METHODOLOGY FOR SOIL CARBON ASSESSMENT REPORT

Document Prepared By: Environmental Services, Inc. (Project Number VO11049.00)

Methodology Element Title	Methodology for Soil Carbon	
Version	1.8	
Methodology Element Category	Methodology	X
	Methodology Revision	
	Modules	X
	Tool	
Sectoral Scope(s)	AFOLU: ALM (ICM, IGM, CGLC)	

Report Title	Methodology for Soil Carbon Assessment Report
Report Version	03
Assessment Criteria	VCS Program Guide (v3.2, 1 February 2012); VCS Standard (v3.2, 1 February 2012); VCS AFOLU Requirements (v3.2, 1 February 2012), and Methodology Approval Process (v3.3, 1 February 2012). Please note: Several Version 3 documents were updated after the methodology assessment began. The methodology was assessed against the required updates.
Client	The Earth Partners
Pages	38

Date of Issue	14 November 2012
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Work Carried Out By	Shawn McMahon – Lead; Richard Scharf-Team Member; John Kimble – Team Member / AFOLU-ALM Expert; Gary Kaster- Team Member / Technical Expert; and Caitlin Sellers –Team Member.

Summary:

Environmental Services, Inc. (ESI) was contracted by The Earth Partners, LLC. (TEP) to perform the first methodology element assessment of their methodology entitled *Methodology for Soil Carbon*, in accordance to the VCS Methodology Approval Process (v3.3, 1 February 2012), the VCS Standard (v3.2, 1 February 2012), VCS Program Guide (v3.2, 1 February 2012), and the VCS AFOLU Requirements (v3.2, 1 February 2012). Please note: Several Version 3 documents were updated after the methodology assessment began. The methodology was assessed against the required updates.

The *Methodology for Soil Carbon* includes methods for quantifying and monitoring changes in carbon accrual in, and emissions from, soils, as well as from other GHG pools and sources which may be impacted by soil focused projects. The method is designed based on guidance provided in the IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry. It is designed to be applicable to conservation, ecosystem restoration, and agricultural projects, as well as other projects where the management of soils directly or management of hydrology, fertility, and vegetation systems can affect changes in soils and soil carbon.

The assessment included the following items: eligibility criteria, baseline approach, additionality, project boundary, emissions, leakage, quantification of GHG reductions/removals, monitoring, data and parameters and adherence to project level principles (relevance, completeness, consistency, accuracy, transparency, conservativeness). ESI's assessment also included a detailed analysis of the methodology, literature reviews, technical reviews and TEP's responses to all non-conformity reports (NCRs) and clarifications (CLs), as well as review of the second assessor's findings.

The ESI assessment team identified 141 NCRs/CLs. All were addressed satisfactorily by TEP during the methodology assessment process. These NCRs and CLs provided needed clarity to ensure that the methodology was in compliance with VCS standards and requirements. Appendix A details each NCR/CL and the resolution.

ESI confirms all methodology assessment (validation) activities, including objectives, scope and criteria, level of assurance and the methodology adherence to VCS Version 3 (and updates), as documented in this report, are complete and concludes without any qualifications or limiting conditions that the methodology element (Methodology for Soil Carbon, Version 1.8, 23 July 2012) meets the requirements of the VCS. ESI recommends that VCSA approve TEP's Methodology for Soil Carbon, Version 1.8.

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1 INTRODUCTION

1.1 Objective

The methodology element objective was to assess the likelihood that implementation of the AFOLU methodology element would result in the accurate calculations and appropriate eligibility criteria of the GHG emission removal methodology as stated by the methodology developer.

1.2 Scope and Criteria

The scope of the methodology element assessment included applicability conditions, project boundary, procedure for demonstrating additionality, procedure for determining baseline scenario, baseline emissions, leakage, quantification of net GHG emission reduction and/or removals, monitoring, data and parameters, adherence to the principles of the VCS Program/Standard and relationship to approved or pending methodologies

The criteria of the methodology element assessment followed the VCS Program guidance documents provided by VCS, located at http://www.v-c-s.org/program-documents/find-program-document. These documents include:

- VCS Methodology Approval Process (v3.3, 1 February 2012)
- VCS Program Guide (v3.2, 1 February 2012)
- VCS Standard (v3.2, 1 February 2012)
- Program Definitions (v3.2. 1 February 2012)
- Agriculture, Forestry and Other Land Use (AFOLU) Requirements (v3.2, 1 February 2012)

1.3 Summary Description of the Methodology Element

The *Methodology for Soil Carbon* includes methods for quantifying and monitoring changes in carbon accrual in, and emissions from, soils, as well as from other GHG pools and sources which may be impacted by soil focused projects. The method is designed based on guidance provided in the IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry. It is designed to be applicable to conservation, ecosystem restoration, and agricultural projects, as well as other projects where the management of soils directly or management of hydrology, fertility, and vegetation systems can affect changes in soils and soil carbon. The method is applicable to a range of project scenarios designed to improve soils, including changes to agricultural practices, grassland and rangeland restorations, soil carbon protection and accrual benefits from reductions in erosion, grassland protection projects, and treatments designed to improve diversity and productivity of grassland and savanna plant communities.

The intention of the developers has been to create a methodology which includes sufficient detail on methods to allow a wide range of people to use the methods during the development of soil carbon projects. However, accurately estimating and projecting the values of the various ecosystem carbon pools does require a significant level of technical ability on the part of the project proponent team. It is therefore expected that in many cases landowners and farmers may need to

work with people with specific technical skills to complete the development of a soil carbon PD using this methodology.

This methodology provides methods for the quantification of soil carbon, as well as methods for quantifying changes in vegetation and litter pools which may be impacted by project activities, as compared with the baseline scenario.

This methodology is focused on addressing *the following key variables:*

- Estimating the amount of carbon in the soil, litter, and living vegetation pools at the start of the project;
- Monitoring and documenting changes in soil carbon and the other carbon pools over time under the project scenario;
- Projecting changes in soil carbon and other pools under the baseline scenario;
- Estimating emissions of nitrous oxides and methane from soils, and,
- Estimating project leakage.

The methodology has been designed using a modular approach. The methodology document lays out the steps required to fulfill estimation, projection and quantification requirements for projects wishing to register credits under the VCS. The methodology calls on the associated modules for specific techniques and options for estimating or projecting the GHG impacts of changes in specific pools and emissions.

The methodology requires the completion of four main tasks:

1. Assessment of applicability and project additionality, identification of project boundaries, and determination of the baseline scenario;
2. Ex-ante estimation and projection of carbon pools and emissions under the baseline scenario;
3. Ex-ante estimation and projection of carbon pools and emissions under the project scenario; and,
4. Development of a monitoring plan and subsequent ex-post monitoring of pools and emissions under the project scenario, as well as under the baseline scenario if a monitored baseline is used including monitoring of leakage.

2 ASSESSMENT APPROACH

2.1 Method and Criteria

The methodology assessment approach closely followed the system outlined in the following documents: VCS Methodology Approval Process, VCS Program Guide, VCS Standard, Program Definitions, Agriculture, Forestry and Other Land Use (AFOLU) Requirements, ISO 14064-3, ISO 14065, and ESI's Management System and Management System Manual. As defined by ISO 14064-3:2006 (E), "validation is the systematic, independent and documented process for the evaluation of a greenhouse gas assertion in a GHG project plan against agreed validation criteria." In the case of a new methodology element assessment (validation), the assessment is the

systematic, independent documented process for the evaluation of a methodology element against the VCS program criteria.

The criteria followed are outlined in Section 1.2 of this report.

ESI's assessment included detailed analysis of the methodology, literature review, technical reviews and use of previously approved methodologies. Our assessment/analysis technique is generally broken down into five basic parts:

- Creation of Methodology Assessment (Validation) Plan
- ESI review and assessment,
- Utilization of independent technical experts, including VCS approved AFOLU-ALM Expert,
- Issuance of non-conformity reports (NCRs) and clarifications (CLs)
- Review of methodology developer's explanations, clarifications and insight.

2.2 Document Review

A detailed review of the methodology element documentation was conducted to ensure consistency with, and identify any deviations from, VCS program requirements. The methodology was reviewed by all team members, with some members focusing on the methodology's adherence to VCS program guide, the VCS Standard, VCS AFOLU Requirements and other guidance documents. Others, including VCS-approved AFOLU expert, John Kimble, focused on technical aspects of the methodology and its adherence to currently accepted principles and methods of soil science. The following is the final list of documents received by TEP and reviewed by ESI:

1 TEP Soil Carbon Methodology 1.8 Final.doc
2 TEP VCS Module Stratification 1.8 Final.doc
3 TEP VCS Module Projection of Future Conditions 1.8 Final.doc
4 TEP VCS Module Project Boundaries 1.8 Final.doc
5 TEP VCS Module Soil Carbon 1.8 Final.doc
6 TEP VCS Module Living Plant Biomass 1.8 Final.doc
7 TEP VCS Module Litter 1.8 Final.doc
8 TEP VCS Module Dead Wood 1.8 Final.doc
9 TEP VCS Module Woody Biomass Harvesting and Utilization 1.8 Final.doc
10 TEP VCS Module Long Lived Wood Products 1.8 Final.doc
11 TEP VCS Module Domestic Animal Populations 1.8 Final.doc
12 TEP VCS Module Emissions from Domestic Animals 1.8 Final.doc
13 TEP VCS Module Emissions of nonCO2 GHGs from Soils 1.8 Final.doc
14 TEP VCS Module Emissions from Power Equipment 1.8 Final.doc
15 TEP VCS Module Emissions from Burning 1.8 Final.doc
16 TEP VCS Module Displacement Leakage 1.8 Final.doc
17 TEP VCS Module Market Leakage 1.8 Final.doc
18 TEP VCS Module Monitoring Plan 1.8 Final.doc
19 TEP VCS Module Summation of net GHG change 1.8 Final.doc

2.3 Interviews

After ESI team members reviewed/assessed the methodology element and compiled a list of NCRs/CLs, the list was presented to the TEP methodology authors. Conference calls were scheduled after each Round of NCRs/CLs was issued. During the conference calls the methodology authors were interviewed by the ESI team to reconcile understanding of the NCRs/CLs. The methodology authors were then able to ask questions of the ESI team if they were unclear about a reviewer's comments regarding particular NCRs/CLs.

The TEP methodology authors, Steve Apfelbaum and Robert Seaton, and ESI team reviewers Shawn McMahon, Gary Kaster, John Kimble (AFOLU expert), Richard Scharf and Caitlin Sellers participated in the interviews. Individual reviewers took part when an NCR/CL found by the reviewer was being discussed.

Additional interviews were arranged, as needed, after the authors addressed NCRs/CLs in subsequent versions of the methodology and reviewers required additional clarification on changes in the new version. (See table below.)

Table 1. Contact Dates between Methodology Developers and Assessment Team Members.

Date	Attendees	Topics Discussed
7 October 2011	Janice McMahon – ESI Shawn McMahon – ESI Steve Apfelbaum – TEP Robert Seaton - TEP	Opening meeting: review of methodology element assessment (validation) plan, and schedule for assessment.
28 October 2011	Shawn McMahon – ESI Richard Scharf – ESI Caitlin Sellers – ESI Gary Kaster – ESI/independent John Kimble – ESI/independent Steve Apfelbaum – TEP Robert Seaton - TEP	NCRs/CLs and responses from Round 1.
31 October 2011	Shawn McMahon – ESI Richard Scharf – ESI John Kimble – ESI/independent Steve Apfelbaum – TEP Robert Seaton – TEP Frederik Vroom – TEP	NCR's/Cl's Round 1
22 November 2011	Shawn McMahon – ESI Gary Kaster – ESI/independent John Kimble – ESI/independent Frederik Vroom – TEP Robert Seaton - TEP	NCR's/Cl's Round 2
13 January 2012	Shawn McMahon – ESI Richard Scharf – ESI John Kimble – ESI/independent Steve Apfelbaum – TEP Robert Seaton - TEP	Remaining technical NCRs/CLs from round 2.
24 July 2012	Janice McMahon – ESI Richard Scharf – ESI Frederick Vroom - TEP	Closing Meeting: review of 2nd assessors findings, review of updated assessment report; next steps, and feedback request

2.4 Use of VCS-Approved Expert

Dr. John Kimble - Validation Team Member /VCS AFOLU ALM - Expert (soilcarbon@aol.com / 607-346-3270).

2.5 Resolution of Any Material Discrepancy

When potential material discrepancies/non-conformities were identified during the assessment process, a NCR/CL was issued. After review and issuance of each round of NCRs/CLs, TEP methodology authors were allowed sufficient time to correct or address non-conformities and make clarifications. Changes were reviewed by the ESI team, who either accepted corrected non-conformities and clarifications, or rejected them with explanation. The methodology authors were then able to confer again with the ESI team to discuss and clarify their findings. If the ESI team were satisfied that corrections and clarifications to the methodology bringing it into compliance with VCS program requirements, the NCR/CL was considered resolved.

After three rounds of review, all NCRs/CLs were considered resolved by the reviewers. Please see Section 4 and Appendix A for a complete description of all NCRs/CLs.

2.6 Internal Quality Control

The Regional Technical Manager is responsible for the overall performance of the methodology assessment process, and is the main authority for quality assurance and quality control of the validation/verification policy and procedures of the ESI Management System. The methodology element assessment was conducted according to ESI's policies and procedures, their accreditation under ISO 14065:2007, and VCS program requirements.

3 ASSESSMENT FINDINGS

3.1 Applicability Conditions

The methodology's applicability conditions are appropriate and adequate. They are in compliance with VCS Standard (v3.2) by identifying activities and conditions under which the methodology can be appropriately used and identify which specific methodology modules apply to specific project activities. Further, it is in compliance with VCS AFOLU Requirements (v3.2), identifying specific activity categories covered by the methodology.

3.2 Project Boundary

The methodology dedicates a module (4 TEP VCS Module Project Boundaries) to address the establishment of spatial and temporal project boundaries, including the selection of mandatory carbon pools, i.e., the sources, sinks and reservoirs relevant to the baseline scenario.

Specific procedures for determining GHG emissions sources and sinks are described, depending on project activities. For temporal boundaries, the methodology refers to the most recent version of the VCS standard.

3.3 Procedure for Determining the Baseline Scenario

The methodology uses the latest version of the "Combined Tool to Identify the Baseline Scenario And Demonstrate Addtionality for A/R CDM Project Activities" approved by the CDM Executive Board," to determine the baseline scenario, and is in compliance with VCS AFOLU Requirements (v3.2).

3.4 Procedure for Demonstrating Additionality

The methodology references the latest version of the "Combined tool to identify the baseline scenario and demonstrate additionality for A/R CDM project activities" approved by the CDM Executive Board, and is therefore in compliance with the VCS Standard (v3.2, section 4.6).

3.5 Baseline Emissions

The methodology adequately addresses baseline emissions from all sources, including direct measurement of soil carbon stocks and estimation of N_2O and CH_4 emissions. Individual methodology modules address emissions sources.

3.6 Project Emissions

The methodology adequately addresses project emissions from all sources, including direct measurement of soil carbon stocks and estimation of N_2O and CH_4 emissions. Individual methodology modules address project emissions sources in the same or similar manner as they do for baseline emissions sources.

3.7 Leakage

The methodology provides procedures to calculate activity displacement leakage from the displacement of agricultural production and the displacement of wood harvesting, as well as market leakage. Methods for projecting ex-ante and accounting ex-post leakage are provided. (PRC projects are not covered by this methodology.) The procedures are appropriate, adequate and in compliance with VCS AFOLU Requirements (v.3.1).

3.8 Quantification of Net GHG Emission Reductions and/or Removals

The methodology provides a procedure for determining net emissions and carbon stocks – separately so that buffer credits can be calculated -- in both the baseline and project scenarios, including leakage. Procedures are appropriate and in compliance with VCS rules.

3.9 Monitoring

The methodology module for project monitoring uses VCS-VM00015 (Methodology for Avoided Unplanned Deforestation) as a guide. It established the purpose of the monitoring, procedures for measurement, calculation, estimation and modelling, procedures for managing data quality, and determining monitoring frequency. The monitoring plan module is in compliance with VCS rules.

3.10 Data and Parameters

Data and parameters to be reported are explained, including sources and units of measurement, at the end of each of the methodology's modules. Specifications for all data and parameters are sound and in compliance with VCS rules.

3.11 Use of Tools/Modules

Six other tools and methodologies were referenced within the Soil Carbon methodology. In all cases the references are appropriate and are used appropriately. See table 2 for places within methodology where other methodologies or tools were referenced.

Table 2. Tools and Methodologies Referenced

Tool/Methodology	**Soil Carbon Methodology References**
CDM-EB Tool for testing significance of GHG emissions in A/R CDM project activities	Module 1, module 4, module 7
VCS Tool for AFOLU Methodology Issues	Module 1
VCS Tool for Market Leakage	Module 1
VCS VM0015, Methodology for Avoided Unplanned Deforestation	Module 3, module 4, module 15, module 18
CDM AR-AM0004, Reforestation or Afforestation of Land Currently Under Agricultural Use	Module 12, module 14
CDM AR-AM0006, Afforestation/Reforestation with Trees Supported by Shrubs on Degraded Land	Module12

3.12 Adherence to the Project Principles of the VCS Program

The methodology adheres to the principles taken from ISO 14064-2, clause 3, and therefore the VCS standard. In terms of relevance, it addresses a large variety of GHG sources, reservoirs and sinks that can be included or excluded from a specific project methodology, depending on the user's needs. In terms of completeness, all relative information to carry out procedures is included. Strict procedures enable comparisons with GHG information within a project or between projects using the methodology. Faithful adherence to procedures should result in a high degree of accuracy. A significant amount of relevant data is expected to be generated in a project using this methodology to meet transparency requirements. The methodology's elements are conservative.

3.13 Relationship to Approved or Pending Methodologies

Related approved and pending methodologies are limited in scope to the types of ALM activities they cover, for example grassland management, rice cultivation or specific management practices. In addition, no currently approved VCS methodology requires or provides a means to assess soil carbon stocks via direct measurement, as does this proposed methodology. It can therefore be used in regions where accepted soil models have not received adequate testing for reliability.

The proposed methodology uses a more general approach that can be applicable to wider variety of conditions and project activities.

3.14 Stakeholder Comments

Two letters from public stakeholders, each consisting of several comments were received during the public comment period. One letter was from Andrea Malmberg of the Savory Institute, the other from Marissa Ahlering of The Nature Conservancy. The comments and developers' responses are listed in Table 3. The developers responded by changing the methodology in some cases, and pointing out where the commenter's concerns were covered in the methodology in others. ESI confirms that the methodology developer's responses were appropriate and adequately addressed all public comments and that the responses/changed made to the methodology are in compliance with both the VCS Standard and VCS AFOLU requirements.

Table 3. Stakeholder Comments and Methodology Developer's Responses.

Comment By:	Comment	Response from Developer
Andrea Malmberg Savory Institute	…one cannot compare the same number of ruminants in a feedlot to those grazing highly nutritious native grasslands. We find it critically important that we first distinguish between those impacts that are due to livestock themselves, and those that are in fact due to how human beings decide to manage livestock.	We agree. To the extent that there is well accepted data available to distinguish these differences, we think that the method addresses these issues, and thus we do not feel that changes are necessary. However, it is clear that a lot more could be done to improve the data and that in future methods may be able to improve the specificity of dealing with these issues.
Andrea Malmberg Savory Institute	Properly managed livestock (planning for the appropriate timing, duration, intensity and frequency of grazing and allowing for adequate recovery periods) is a key in sequestering carbon while at the same time enhancing the viability of pastoralists' livelihoods.	Because the method is sampling based, it will allow these effects to be measured and credited.
Andrea Malmberg Savory Institute	We contend and think that your methodologies should expose that properly managed livestock may be considered a zero emitter of CH4 since what the bacteria in the rumen emits, microbial activity in	Using the combination of the soil emissions and livestock emissions modules will allow this to be accounted.

	healthy soils are able to use up.	
Marissa Ahlering TNC	Project Description developers should also be allowed to use VCS's "Tool for Demonstration and Assessment of Additionality."	We have added this option. If this option is used, we have requested that project developers continue to use the baseline determination section of the CDM tool
Marissa Ahlering TNC	Task 2.6 under this section deals with projecting future biomass under the baseline scenario, but the goal statement only refers to woody biomass. This seems inconsistent with a more general approach to project total future biomass including non-woody vegetation. The language around biomass is somewhat inconsistent throughout the documents/modules about whether they include non-woody biomass or not. The language in the modules themselves seems more general.	This correction has already been made
Marissa Ahlering TNC	Tasks 2.12 through 2.14 deals with estimating current animal populations, future animal populations and projecting emissions under the baseline scenario, but there is no task for projecting animal emissions under the project scenario. This seems like a necessary task to include given that animals are likely to still be present in some project scenarios.	Not true. Tasks 3.8 and 3.9 deal with this issue ex-ante and 4.8 and 4.9 deal with it ex-post.
Marissa Ahlering TNC	As written, Project Developers are not required to account for the loss of fertilizer applications from a baseline scenario. This seems like a major omission.	It's not entirely clear what is meant by this comment. However, I believe that tasks 2.15, 2.16, 3.10 and 4.12 deals with the issue of soil emissions changes due to changes in fertilizer, and tasks 2.6, 3.4 and 4.4 would deal with changes in biomass production. This is one where I would love to have a dialogue with the person writing the comments.
Marissa Ahlering TNC	Task 3.16 refers to displacement of agricultural production but only lists domestic animals as the relevant variable in the Methods section of this task. It seems agricultural production has been forgotten from the text of the goal and methods sections.	Good point. Changes made to task 3.16
Marissa Ahlering TNC	Suggest allowing people to choose to use VCS's "Tool for Market Leakage" (under development).	Text added to allow this option if the market leakage tool is finished
Marissa Ahlering TNC	The same issues arise under the both the ex ante and ex post estimation since the same methods and	Partly true, but I would prefer to keep them as separate sections since the ex-post involves

	tools are used for both.	monitoring which is not undertaken for the ex-ante.

Comment By	Comment	Response from Developer
Marissa Ahlering TNC	Even though the applicability criteria in the overview document clearly outline only ALM projects, the applicability criteria for many of the modules is listed as all AFOLU projects. More consistency is needed.	This was deliberate, since we want to maintain as wide an applicability for the modules, as versus the method, as we can, to allow these modules to be used for other methods. Otherwise the use of the modular approach is pointless.
Marissa Ahlering TNC	Numerous editing errors were present throughout all the documents that need to be corrected, but they became way too numerous to detail here. The writing and language needs to be improved.	Without specific examples it is impossible to know if she is pointing to things other than those that have already been corrected.

4 RESOLUTION OF CORRECTIVE ACTION REQUESTS AND CLARIFICATION REQUESTS

The ESI assessment team identified 141 non-conformity reports (NCRs) and clarifications (CLs). All were addressed satisfactorily by TEP during the methodology element assessment process. These NCR's and CL's provided needed clarity to ensure technical accuracy and to ensure that the methodology was in compliance with the VCS Standard. All NCRs/CLs with the agreed upon resolution are outlined in Appendix A.

5 ASSESSMENT CONCLUSION

ESI confirms all methodology element assessment (validation) activities, including objectives, scope and criteria, level of assurance and the methodology adherence to the VCS Program Guide, VCS Standard, and VCS AFOLU Requirements as documented in this report are complete and concludes without qualification or limiting conditions that the *Methodology for Soil Carbon* (Version 1.8, 23 July 2012) meets the requirements of the VCS.

ESI recommends that VCSA approves TEP's Methodology for Soil Carbon, Version 1.8.

6 REPORT RECONCILIATION

ESI has reviewed the second assessor's report and findings, as well as the methodology modifications resulting from the second assessor's findings. ESI finds the methodology modifications acceptable and has reconciled our report accordingly by issuing version 2.

7 EVIDENCE OF FULFILMENT OF VVB ELIGIBILITY REQUIREMENTS

As set out in the VCS document Methodology Approval Process for Non-ARR AFOLU Methodology Elements:

1) Both validation/verification bodies shall be eligible under the VCS Program to perform validation for sectoral scope 14 (AFOLU); AND
2) At least one of the validation/verification bodies shall use an AFOLU expert (see Section 9) in the assessment; AND
3) At least one of the validation/verification bodies shall have completed at least ten project validations in any sectoral scope. Project validations can be under the VCS Program or an approved GHG program, with the projects having been registered under the applicable program. A validation of a single project under more than one program (eg, VCS and CDM) counts as one project validation. The validation/ verification body that meets this eligibility requirement may be the same validation/verification body that uses an AFOLU expert

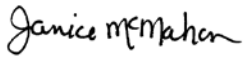
ESI fulfils the eligibility requirements in the following ways:

1) ESI is accredited by the American Standards Institute under ISO 14065:2007 for GHG Validation and Verification Bodied; including validation/verification of assertions related to GHG emission reductions and removals at the project level for Land Use and Forestry (Group 3). VCS accepts this accreditation.
2) ESI added Dr. John Kimble (VCS Approved AFOLU-ALM Expert) to our team. Dr. Kimble was considered a full team member with his main role being technical review.
3) Based on the date of the original contract and when the methodology assessment started, ESI had only completed 8 project validations; therefore ESI did not meet this VCS requirement.

8 SIGNATURE

Signed for and on behalf of:

Name of entity: Environmental Services, Inc.



Signature:

Name of signatory: *Janice McMahon*
Vice President / Regional Technical Manager
Forestry, Carbon, and GHG Services Division

Date: *14 November* 2012

9 APPENDIX A. NON-CONFORMITY REPORTS/CLARIFICATIONS AND RESOLUTIONS

NCR/CL No.	Module/Page /line	NCR/CL	Response
1	1/definitions, p7	Why differentiate between coarse fragments, since neither large nor small coarse fragments are included in a typical bulk density determination?	Since the bulk density sample will be sent to the laboratory undisturbed, it may contain "small coarse fragments", which will be screened out at the lab. However, if the soil also contains coarse fragments too big to fit in the bulk density sample, these will have to be avoided in taking the sample, which would create a potential error in calculating total soil carbon if they were not also accounted. As per our discussion I have added explicate size based definitions for small and large course fragments, and increased guidance on sample size for determining large course fragment content.
2	1/definitions, p8	It seems that by "small coarse fragments" the authors mean coarse fragments that will fit into the cylinder/can or other container by which the bulk density sample is taken. If this is the case, why not refer to them as something other than "included in the bulk density sample," which implies they will not be removed by sieving, and can cause confusion?	The method specifies that the % coarse fragments in BD samples be quantified, because they are "included in the BD sample". This is explicitly dealt with in Module 5, Step 4.3f. I have now revised the definitions of small and large course fragments to give explicate, size based cut-offs.
3	1/sec 2, p3	General editing comment: substitute affect for effect.	Changed
4	1/sec2, p3	Surficial horizons implies the A and O horizons only, but B horizons are included in this methodology. Can this be worded differently?	The words surficial horizons have been deleted, as noted in our response to comment 5 below.
5	1/sec2, p4	Does this methodology include spodic (podzolic) horizons?	Change made to #1 - Methodology, last paragraph, and page 3: remove "in surficial soil horizons". Change made to Module 5, page 6, first bullet: delete "the lesser of a) 90 centimeters or b)". In the same sentence, after "resulting from the project activity" add "as compared with the projected soil carbon change under the baseline scenario within the crediting period, or 2m,

			whichever is less. Identification of the depth above which 90% of the change is expected to occur should be based on current research which has examined changes at depth, since much of the older research limited sampling to 30 cm or less, and did not quantify soil carbon dynamics at depth. In general, proponents should start from an expectation of a 1m calculated depth, and adjust to reflect the particular dynamics of the project area."
6	2/sec 5, p5	Can the difference between a variable X and a factor be better explained? Earlier, soil texture was mentioned as an example of a variable X, while it can be considered a factor affecting soil C, which would be considered a variable X, from my understanding.	It is true that soil texture could be either the variable for which the stratification is being done, or a factor determining variation in another variable. It all depends on why you are stratifying, and can't be determined within this module. However, I have altered the first sentences of the Method section of Step 4 to read: ``Identify, for the variable X, the key factors. For any variable X, there will be a number of key factors within the project area, either currently or in the future, which tend to cause change in the variable, and where the amount of change caused by that factor is expected to vary across the project area." Hopefully this helps to make it clearer.
7	3/definitions, p2	Reference region/area: Is this region an example of a place with the 'reference condition,' described above? If not, a different name might reduce confusion.	This is a terminological problem caused by being at the intersection of two separate fields. "Reference condition" has a specific technical meaning in ecology and restoration, "reference region" has a related, but different meaning in carbon accounting and methodologies. Given that both of these are known terms of art, I am reluctant to change either. My feeling is that definitions as given make the difference clear.
8	3/p4, p6	General editing comment: repeated word appears multiple times (project).	done

9	3/Page 20,21, 22, 24, 25	same as above, please correct all typos - at least 24 instances	done
10	3/page 4	Check doc for typos - four more instances of the above	done
11	3/page 6	Check doc for typos - six more instances of the above	done
12	3/Section 1, page 2	Reference for VM0015 should be included in the reference section of this module	done
13	3/Section 3, page 2 - def. of Controlled, Planned, and Project Area	Typo - delete second "project"	done
14	3/Section 7c.6, page 12	"The minimum overall accuracy of the map assessed should be 90%" - comment - complies with other imagery standards of VCS.	No change made - appears to be in compliance
15	3/Section 8f, page 18	In the last bullet of the section - “in case the evidence is conclusive…" Please define conclusive. As stated, it appears to be rather subjective.	In section 8f, after the second bullet, "Conclusive", add "In order to be conclusive, the analysis of chain of events undertaken in step 8e must show that at minimum 80% of the identified drivers, agents and causes are tending to drive the future trend in change in the variable X in the same direction, and that the relative ranking points to these drivers agents and causes as being the key drivers of change."
16	3/Section Step 7a, page 8	Last sentence in Step 7a- "the remote sensing analysis described below as a back-up to the existing data". Please clarify “below" where. Is it 7c and 7c.2?	add "in step 7c" before the word "below"
17	3/Section Step 8, page 14	"since we know who is driving change in the variables" - comment - should this be who or what? Please explain.	"Who" is correct. The definitions for planned and controlled variables and the earlier description of these variables in Step 5 identify who the "who" is in each case.
18	3/Section Step 9, page 18	Typo - delete second "project" (two instances)	done
19	4/Meth and	Per asterisked note in 4.3.1, please refer to the pools as aboveground woody and aboveground	done

	Module 4	non-woody in the module.	
20	4/Section 1.1, page 4	Appropriate sources don't quite define how accurate the imagery might be. Perhaps could use some other terminology that qualifies the sources of data and imagery.	At the end of paragraph 2, section 1.1.2 add "meeting the requirements laid out in the latest version of the VCS Standard."
21	4/Section 1.3, page 6	Last bullet in section. "maybe", should be "may be"	changed
22	5/bedrock, p5	Bedrock: How can the depth be greater than the depth to the bed rock or cemented layer? If you use a deeper depth then you would increase the SOC that was reported but not really there?	bullet changed to: "While bedrock or cemented layers may limit the total depth of the soil in some plots to less than the calculated depth, soil depth in a majority of the plots should be expected to be greater than or equal to the calculated depth." The issue of how to deal with plots where sampling cannot be completed to the full calculated depth due to bedrock or cemented layers is dealt with in step 6.4, where the actual average depth of each soil layer as sampled is used for the calculations. See the first note after the equation.
23	5/bulk density, p13	Should you not discuss pressing can in to the soil face and not say filling as you want undisturbed material? Cannot core samples be cut to length and place into a bag and not into a can?	Section 4.3 e, para 3, second sentence rewritten to read "Typically this can be achieved by pressing a soil can of known volume into an undisturbed section of soil from the intact sides of a pit, or cutting a section of known length out of a sufficiently large diameter core sample and bagging it."
24	5/carbon testing, inorganic carbon, p15	How do you determine if it is pedogenic? Many times the carbonates are from the dedeposition for dissolved lithogenic carbonates and cannot be distinguish from pedogenic where CO2 was removed for the formation.	As discussed, the guidance on inorganic carbon has been substantially changed. The section on Carbon testing in Step 5.2 has been removed. The following text has been added to the introduction: "Conditions under which inorganic carbon must, or may, be accounted" This method contains guidance for quantification of both organic and inorganic carbon in soils. However, in many cases changes in inorganic carbon content are slow and unlikely to be significant. Furthermore,

			accurate estimation of reductions in atmospheric GHGs due to accretion of inorganic carbon may be difficult, for several reasons: • Carbonates may be transported from other locations in dust, or in solution, and increases in carbonates in the soil may therefore not represent the formation of new carbonates • Available calcium or magnesium for the formation of carbonates may be derived from the breakdown of carbonates at another location. In general, therefore, it is recommended not to account inorganic carbon under most project scenarios, with the following exceptions: 1. Inorganic carbon must be accounted where project activities are likely to lead to changes in soil chemistry or processes (for instance, increased acidity in the soil), which may be expected to lead to the breakdown of carbonates and the release of atmospheric carbon. 2. Inorganic carbon may be accounted where it can be conclusively demonstrated that a. Increases in inorganic carbon in the soil are not the result of the transport of carbonates from outside the project boundary, or from below the sampled depth, for instance through irrigation or percolation. b. Calcium and magnesium for the formation of carbonates are not sourced from breakdown of carbonates outside the project boundary or below the sampled depth. In either case, projection of a baseline for inorganic carbon must take into account the full range of carbonate formation, transport and breakdown processes and environmental conditions. If possible, and if suitable sites are available, strong consideration should be given to the use of a

			monitored baseline in addition to the ex-ante estimation, due to the complexity of inorganic carbon processes."
25	5/definitions	You give a definition of organic soils and then say this module cannot be used for sampling organic soils so in the stratification process how do you separate out the organic soils or check to see if they really are organic soils?	We actually say that the method cannot be used for accounting organic soils. We do not say that organic soils cannot be sampled using the methods given for sampling in the module. To clarify this I have added the following text to the end of step 1: "Note also that pre-sampling may be used to identify and eliminate areas containing organic soils, which may be sampled using the methods given below, but must not be accounted using this module."
26	5/definitions, p2	Why is no reference give for the definition of organic soils? One is needed so it can be checked to see if this is the same as may have been used for making soil maps. i.e. USDA Soil Taxonomy.	The definition given is an adaptation of the following USDA definition: "Organic soil material. Soil material that is saturated with water for long periods or artificially drained and, excluding live roots, has 18 percent or more organic carbon with 60 percent or more clay or 12 percent or more organic carbon with 0 percent clay. Soils with an intermediate amount of clay have an intermediate amount of organic carbon. If the soil is never saturated for more than a few days, it contains 20 percent or more organic carbon. Organic soil material includes muck, mucky peat, and peat." : Field Indicators of Hydric Soils in the United States A Guide for Identifying and Delineating Hydric Soils, Version 7.0, 2010. The definition used in the methodology provides the interpolation for the intermediate amounts of clay. The reference has been added to the module.
27	5/definitions, p2	Definition for organic soil appears to be incorrect. I.e., should be greater than, not less than, each time the latter appears.	Corrected

28	5/definitions, p3	Pedogenic carbonate: How do you separate soil carbonates that are in the soil from the dissolution and re-precipitation of carbonates from the capture of atmospheric CO2 from ones that are just from the dissolution of existing carbonates that would not remove CO2 from the atmosphere? One process sequesters CO2 the other does not.	see comment 24 above.
29	5/definitions, p2	Why not place limits on coarse fragments when you have one that goes from > 2mm to any size and then list embedded boulders and large coarse fragments?	see comment 1 above.
30	5/definitions, p2	Why is only long lived carbon give a life span? Why not for other fractions? For example charcoal is much different than other types of SOC.	We are primarily interested in improving long term stable forms of carbon, including such fractions as charcoal, which would be measured as SOC and by measurement of the TC prescribed in the method. Long lived carbon as defined would include charcoal.
31	5/eroded sites, p19	Is it not the case if large amounts of erosion occur there would really be no way to determine changes in C? Would it not be better to drop such sites?	See step 6.2b Erosion. The issue is whether or not the erosion is representative of processes within the stratum as a whole. If it is, the plot should be included, even if the erosion is so severe that no sample can be taken. On the other hand, if it is a small anomolous event, the method allows the plot to be dropped. Note that I have changed the definition of "unrepresentative" from "<5% of the stratum area" to "<1/ (the number of plots times 2)% of the stratum area".
32	5/inorganic C, pedogenic vs. added P15&16	Is this really possible? Need to reference this as has always been a question in soils work of this type. If there are changes it needs to be shown that there was an external source of Ca or Mg for the formation of the carbonates and that this did not come from limestone as then there really is not a net change in CO2.	see comment 24 above.
33	5/Soil Carbon, Page 16	Please discuss how uncertainties related to soil sampling will be addressed in the methodology or modules.	Uncertainties are statistically evaluated during presampling, and then minimized using stratification and the deployment and allocation of a stastical sampling approach to document variance, uncertainties,

			errors, at each sampling time period. The method also requires that the number of samples taken at the baseline period or added over time are decided using standard stastical methods for accounting for uncertainty (e.g. coefficient of variance, standard error of the mean, etc.) and developing sampling sizes commensurate with the statistical reliability required for by the user. Specific causes of uncertainty (erosion, compaction, etc.) are dealt with separately. Step 6.5 then deals with the statistical calculations to assess the degree of uncertainty in the resulting data. I don't see that any changes are required.
34	5/p10	Do you discuss how newer methods (probes) can be used in soils high in coarse fragments or cemented layers? Needs to be covers as these methods will not work in many soils -- nor how well they integrate with depth or factor in roots as a problem.	Section 4.3d, para 2 deals with exactly these issues in the use of probes. We do not discuss newer methods (e.g. IR spectrophotometric, laser irradiance, etc.), as they are difficult to use reliably in soils with coarse fragments and cemented layers because of the nature and density of these materials and layers, their moisture content and other variables which can significantly effect the reliability of the measures and damage the instruments. Massive data sets need to be developed using such new technologies and statistically compared with standard wet labortatory methods to be able to use the data generated from new technologies.
35	5/p10	Figure 1. Do you have a reference for this method as it has been published?	Not to my knowledge
36	5/p11	Can you not combine these sections so users do not need to jump from one to the other?	Agreed. The plot layout steps have been moved to become section 4.3b, and the other sections in 4.3 renumbered accordingly.
37	5/p9	How is this done in agriculture fields, as rods would be impacted by tillage equipment would they not? Would you not expect most erosion to	The second and third bullet points in Step 3.2 deal with this issue.

		occur in tilled fields?	
38	5/parameter ts, p26	How can you have a mass with only two dimensions?	Changed to cm3
39	5/plot maint. & records, p12	You say how to fill pits with the extracted material but do not say anything about filling core holes and, if left unfilled, this would cause changes in hydrology, would it not? Are core holes filled?	True. Step 4.3d (was step 4.3c) first two sentences changed to read: "To ensure independence among samples from the first and all subsequent soil sampling events, no extracted soil materials shall be deposited on the surface of the sample plot. The soils removed from pits will be used to backfill the pits and backfill or cap the boreholes."
40	5/presampling, p5	Here it says pre-sample vegetation, but what if the area is corn (is it silage or grain, is biomass removed or not?) What kind of detail is needed? Jumping from module to module is confusing.	The word sample/sampling in step 1 point 3 has been changed to record/recording, as the two had been used inconsistently. It now reads: "Recording Vegetation: In each area sampled, record vegetation composition. The goal is to identify vegetation species and their corresponding percent cover values and communities which may be indicators of soil conditions. Recording vegetation during this phase is aimed at fine tuning soil classification, and not at developing a vegetation classification"
41	5/sample prep, p14	Most laboratories do not do constant weight measurements they oven dry to 50 C and take a subsample and over dry to 100 C and use this number to put all data on oven dried basis.	The standard lab method assumes constant over dry weight has been achieved as a basis for the method. We have asked laboratories to provide constant dry weight basis which is a standard method in the USDA lab procedures handbook cited.
42	5/sampling depth p5	General comment: Need to keep all steps in one place this is confusing and makes use of the material difficult.	As discussed on the phone, some degree of jumping from one module to another is the inavoidable consequence of a modular method.
43	5/sampling depth p5	How do you deal with deep rooted crops such as alfalfa that may root to 2 or more meters? Or deep rooted trees? Work in the tropics has shown CO2 emissions from depth in excess of 3 meters.	See comment 5

44	5/sampling depth, p4	What is meant by "one soil layer below"? Is this a master horizon, a subhorizon or a diagnostic horizon, or something else?	It's a marker horizon. The goal is to always sample below the depth to which claims on Soil chemistry will be made. Whether it is a master horizon or sub-horizon will be field specific, depending on soil dynamics.
45	5/sampling depth, p4	In some regions (southeastern US, for example) layers of little organic input often occur at much shallower depths. Can preliminary sampling in reference or project areas be used to help determine sampling depth?	see comment 5
46	5/sampling depth, p5	If a predetermined depth is used and there is erosion or compaction, then the next sampling would be done in different soil material would it not? When a soil is compacted and you sample to a set depth you are actually sampling more soil and this could possibly give an altered result would it not?	Steps 3.1 and 3.2, along with 6.2, deal with exactly these issues
47	5/sampling depth, p7	Aren't organic soils specifically excluded from this methodology? (See applicability conditions, chapter 1.)	The words "or in organic soils" have been removed
48	5/sampling depth, p7	"The goal of this reconnaissance is to identify the depth to which active and significant modification of the soil carbon is occurring due to both natural and anthropogenic processes." How can it be determined that "significant modification" in SOC are taking place by a single sample in time? Does not such sampling just give a base line at a point in time for a set point?	Whether or not significant modification is taking place will necessarily be based on a combination of observation (the presampling points and general observation of the landscape), knowledge, and extant science. We cannot require time series sampling prior to project commencement. It shouldn't be necessary, either, in most cases.
49	5/sampling depths p5	Why does this section give conflicting depths for sampling? Many soils are developed to depths greater than one meter and not just by deposition but by deep weathering and plant rooting, why is the arbitrary depth of 90 or 100 cm's used?	see comment 5
50	5/section 5, p4	What is an under-graded site?	Typo. "under-graded" removed. This phrase now reads "on sites where conditions reasonably resembling those expected to exist under the project scenario are found..."
51	5/small course	Would it not be better to day for each bulk density	I think that it does say for each bulk density sample. The section reads:

	fragments, p14	sample and not say layer?	"Where soil contains significant amounts of coarse fragments small enough to be included in the bulk density sample, the mass of the bulk density sample without the coarse fragments must be determined. This can be done in the laboratory by screening the bulk density samples. Determination must be done separately for each soil layer."
52	5/step 1, p4	How do you define soil type?	Have added the following explanation: "(typically major soil types are derived from existing regional or national level soil mapping)" I don't want to specifically cite the USDA in this.
53	step 2, p5	Why are native areas not the most homogenous? Agriculture lands are more mixed with many more inputs and this will have a major influence on SOC, will it not?	Native areas typically include ecotones (transitions) in vegetation, soils and hydrology and in most tilled (land leveled, drained) agricultural fields this heterogeneity has been obscured.
54	5/step 3.2, p9	Remeasuring soil profiles: Would it be better to say redone in place of remeasured?	Remeasured is more precise on what the method requires
55	5/Step 4 sampling, p9	Total suggest a series of items. Do you really not mean total organic and inorganic carbon?	Now reads: "Plot data on total soil carbon, and organic and inorganic soil carbon separately."
56	5/step 4.3b, p12	Sentence reads "…prevent collecting samples at designated." Designated what? Please complete sentence.	designated points. Changed.
57	5/step 4.3d, p13	What is the purpose of taking soil stratigraphy samples? Are profile descriptions taken in the field inadequate?	There was some redundancy between this subsection (4.3d - now e) and the next one. I have removed the sampling from this subsection and put it all into the next one. This subsection now deals entirely with recording stratigraphy
58	5/step 4.3d, p13	Would it not be useful to reference standard soil survey procedures for (NRCS) pedon descriptions? If you are using Soil Survey Data for information this would insure that methodology is the same.	As noted above, we want this method to be applicable outside of the US, and have thus generalized the tasks, since soil survey data in other jurisdictions may be collected to different standards. However, a set of soil profile parameters that must be

			recorded as a minimum is now included.
59	5/step 4.3e, p13	Would it not be easier to have a standard data sheet and on it numerically number the lines and from this number it is much easier to line up samples in the laboratory? Suggestion: point out that tags should not be placed inside the bags as many seem to do as they break down and increase the carbon in the bag and all information on the tag is lost.	Steve's answer: This is the standard method we use and all bags/cans/plastic sheeves are twice labelled with indelible codes, or with waterproof indelible bar code labels. Before all samples are sent to the lab, we tabulate all samples in the delivery package, and create a chain of custody spreadsheet with the samples included in the package, cross checking all labeling and codes for QA/QC purposes. Robert`s addendum: too much detail!
60	5/step 5, p15	Sample archiving: How long should samples be stored for potential re-testing? What would trigger the need for re-testing?	All samples are dried and placed in either a freezer (if we are interested in N or other constituents that can decompose if moisture is present) or placed back in labeled sample bags and placed in dry cold storage. Re-testing can be triggered by questions raised by any party about the precision of the laboratory testing, to check aberrent data points, etc. Module now states samples will be stored for the life of the project.
	5/step 6.4, p22	Why not use an oven dry conversion factor to put all the data on the same base for calculations?	definition of sdens now reads "The average oven dry bulk density of soil layer x after removal of coarse fragments, found in the sampling points within the plot, g/cm3"
62	5/stratification, p4	Why not soil mineralogy as having a large influence on the SOC in the soil, rather than texture, which is less important?	I read "parent material" as implying minerology. Now reads "Soil texture, minerology and parent material"
63	6/Number of Plots, page 8	It would be useful to also add that this is AR-AM Tool 03-v2 to make it easier to find. Also both here and in the tool it is assumed that the developer knows something about the standard deviation of the mean ….	"AR-AM Tool 03 - version 2 or later version" added. I think that we have to assume that the developer knows something about the standard deviation of the mean.
64	6/page 6	"As noted above the woody species…" Comment: does this means woody biomass – should this not be change to be consistent with parameter descriptions in formula above?	No, this specifically refers to the woody species layer, as it is referring to those individuals in that layer which are below the size cut-off for

			remote sensing detection.
65	6/page 6	This paragraph appears to be repetitious: "As noted above, the woody species layer may also contain some individuals below a cut-off for detection by remote sensing. Biomass for these size classes will be estimated using the plot methods given below"	Repetition deleted
66	6/Parameters: c, page 15	"Determined by dividing the range of the canopy sizes..." Is there a basis for this, origin?"	Basic stratification technique to reduce the variance. See note 69 below.
67	6/part b, page 6	"reliable correlation" - define reliable correlation.	Was defined in step 2 1) a fifth bullet. I have added a reference to this in this sentence.
68	6/second to last bullet on page 7	This is practical – however the PLOT (as opposed to BEF) expansion factor may over estimate the amount contributed by non-tree woody vegetation. One would also expect to have a much higher variability for this pool and therefore less precision.	Note that in Part B, small woody and non-woody vegetation, we are using destructive sampling. Therefore no expansion factor is required.
69	6/Section Step 2, Determining the size of species, page 5	From where does the canopy size class come from? The chosen software mentioned above ECognition, ArcGIS?	As noted in #66 above, this is a stratification approach, and can be qualitative or quantitative depending on resources. I don't want to be prescriptive here. However, I have added a sentence to the first bullet to make the goal explicate : "The goal of identifying canopy size classes is to reduce the variance, and therefore the number of samples required to achieve acceptable statistical significance in correlating canopy size to biomass."
70	6/Section Step 2, last sentence on page 4	What if the 10% level of correlation cannot be reached? More ground truthing. Stop and go to another method take a deduction for uncertainty?	Text parallel to that used in the soil carbon module (step 6.5) has been added to both the large woody biomass and the small woody and non-woody biomass sections to address this issue.
71	6/Section Step 2, last sentence on page 5	What is the definition of a good correlation? Do you do an r^2 analysis or a significant difference test on ground truthed data to remote sensing results?	The test is given in the bullet point immediately prior to the one in question. I have changed this bullet to point to that test. It now reads: "If good statistical correlation based on

			the analysis of statistical variance is found between canopy size class and biomass, a function can be developed, and woody species biomass can be calculated from the remote sensing images."
72	6/Step 3, Page 13	"Calculations to test the statistical confidence of the data…" Please clarify - it appears that is should be "of the means for each pool."	Changed to read "Calculations to test the statistical confidence of the mean…"
73	6/Step 4, note #2, page 13	"root-to-shoot ratio should be used for the calculations..." Are these found in Chapter 4.3 in GPG LULUCF (2003)?"	Not necessarily. Step 4 note #2 gives a fair amount of discussion on various options, including the IPCC, other literature, or onsite measurement. I'm not sure what should reasonably be added here.
74	6/Step 4, Page 13	Step 4 header should reference calculations of total small woody and non-woody biomass.	Change made
75	6/Step 5, Page 11	"Calculations to test the statistical confidence of the data…" Please clarify if this is the mean of the data.	Same change made as in note 72
76	6/Step 5, Page 11	"Confidence interval should not be greater than…" What if the interval is greater? Is there a deduction?"	Same change made as in note 70
77	6/Step b, page 10	Step1 and 2 of what?	should have read "step a above and this step" changed
78	6/Step c, page 10	"as described in the Allometric method below…." Shouldn't' this be "above"?	Corrected
79	6/Step c, page 9	"Root-to-shoot ration for the given tree species and size class" - where does the "class" come from? Chapter 4.3? If so, please make it clear.	This was confusing. I have deleted "for the given tree species and size class" At the end of this section I have added "Where a root-to-shoot ratio is used, it should be selected based on the same criteria as those discussed in step C of the BEF method, below."
80	6/Step c, Pager 12	Title of this step does not match the section. Please re-evaluate.	Now called "Installation of plots and measurement of biomass"

81	7/1)Dispersed, page 3	"+/- 10% at a 95% confidence" For this pool this level of precision may be reasonable to attain but still it seems like a high hurdle to reach. Please discuss other options/explanations.	A section has been added at the end of the module dealing with statistical issues, matching the text used in Module 5.
82	7/2) Accumulated, first bullet, page 4	"direct detect" Please provide evidence/research to prove that remote sensing can do this. Assessing the % of the area is going to be subjective and would be best to determine by on the ground inspection.	Steve: AES is the only civilian firm that has access to subcentimeter very high resolution multispectral imaging (and lidar) on one of its airplanes. We can accurately measure bare soil in open areas, cover by individual plant species or types of groups of species (see AES web site). Robert: I have now added the specification that this can only be done if subcentimeter multi-spectral is available. I don't know of any publications on this technique, which is quite new.
83	7/2)Accumulated, second bullet, page 4	"+/-10% at a 95% confidence" It appears that you will get a lot of variability, so it would be very difficult to achieve this level of precision. Are there alternatives or next steps if the level of precision is not met?	Same response as comment 81 above.
84	7/3) Point Source number 5, page 5	This calculation method is not familiar. Had this process been employed by others? What level of precision does once need to achieve?	The method is a derivation of standard forestry line intersect methods, miniaturized and adapted to the unique problem of point source litter. It arose out of work we were doing in savanah type conditions, where we had a combination of dispersed, predominantly grass sourced litter, and concentrated tree source litter consisting primarily of litter from the tree, but including some capture of windblown (cheatgrass, in this case) litter. I have now changed step 5 of this section to sum the point source litter per point source, and added a 6th step to sum the total point source litter in the stratum. In so doing I have corrected the equation (there was an error!)
85	7/References,	Please clarify: Does this module come from another peer reviewed source or is it completely	Original - parts of the module are

	page 9	original? References?	widely used standard techniques
86	8/References, page 14	Please clarify: Does this module come from another peer reviewed source or is it completely original? References?	Original - parts of the module are widely used standard techniques
87	8/Step 1, page 3	Could this also not be done within a plot or subplot? Please discuss.	Due to the high variability of deadwood, we typically find that this line intersect approach is more suitable and economical than plots, as the plots have to be large to work
88	8/Step 2, page 3	Please explain how to get the average diameter of dead wood. Add to methodology.	Same question should be asked of soil particles… but we won't :-) I have added "The average may be calculated as the maximum diameter measured plus the minimum diameter measured, divided by two."
89	8/Step 2, page 3	Considering how prescriptive the rest of the modules and this module are, shouldn't there be something defining how you determine the three categories. Please discuss.	I don't want to become excessively presriptive in this case, as sensible dividing lines may vary widely - for instance between temperate softwoods and tropical hardwoods. However, I have added the following text to provide more guidance: "Typical field techniques may include assessment of the degree of penetration with a knife or other instrument. A clear dividing line must also be defined between dead wood and material sufficiently rotted that it will be quantified as litter or humus, to avoid double counting. Typically any material which substantially retains the shape of the original wood is considered dead wood, while material which has disintegrated is defined as litter or humus, depending on the degree of disintegration."
90	8/Step 2, page 5	"+/-20%" - Please clarify - shouldn't this precision number and the precision stated above be consistent?	Agreed. They have been standardized at +/- 15% with 95% confidence.
91	8/Step 2, page 5	" windrows exist, and where hose size…"Appears to be a typo - please correct.	Corrected
92	8/Step 3, page 3	Phrase appears to be missing from first sentence. Please correct " For each piece of wood found	Corrected

		along the 100 m.."	
93	8/Step 4, page 4	This level of precision is more liberal, but still high; please discuss how this was determined.	I have added the same statistical section as to the other modules, to allow achievement of lower confidence intervals.
94	9/Page 5, last paragraph	Please clarify/explain the "hoppus system".	I have added ", which estimates log volumes in terms of net milled timber volumes rather than total volume."
95	9/References, page 5	Please clarify: is all material in this module original or have portions been borrowed from some other sources. References?	Original
96	10/overall	If the above appears to follow the guidance, though this is a very detailed and complicated process. Why not just say that long lived wood products will be determined by this document?	As discussed, this was drafted prior to the development of the standard VCS method for wood products.
97	10/Section 1, page 3	It would be helpful to add a reference asterisk to the various equation parameter description, to show proponents where to go to get information (i.e. add asterisk to take you to Wood Waste paragraph below).	Done
98	10/Section 5, Procedures, page 2	"This module estimates annual sequestration of carbon stock in wood products…" Please confirm and state in module if this module should be used in conjunction with the Woody Biomass Harvesting Module as the determined harvested volumes could be used in these calculations.	In the Summary Description section I have added the sentence "It is intended to be used in conjunction with estimates of harvest volumes undertaken using the module "Woody Biomass Harvesting and Utilization"."
99	10/Step 1, page 3	"Basic wood Density" Please discuss specific gravity.	It now reads "= Wood density (specific gravity) of species j; t d.m.m-3"
100	10/WW and SLF fraction, page 3	WW and SLF sections -should be indented and noted as further explanation of the values to be used for this parameter in the above (below) calculation.	Done
101	11/overall	How are non-domesticate animals dealt with, on game farms or wild horses, etc., on rangelands? Are yaks considered dairy animals? Are water buffalo and bison treated similarly?	As discussed, this module follows the guidance given in the IPCC GPG for LULUCF

102	13/definitions, p2	In the definition of organic soils, shouldn't the organic carbon content be greater than the listed percentages, rather than "less than"?	Yes. Changed
103	13/definitions, p2	Why no reference for the definition of organic soils?	Revised to USDA definition of organic soils.
104	Module 13	Please discuss minimum baseline estimates in the methodology or Module 13.	The following text has been added to the Introduction section, following Table 1 and its associated note: "When using this module to project baseline emissions, minimum baseline estimates for N2O and CH4 emissions shall be based on documented management records averaged over the five year period prior to the project start date. Documented management records may include fertilizer purchase records, manure production estimates and/or livestock data. For new management entities or where such records are unavailable, minimum baseline estimates may be based on a conservative estimate of common practice in the region."
105	13/p5	Are methane emissions from termites significant?	They certainly could be. At this point I think that the wisest course for this is to add applicability criteria in the methodology "f. The project activity must not cause a significant change in termite populations, as compared with the baseline scenario".
106	13/p6	Are there references for the terms used in table 2 for the different ecosystems? What is boreal vs. cold temperate, for example?	Source for definitions added below table "Definitions of the ecosystem types may be found in the Glossary of the IPCC GPG for LULUCF 2003 (IPCC 2003)"
107	13/p7 & 8	Does this assume that all the N is moved into water bodies and none of it is buried and not broken down?	That is correct - that is the conservative default assumption in this simplified approach.
108	13/p8	Is DNDC the only model use? ARS has other models have they be checked?	At this point we feel that DNDC is the mostly widely checked and calibrated model, and is preferred for that reason. However, note the last paragraph in Step 3, which opens the

			door to other models.
109	13/procedures intro, p3	"Emissions of methane and nitrogen compounds…" Would substituting the word nitrogenous be better than using the word nitrogen?	Changed.
110	13/procedures, step1, p5	What about the form of nitrogen fertilizer? For example, slow release vs. non-slow release.	Changed. Step 1 first bullet now reads: "Amount, location, timing and conditions of applications of organic or inorganic fertilizers, and type of fertilizer applied."
111	13/step 1, p4	Emissions from organic fertilizers applied as a direct result of grazing animals should be addressed in which module? Only "the module" is mentioned.	Changed. Note now reads: "Note that if application of organic fertilizers is a direct result of grazing of domestic animals resident within the project area, calculations of emissions should be made using the module “Emissions from Domestic Animals”.. Summation of net GHG change for those applications of organic fertilizers should not be accounted in this methodology, to avoid double counting."
112	14/Sources, page 2	CDM AR-AM0004 should be added to the reference section	It is there.
113	14/Step 2, page 3	Please clarify - are you stating that national emission factors are the preferred method and that regional emission factors are to be used secondarily as necessary.	Order has been changed to put regional factors first
114	14/Step 3, page 3	What happens if these are not significant – less than 5%?	Dealt with in Module 4 - Project Boundaries
115	15/End of page 3	"Table 17.1 below (IPCC GPG for LULUCF Table 3A.1.13), tonnes/hectare". Numbering should be the same as that in the header of the Table.	Changed
116	15/First Sentence page3	"Emissions from burning under the baselines scenario are conservatively accounted as 0" I’m sure this provides for a greater degree of conservativeness, but if significant (over 5%) most other accounting would include them?	"As we discussed. The new text is: ""Note that in this methodology, emissions from burning under the baseline scenario are only accounted if: • Burning would be as a result of planned, controlled burns

			• The conditions (temperature, humidity, fuel moisture content, windspeed, etc.) under which burning would take place are prescribed, and sufficient ecosystem specific information exists to forecast the amount of fuel that would be consumed under these conditions. Otherwise, emissions from burning under the baseline scenario must be conservatively accounted as 0.
117	15/Method 2, page 7	Please discuss, couldn't you arrive at a quantity that could be more easily reached by following Method 1? Please clarify approach.	See note on page 3 : "Method 1 has the virtue of simplicity. However, the IPCC default values have extremely high ranges of variance, and may introduce significant errors, particularly where repeat burning is used as a management tool to reduce woody invasive species. If Method 1 is used, the proponent must provide sufficient information to demonstrate that the calculations produce conservative results."
118	15/Sources, page 2	Please add VM0015 v1.0 to the Reference section	Done
119	16/Introduction , page 3	Please discuss the possibility of using project scope as a determinant of which approach to follow.	I'm unsure what more could be said here. The third paragraph of this section currently reads "In general, use of the first approach is strongly recommended as being less vulnerable to masking or exaggerating of effects by exogenous factors. However, in some cases the second approach may be preferable, particularly with very large scale projects."
120	16/Page 3	Please check labelling in this section. It appears that approaches should be labelled A and B	Done
121	16/Procedures, page 3	Please state in module that it needs to be used in conjunction with the Projection of Future Conditions Module.	Interesting, and possibly contentious point. In general, the issue of equivalent changes which would have occurred under the baseline scenario (and which would therefore require use of the "Projection of Future Conditions" module, has not

			been addressed in methodologies to date. However, I think that this suggestion has substantial merit, and I have added the following paragraph as paragraph 2 in the introduction: "This module provides methods to be used to estimate emissions due to displacement leakage under the project scenario. It is possible that some similar changes (for instance movement of populations to other areas, clearance by local actors of areas outside the project area, etc.) might also have occurred under the baseline scenario, due to causes not associated with the project. In such cases, these changes under the baseline scenario must be projected using the "Projection of Future Conditions". Module, and deducted from those found using the methods in this module."
122	16/Step 4, page 8	Please clarify if the definition of significance is 5% or greater.	Definition of "significant" is given in the definitions section of this module
123	18 TEP Module	In the Monitoring Plan Module, please include the requirement for a purpose in the monitoring plan.	The required sections for each task in the Monitoring Plan now includes: "a) Purpose of the monitoring"
124	18 TEP Module	Please describe how the monitoring plan should detail estimation, modelling, measurement or calculation approaches.	The new first bullet in 1.2 reads: "The estimation, modelling, measurement or calculation approaches to be used in monitoring the variable"
125	18 TEP Module	Please include a requirement for monitoring frequency to be detailed in the monitoring plan.	For each task in the monitoring plan I have added another section: "e) Frequency of the monitoring"
126	19/definitions, p2	Why include the list of animals in the definitions? Will this exclude large game farm animals?	As discussed : IPCC standard
127	3&4/definitions p2 & p2-3	Why are definitions of the same terms in different modules different? For example, ex ante and ex post definitions are different in modules 3 and 4. Identical definitions will avoid confusion.	Dealt with
128	Modules 4 & 13	Please indicate where "the criteria and procedures have been established by which changes in soil carbon stock may be deemed de minimis or	This is not a methodology targeting N2O reductions.

		conservatively excluded".	
129	General	Please explain in the methodology how the processes to quantify the GHG emissions or removals for the baseline and project scenarios were derived.	Methodology, section 2, new sentence 2 reads "The method is designed based on guidance provided in the IPCC 2003 Good Practice Guidance for Land Use, Land-Use Change and Forestry."
130	n/a	Please provide a description of how to define and address de minimis pools in the module/ methodology.	Definition is given in the methodology. Issue of pools/emissions which are not significant is dealt with in Module 4.
131	n/a	Please clarify if the methodology should reference these criteria in one of the modules or the main document.	See note 116
132	n/a	Please address this component of leakage in the methodology, as required.	This is dealt with in module 16
133	Page 23, Task 3.16	Please include the requirement for Module 13, or clarify if this task will lead to a Module where CH4 and N2O emissions outside the project area will be quantified.	This is dealt with in module 16
134	Page 25, Section 9.1	Although the modules detail the data and parameters to be reported through the entirety of the modules, please summarize the data and parameters *or* refer to associated modules in this section of the PDD, as the requirement is for the methodology to describe the data and parameters to be reported.	The tables with variables will be included in the final version.
135	Pages 12-16	Please ensure the Task 2: Baseline Study was derived from an internationally accepted GHG Inventory protocol.	Baseline scenario is derived using the CDM tool, which follows the IPCC protocol
136	Pages 23 & 24 of Meth; Section 8.11	Please include leakage mitigation in the methodology.	I have added the following to the introduction to Task 4 in the methodology : "Note that where leakage mitigation measures include tree planting, agricultural intensification, fertilization, fodder production, and/or other measures to enhance cropland and/or grazing land areas, then any significant increase in GHG emissions associated with these activities shall be accounted for using the relevant module, whether or not they occur

			within the project area, unless deemed not significant, or unless it can be conservatively excluded."
137	Pages 23 & 24 of Meth; Section 8.12	Please add this exclusion to the methodology and/or associated modules.	I have added a sentence of the introduction to section 8.3, Leakage, in the methodology: "Note that projects shall not account for positive leakage (ie, where GHG emissions decrease or removals increase outside the project area due to project activities)."
138	Pages 23 & 24 of Meth; Section 8.7	Please provide a description of how to define and address de minimis leakage in the methodology.	Dealt with in the introduction to module 16, and inherently in module 17, which is essentially entirely about how to determine if *significant* effects can be identified
139	3/References, page 11	Reference appears to be missing (VM0015, CDM AR-AM004, draft methodology for estimating reductions…)	Added reference +links
140	11	Would it not be good to reference NRCS field methods as the amount of material for such sampling needs to be many times the size of the fractions?	this is referenced in the cited publications
141	6/References, page 23	Please add the reference for CDM A/R Methodological Tool " Calculation of the number of plots….. And version number	Added reference +links