to reduce the error to about 1%, the area of LiDAR samples must be at least 100 times larger" indicates a mathematical relationship, the indicated mathematical relationship only holds true under the conditions set out in the example (that is, where "LiDAR estimators have about 10% error relative to SP estimates") and will not necessarily hold true in all cases. Therefore, the statement in question does not set out any underlying mathematical principle. For these reasons, the observations noted in the text of the finding remain relevant.
3. Additional clarity has been added through an explicit reference to Equation 2.
4. Additional clarity has been added to confirm that what is important is the combined size of RSSUs (as opposed to the average size or some other metric).

However, due to the continued relevance of the observation in item 2 of the text of the finding, the non-conformity has not been fully resolved.

**Developer's Response 2:** 2. The exemplary sentence has been removed.

**Auditor Response 2:** Through review of Section 5.1.2.1 of the updated tool, entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm that the sentence "For example, most common LiDAR estimators have about 10% error relative to SP estimates at the 1-ha scale, thus to reduce the error to about 1%, the area of LiDAR samples must be at least 100 times larger" has been removed. The assessment team agrees that the sentence in question was not critical to the proper functioning of the tool, and its removal does not result in a non-conformity. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.30 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 5; VCS Methodology Template, V3.3, Section 8.1

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.2.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 5 of the VCS Module Template requires the following: "Follow the instructions provided in any relevant sections of the VCS Methodology Template (eg, project boundary, baseline scenario, additionality and quantification of GHG emission reductions and removals)." Section 8.1 of the VCS Methodology Template requires the following: "Include summary information to describe the context of equations, and use an appendix for any lengthier explanations. Use the example format below (copy and paste) for specifying equations and defining the associated parameters and variables, including the unit of measure. Ensure all equations are numbered using captions to specify the equation number and enable cross-referencing." Section 8.1 of the VCS Methodology Template contains specific guidance for procedures for quantification of baseline emissions, and the assessment team understands that the methods set out in the tool are generic and can be used in the quantification of baseline emissions, project emissions or leakage emissions. However, Sections 8.2 (project emissions) and 8.3 (leakage emissions) refer to Section 8.1, and so the guidance provided by Section 8.1 of the VCS Methodology Template is applicable, and mandatory, in any case.

The Equations in Section 5.1.2.1.1 of the tool exhibit the following non-conformities with respect to the requirements of the VCS Methodology Template.

1. The symbol of the defined variable "Range (m) from semivariogram quantifying the spatial correlation of errors associated with cluster samples in RSSU" does not display clearly in the Microsoft Word version of the tool that was provided to the assessment team for review. This, it is not clear what parameter this variable refers to.
2. Several of the variables used in the equations (e.g.,  $cr$ ,  $z(v)$ ) are not defined.
3. The tool does not provide any guidance as to how many of the variables (e.g., "Range (m) from semivariogram quantifying the spatial correlation of errors associated with cluster samples in RSSU", "Spatial correlation function in terms of distance  $d$  based on exponential semivariogram model", "Variance associated with PM error for each 1-ha pixel") are to be calculated in the absence of RS data. Since the equation is intended to provide guidance as to the number of RSSUs to sample, and the tool contains no guidance on how to quantify the above variables in the absence of sample data, the tool does not provide sufficient guidance to ensure that the equation can be successfully implemented.
4. The parameter  $d$  is defined as "Distance (m) between center of two RSP's within the RSSU", but it is not clear which RSPs are being referred to. (While the distance between two adjacent RSPs may be quite small, it is anticipated that the difference between two RSPs located at opposite ends of the RSSU would be larger.)
5. The parameter  $m$  is defined as "The number of 1-ha pixels (RSPs) within RSSU". This definition explicitly indicates that an RSP is defined as being a "1-ha pixel". However, the definition of RSP in Section 3 of the tool does not contain a specification of the size of the RSP, and the tool contains no requirements for the size of the RSP elsewhere, other than the requirement, in the same section, that "The pixel resolution of the produced from the RS platform should not exceed the size of the SP." Thus, the specification of the parameter  $m$  is inconsistent with the definition of RSP, as provided in Section 3 of the tool.

**Developer's Response:** 1. The term '(m)' was removed from the text as a typo.  
 2. c,r are defined in the table following the equations. They are distinct terms.Z\_v has been replaced by t\_val.  
 3. The equation is provided to allow for including spatial correlation in calculating the number of samples. This can be done, by using available models in literature for typical lidar data allowing bounds for sample size for each lidar transect (Reference provided). The paraterms can also be estimated using a previously flown lidar transect using similar measurement characteristics and similar forest types. Default bounds from literature are the best approach to allow for the sample size estimates.  
 4. d is defined as the distance between two RSP's but as in semivariograms it is a variable allowing distance to be large for pixels or RSP's being far from each other. Larger distances have lower value of spatial correlation and less impact on the sample size selection.  
 5.'(RSPs)' was removed from the definition of m  
 5.'(RSPs)' was removed from the definition of m

**Auditor Response:** Through review of Section 5.1.2.1.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the comments of the assessment team have been addressed as follows.

1. The assessment team has identified no change in the tool in response to this item. The symbol of the defined variable "Range (m) from semivariogram quantifying the spatial correlation of errors associated with cluster samples in RSSU" continues to not display clearly in the Microsoft Word version of the tool.
2. The variables c and r are defined. However, the definition for r, as given in Equation 6, is confusing, as it seems to indicate that r should be calculated as the difference between 100 and 1000 (but this does not seem consistent with the explanatory text).
3. While additional guidance regarding calculation of variables of interest is provided, the tool does not contain clear instruction as to how the "Variance associated with PM error for each 1-ha pixel" is to be determined in the absence of a priori data or a pilot study, or how it is to be calculated in the event that a priori data exist or a pilot study is conducted.
4. Additional clarity has been provided to address this point.
5. Section 3 of the tool clarifies that a RSP is equal in area to 1 ha; therefore, this item has been addressed.

While many of the non-conformities have been resolved, this finding remains open regarding items 1, 2 and 3 above.

**Developer's Response 2:** 1. In the version submitted there is no parenthetical 'm'. The definition of 'r' has been changed.  
 2. The definition of 'r' has been clarified.  
 3. The verbiage has been changed to reflect that the variance used in estimate the number of RSSUs is not the PM error but the variance of ALFB from a priori data or a pilot study. Prescribing a method for a pilot study to provide input parameters to estimate RS coverage area is beyond the scope of this analysis. Provision has been made to document and/or justify the pilot study or a priori dataset used in this step. In addition a method has been provided to estimate  $\sigma^2_{ui,j}$  using a single estimate of ALFB density over the entire AOI.

**Auditor Response 2:** The assessment team can confirm, through review of what is now Section 5.1.2.1 of the updated tool entitled "VCS\_RSBM\_T\_v3.3", that all symbols display clearly and that criteria have been provided for ex-ante estimation of variance. The assessment team agrees that it is not incumbent upon the tool to provide highly prescriptive criteria regarding this aspect of the tool, as it pertains solely to the ex-ante determination of sample size, rather than the quantification of GHG emission reductions/removals.

However, while a clearer description of the variable r has been provided, this description is not completely clear regarding the unit of measure for this variable. The text states that the unit is "distance measurement units in units of pixels". This appears to conflict with the text indicating that the "Default value is 1000 m or ten 1ha pixels". The tool does not clearly stated whether (or under what conditions) the default value is 1000 m or ten pixels. It can be intuitively seen that very different results will be obtained from inputting the value 1000, versus the value 10, into Equation 4.

Therefore, the non-conformity has not been completely resolved.

**Developer's Response 3:** The defintion of r has been modified, the reference to meters has been removed

**Auditor Response 3:** Through review of the updated tool, entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that an effort has been made to revise the description of the variable "r" to indicate that unit of measure is pixels. However, the tool remains not completely clear on this matter. For administrative reasons, this finding will be closed and another finding, NCR 2014.51, will be opened to address the remaining discrepancies.

**Closing Remarks:** While the Developer's response does not adequately address the finding, all remaining discrepancies are addressed in NCR 2014.51.

**NCR 2014.31 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.2.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool contains the following language under Section 5.1.2.1.1:

"A map of the RS data collection plan, reporting of the method used to achieve randomized RS data collection, and tabular reporting of RS data coverage by strata must be included... The pixel resolution of the produced from the RS platform should not exceed the size of the SP."

This language is unclear in the following instances, which may preclude consistent application by intended users:

1. It is unclear where, exactly, the "map of the RS data collection plan, reporting of the method used to achieve randomized RS data collection, and tabular reporting of RS data coverage by strata" must be included.

2. It is unclear exactly what is meant by "The pixel resolution of the produced from the RS platform".

**Developer's Response:** 1. 'Included' changed to 'reported'

2. Text modified for clarity

**Auditor Response:** Through review of Section 5.1.2.1.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the first instance of confusing language has been removed altogether. The assessment team agrees that the language was not necessary within the tool. The assessment team can also confirm that the second instance of confusing language was modified for greater clarity. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.32 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.2.1.2

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool contains the following language under Section 5.1.2.1.2:

"Level 1 and level 2 sampling must be independent, hence the location of SPs must be established at random or systematically within each RSSU. Adherence to random selection without replacement of SP locations is critical. There is no requirement for SPs to be co-located with all RSSUs... If stratification with distinct ground tree allometric relations is used, distinct RS -> ALFB allometric relationships must be developed for each stratum; therefore sampling to develop the relationship should be conducted within the overlapping area of the RS data extent and the stratum and in areas accessible to the field crew. The number of strata for developing RS -> ALFB allometric relationships must be limited to the number of available ground allometric relations (i.e. wet, moist, dry tropical forests). If stratification is within one forest type with one allometric equation, only one RS -> ALFB allometric relationship must be used. In this case, the RS ALFB estimator will rely on the number of RSSUs within each stratum to provide ALFB with the required precision. A minimum of 45 SPs should be established within the area covered by the RS data within the AOI. Of the 45 SPs 30 Calibration Plots (CP) should be used to develop the PM and 15 used as Validation Plots (VP) (Asner & Mascaro 2014). In the case of stratification within one forest type (i.e. one ground allometric equation), the total number of plots required for the methodology will remain at minimum of 45. Sample plots must be large enough to avoid edge effects and provide unbiased relationship with RS metrics (e.g. mean canopy height, top canopy height). Minimum size of 0.25 ha (rectangular: 50 m x 50 m) or 0.28 ha (circular: 30 m radius) (Meyer et al. 2013; Asner et al. 2012; Asner et al. 2013) should be used for developing RS -> biomass allometry. These plots are temporary plots used to calibrate the RS data.

1. The QA/QC for data collection must follow the existing methodology as in AR-TOOL-14
2. RS-ALFB model includes only the aboveground live biomass in shrubs and trees.

The components of vegetative biomass that are to be estimated using this tool must be measured as directed in the overarching methodology.

Positional accuracy of plots used in calibrating RS models is critical in contrast with traditional stratified random sampling. Error in positional accuracy of in-situ plot location should be less than the single pixel extent of the RS data being used and must be reported. The manufacturer and model of the Global Positioning System used should be reported and the reported accuracy of the location by the instrument should be recorded at each plot. The average positional accuracy for all in-situ plot locations should be less than 1.5 times the length of the hypotenuse of the triangle formed by the x and y pixel extent of RS data."

This language is unclear in the following instances, which may preclude consistent application by intended users:

1. The tool states that "Level 1 and level 2 sampling must be independent, hence the location of SPs must be established at random or systematically within each RSSU." This language appears to be self-contradictory, as the requirement that SPs be specifically located within RSSUs appears to contradict the requirement that "Level 1 and level 2 sampling must be independent".
2. The tool states that "the location of SPs must be established at random or systematically within each RSSU" but also states that "There is no requirement for SPs to be co-located with all RSSUs". This language appears to be self-contradictory, as the first sentence indicates that SPs must be located within each RSSU and the second sentence explicitly indicates that this is not a requirement.
3. The tool refers to "distinct ground tree allometric relations" and "available ground allometric relations"; it is entirely unclear what is meant by these terms.
4. The purpose of the paragraph beginning with "If stratification with distinct ground tree allometric relations is used..." is entirely unclear.
5. The tool states that "sampling to develop the relationship should be conducted within the overlapping area of the RS data extent and the stratum and in areas accessible to the field crew". Depending on how the term "accessible" is defined, this may well contradict the requirement that "the location of SPs must be established at random or systematically within each RSSU". The second sentence requires that SPs be established using a statistically valid sampling design, while the first sentence indicates that convenience and accessibility may be a consideration in determining the location of SPs.

6. The statement that "In the case of stratification within one forest type (i.e. one ground allometric equation), the total number of plots required for the methodology will remain at minimum of 45" appears to contain a specific requirement; this contradicts language earlier in the paragraph, which uses the term "should" to indicate a recommendation regarding sample size (e.g., "A minimum of 45 SPs should be established within the area covered by the RS data within the AOI").

7. The tool states that "In the case of stratification within one forest type (i.e. one ground allometric equation), the total number of plots required for the methodology will remain at minimum of 45", which appears to indicate a requirement of the tool (in this case, the requirement that at least 45 plots are installed). This appears to contradict the preceding sentence, which uses the term "should" to indicate a recommendation, as opposed to a requirement, that 45 plots be installed.

8. The tool states that "Sample plots must be large enough to avoid edge effects and provide unbiased relationship with RS metrics (e.g. mean canopy height, top canopy height)", but does not provide criteria to aid in the determination of whether a given sample plot is "large enough". The tool does provide some recommendations in the following sentences, but the term "should" is used to denote these as non-binding recommendations, as opposed to auditable criteria.

9. The tool states that "The QA/QC for data collection must follow the existing methodology as in AR-TOOL-14", but does not provide a clear reference to "AR-Tool-14".

**Developer's Response:** 1. 'RSSU' should be 'stratum' in the quoted sentence. SP and RSSU do not have to be coincident.

2. Resolved by change from (1).

3. the terms 'ground' and 'tree' have been removed in both cases.

4. This paragraph has been rewritten.

5. See (1) for resolution.

**Auditor Response:** Through review of Section 5.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that many of the observations described in the text of the finding have been addressed. However, the following discrepancies, as reproduced below using the numbering system employed in the text of the finding, have not been addressed:

9. The tool states that "The QA/QC for data collection must follow the existing methodology as in AR-TOOL-14", but does not provide a clear reference to "AR-Tool-14".

In addition, it is unclear what is meant by the sentence "The number of strata for developing RS allometric relationships must be limited to the number of available allometric relations (i.e. wet, moist, dry tropical forests)." This is primarily due to lack of clarity in the intended meaning of the phrase "available allometric relations".

Therefore, the non-conformity has not been fully resolved.

**Developer's Response 2:** The reference to AR-Tool-14 has been added. The unclear sentence has been removed from the text which should clarify meaning.

**Auditor Response 2:** The assessment team can confirm, through review of the updated tool entitled "VCS\_RSBM\_T\_v3.3", that the text "The number of strata for developing RS

relationships must be limited to the number of available allometric relations (i.e. wet, moist, dry tropical forests)" has been removed. The assessment team agrees that this text was not critical to the functioning of the tool, nor did it add much clarity. Therefore, the assessment team agrees that it is acceptable to remove the text.

In addition, the assessment team confirmed that the reference to "AR-TOOL-14" has been clarified. Once the tool in question was identified, the assessment team referred to the tool to determine whether it contained clear "QA/QC procedures" that could be followed. The only instances of this term identified through a word search of the AR-TOOL-14 are located under "Data and parameters measured". All instances are highly specific to measurement of individual parameters. As the tool does not use the same parameters presented in the AR-TOOL-14, it is unclear how a user is intended to adapt the QA/QC procedures in AR-TOOL-14 for use with the tool, and the tool does not provide sufficient guidance regarding this topic. Therefore, the non-conformity has not been resolved.

**Developer's Response 3:** Reference to AR Tool 14 has been changed to Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC, 2003) which has specific guidelines for QA/QC procedures.

**Auditor Response 3:** Through review of the updated tool, entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that the Good Practice Guidance for Land Use, Land-Use Change and Forestry is now referenced for QA/QC procedures. However, the reference is not sufficiently clear. For administrative reasons, this finding will be closed and another finding, NCR 2014.52, will be opened to address the remaining discrepancies.

**Closing Remarks:** While the Developer's response does not adequately address the finding, all remaining discrepancies are addressed in NCR 2014.52.

**NCR 2014.33 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.2.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool states, in Section 5.1.1, that "If this method is being deployed independently of other methodologies and no guidance is available see Johnson (Johnson 2000)." The term "methodology" is consistent with the definition in the Program Definitions, it is unclear under what circumstances the tool would be applied "independently of other methodologies". It is also unclear what guidance is intended to be sourced from Johnson 2000. In the absence of further clarification regarding the circumstances under which the language in question may be applicable, and in the absence of further clarification regarding how the guidance from Johnson 2000 is intended to be used, confusion and inconsistent application by intended users may result.

**Developer's Response:** See revised text. It is conceivable that the tool could be used independently of any other VCS, CDM, REDD.....etc. methodology. The intent of the text is to acknowledge this possibility a useful reference on stratification in that case.

**Auditor Response:** Through review of the Section 5.1.2.1.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that additional information has been provided to clarify the circumstances under which the tool would be applied "independently of other methodologies". In addition, the assessment team notes that the consistent usage of the terms "tool" and "methodology" have helped, in and of themselves, to clear up much of the potentially confusing language present in the previous version of the tool. Finally, additional clarity has been added regarding the manner in which the Johnson (2000) publication is referenced by the tool. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NIR 2014.34 dated 10-25-2014**

**Standard Reference:** VCS Standard V3.4, Sections 2.4.1 and 4.1.4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.2.1.2

**Finding:** The VCS Standard requires, under the principle of "accuracy" (as set out in Section 2.4.1 of the VCS Standard, as referenced via Section 4.1.4 of the VCS Standard), that bias and uncertainties be reduced "as far as is practical" (allowing that "the hypothetical nature of baselines, the high cost of monitoring of some types of GHG emissions and removals, and other limitations make accuracy difficult to attain in many cases... conservativeness may serve as a moderator to accuracy in order to maintain the credibility of project and program GHG quantification").

The tool states, in Section 5.1.2.1.2, that "Positional accuracy of plots used in calibrating RS models is critical in contrast with traditional stratified random sampling." The tool then provides guidance (in the form of recommendations) for minimum accuracy thresholds, but does not provide auditable criteria (i.e., requirements) for minimum accuracy. If the positional accuracy is critical, it seems strange that minimum thresholds for said accuracy would not be set out as mandatory by the tool. Please provide a justification for the approach taken by the tool, along with a justification that the principles of accuracy and conservativeness, as set out in the VCS Standard, are not violated.

**Developer's Response:** see revised language

**Auditor Response:** Through review of the Section 5.1.2.1.2 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the following binding guidance has been added regarding positional accuracy:

1. The tool requires that "error in positional accuracy of in-situ plot location must be less than the single pixel extent of the RS data being used and must be reported."

2. The tool requires that "The average positional accuracy for all in-situ plot locations must be less than 1.5 times the length of the hypotenuse of the triangle formed by the x and y pixel extent of RS data."

While the tool now contains criteria for positional accuracy of sample plot locations, it appears doubtful that these criteria are suitably rigorous to ensure high-accuracy data. Section 5.1.2.1.1 of the tool states that "The pixel resolution of the data produced from the RS platform must not exceed the size of the SP". Section 5.1.2.1.2 of the tool states that "Minimum size of 0.25 ha (rectangular: 50 m x 50 m) or 0.28 ha (circular: 30 m radius) (Meyer et al. 2013; Asner et al. 2012; Asner et al. 2013) must be used for developing RS

allows for positional error in sample plot locations up to the width of the plot (assuming a square plot). For example, where a 0.25 ha plot is used, the tool allows for positional error of up to 50 m. The thresholds for positional error appear far more relaxed than would be appropriate to ensure high-quality data.

Given the above, please provide evidence that the criteria set out in the tool are sufficient to ensure that the principle of accuracy, as set out in Section 2.4.1 of the VCS Standard, is not compromised.

**Developer's Response 2:** It should be noted by the Auditor that the specification for positional accuracy was present in the document initially submitted to VCS. The criteria stating "The average positional accuracy for all in-situ plot locations must be less than 1.5 times the length of the hypotenuse of the triangle formed by the x and y pixel extent of RS data." has been removed from the tool. The criteria for positional accuracy of the plot locations is stated as "The error in positional accuracy of in-situ plot location reported by the GPS system used must be less than the single pixel extent of the RS data being used and must accompany documentation of the application of this tool

**Auditor Response 2:** While the assessment team understands that the second criterion pertaining to "the hypotenuse" has been removed, this does not, fundamentally, resolve the concern expressed in the finding, which is that the criteria for positional accuracy appear to allow error up to the width of the (square) plot size being used. This does not appear sufficient to ensure an adequate quality of data in the estimation process.

It is the understanding of the assessment team that much greater accuracies in position are frequently targeted in research studies in which LiDAR data and traditional forest inventory data are integrated. For example, the study "LiDAR Forest Inventory with Single-Tree, Double-, and Single-Phase Procedures" (Parker and Evans 2009), accessed 14 January 2015 from

<http://www.hindawi.com/journals/ijfr/2009/864108/> and published in the International Journal of Forestry Research, reported the following in Section 2.2: "UTM coordinates were established at the center of each circular Phase 2 plot or at the endpoints of rectangular plots for navigation with a real-time Differential Global Positioning System (DGPS). Differential corrections from either the U.S. Government WAAS or private enterprise OmniStar geostationary satellite were obtained satisfactorily under tree canopies by using a large dome antenna. Based on informal field tests on surveyed bench marks, field locations were obtained with approximately 1 m accuracies with both systems." There is a substantive difference between an accuracy of 1 meter, as reportedly attained by the authors of the study, and an accuracy on the order of 50 meters.

As the fundamental concern of the finding has not been addressed, the information request has not been satisfied.

**Developer's Response 3:** The text has been changed to reflect a minimum of 10m accuracy

**Auditor Response 3:** Through review of the updated tool, entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that the tool now states that the error in positional accuracy "must be equal to or less than 10 meters". The stated criterion, while unequivocally superior to the prior criterion of "the single pixel extent of the RS data being used", remains substantively higher than the accuracy attained in implementing procedures similar to those described in the tool. For example, Ståhl et al. (2011) report on page 98 that "The coordinates of each plot center were determined with an average accuracy <1 m using differential Global Positioning System and Global Navigation Satellite System measurements according to the procedures suggested by Næsset (2001)." The study "Effects of differential single- and dual-frequency GPS and GLONASS observations on point accuracy under forest canopies" by Næsset (2001), accessed 27 January 2015 from

[http://www.asprs.org/a/publications/pers/2001journal/september/2001\\_sep\\_1021-1026.pdf](http://www.asprs.org/a/publications/pers/2001journal/september/2001_sep_1021-1026.pdf), describes a study wherein accuracies of approximately one meter were attained. However, the others of that study do report that lower accuracies were attained in previous studies. Depending upon field conditions and equipment used, it may not be possible to achieve accuracies on the order of those achieved by Næsset (2001) and Ståhl et al. (2011).

Ultimately, while a lower threshold for accuracy (i.e., a more restrictive criterion) would ensure that higher-quality data are used to quantify GHG emission reductions or removals, higher accuracy may not be available in all settings. The assessment team notes that the gray instructional text of Section 2.4.1 of the VCS Standard states that "Accuracy should be pursued as far as possible, but the ... high cost of monitoring of some types of GHG emissions and removals, and other limitations make accuracy difficult to attain in many cases. In these cases, conservativeness may serve as a moderator to accuracy in order to maintain the credibility of project and program GHG quantification."

Furthermore, the assessment team notes that error in measuring the locations of sample plots is captured in assessment of uncertainty in the procedures set out by the tool. Therefore, per Section 4.1.4 of the VCS Standard, the tool contains procedures to capture uncertainties introduced through error in measuring plot location, which can be used, within the methodology used in conjunction with the tool, to quantify an uncertainty deduction in order to ensure that GHG quantification remains conservative.

In summary, while the tool does prescribe accuracy levels as high as those that have been attained in some circumstances, the assessment team agrees that the stated accuracy threshold is sufficient to provide a lower limit for positional accuracy, and that the procedures within the uncertainty quantification procedures of the tool also ensure that conservativeness serves as a moderator to accuracy. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.35 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.2.2

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool states the following in Section 5.1.2.2: "To estimate the ALFB of a specific tree species within a sample plot based on field measurements, relevant allometric equation should be applied. If this methodology is being conducted to comply with REDD+, ARR, or IFM methodologies that specify allometric equations, selection and use of allometric equations must follow the guidelines therein. For cases in which there is no guidance from overarching REDD+, ARR, or IFM methodologies, species-specific biomass measured via destructive sampling methods for forests similar to those found in the AOI may be used to derive allometric equation coefficients or equations specified in GPG-LULUCF Annex 4A.2 Table 4.A.1 (Intergovernmental Panel on Climate Change 2006), Chave et al (2014). See additional guidance on selection and use of allometric equations for ALFB in Picard et al. (2012) and Chave (2005)." This language is unclear in the following instances, which may preclude consistent application by intended users:

1. The guidance provided by the tool covers the situation where the tool is being applied in conjunction with a REDD+, ARR, or IFM methodology, but provides no guidance in the cases that the tool is being applied in conjunction with another type of methodology (e.g., a methodology for WRC project activities).
2. The sentence beginning with "If this methodology is being conducted to comply with REDD+, ARR, or IFM methodologies..." is confusing, for the following reasons:
  - 2a. The tool refers to itself as "this methodology", when it is not a methodology.
  - 2b. It is unclear what is meant by "conducted to comply with..."
3. The sentence beginning with "species-specific biomass measured via destructive sampling methods..." is confusing, for the following reasons:
  - 3a. IPCC Good Practice Guidance for LULUCF was published in 2003, not in 2006; the reference to 2006 may lead the user to believe that intended reference is to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
  - 3b. The tool states that "species-specific biomass measured via destructive sampling methods... may be used to derive allometric equation coefficients or equations specified in GPG-LULUCF Annex 4A.2 Table 4.A.1", but the table indicated by the tool only contains a list of allometric equations developed previously. It is unclear how "species-specific biomass measured via destructive sampling methods" is intended to provide information for use with the IPCC Good Practice Guidance for LULUCF.
  - 3c. It is unclear what information or guidance is intended to be derived from Chave et al (2014).
4. It is not completely clear what is meant by "field-based direct volume measurement (terrestrial LiDAR scanning)" or what other "sampling techniques" are referred to. It is unclear how these techniques diverge from the guidance provided in the tool, or how they do not use allometric equations. Clear criteria for determination of whether said techniques "meet or improve accuracy of the above allometric equation" are not provided.

**Developer's Response:** see revised language

**Auditor Response:** Through review of the Section 5.1.2.2 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that many of the discrepancies noted in the text of the finding have been addressed. However, the following discrepancies, as reproduced below using the numbering system employed in the text of the finding, have not been addressed:

3. The sentence beginning with "species-specific biomass measured via destructive sampling methods..." is confusing, for the following reasons:

3a. IPCC Good Practice Guidance for LULUCF was published in 2003, not in 2006; the reference to 2006 may lead the user to believe that intended reference is to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

3b. The tool states that "species-specific biomass measured via destructive sampling methods... may be used to derive allometric equation coefficients or equations specified in GPG-LULUCF Annex 4A.2 Table 4.A.1", but the table indicated by the tool only contains a list of allometric equations developed previously. It is unclear how "species-specific biomass measured via destructive sampling methods" is intended to provide information for use with the IPCC Good Practice Guidance for LULUCF.

3c. It is unclear what information or guidance is intended to be derived from Chave et al (2014).

4. It is not completely clear what is meant by "field-based direct volume measurement (terrestrial LiDAR scanning)" or what other "sampling techniques" are referred to. It is unclear how these techniques diverge from the guidance provided in the tool, or how they do not use allometric equations. Clear criteria for determination of whether said techniques "meet or improve accuracy of the above allometric equation" are not provided.

Regarding observation #4 above, it is noted that the tool now has an indication that "Evidence may include peer reviewed publications and government publications", but this only addresses the format in which the evidence is to be provided, as distinct from the criteria by which the evidence must be evaluated to determine whether they "meet or improve accuracy of the above allometric equation". This additional criteria has not been provided.

Therefore, the non-conformity has not been completely resolved.

**Developer's Response 2:** 3a. Publication date has been changed.

3b. Species specific destructive sampling can be used to calculate equation coefficients that can then be used for the equations presented in the Annex. I'm not sure how to make this more clear in the text. It is possible that a typo was confusing: 'used to derive allometric equation coefficients or equations specified' has been changed to 'used to derive allometric equation coefficients for equations specified'

3c. Text was revised to clarify the relevance of the Chave reference.

4. Not sure how to make this any more clear. "Direct volume measurement" means without the use of an allometric relationship. 3 dimensional volumetric measurement is possible with terrestrial LiDAR. It is not within the scope of this tool to provide methods comparative analysis of allometric vs volumetric estimation of tree biomass. The use of the terms 'meet or exceed accuracy' clearly establishes the criteria in general terms. Some clarifying verbiage has been added to the text

**Auditor Response 2:** Through review of Section 5.1.2.2.1 of the updated tool, entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm that the references to the IPCC Good Practice Guidance for LULUCF and to Chave et al. (2014) have been clarified, thus resolving items 3a and 3c. The assessment team agrees that the correction to the typo noted in the methodology developer's response has added some clarity. However, the text in question remains unclear. The IPCC Good Practice Guidance for LULUCF and Chave et al. (2014) contain complete equations that predict biomass on the basis of DBH and, in some cases, height and wood density. "Destructive sampling" is not necessarily required for measurement of these variables. The text does not appropriately clarify how any "allometric equation coefficients" that may be derived from "destructive sampling methods" are to be used in these equations.

Regarding the reference to "field-based direct volume measurement", the assessment team agrees that the explanatory text helps to clarify what is meant. However, to state the obvious, volume is not the same as biomass. The tool is lacking in clear procedures as to how biomass is to be derived from field-measured volumes. In addition, the assessment team does not agree that the provision of criteria for whether techniques "meet or improve accuracy of the above allometric equation" is outside the scope of the tool. A comparative assessment of accuracy of two very different approaches for estimating biomass (allometric equations and field sampling) is not a trivial task, nor is it likely to be clear to all users how this task should be carried out. In the absence of clear criteria, the text in question is likely to be significantly open to interpretation. The reference to "comparative accuracy assessment" is not sufficient to provide the required criteria.

Therefore, the non-conformity has not been fully resolved.

**Developer's Response 3:** The sentence using the term destructive sampling has been modified in response to the finding. The paragraph referencing direct volume measurement has been removed, resolving the second part of the non-conformity.

**Auditor Response 3:** Through review of the updated tool, entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that the references to the GPG-LULUCF Annex 4A.2 Table 4.A.1 and Chave et al. (2014) have been clarified and that the tool no longer implies that results from destructive sampling must be used in order to use the allometric equations found within those sources. In addition, the entire paragraph pertaining to "sampling techniques such as field-based direct volume measurement" has been removed. The assessment team agrees that this paragraph was not critical to the functionality of the tool, and its removal has made the second set of concerns expressed in the assessment team's feedback irrelevant. Therefore, the non-conformity regarding lack of clarity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.36 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.3.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool states the following in Section 5.1.3.1.1:

"ALFB density prediction for each RSSU (R<sub>i</sub>) is accomplished using a random selection of Calibration Plots (CP) from the SPs within the RSSU to develop and validate the PM relating RS data to field-measured ALFB. In this step, metrics contained in the RS data are mined for their predictive power vis a vis ALFB as measured in CPs. One or several predictors are selected and used to estimate ALFB for the remainder of CPs constituting the Validation Plots (VP) within the RSSU. This process can be conducted iteratively preserving the ratio of CP to VP to improve the strength of the predictor. It is critical that CPs are used only for developing the predictive model and VPs are used only for assessing the accuracy of the model. A minimum of 10 (K) rounds of cross validation should be employed and results reported to assess the precision of the PM."

This language is unclear in the following instances, which may preclude consistent application by intended users:

1. The tool states that "This process can be conducted iteratively preserving the ratio of CP to VP to improve the strength of the predictor", but it is not clear exactly what task(s) can (or must; see below) be conducted iteratively. It is also unclear whether the preservation of the ratio of CP to VP is a requirement or merely a recommendation.
2. The tool states that "It is critical that CPs are used only for developing the predictive model and VPs are used only for assessing the accuracy of the model". It is unclear whether it is meant that a single SP, once assigned as either a CP or VP, must retain that identity for the remainder of the analysis, or whether it is only meant that the same identity must be retained for the remainder of a given iteration (or "round").

**Developer's Response:** See revised text

**Auditor Response:** Through review of Section 5.1.3.1.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the replacement of "can be" with "is", in the text identified in the first item, is sufficient to resolve that non-conformity. However, it does not appear that any modifications have been made to address the second item, which is reprinted as follows:

The tool states that "It is critical that CPs are used only for developing the predictive model and VPs are used only for assessing the accuracy of the model". It is unclear whether it is meant that a single SP, once assigned as either a CP or VP, must retain that identity for the remainder of the analysis, or whether it is only meant that the same identity must be retained for the remainder of a given iteration (or "round"). Therefore, the non-conformity has not been resolved.

**Developer's Response 2:** The text of document submitted for the second review states "It is critical that, for each iteration, CPs are used only for developing the predictive model and VPs are used only for assessing the accuracy of the model." The previous sentence clearly establishes the meaning of 'iteration' in this context. I'm not sure how to make this any more clear...

**Auditor Response 2:** The methodology developer is correct that the text in question was revised, in the versions of the tool entitled "VCS\_RSBM\_VT\_v3.1.2" and "VCS\_RSBM\_T\_v3.3", to add the clarifying text "for each iteration", and that this addition was missed in the initial review of findings responses. With the addition of this text, it is clear that it is only required that the identity of CPs and VPs be retained for the duration of a single iteration. Therefore, the non-conformity has been fully resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.37 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 5; VCS Methodology Template, V3.3, Section 8.1

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.3.1.2

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 5 of the VCS Module Template requires the following: "Follow the instructions provided in any relevant sections of the VCS Methodology Template (eg, project boundary, baseline scenario, additionality and quantification of GHG emission reductions and removals)." Section 8.1 of the VCS Methodology Template requires the following: "Include summary information to describe the context of equations, and use an appendix for any lengthier explanations. Use the example format below (copy and paste) for specifying equations and defining the associated parameters and variables, including the unit of measure. Ensure all equations are numbered using captions to specify the equation number and enable cross-referencing. Ensure that parameters and variables are consistently applied throughout the equations in the methodology. " Section 8.1 of the VCS Methodology Template contains specific guidance for procedures for quantification of baseline emissions, and the assessment team understands that the methods set out in the tool are generic and can be used in the quantification of baseline emissions, project emissions or leakage emissions. However, Sections 8.2 (project emissions) and 8.3 (leakage emissions) refer to Section 8.1, and so the guidance provided by Section 8.1 of the VCS Methodology Template is applicable, and mandatory, in any case.

The associated parameters and variables for the equations in Section 8.1.3.1.2 of the tool are not provided in the format required by Section 8.1 of the VCS Methodology Template. In addition, the following discrepancies exist with respect to consistent application of the parameters and variables:

1. There is no explicit link between the variable  $e(R_i, K_i)$ , which is the output of the first equation, and the variable  $e(k)$ , which is an input to the second equation.
2. There is no explicit link between the variable  $R^2(R_i, K_i)$ , which is the output of the third equation, and the variable  $R^2(k)$ , which is an input to the sixth equation.
3. There is no explicit link between the variable  $B(R_i, K_i)$ , which is the output of the seventh equation, and the variable  $B(k)$ , which is an input to the eighth equation.

**Developer's Response:** Equations in this section have been revised and formatted per the specification identified.

**Auditor Response:** Through review of Section 5.1.3.1.2 (not Section 8.1.3.1.2, as mistakenly referenced in the text of the finding) of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that corrections have been made to the system of equations to address all of the observations in the text of the finding. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.38 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.3.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool contains numerous references to information that must be "discussed" or "reported" (e.g., Section 5.1.3.1.2 states that "The range of applicability of the PM must be discussed in terms of the range of biomass densities in measured SPs and the range of RS metrics used in the PM".) However, it is unclear where this discussion or reporting must occur. In the absence of clear guidance on the location of reporting, the requirements in the tool are likely to be interpreted variously by different parties, leading to inconsistent application by intended users.

**Developer's Response:** Text has been modified per the finding.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the term "reported" is now universally followed with "in any official documentation of the application of the results of this tool" (and all instances of usage of the term "discuss" have been stricken). However, it remains unclear exactly where information must be reported, as it is unclear what constitutes "official documentation". The definition of "official", as given by Merriam-Webster (accessed 26 November 2014 from <http://www.merriam-webster.com/dictionary/official>) is very broad ("of or relating to the job or work of someone in a position of authority") and thus does not provide adequate clarity regarding exactly which documentation must contain the reported information. In one instance, in Section 5.1.3.1.2, the requirement in question states "The models RMSE ( $\epsilon_{(R_i)}$ ), coefficient of variation ( $R_{(R_i)}^2$ ) and bias ( $B_{(R_i)}$ ) must be reported. in any official documentation of the application of the results of this tool (Project Document, etc.)". While this adds some additional light regarding what is required, it is unclear whether this added guidance exists with respect to all instances of usage of the term "official documentation" or simply to the specific instance in question. It is also unclear what the term "Project Document" means in the context of the tool, as the term is not defined under the VCS Program or within the body of the tool. Therefore, the non-conformity has not been resolved.

**Developer's Response 2:** In each instance of the text 'reported in any official...', exemplary text is provided such as: 'VCS Project Description'.

**Auditor Response 2:** While the assessment team appreciates the actions undertaken in an attempt to resolve the non-conformity, it is important to be completely clear in describing any prescriptive requirements set out in the tool. Complete clarity has not been attained in the version of the tool entitled "VCS\_RSBM\_T\_v3.3", for the following reasons:

1. While the methodology developer is correct that the exemplary text indicated in the second Developer's Response has not been added in all instances of the text "reported in any official...", no clarifying text has been added in instances of the equivalent (for all practical purposes) text "provided in any official...".
2. While the examples provided in the text "(e.g.: REDD+ Project Design Document, VCS Project Description, etc.)" are helpful, they do not fully clarify the conditions under which information must be reported. The term "REDD+ Project Design Document", while not necessarily problematic, has no meaning under the VCS Program. The term "VCS Project Description" clarifies that reporting must be provided in the project description, if results of application of the tool are being submitted at validation, and that is certainly helpful. However, it is unclear whether results of application of the tool are required to be made available in a monitoring report, in the case that results are being submitted at verification. Furthermore, since (as previously discussed) the term "official documentation" is not defined under the VCS Program or in customary use under the VCS Program, the user of the tool may be left to guess at the possible scope of the term, including whether it extends to documents other than the project description and the monitoring report.

Therefore, the non-conformity has not been resolved.

**Developer's Response 3:** Removed all text referring to 'official documentation' and replace with 'results reported in any documentation of the application of this tool'

**Auditor Response 3:** Through review of the updated tool, entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that all instances of usage of the word "official" have been stricken, and the language in question now reads "must accompany documentation of the application of this tool (e.g.: REDD+ Project Design Document, VCS Project Description, etc.)" or, simply, "documentation of the application of this tool ". The assessment team agrees that the language is now both flexible, to allow for documentation of the application of the tool in different contexts, and clear, to indicate that the required information must be provided in any documentation of the application of the tool. As the word "documentation" has a (relatively) unambiguous meaning in the English language, the assessment team agrees that the language in question has been crafted "in a clear, logical, concise and precise manner", as required by the VCS Module Template. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.39 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.3.2

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The following discrepancies, which may preclude consistent application by intended users, are clearly evidence in Section 5.1.3.2 of the tool:

1. In the first equation, the parameter  $n(i,j)$  is defined as "The number of RSSU  $i$  intersecting the stratum  $j$ ". Although  $i$  is not clearly defined in the equation, it appears that  $i$  is an index to denote the RSSU. If this is the case, it appears that the "number" of RSSU associated with each value taken by  $i$  is one. In this case, the summation in the denominator in the first equation appears to sum the value of one across all values of  $n(j)$ , thus resulting in a calculated value for the denominator of 1. This does not appear to be the intended result, and is likely to confuse users of the tool.
2. The first equation does not appear to account for the fact that RSSU may be of different sizes, either due to the differing areas covered by the underlying RS data or due to differences caused by the process of clipping the RS data to the boundary of the stratum or AOI.
3. The text below the fifth equation refers to the "tth pixel within the ith RSP in stratum  $j$ ". This appears to conflict with the following definition of RSP, as provided in Section 3 of the tool: "Individual pixels of RS data used to estimate ALFB". If an RSP is defined as an individual pixel, it cannot itself contain multiple pixels.
4. The tool states that "The uncertainty is given by CDM (2013)" and then provides an equation for calculation of uncertainty. It is unclear whether the tool is calculating uncertainty using CDM (2013) or whether the reference is simply acknowledging that the equation below the quoted text is adapted from CDM (2013).

**Developer's Response:** 1.  $n(i,j)$  is defined the number of grid cells or 1-ha pixels in lidar transect  $i$  intersecting stratum  $j$ . If all lidar RSSU's have same number of 1-ha grid cells, (e.g. 1000) then the denominator because 1000. If they are variable, then the number can be the average. Correction must be made in the description of  $n(i,j)$ . 2. The above correction will correct the second comment.

The number of pixel are allowed to be different in each lidar transect, particularly crossing the boundary and the equation allow for it. 3. tth pixel within RSSU is the correct definition.

**Auditor Response:** Through review of Section 5.1.3.2 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the reference to "CDM (2013)" has been removed, as has the reference to the "tth pixel within the ith RSP", thus resolving items 3 and 4 in the text of the finding. However, while the information provided in response to the finding is both helpful and appreciated, no discernable modification has been made to the tool in response to items 1 and 2 in the text of the finding. Therefore, the non-conformity has not been fully resolved.

**Developer's Response 2:** The definition of  $\eta_{i,j}$  has been modified for clarity resolving 1 and 2

**Auditor Response 2:** Through review of what is now Section 5.1.3.3 of the updated tool, entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm that the definition of the parameter in question has been clarified, thus resolving both remaining concerns. The non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.40 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 3

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 3 of the VCS Module Template requires the following: "Ensure all defined terms are used, and consistently applied, in the module". The following defined terms are not used in the tool:

- Agricultural Land Management (ALM)
- Avoided Planned Deforestation (APD)
- Improved Cropland Management (ICM)
- Logged Forest to Protected Forest (LFPF)
- Measurement, Reporting, and Verification (MRV)
- Restoring Wetland Ecosystems (RWE)
- Wetland Restoration and Conservation (WRC)

**Developer's Response:** Resolved

**Auditor Response:** Through review of Section 3 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that most of the terms listed in the text of the finding have been stricken from the tool. However, the term "Measurement, Reporting, and Verification (MRV)" continues to be defined in Section 3, and the assessment team has been unable to identify any instances of usage of this term elsewhere in the tool. Therefore, the non-conformity has not been fully resolved.

**Developer's Response 2:** MRV has been removed from the definitions section.

**Auditor Response 2:** Through review of the updated tool, entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm that the definition in question has been removed. This is sufficient to resolve the non-conformity.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.41 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 6.1

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 6

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 6.1 of the VCS Module Template requires the following: "Ensure that all data and parameters used in equations in the module are included in this section (Data and Parameters Available at Validation) or the following section (Data and Parameters Monitored)".

Many of the data and parameters used in equations in the tool are not included in Section 6.1 or Section 6.2 of the tool. The following are provided as examples of such data and parameters.

E (Section 5.1.2.1.1)

d (Section 5.1.2.1.1)

cr (Section 5.1.2.1.1)

m (Section 5.1.2.1.1)

y(i) (Section 5.1.3.1.2)

w(j) (Section 5.1.3.2)

**Developer's Response:** resolved

**Auditor Response:** While many data and parameters have been added to Section 6.1 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the following data and parameters are used in the equations in the tool and are not provided in either Section 6.1 or Section 6.2 of the tool:

t(val) (Equation 2)

sigma(ui) (Equation 2)

sigma(uj) (Equation 2)

c (Equation 4)

d (Equation 4)

r (Equation 4)

the "predicted and observed ALFB density" (inputs to Equations 5, 7, 8 and 9)

F(ij) and many other inputs to Equations 10, 12, 13 and 14

w(j) (Equation 11)

Therefore, the non-conformity has not been fully resolved.

**Developer's Response 2:** 1.  $t_{val}$ ,  $\sigma_{ui}$ ,  $\sigma_{uj}$ ,  $c$ ,  $d$ ,  $r$  have all been added to section 6.1.

2. All other parameters have been evaluated for inclusion in section 6.1.

3.  $F_{ij}$  is a calculated intermediate derived from the PM and therefore does not belong in section 6.1 per VCS template language

4.  $w_j$  is also a calculated intermediate derived from the calculation of  $n$  in Section 5.1.3.1

**Auditor Response 2:** Through review of the updated tool, entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm that information regarding many of the parameters has been provided in Section 5.1. However, the assessment team is unable to locate the calculation for the parameter w(j) in Section 5.1.3.1 and, therefore, has been unable to determine that the parameter is calculated and does not need to be included in Section 6.1. Therefore, the non-conformity has not been fully resolved.

**Developer's Response 3:** A new equation (19) has been added representing the calculation of  $w_j$  as described in the existing description of the variable.

**Auditor Response 3:** Through review of the updated tool, entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team has confirmed that the variable w(j) is now calculated within Equation 19. Therefore, the assessment team agrees that it is not necessary to include the variable w(j) within Section 6.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NIR 2014.42 dated 10-25-2014**

**Standard Reference:** VCS Standard V3.4, Sections 2.4.1 and 4.1.4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.2.1.2

**Finding:** The VCS Standard requires, under the principle of "accuracy" (as set out in Section 2.4.1 of the VCS Standard, as referenced via Section 4.1.4 of the VCS Standard), that bias and uncertainties be reduced "as far as is practical" (allowing that "the hypothetical nature of baselines, the high cost of monitoring of some types of GHG emissions and removals, and other limitations make accuracy difficult to attain in many cases... conservativeness may serve as a moderator to accuracy in order to maintain the credibility of project and program GHG quantification").

The tool contains systems of equations, in Sections 5.1.2.1.1 and 5.1.3.2, that cannot be readily confirmed accurate with the available information. In order to facilitate the determination by the assessment team that the systems of equations are completely accurate, please provide a description of how the equations were adapted from methods that are published in peer-reviewed, or otherwise reputable, sources, by authors who are experts in the field. Please provide any referenced articles or other source materials for review by the assessment team.

**Developer's Response:** For each equation adapted from literature a footnote has been made referring to the specific journal and equation number.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that footnotes have been provided indicating the source for most relevant equations. However, literature references have not been provided for the following critical equations: Equation 3 (a literature reference has been provided, but the assessment team has been unable to identify any correspondence between Equation 3 and "Weisbin et. al (2014), equation 13")  
Equation 6 (the origin of the values in this equation is unclear)  
Equation 14

Therefore, the information request has not been fully satisfied.

**Developer's Response 2:** The sources of reference values in Equation 6 is (Weisbin et al. 2014; Zolkos et al. 2013; Asner & Mascaro 2014) as stated in the parent item (3) of the list. An alternate form of the equation has been added to assist in relating to the cited text. The source of Equation 14 (Stahl) has been identified in a footnote.

**Auditor Response 2:** Through review of the updated tool, entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm that additional information has been provided to clarify the source of all but one equation. While information has been added to state that Equation 14 is derived from "Ståhl (2011), equation 15", the assessment team has been unable to identify the relationship between Equation 14 and Ståhl (2011), equation 15. Therefore, the information request has not been fully satisfied.

**Developer's Response 3:** Equation 14 references Ståhl (2011), equation 12, not 15 as stated in the finding. Please review the text.

**Auditor Response 3:** It is correct that Equation 14 references equation 12 (not 15) from Ståhl (2011). Through comparison of the tool entitled "VCS\_RSBM\_TOOL\_v3.4" with Ståhl (2011), the assessment team can confirm that Equation 14 can be traced to equation 12 of that publication. Therefore, the assessment team agrees that the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.43 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 4 of the VCS Module Template requires the following: "Applicability conditions must be specified clearly, and in a manner that allows easy determination of whether the module can be used by a methodology or other module." In review of the tool, several conditions have been identified by the assessment team, the absence of which will not allow the tool to be used correctly by an applied methodology. These conditions are as follows.

1. The methodology must contain directions for measurement of the components of vegetative biomass (per Section 5.1.2.1.2 of the tool).
2. The methodology must contain biomass estimation methods (per Section 4 of the tool).
3. The methodology must contain procedures for "QA/QC for data collection" (per Section 5.1.2.1.2 of the tool).
4. The methodology must contain procedures for estimating a 90 or 95 percent confidence deduction (per Section 5.1.3.2 of the tool).
5. The methodology must contain procedures for discounting (per Section 5.1.4 of the tool).
6. The methodology must contain procedures that can gracefully handle the discounted estimate of AFLB (per the instruction of Section 5.1.4 of the tool that "Once discounting of the estimate has been applied, the estimate can then be combined with other carbon pools used in superseding methodologies").

However, the above conditions are not set out as applicability conditions in Section 4 of the tool.

**Developer's Response:** Text has been modified per the finding.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team has found that no modification to Section 4 of the tool appears to have been made in response to this finding. In some cases, the text of various other portions of the tool has been made in such a manner as to make some observations documented in the finding irrelevant (e.g., the requirement that "The components of vegetative biomass that are to be estimated using this tool must be measured as directed in the overarching methodology" has been stricken from Section 5.1.2.1.2). However, the tool continues to have specific conditions for the methodology using the tool, the absence of which will not allow the tool to be used correctly by an applied methodology. These conditions are as follows.

1. The methodology must contain procedures for estimating a 90 or 95 percent confidence deduction (per Section 5.1.3.2 of the tool).
2. The methodology must contain standards for assessing allometric equations (per Section 4 of the tool).
3. The methodology must contain standards for "discounting of the estimated ALFB density" (per Section 4 of the tool).

Therefore, the non-conformity has not been fully resolved.

**Developer's Response 2:** 1. All reference to specific confidence intervals (90%, 95%) have been removed from section 5.1.3.3 and instead specify the 'desired' confidence interval, thus precluding a requirement of an overarching methodology CI specification in applicability conditions.

2. and 3. : These issues have been resolved by altering the language in section 5.1.4 Step 4:

Discounting. The scope of this tool should not extend to discounting the ALFB estimate. The language has been altered in the section from imperative ('must') to suggestive ('may be required to...').

Realistically, the applicability conditions should not constrain the use of the tool to conditions in which a discounting regime is present.

**Auditor Response 2:** Through review of the updated tool, entitled "VCS\_RSBM\_T\_v3.3", the assessment team can confirm all of the previous requirements of applied methodologies, as listed in the text of the finding, have been made optional. Therefore, the tool is no longer constructed such that it requires the applied methodology to provide guidance for deduction for uncertainty or for assessment of allometric equations in such a manner that the tool is not fully functional without said guidance. This being the case, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.44 dated 10-25-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 5.1.3.2

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool uses the phrase "superseding methodology" or "superseding methodologies" in Sections 3 and 5.1.4. It is unclear what is meant by "superseding" in this context. The definitions of "supersede", as provided by Merriam-Webster (accessed 25 October 2014 from <http://www.merriam-webster.com/dictionary/supersede>), do not appear consistent with any usage that may be intended by the tool.

**Developer's Response:** All instances of 'supersede' have been replaced with 'overarching'

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that all instances of usage of the term "superseding" have been removed.

In some cases, this term has been replaced with the term "overarching". The applicable definition of "overarching" is given by Merriam-Webster (<http://www.merriam-webster.com/dictionary/overarching>; accessed 26 March 2014) as "dominating or embracing all else". Although the term "overarching methodology" is not a defined term under the VCS Program, the assessment team agrees that the meaning of the term is clear insofar as it is used within the context of the tool. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.45 dated 10-27-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 4

**Document Reference:** VCS\_RSBM\_VT\_v2 2 7, Section 4

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 4 of the VCS Module Template requires the user to "set out specific conditions under which the module can be used such as geographic location, technology type, methodology type and any other conditions that determine the applicability of the module."

The specific project categories for which the tool is applicable are set out on the cover page of the tool and in Section 2 of the tool (albeit inconsistently, as noted in NCR 2014.24). However, this information is missing from Section 4 of the tool. Therefore, the tool does not contain a clear specification of the "methodology type" for which the tool is applicable.

**Developer's Response:** Text has been modified per the finding.

**Auditor Response:** Through review of Section 4 of the updated tool, entitled "VCS\_RSBM\_VT\_v3.1.2", the assessment team can confirm that the following requirements have been added: "The tool is applicable in conjugation with AFOLU methodologies in which one of the requirements is estimation of ALFB" and "The AOI qualifies as forest". Given these requirements, the methodology type is clearly specified, in a manner consistent with the specification given on the cover page and in Section 2 of the tool. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NIR 2014.46 dated 11-26-2014****Standard Reference:** VCS Standard V3.4, Sections 2.4.1 and 4.1.4**Document Reference:** VCS\_RSBM\_VT\_v3.1.2, Section 5.1.2.1.2**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

In response to NIR 2014.34 the following binding guidance has been added to Section 5.1.2.1.2 of the tool regarding positional accuracy:

1. The tool requires that "error in positional accuracy of in-situ plot location must be less than the single pixel extent of the RS data being used and must be reported."

2. The tool requires that "The average positional accuracy for all in-situ plot locations must be less than 1.5 times the length of the hypotenuse of the triangle formed by the x and y pixel extent of RS data."

The above criteria are not described, in the following aspects, with sufficient precision to ensure consistent application by intended users.

1. It is not clear how the error in positional accuracy of sample plot locations is to be measured, in the absence of knowledge of the true locations of the sample plots (which will rarely, if ever, be available in practice).

2. For the first criterion quoted above, it is unclear whether the requirement pertains to the location of each plot individually or to the average of all plot locations (i.e., whether the error in positional accuracy for each individual plot must be less than "the single pixel extent of the RS data being used", or whether the average error in positional accuracy, across all plots, must be less than this threshold).

**Developer's Response:** It should be noted by the Auditor that the positional accuracy requirements were present in the original document as submitted to SCS.

1. The text in section 5.1.2.1.2 states "The manufacturer and model of the Global Positioning System used must accompany documentation of the application of this tool and the reported accuracy of the location by the instrument must be recorded at each plot. " This statement clearly presents a method for establishing the positional accuracy of the Sample Plot locations.

2. The last sentence in the paragraph describing the threshold (1.5x hypotenuse) was removed. The the first criteria was retained.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.3", the assessment team can confirm that the updated tool clarifies that the error in positional accuracy must be "reported by the GPS system used", and that the second requirement in question has been stricken. Therefore, the area of potential confusion described in the finding text has been clarified, and the non-conformity has been resolved.**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.47 dated 11-26-2014**

**Standard Reference:** Methodology Approval Process V3.5, Sections 7.1.1 and 5.1.4

**Document Reference:** VCS\_RSBM\_VT\_v3.1.2, Section 5.1.2.1.2

**Finding:** Section 7.1.1 of the Methodology Approval Process requires that "New modules and tools shall be assessed against the aspects of the assessment scope for new methodologies set out in Section 5.1 that are relevant to the specific module or tool." Section 5.1.4 of the same document requires that "Where the proposed methodology references tools or modules approved under the VCS or an approved GHG program, the validation/verification body shall determine whether the tool or module is used appropriately within the methodology."

The tool states that "The QA/QC for data collection must follow AR-TOOL-14 or any other procedure approved by VCS." In referencing "any other procedure approved by VCS", the tool appears to reference other tools or modules approved under the VCS, but does not clearly specify which tools or modules are identified. In the absence of this identification, it is not possible for the assessment team to assess whether any tool or module is used appropriately within the methodology.

**Developer's Response:** The statement 'or any other procedure approved by VCS' has been removed from the Tool.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.3", the assessment team can confirm that the reference to "any other procedure approved by VCS" has been removed. Therefore, the finding is no longer relevant and may be withdrawn.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.48 dated 12-02-2014**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v3.1.2

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool contains numerous references to "K" validation rounds, but the notation "K" is not used within the series of equations within the tool. This discrepancy is likely to result in confusion for, and may result in inconsistent application by, intended users.

**Developer's Response:** K is used in equation 9 though the document as submitted used the variable m. Notation in Eqn 9 has been changed. In addition, k is used as an index denoting kth cross-validation round in many equations.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_VT\_v3.3", the assessment team can confirm that the variable K has been substituted for the variable m in what is now Equation 12. Thus, the variable K is now consistently used to refer to the number of rounds of cross-validation, and the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.49 dated 01-14-2015**

**Standard Reference:** VCS Standard V3.4, Section 4.1.4

**Document Reference:** VCS\_RSBM\_T\_v3.3

**Finding:** The VCS Standard requires that "Where applicable, methodology elements shall provide a means to estimate a 90 or 95 percent confidence interval". While procedures to estimate a confidence interval are provided within the tool, the procedures to estimate sample size for this purpose are not completely correct.

In Equation 2, the tool indicates that the sample size is a function of the t-value, the estimated variance and the allowable error. While the equation itself is correct, the tool states that the allowable error, as used within that equation, should be in units of "percentage". This is not correct. The only circumstances under which it is correct to specify the allowable error as a percentage of the mean is in the case where the standard deviation or variance, depending on the equation form, is also specified as a percentage (e.g., in the form of a coefficient of variation). This can be confirmed through review of the CDM tool "Calculation of the number of sample plots for measurements within A/R CDM project activities" (referenced in the CDM tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" for determination of sample size), in which the allowable error is specified to be in units of " t d.m. (or t d.m. ha-1), i.e. in the units used for [the standard deviation]". Another confirmatory resource is Section 3.6 of Shiver and Borders' "Sampling Techniques for Forest Resource Inventory", in which all equations consistently present either (1) both the allowable error and standard deviation (or variance) in terms of the attribute of interest or (2) both of these variables in percentages.

**Developer's Response:** The units were noted mistakenly as a percentage. The auditor is correct that th units should be in t/ha. The units have been changed throughout the document where relevant.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that the units of E are correctly and consistently stated within both Section 5.1.2.1 and Section 6.1 of the tool. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.50 dated 01-14-2015**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v3.3

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 6.1 of the VCS Module Template requires that the indicated table be completed "for all data and parameters that will be determined or available at validation and remain fixed throughout the project crediting period". The guidance within the table indicates that, within the "Purpose of Data" field, one of four categories be indicated. While the table in question has been filled out, the information provided in the "Purpose of Data" is not consistent with the four categories indicated.

**Developer's Response:** Purpose of Data has been provided per the VCS MODULE/TOOL template guidelines for all parameters in section 6.

**Auditor Response:** Through review of the updated tool, entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that the purpose of data is stated, in accordance with one of the four categories, set out in Section 6.1 of the VCS Module Template, for most parameters. However, the purpose of data for parameter d contains to be stated as "Estimation of the size of the RSSU". Therefore, the non-conformity has not been fully resolved.

**Developer's Response 2:** Purpose of the data for parameter d has been changed.

**Auditor Response 2:** Through review of the updated tool, (still) entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that the purpose of data has been stated, for the parameter "d" using one of the categories set out in the VCS Module Template. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.51 dated 01-27-2015**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 5; VCS Methodology Template, V3.3, Section 8.1

**Document Reference:** VCS\_RSBM\_TOOL\_v3.4, Section 5.1.2.1.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 5 of the VCS Module Template requires the following: "Follow the instructions provided in any relevant sections of the VCS Methodology Template (eg, project boundary, baseline scenario, additionality and quantification of GHG emission reductions and removals)." Section 8.1 of the VCS Methodology Template requires the following: "Include summary information to describe the context of equations, and use an appendix for any lengthier explanations. Use the example format below (copy and paste) for specifying equations and defining the associated parameters and variables, including the unit of measure." Section 8.1 of the VCS Methodology Template contains specific guidance for procedures for quantification of baseline emissions, and the assessment team understands that the methods set out in the tool are generic and can be used in the quantification of baseline emissions, project emissions or leakage emissions. However, Sections 8.2 (project emissions) and 8.3 (leakage emissions) refer to Section 8.1, and so the guidance provided by Section 8.1 of the VCS Methodology Template is applicable, and mandatory, in any case.

The unit of measure, and the accompanying default value, for the parameter "r" are not clearly and consistently stated within the tool. The tool states, below Equation 4, that "Default value ten 1ha pixels [sic]". While the assessment team understands that the intent is to indicate that the unit of measure is pixels and the default value is 10, the grammatical error is such that this information may not be clearly conveyed to the user of the tool. In addition, the tool states, in Equation 6, that "r = 10000 m (ten 1 ha pixels)". This implies that the unit of measure may be meters and the default value may be 1000, which is inconsistent with the other information presented in the tool.

**Developer's Response:** The grammar has been revised in the parameter definition below Equation 4. Equation 6 has been edited to resolve the inconsistency.

**Auditor Response:** Through review of the updated tool, (still) entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that the grammatical error has been corrected and that the description of the parameter "r" no longer implies that the default value is "1000 m", and thus all information provided in the tool regarding parameter "r" is internally consistent. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.52 dated 01-27-2015**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_TOOL\_v3.4, Section 5.1.2.2

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." The introductory text of the VCS Module Template requires that "The module must be written in a clear, logical, concise and precise manner, to aid readability and ensure consistent application by intended users."

The tool states, regarding in-situ (i.e., field) measurement procedures, that "The QA/QC for data collection must follow Good Practice Guidance for Land Use, Land-Use Change and Forestry (Intergovernmental Panel on Climate Change 2003)". While the assessment team agrees that the Good Practice Guidance for Land Use, Land-Use Change and Forestry (GPG LULUCF) document is generally a sound reference, the assessment team also notes that the GPG LULUCF is 632 pages long, with 76 instances of use of the term "QA/QC". By referring to the document, as a whole, as a source for QA/QC procedures, the tool has not provided clear guidance to the user regarding the QA/QC procedures to be implemented.

**Developer's Response:** A reference to Chapter 5.5 has been added to the text.

**Auditor Response:** Through review of the updated tool, (still) entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that Chapter 5.5 is specifically referred to for "the QA/QC for data collection". While this is certainly an improvement over the previous iteration of the tool, a blanket reference to Chapter 5.5 is still likely to result in confusion and inconsistent application on the part of users of the tool. Some examples of areas that are likely to result in confusion and inconsistent application are provided below.

1. Chapter 5.5 uses the terms "Tier 1" and "Tier 2", which are not in general use under the VCS Program.
2. Chapter 5.5 speaks of "assumptions and criteria for the selection of activity data, emission factors and other estimation parameters", which are not relevant to data collection procedures.
3. Chapter 5.5 does not contain a clearly identifiable section that specifically addresses QA/QC procedures for data collection. While Chapter 5.5 does contain some guidance pertaining to the data collection process, this guidance is spread throughout the document, such that the user of the tool would likely be required to "pick through" Chapter 5.5 to find said guidance, a task prone to both frustration and inconsistent application.

Therefore, the non-conformity has not been resolved.

**Developer's Response 2:** The auditor is applying a standard to this review that goes well beyond that applied to other VCS tools such as: Methodology for Improved Forest Management: Conversion from Logged to Protected Forest, v1.2, Methodology for Improved Forest Management through Extension. The only text in these tools is a general reference to GPG LULUCF without any greater specificity. The text of the document has been changed to equivalency with the text in the approved methodologies referenced above AND includes reference to the specific chapter.

**Auditor Response 2:** Through review of the updated tool, (still) entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that the language of the updated tool reads as follows: "Standard quality control / quality assurance (QA/QC) procedures for field data collection and data management must be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from [sic] the Chapter 5.5 of Good Practice Guidance for Land Use, Land-Use Change and Forestry (Intergovernmental Panel on Climate Change 2003), is recommended."

The assessment team agrees that the VCS rules do not require methodology elements to be highly prescriptive with respect to QA/QC procedures to be adopted for certain measurement tasks. Therefore, the assessment team agrees that it is not necessary to require use of any one source for QA/QC procedures. Furthermore, the assessment team agrees that recommendation of "use or adaptation" of the Chapter 5.5 of Good Practice Guidance for Land Use, Land-Use Change and Forestry is acceptable, since that language clearly indicates that some flexibility in interpretation and adaptation of the text of Chapter 5.5 is acceptable. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.53 dated 01-27-2015**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3, Section 6.1

**Document Reference:** VCS\_RSBM\_TOOL\_v3.4, Section 5.1.3.3

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 6.1 of the VCS Module Template requires the following: "Ensure that all data and parameters used in equations in the module are included in this section (Data and Parameters Available at Validation) or the following section (Data and Parameters Monitored)".

The parameter A(j) is used within Equation 19 of the tool but is not included in Section 6.1 or Section 6.2 of the tool.

**Developer's Response:** The parameter \$A\_j\$ has been added to section 6.1.

**Auditor Response:** Through review of the updated tool, (still) entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that parameter A(j) has been added to Section 6.1, as stated. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.54 dated 01-28-2015**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v3.4, Section 6.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 6.1 of the VCS Module Template requires that the indicated table be completed "for all data and parameters that will be determined or available at validation and remain fixed throughout the project crediting period". The guidance within the table indicates that the following information be provided within the "Justification of choice of data or description of measurement methods and procedures applied" field: "Where values will be based on measurement, include a description of the appropriate measurement methods and procedures that must be applied (eg, what standards or protocols must be followed)."

The values for parameter A(j) will be based on measurement. However, the "Justification of choice of data or description of measurement methods and procedures applied" field does not contain a description that meets the requirements cited above.

**Developer's Response:** If a need for a description of the method for calculating area is being implied by this finding, the auditor is again exceeding the standard that has been used to evaluate other approved VCS tools/methodologies. Please see Section 9.1 parameter ABSL, I in VM0003 Methodology for Improved Forest Management through Extension of Rotation Age, v1.2

**Auditor Response:** The developer is correct that the tool is being held to a different standard than was applied to VCS-approved methodology VM0003. Specifically, the version of the VCS Methodology Template that prevailed at the time of approval of VM0003 did not include the requirements contained in the current version of the VCS Methodology Template and VCS Module Template. In fact, VM0003 was originally approved prior to release of the VCS Version 3 in March 2011. Although it was later upgraded (with Version 1.1) to use of a prior version of the VCS Methodology Template, it can be safely assumed that the methodology was never assessed against the requirements quoted in the text of this finding. As the finding has not been addressed, it remains open.

**Developer's Response 2:** Additional text has been added to the document in the location indicated by the finding giving instruction for measuring/calculating the required metric.

**Auditor Response 2:** Through review of the updated tool, (still) entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that Section 6.1 contains a description of the methods that may be used to measure the parameter A(j). Given that common techniques for area measurement are well-understood and widely taught (being covered, for example, in most undergraduate natural resources/forestry programs in the United States), the methods provided are sufficiently descriptive to point the user toward the established methods that are available for this task. Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

**NCR 2014.55 dated 01-28-2015**

**Standard Reference:** Methodology Approval Process V3.5, Section 3.2.2; VCS Module Template V3.3

**Document Reference:** VCS\_RSBM\_VT\_v3.4, Section 6.1

**Finding:** The Methodology Approval Process requires that "Methodologies and methodology revisions shall be prepared using the VCS Methodology Template and modules and tools shall be prepared using the VCS Module Template. All instructions in the templates must be followed." Section 6.1 of the VCS Module Template requires that the indicated table be completed "for all data and parameters that will be determined or available at validation and remain fixed throughout the project crediting period". The guidance within the table indicates that the following information must be found in the "Equations" field: "List the equation(s) that use this data/parameter". The guidance within the table indicates that the following information must be found in the "Value applied" field: "Provide the value applied, if any". For the parameters "m" and "tval", the information in the Equations field is incorrect, as it refers to equations that do not use the respective parameters (parameter "m" is used in Equation 3 and parameter "tval" is used in Equation 18). For the parameter "tval", the "Value applied" field contains an equation number and therefore does not contain "the value applied, if any".

**Developer's Response:** [A response to this finding was provided outside the cover of the findings workbook.]

**Auditor Response:** Through review of the updated tool, (still) entitled "VCS\_RSBM\_TOOL\_v3.4", the assessment team can confirm that the equation references have been corrected and that an erroneous "Value applied" is no longer indicated for parameter "tval". Therefore, the non-conformity has been resolved.

**Closing Remarks:** The Developer's response adequately addresses the finding.

APPENDIX B

An explanation of whether and how the developer has taken due account of all comments received during the public stakeholder consultation is contained within the below table. “We” should be read as shorthand for “the assessment team” within the below table. It should be noted that all language under “Developer’s Response” is a verbatim transcription of responses provided by the tool developer.

Commenter	Comment(s)	Developer's Response	Assessment Findings
Merga Diyessa	I'm Ethiopian and GIS specialist by profession working for FARM Africa mainly on Bale REDD+ project. Really I found the tool very interesting. For us as we are the first REDD+ project in the country we really lack skill like this which we really need to get it. Finally my question is can you please arrange a sort of capacity building training for experts like me who lacks this skill and could not really get it anywhere. Merga FARM Africa GIS Specialist. Finally my comment on the tool, It would be much better to be prepared with technical steps to be used for RS software that would help the experts on this field to produce their own estimated Biomass map	The intent of the tool is to provide a fundamental framework for the measurement of biomass. Software-specific tutorials are beyond the scope of the intent.	While we are sympathetic to the commenter's request, we concur that software-specific tutorials are outside the scope of the tool.
Inga P. La Puma...	Check the old growth definition: Should it be >10cm for old growth in the diameter at breast height instead of <10cm	Notation has been chance per the suggestion.	This comment may have been significant at the time of issuance, but is not relevant at this time, as the tool does not presently contain a definition of "old growth".
Inga P. La Puma...	How you will take into account areas of recent disturbance, such as wildfire or wind-throw in your protocol. Will these areas necessarily be stratified out of the one time AGLB estimation via LULC for a given analysis region	Any measurement can be expected to be reflective of the conditions at the time of data collection. Disturbance must be accounted for in MRV exercises.	We concur that this comment is irrelevant, as the tool provides procedures for the sole purpose of estimating biomass at a given point in time, and provision of a wider framework for change detection is outside of its scope. This is made clear in the non-applicability condition listed in Section 4 of the tool.

Commenter	Comment(s)	Developer's Response	Assessment Findings
Inga P. La Puma...	In areas prone to forest disturbance the LULC stratification step should be mandatory given the inherent variability in most forested regions.	The tool is intended for a single point in time measurement. The tool can be used at a point in the future as a part of MRV to detect disturbance.	See above.
Rutishauser Ervan	This a very standard approach that is currently used in both REDD+ and AFOLU projects. Calibrating RS data with field based inventories has been done since the 90's, with now good results with LiDAR/radar data. To enhance remotely-sensed prediction of AGB, I suggest to follow Vincent et al. 2014 (Oecologia) rather than Asner et al. 2013. Moreover, you should include a paragraph on error propagation, as proposed in Pearson et al. 2005, to assess uncertainties on field-based AGB estimates.	Have added a reference to Vincent et. al.	This comment may have been significant at the time of issuance, but has been addressed. A reference to Vincent et al. (2014) is present within Section 5.1.2.1 of the tool. The tool contains equations, in Section 5.1.3.3, to quantify variance that incorporate uncertainties in field-based biomass estimation. Specifically, Equation 15 is sourced from equation 15 in Ståhl et al. (2011), which is stated in that publication to incorporate "the sampling error".
Peter Schlesinger	1) First off, the text needs a good edit: there are a number of English language typos, grammatical issues, sentences that are really run-on phrases.	-	This comment may have been significant at the time of issuance, but the tool does not, in our judgment, presently contain errors or difficulties in the text that could lead to confusion or inconsistent application.
Peter Schlesinger	2) It says strata are optional in 5.1 and 5.2.1 but then requires strata for the equations in 5.2.2.2 and subsequent equations. There are no equations that specify what to use if stratification was not used.	no equations in the current version require stratification	This comment may have been significant at the time of issuance, but is not relevant at this time, as the tool does not presently contain any indication that stratification is required, and the tool elegantly handles the case where stratification is not employed through language such as "each stratum or AOI".

Commenter	Comment(s)	Developer's Response	Assessment Findings
Peter Schlesinger	3) The equation in 5.2.2.3 is faulty. The text says this is going to be "Mean ALFB and variance of ALFB per hectare in the stratum", the first equation is NOT Mean ALFB per hectare, but mean / plot, because $n_{sub\ i}$ is the number of plots in stratum $i$ , not the number of hectares. AND in the same section "Mean ALFB per hectare within the project area" is also incorrect too because it is calculating number of tons per plot ( $n_{sub\ i}$ ) NOT tons/hectare.	section has been removed; mean ALFB at the stratum and project level are calculated in 5.1.3.2	This comment may have been significant at the time of issuance, but is not relevant at this time, as the tool does not presently contain any equations to calculate biomass at the plot level. All equations within the tool are clear and without error.
Peter Schlesinger	4) in the same section 5.2.2.3, ATB UNIT, $p,i$ is undefined. One might be able to guess that it is Aboveground Tree Biomass, but UNIT is undefined, and UNITS are tons in one case and hectares in another, so it is unclear what this is.	section has been removed; UNIT nomenclature is not longer used	This comment may have been significant at the time of issuance, but is not relevant at this time, as the tool does not presently contain the terms "ATB" or "UNIT".
Peter Schlesinger	5) In the same section 5.2.2.3, there is a ATFL defined, but there is no ATFL used in the equations in this part.	section has been removed; All instances of the acronym have be edited to 'ALFB'	This comment may have been significant at the time of issuance, but is not relevant at this time, as the tool does not presently contain the term "ATFL".
Peter Schlesinger	6) The nomenclature in the units is not consistent. in two places in the definitions for section 5.2.2.3 it uses tons/ha and in two other places it uses "tons ha-1" which means the same thing as tons/ha, but this could be made to be consistent. Likewise in 5.2.3, it uses "t ha-1".	notation has been made consistent	This comment may have been significant at the time of issuance, but is not relevant at this time, as the unit notation is presently consistent throughout the tool (i.e., units on a per-hectare basis are consistently specified as "t ha-1").

Commenter	Comment(s)	Developer's Response	Assessment Findings
Peter Schlesinger	7) to follow on in the same section the nomenclature for the standard deviation and the error is either not correct or not consistent because, the definitions prior indicate that ALFB is the mean tree biomass per hectare within the stratum, where as here both s and e refer to the mean tree biomass per hectare within the project boundary.	section has been removed; all references to stdev and error have been fixed and are consistent	This comment may have been significant at the time of issuance, but is not relevant at this time, as the tool does not presently contain any erroneous equations. All equations within the tool are clear and without error.
Peter Schlesinger	8) in the definitions for the same section describing "t val" it says in subsection "(i) Degrees of freedom equal to $n - M$ ", but M is never defined.	m has been defined in 5.2.1.1	This comment has been addressed; "M" is defined in Section 5.1.3.3 as "is the total number of tree biomass estimation strata".
Peter Schlesinger	9) In the same section 5,2,2,3 it says in the last paragraph "prescribed in the methodology" but it does not specify whether this means the methodology of the tool or the methodology applying the tool (e.g.VM006 or VM0015).	section has been removed; reference to overarching methodologies has been revised and made consistent throughout.	This comment may have been significant at the time of issuance, but is not relevant at this time, as all instances of usage of the term "methodology" refer to the term as commonly understood under the VCS Program, and there is no potential for confusion regarding the meaning of the term.
Peter Schlesinger	10) Across the tool it uses the phrase "RS metric(s)" but never states what this means. this should be dictated for a list of examples should be stated, so the user can know what is being suggested.	A description and examples of RS metrics has been added to the definition of Remote Sensing.	We agree that the following sentence has been added to the definition of "Remote Sensing (RS)" which addresses the comment: "Metrics derived from remote sensing platforms can include directly measured reflectance at a given frequency, or derivative metrics such as gridded raster of tree canopy height from LiDAR".
Peter Schlesinger	11) Page 8, 11, 12 uses the acronym PSP and PSPs but this is never defined in the entire methodology.	fixed	This comment may have been significant at the time of issuance, but is not relevant at this time, as the term "PSP" does not presently exist within the tool.

Commenter	Comment(s)	Developer's Response	Assessment Findings
Peter Schlesinger	12) There are no clear steps showing calibration, validation, nor sensitivity analysis.	the tool gives sufficient instruction for conducting calibration validation and error estimation.	With respect to calibration and validation, this comment may have been significant at the time of issuance, but is not relevant at this time, as Section 5.1.3 of the tool contains a clear description of the calibration and validation processes. It in the absence of further clarity regarding what is meant by "sensitivity analysis", it appears that the request for "clear steps showing... sensitivity analysis" is not relevant, as sensitivity analysis is not a prerequisite for effective application of the techniques set out in the tool.
Peter Schlesinger	13) In section 5.2.3.1 There is "E sub int" but "int" is never defined. I presume it means the Error of the intermediate RS data set, but it does not specify this nor specify what this means nor how to calculate that to be in compliance with the terms of the tool's requirements.	section has been modified. no E_int in current draft.	This comment may have been significant at the time of issuance, but is not relevant at this time, as the term "E sub int" does not presently exist within the tool.

<p>Peter Schlesinger</p>	<p>14) There are no or no useful QA/QCs recommended to follow in this tool, though the term QAQC is in Part 6 listing of Data and Parameters. It only says to use "Utilize industry standard techniques for measurement". This is insufficient because there are many ways to calculate many of the parameters. For example, one can use an clinometer, laser rangefinder, hysometer, or use LIDAR, all of which would be industry standards but would give four different estimates of tree height. The purpose of the QAQC is to give clear advice on how and what to do to avoid discrepancies in estimation.</p>	<p>A requirreement for QA/QC procedures has been added in section 5.1.2.1</p>	<p>As noted, requirements for QA/QC procedures have been added to what is now Section 5.1.2.2 of the tool. While these requirements are quite generic, and do not provide specificity at the level of detail requested by the commenter, the level of detail provided is considered sufficient by the assessment team. The assessment team agrees that the VCS rules do not require methodology elements to be highly prescriptive with respect to QA/QC procedures to be adopted for certain measurement tasks. Therefore, the assessment team agrees that it is not necessary to set out detailed QA/QC measures for common forest inventory tasks. It may be noted that Section 3.16.2 of the VCS Standard states that "Quality management procedures to manage data and information shall be applied and established", thus introducing a generic requirement for QA/QC procedures against which individual projects are assessed. In summary, while the tool is not as prescriptive regarding measurement procedures as would be preferred by the commenter, the assessment team agrees that the VCS rules, as a whole, provide sufficient safeguards to ensure adequate quality of</p>
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Commenter	Comment(s)	Developer's Response	Assessment Findings
			forest inventory data in this instance.

Commenter	Comment(s)	Developer's Response	Assessment Findings
Peter Schlesinger	<p>15) The reference for Asner 2013, page 5, dictates that there are applicability conditions for the methodology that they describe, stating that their "LiDAR approaches can stand in for field plots, both in humid tropical forests and among drier tropical vegetation types". but these conditions are not listed in section 4 of the Tool's methodology. Perhaps the methodology should be amended to ask that the developer prove that his application is within the area applicable by the Asner document if using LiDAR as the intermediate RS method.</p>	<p>there are no applicability conditions necessarily implicated in citing the Asner paper</p>	<p>This comment may have been significant at the time of issuance, but is not relevant at this time, as we agree that there are no applicability conditions necessarily implicated in citing the Asner paper, nor does the reference to said paper make mention of applicability conditions.</p>
Donald E. Strebel	<p>This conceptual framework still needs a lot of work to be forged into a practical tool. The conditions under which the tool is applicable are vague, and the most critical part of a remote sensing based biomass measurement procedure (the prediction method) is not fully addressed. There are some very muddled, and occasionally conflicting, discussions of statistical concepts important to implementing the procedure. In addition, there are numerous errors in the text and inconsistencies in the statistical formulas. In some places slang or jargon is used instead of precise English, and some of the units are ambiguous or not properly defined. It appears that this proposed module has not been subjected to a thorough quality assurance review or a field test.</p>	-	<p>This comment may have been significant at the time of issuance, but is not relevant at this time, as the tool presently does not contain vague applicability conditions or any of the other negative attributes listed in the comment. We believe that the tool is written in precise English and without statistical errors or inaccuracies.</p>

Commenter	Comment(s)	Developer's Response	Assessment Findings
Donald E. Strebel	1. Definitions (Section 3). Validation Plot definition is circular. "VPs" should be "CPs"?	not circular, clarified VP definition'	This comment may have been significant at the time of issuance, but is not relevant at this time, as the tool presently contains a clear and non-circular definition of "Validation Plot (VP)".
Donald E. Strebel	2. Applicability Conditions (Section 4). What is meant by requiring that remotely sensed data must be available "for the time period required"? Remote sensing instruments and technology change rapidly while biomass offset project monitoring must be repeated periodically and consistently for decades. It is very unlikely that a consistent set of remotely sensed data will be available throughout the lifetime of a biomass project. If the same type and quality of remotely sensed data has to be available at every monitoring event, then this is a useless module for VCS – the condition will never be met. To be useful, the module must address the effects of using different remotely sensed data sets (including a gap in data availability) at different monitoring events.	Thephrasing has been changed to reflect the condition that RS dat must be available for the point in time that an estimate of ALFB is required.	This comment may have been significant at the time of issuance, but is not relevant at this time, as (1) Section 4 of the tool clarifies that the tool only provides procedures to estimate biomass at a single point in time, and (2) the tool currently states in Section 4 that "The remotely sensed data necessary to estimate ALFB is accessible for the time period desired", and this seems to indicate, with reasonably clarity, that remotely sensed data must be available for the particular point in time of interest

Committer	Comment(s)	Developer's Response	Assessment Findings
Donald E. Strebel	<p>3. Estimation (Section 5.2, page 6). The expression <math>f(x) = \text{ALFB}</math> is mathematically incorrect. The function definition is always on the right, with the result on the left. Thus, <math>\text{ALFB} = f(x)</math>. Technically, you should write <math>f(x_1, x_2, \dots, x_n)</math> to indicate that there are <math>n</math> metrics that contribute to the function, or state that "x" is a vector of <math>n</math> metrics. It would be appropriate to use the same level of mathematical rigor in describing the remote sensing estimation/prediction methods as is used in describing the statistics.</p>	fixed notation per the suggestion	This comment may have been significant at the time of issuance, but is not relevant at this time, as all equations in the tool follow the convention described in the comment.