Guidance for Verifying RGGI U.S. Forest Project Inventories

May 13, 2015

Verification bodies are required to verify carbon stock inventory estimates of all sampled carbon pools within the project area. Inventories of carbon stocks are used to determine the project baseline and to quantify GHG reductions and removals against the project baseline over time. Verification of carbon inventories consists of ensuring the Project Sponsor's sampling methodology conforms to requirements in the RGGI U.S. Forest Projects Offset Protocol (protocol) and that the project's inventory sample plots are within specified tolerances when compared to the verifier's sample plots.

Verification is effectively an audit to infer that the inventory estimate is sound. Verification of the project's onsite stocks must occur at each site verification and focus on ensuring that the project's inventory methodology is technically sound and that the methodology has been correctly implemented.

The verification of project inventories includes several elements, some of which are evaluated prior to engaging in field activities. Table 1 addresses inventory methodological issues that must be verified. The verifier should only proceed to field verification of plot data after the Project Sponsor has met each of the standards in Table 1.

Table 1. Inventory Methodology Verification Items

Verification/Evaluation Standards	
1.a	Confirm the inventory methodology describes the methodology for plot location in the field. The plot locations should either random or systematic with a random initial point.
1.b	If inventory methodology describes a stratification design, confirm the stratification methodology, including rules for stratification, is clearly defined. Confirm the stratification design is relevant for the sampling of biomass. In particular, confirm the stratification design applies to all tree species without a bias for commercial tree species. Verifier shall randomly select 10% of the vegetation units or strata polygons by area, or 500 acres (whichever is the least) to evaluate that the vegetation (or stratum) label assigned to the polygon is consistent with the stratification rules documented in the inventory methodology. The selection shall be made from a database or spreadsheet list of all vegetation (stratum) polygons within the project that have not experienced a harvest or disturbance that affects carbon stocks by more than 10%, using verifier judgment, within the past 10 years. Evaluation of post-harvest polygons and plots is described in 1.c. Evaluation for consistency shall be conducted through comparison with aerial photos or other remotely sensed data, and/or field observation. During evaluation, a verifier must use professional judgment to determine if a polygon is consistent or inconsistent with the stratification rules. Inconsistent means the existing vegetation (stratum) label is grossly incorrect to an extent that would substantially alter the associated carbon stocks. If more than 10% of the polygons evaluated are determined to be inconsistent with the stratification rules documented in the inventory methodology, the verifier shall expand the assessment to an additional 10% of the vegetation units (stratum polygons) or an additional 500 acres (whichever is least) until the project passes or it is determined that the project has failed to meet the standard.

Verification/Evaluation Standards	
1.c	Confirm the inventory methodology states how the inventory is updated on an annual basis to reflect growth, harvest, and other disturbances. An event is deemed to be a disturbance, whether natural or the result of human activities, if the event results in an estimated loss of more than 10% of the pre-disturbance carbon stocks in the applicable carbon pools. Confirm the methodology includes a process to update the inventory for harvest and other disturbances. The immediate updating of an inventory for disturbances will require that a tree list is assigned to the area disturbed, rather than developing a tree list from field measurements, to represent the area disturbed. This may occur by assigning a vegetation label (stratifying) and compiling the inventory so that the area disturbed obtains a tree list representative of the disturbed condition. For stratified inventories, this may be a solution that lasts many years until the forest vegetation is re-stratified due to changes from forest growth. Immediately updating an inventory may also occur by assigning a 'best-fit' tree list that represents the stand conditions to the plots that were affected by disturbance. This solution is a shorter term solution since the plots used to estimate the inventory have been affected. During all site visit verifications (following the initial site visit verification in cases where the project start date is the same year as the initial site visit verification),the Project Sponsor must provide a map(s) that displays areas where disturbance has occurred. For stratified inventories, a pre-disturbance map must display the vegetation stratum prior to the disturbance and a post-disturbance map must display the vegetation stratum following the disturbance. For non-stratified inventories, the disturbance map must display the underlying plots, if any, affected by the disturbance. For stratified inventories, a summary tree list associated with the updated vegetation strata shall be provided. For non-stratified inventories, tree lists shall be provided for each plot affected by disturbance. During site verification, verifiers shall randomly select a minimum of 10% of the vegetation polygons (strata polygons) or plots updated for disturbance, and determine if the assigned tree lists do not obviously overestimate the carbon associated with the forest structure remaining after the disturbance. Where plots are updated through assignment of a tree list (instead of assigning a vegetation stratum) following the disturbance, the verifier shall ensure all plots have been updated and the updated tree list is consistent with the forest structure remaining after disturbance. For non-stratified inventories, it is not acceptable for a Project Sponsor to simply remove disturbed plots from the inventory. The plots must be assigned a tree list to estimate the post-disturbance condition. It is acceptable to remove plots from an inventory that is strata-based upon disturbance that affects the plots. Tree lists resulting from stratification or assignment are determined to be inconsistent if the tree list would result in carbon stocks substantially above what in the verifier's professional judgment would associate with the post-disturbance condition. The determination for consistency can be made through an office review by comparing the assigned tree lists with the disturbance events. A verifier can choose to enhance their review for consistency by visiting disturbed sites in the field. To minimize the risk of inaccuracies to the inventory, no more than 10% of the plots used to characterize the project's inventory can be developed from estimated tree lists without increased scrutiny from verification. The plots assigned an estimated tree list must be appropriately coded in the inventory database so that they can be queried and isolated. Plots assigned with an estimated tree list are not to be used in sequential sampling efforts unless the number of plots with estimated tree lists exceeds 10%, in which case all plots, measured or estimated, must be available for random selection for sequential sampling during verification. Confirm the Project Sponsor has updated the inventory for growth using and approved growth model or a stand table projection, as described in Appendix B, Section B.1 of the RGGI U.S. Forests Project Protocol. The inventory being verified must be determined to be current using the updated methodology.
1.d	Confirm the inventory methodology has been implemented in a consistent manner since the project's inception. If changes have been made to the inventory methodology, confirm such changes have been discussed and

Verification/Evaluation Standards	
	approved in writing by RGGI.
1.e	Confirm the inventory methodology describes the volume and biomass equations used to compute the project's carbon stocks and these equations are consistent with those required by the protocol. Appropriate use of biomass equations must be demonstrated.

Field Verification of Plot Data

The reported inventory must meet the minimum sampling error threshold stated in the protocol of +/- 20 percent at the 90 percent confidence interval. Project Sponsors can improve the precision of their estimates through additional inventory effort, but can only include it in their reporting after the confidence estimate has been verified. Projects must include the uncertainty adjustment associated with their most recent verification effort. The emissions associated with site preparation activities (soil, shrubs, and herbaceous understory) are not subject to the same sequential sampling requirements and shall be verified according to the guidance for estimating site preparation emissions for reforestation projects in Section 6.1.1 of the protocol.

The level of field review during the verification of the project's onsite stocks is based on the programmatic risk (risk of inaccuracy to the entire forest offset program) and project risk (risk of inaccuracies at the project level). Small projects with low levels of reported reductions/removals are verified with a smaller number of plots than large projects with high levels of reported reductions/removals. All projects must be within the maximum acceptable error of ten percent (verifier estimates compared to project estimates).

In order to ensure a trend of agreement with sampled data is sustained between the verifier and Project Sponsor, the protocol requires a sequential sampling method for verification of project estimates. Sequential sampling is intended to provide an efficient sampling method for verifiers to determine if randomly selected project measurements are within specified tolerance bounds established by the protocol.

Section 10.2.2 of the RGGI Forest Protocol addresses the use of sequential sampling to verify sampled data. Sequential sampling worksheets and instructions for utilizing the worksheets are provided on www.rggi.org for use by verifiers to assist in verifying sampled data. These worksheets are to be used for plot estimates of the above and below-ground portions of standing live and dead trees. For effective application of the sequential statistics in the field, the entry of verification data will occur after a group of plots are measured in the field and analyzed in terms of CO_2e, rather than entering the plot data one at a time. The verifier might base the decision to enter plot results into the worksheets after a day's worth of plot sampling or after a hypothesized number of required plots has been completed.

Separate worksheets have been developed to assess both monumented (paired) and non-monumented (unpaired) plots.

Field Measurement Specifics for Verifiers

Verifiers must use the highest standard to conduct measurements during field measurements. Measurements utilized by verifiers during field inspections shall be consistent with the tolerance standards for measurements identified in the supplemental quantification guidance document

available on www.rggi.org, with the following exceptions:

1. Verifiers shall measure the heights of all trees according to the height measurement used for the species-specific biomass equation provided by RGGI.
2. The use of regressions to estimate heights is allowable for Project Sponsors; verifiers should measure each height for comparisons with Project Sponsor estimates.
3. Tools and methods used for distance measurements for plot boundaries should be accurate within 1”/30’.
4. Tools and methods used for distance measurements for height measurements must be able to obtain an accuracy of 6”/100’.
5. All borderline trees should be measured to determine their status as an ‘in’ or ‘out’ tree.