Kariba REDD+ Project
CCBS Gap Validation for CCB Climate Section

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Overview

The gap validation carried out in this document aims to align the climate section of CCB with the methodology used for Verified Carbon Standard (VCS) validation and subsequent verifications (VM0009 (Methodology for avoided mosaic deforestation of tropical forests), Version 1.1, 10 November 2011, sectoral Scope 14). Therefore, the gap validation aim is to carry out the monitoring of CCBS climate section using the same methodology as used for VCS, which was validated and verified twice.

III. Climate Section

CL1. Net Positive Climate Impacts

CL1.1 Estimate the net change in carbon stocks due to the project activities using the methods of calculation, formulae and default values of the IPCC 2006 GL for AFOLU or using a more robust and detailed methodology. The net change is equal to carbon stock changes with the project minus carbon stock changes without the project (the latter having been estimated in G2). This estimate must be based on clearly defined and defendable assumptions about how project activities will alter GHG emissions or carbon stocks over the duration of the project or the project GHG accounting period.

The Kariba REDD+ Project already generated and will continue to generate a Net Positive Climate Impact due to avoided deforestation in the project area. The VCS methodology used to estimate the net change in carbon stocks is VM0009, Version 1.1.

Baseline emissions are calculated as the carbon pools measured in the project area, which are applied to the deforestation model. The amounts of emissions assigned for each selected carbon pool (above ground large tree biomass, above ground small tree biomass, above ground non-tree biomass, below ground large tree biomass, below ground small tree biomass, below ground non-tree biomass, standing dead wood and soil) are determined at every verification period.

The sum of estimated emissions over selected carbon pools is calculated according to eq. 20 of the methodology.

The following equations from the methodology will be used at the monitoring and verification stage to calculate the baseline emissions:

- Baseline emissions in above ground large trees is calculated using eq. 21.
- Baseline emissions for above ground small trees is calculated using eq. 22.
- Baseline emissions in above ground non tree biomass is calculated using eq. 23.
• Baseline emissions in below ground large trees is calculated using eq. 24.

• Baseline emissions for below ground small trees is calculated using eq. 25.

• Baseline emissions in below ground non tree biomass is calculated using eq. 26.

• Baseline emissions in standing dead wood is calculated using eq. 27.

• Eq. 62 of the methodology is applied to calculate the total carbon stock in all selected carbon pools.

The project employs permanent sample plots (PSP) coupled with allometric equations for estimating carbon stocks in trees. Non-tree biomass and standing dead wood are also measured in the PSP, while carbon pools of lying dead wood is conservatively omitted. Soil carbon is estimated using soil samples collected. These sampling procedures are designed to detect both increases in carbon stocks, such as those that occur as a result of forest growth, and decreases in carbon stocks, such as changes that may take place as a result of degradation or natural disturbance events.

The project leads to the protection of both unlogged forest and previously logged forest that has the regenerative capacity to reach a mature, old growth state.

The project activities to stop deforestation and degradation are designed to be financially self-sufficient in the long run. By opening new sources of income, and after initial investments have been made and capacity reaches a certain level, the local population will perpetuate the project activities because it will be in their self-interest to do so. Thus we expect project activities to continue far beyond the lifetime of the project.

The following project activities are implemented to achieve GHG emission reductions:

*Improved Agriculture*

In the project area, access to technology and investment in rural subsistence farming is largely absent in the without project scenario. The Kariba REDD+ Project includes a program aimed at improving rural agricultural productivity through provision of inputs and equipment, maintenance and establishment of infrastructure, and training of local farmers.

The Kariba REDD+ Project promotes conservation agriculture techniques that have the potential to increase the agricultural output of given plots and thus reduce the need for rotational agriculture. Techniques applied in conservation agriculture include planting basins, use of organic manure, precision planting, moisture conservation through mulching and making the most of the first rains, and minimal use of inorganic fertilizers. To promote conservational agriculture, training sessions were carried out and are a continuous effort in the project area. Inputs such as tools and seeds are provided.

To further increase agricultural production, community gardens were established and are an ongoing effort. This is done where water is available from boreholes. For protection against wildlife, community gardens will be fenced. As the community gardens are cultivated quite intensively, they contribute significantly to food production, thus reducing pressure on the forest from the expansion
of subsistence farming. Where necessary, boreholes will continue to be established or maintained. The management of boreholes is seen as an opportunity to make agriculture on existing plots more attractive than on newly deforested plots where no boreholes are available.

*Beekeeping*

Beekeeping adds value to standing forests and enables locals to generate income streams that do not cause deforestation. On the ground, beekeeping activities include workshops on the construction of beehives and assistance in processing and marketing the produced honey within regional markets.

From the perspective of locals, beekeeping increases the value of the standing forest. The nectar of a tree that is located within a radius of two km from a hive increases the value of a tree. Trees with nectar that are located within an area of 1’200 ha per location of hives tend to be protected because of their nectar. Bees can be constructed using waste wood from sawmills in the region. “Cultivated” beehives can produce 15 - 30 kg per harvest and up to three harvests per year, which can generate incomes of 500-1000 U$D/year.

*Fuelwood plantations*

The establishment of sustainably-managed fuelwood plantations has the potential to reduce the pressure on natural forests and improve the livelihoods of locals because labor force becomes available that would otherwise be needed to collect fuelwood.

The tree planting project activity aims to create an alternative source of fuelwood for tobacco curing and household use, decreasing the deforestation and forest degradation in the project area.

The project also promotes the multipurpose tree Moringa (*Moringa oleifera*) for nutritional purposes. Some of the multipurpose trees will be planted in irrigation schemes and community gardening projects. Communities were trained in tree planting and seedling production as precursors for the actual tree planting. The trees to be planted are fast growing in nature and can give good firewood in five years; they are also good in that they have a very high coppicing capacity. Planting trees will have additional mitigation benefits for the climate, but this is not planned to be accounted for as the projects aims to certify its emission reductions under a VCS REDD methodology (VM0009).

*Social forestry*

The indigenous knowledge in forest conservation and management will be documented and shared across the project areas. The areas and trees that are of value to indigenous peoples have being recognized and mapped and this is an ongoing effort. This enhances the conservation efforts of the forest resources.

*Fire management*

Fires are native to dry miombo woodlands during the dry season, but have increased due to man-made fires associated with poaching and opening new fields for subsistence agriculture. Tourists may also be responsible for some fires. Fire breaks next to roads and along the RDC’s Safari concession boundary in the south towards settled areas (e.g., Binga and Hurungwe) were established and maintained by setting controlled fires at the start of the dry season to avoid the spread of high-dry-season fires. Firebreaks were established at the side of roads. The controlled
fires burn the vegetation covering the soil, but not the trees. Fire management reduces the degradation of the forest, allow the forest to recuperate and stop and reverse (slowly) soil carbon loss. Controlled burning is therefore an important activity in keeping bush fire damage to a minimum. The best way to conduct a controlled burn or cold fire is to burn the wet grass in the early months (March to May) as soon as the grass can burn. This creates a “cold” burn, which burns very little vegetation except grass. Grass, if burned at the right time, is not completely burnt. This allows a fresh flush of green grass to rejuvenate, giving more grazing grass for the fauna and creating an inherent firebreak that is supposed to stop “hot fires” later in the season. Controlled burning is carried out by the project’s on-the-ground-management teams. Fire management activities are an ongoing effort in the project area. Additionally, awareness campaigns were performed other training on fire making, fire fighting and management were conducted and will continue in the project area.

On the Ground Management Teams

The Kariba REDD+ Project is present within the local communities via its on-the-ground-management (OGM) teams. OGM teams include one team leader, two trackers, one community game scout, one National Parks scout (when necessary for anti-poaching follow ups) and one camp attendant. All team members were recruited locally. CGI have a strong influence on the selection of team leaders, to ensure their reliability. There is one OGM team per RDC, where they have a steady office/camp that also serves as a contact point for the local population. The OGM teams are in charge of:

- Maintaining technical equipment (e.g. water pumps) if provided by the project,
- Fire prevention via “cold fires” and fire fighting where possible,
- Patrolling the area to prevent illegal deforestation,
- Carrying out the project monitor requirements according to the applied standards,
- Maintaining roads to ensure accessibility of the project area,
- Facilitating the relations to the local authorities, and
- Receiving feedback and grievances from the local communities.

For further information on estimation of net change in carbon stocks due to project activities, please refer to VCS PDD, section 3 “Quantification of GHG Emission Reductions and Removals”, section 1.8 “Description of the project activity” and section 4 “Monitoring”. In addition, refer to VCS first and second monitoring report for already verified calculation of the net change in carbon stocks due to project activities.

**CLL2 Estimate the net change in the emissions of non-CO₂ GHG emissions such as CH₄ and N₂O in the with and without project scenarios if those gases are likely to account for more than a 5% increase or decrease (in terms of CO₂-equivalent) of the project’s overall GHG emissions reductions or removals over each monitoring period.**
CH$_4$ and N$_2$O are conservatively excluded under the methodology VM0009, version 1.1.

**CL1.3 Estimate any other GHG emissions resulting from project activities.** Emissions sources include, but are not limited to, emissions from biomass burning during site preparation, emissions from fossil fuel combustion, direct emissions from the use of synthetic fertilizers, and emissions from the decomposition of N-fixing species.

Project emissions are estimated for every monitoring period and are estimated by the events of woody biomass consumption.

Forest fires: The Project proponent understands that should significant forest fires occur during the project crediting period, a map of the boundaries of the fire during the monitoring period will be elaborated. The project area may need to be re-stratified based on the significance of possible fire events.

Emissions from burning: No emissions from the burning of woody biomass as a result of project activities in the project area occur.

The project emissions are calculated according to equation 31 of the methodology.

Project emissions is also described under VCS PDD, section 3.2 “Project Emissions”.

**CL1.4 Demonstrate that the net climate impact of the project is positive.** The net climate impact of the project is the net change in carbon stocks plus net change in non-CO$_2$ GHGs where appropriate minus any other GHG emissions resulting from project activities minus any likely project-related unmitigated negative offsite climate impacts (see CL2.3).

The net reduction in CO$_2$ emissions is calculated as tCO$_2$ equivalent according to the methodology VM0009 (Version 1.1). The net climate impacts were demonstrated to be positive in the first two monitoring periods already verified and is under the third verification. In addition, the positive net climate impact was also supported in the first PIR of the Kariba REDD+ Project. The positive net climate impacts are caused due to project activities that avoid deforestation as improved agriculture, fuelwood plantation, fire management, etc.

**CL1.5 Specify how double counting of GHG emissions reductions or removals will be avoided, particularly for offsets sold on the voluntary market and generated in a country with an emissions cap.**

Zimbabwe has signed the Kyoto Protocol, but being a Non-Annex 1 country it did not commit to emissions reductions. Zimbabwe has not set its own emission cap. Therefore, created emission reductions are not double-counted by any national reduction scheme.

The Kariba REDD+ Project certify its emission reductions under the VCS, the best-accepted carbon standard for the voluntary carbon market. The VCS requires registration of all emission reductions in an independent registry, where each single VER can be identified and is tracked from issuance to retirement. Furthermore, South Pole Carbon Asset Management Ltd. – the project partner
responsible for the commercialization of the carbon credits – applies a sophisticated internal accounting scheme to guarantee a complete track record of emission reductions before issuance. This guarantees that emission reductions are only sold once.

For further information, please refer to VCS PDD, section 1.12 “Ownership and Other Programs”.

**CL2. Offsite Climate Impacts (‘Leakage’)**

**CL2.1 Determine the types of leakage that are expected and estimate potential offsite increases in GHGs (increases in emissions or decreases in sequestration) due to project activities. Where relevant, define and justify where leakage is most likely to take place.**

No leakage of emissions is expected from the Kariba REDD+ Project. However, the following potential leakage channels have to be assessed in the Kariba REDD+ Project.

*Activity shifting (primary leakage)*: The main primary leakage threat is agricultural conversion. The project attempts to prevent that such conversion will shift to outside the project area. There are two arguments why this is not likely to happen:

- The Kariba REDD+ Project covers a large area totalling 784'987 ha. Therefore, most of the local population is unlikely to establish agricultural fields outside the project area because of their low mobility. However, the only forest area ever possible to be accessible has been included to the leakage area, by applying a leakage belt around the project area.

- More important, the Kariba REDD+ Project actively assists the local population in increasing the efficiency of their agricultural on already existing plots. Increased agricultural output will make shifting of plots to outside the project area highly unlikely.

Activity shifting could occur if the project reduces employment in the area and lowers income to the local population. Our project, however, have the opposite impact: agricultural intensification and community-enhancing activities are designed to improve rural livelihoods. And local employment will be created as a result of the project, directly improving the income of the recruited locals.

*Market leakage (secondary leakage)*: Lower harvest of wood products leads to a scarcity of wood and therefore a higher price. This could lead to increased harvest of wood outside the project area and thus leakage of emissions. Even though the low mobility of the local communities reduces this risk, our fuelwood plantation project activity is designed to mitigate this risk. By establishing sustainably managed woodlots within the project area, the wood resource needs of locals will be provided without causing forest deforestation/degradation. The long-term presence of the Kariba REDD+ Project team in the area ensures appropriate support in developing this long-term solution for the provision of sustainable wood products.

As the mobility of the local population (only agents of deforestation and forest degradation) is very low and the vast majority of households are bound to their villages without any motorized means of transport, effects of leakage outside of the project areas with respect to deforestation and forest degradation is expected to be absent. Due to the vast extent of the project areas and villages lying
in their centers, displacement of deforestation and forest degradation from current locations outside the project areas is virtually impossible. Any deforestation and forest degradation from current locations is only possible to occur in other parts of the project areas and is monitored continuously. However, the idea is to extend the project activities extensively and adapted to the local needs of the leakage area.

In sum, no leakage of emissions is expected from the Kariba REDD+ Project into adjacent areas. Nevertheless, the leakage area is sampled prior to the end of each monitoring period. To reduce uncertainty in leakage measurement as much as possible a field protocol for sampling forest degradation and trainings are implemented.

For further information, please refer to VCS PDD, section 1.13 "Additional Information Relevant to the Project" and section 3.3 "Leakage".

**CL2.2 Document how any leakage will be mitigated and estimate the extent to which such impacts will be reduced by these mitigation activities.**

Agents of deforestation have generally a very low mobility to implement baseline activities (subsistence agriculture) and are loyal to communal rights of their communities and the support of their villages. Even if the mobility situation would change in the future (which is not expected and not promoted by the project proponent), the legal status of surrounding land prohibits agents of deforestation from living adjacent to the project area to utilize forests outside of the project area. Agents of deforestation adjacent to the project area only possess traditional usufruct rights in the project area, as surrounding lands are either National Parks, privately owned commercial farms or communal lands of other ethnicities. Agents of deforestation with usufruct rights in the project area generally do not possess financial resources to buy or lease land outside of the communal land and this is also not a common practice in this region. No leakage of emissions is expected from the Kariba REDD+ Project. Nevertheless, the leakage area will be sampled prior to the end of each monitoring period. Leakage is quantified as emissions from both forest degradation and deforestation caused by activities displaced from the project area due to the presence of the project. Degradation activities include the removal of biomass for fuel wood, charcoal production and harvesting of large trees for wood products. Degradation will be reported during the on-the-ground measurements of the leakage area. For the leakage area, the same baseline is used for the leakage model as for the cumulative deforestation model of the project area.

Leakage mitigation measures are equal to project’s activities to reduce deforestation and forest degradation established in the core project activities.

For further information on leakage mitigation strategies, please refer to VCS PDD, section 3.3.1 "Leakage Mitigation Strategies".

**CL2.3 Subtract any likely project-related unmitigated negative offsite climate impacts from the climate benefits being claimed by the project and demonstrate that this has been included in the evaluation of net climate impact of the project (as calculated in CL1.4).**
As stated on the VCS PDD, section 3.3 “Leakage”, leakage is monitored and deducted from the climate benefits if needed. The leakage model is calculated according to equation 8, the leakage factor will then be calculated using equation 3 and leakage emission are calculated by using equation 32. 50 leakage plots are sampled for every monitoring period. Furthermore, leakage emissions observed according to VM0009 are small and likely have a very distant relation to the project activities if any. The overall project design with focusing activities at local communities living inside the project area are designed to mitigate the leakage risk (please, refer to VCS PDD, section 3.3.1 “Leakage Mitigation Strategies” and section 1.8 “Description of the Project Activity”).

| CL2.4 Non-CO₂ gases must be included if they are likely to account for more than a 5% increase or decrease (in terms of CO₂-equivalent) of the net change calculations (above) of the project’s overall off-site GHG emissions reductions or removals over each monitoring period. |

Only CO₂ is included under VCS methodology VM0009 (Version 1.1). Therefore, this section does not apply. In addition, no leakage is expected.

**CL3. Climate Impact Monitoring**

**CL3.1 Develop an initial plan for selecting carbon pools and non-CO₂ GHGs to be monitored, and determine the frequency of monitoring. Potential pools include aboveground biomass, litter, dead wood, belowground biomass, wood products, soil carbon and peat. Pools to monitor must include any pools expected to decrease as a result of project activities, including those in the region outside the project boundaries resulting from all types of leakage identified in CL2. A plan must be in place to continue leakage monitoring for at least five years after all activity displacement or other leakage causing activity has taken place. Individual GHG sources may be considered ‘insignificant’ and do not have to be accounted for if together such omitted decreases in carbon pools and increases in GHG emissions amount to less than 5% of the total CO₂-equivalent benefits generated by the project. Non-CO₂ gases must be included if they are likely to account for more than 5% (in terms of CO₂-equivalent) of the project’s overall GHG impact over each monitoring period. Direct field measurements using scientifically robust sampling must be used to measure more significant elements of the project’s carbon stocks. Other data must be suitable to the project site and specific forest type.**

*Carbon pools*

The following table indicates carbon pools required for consideration under the methodology VCS VM0009, Version 1.1, including those pools that are mandatory, optional and respective justification for selection under this project:

**Table 1. List of included carbon pools**

<table>
<thead>
<tr>
<th>Pool</th>
<th>Required</th>
<th>Included in Project?</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
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<td></td>
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## CCBA
**GAP VALIDATION ON CLIMATE SECTION**

<table>
<thead>
<tr>
<th>Carbon Pool</th>
<th>Yes/No</th>
<th>Major Pool Considered</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Above-ground large tree biomass</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Above-ground small tree biomass</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Above-ground non-tree biomass</strong></td>
<td>Optional</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Below-ground large tree biomass</strong></td>
<td>Optional</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Below-ground small tree biomass</strong></td>
<td>Optional</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Below-ground non-tree biomass</strong></td>
<td>Optional</td>
<td>Yes</td>
</tr>
<tr>
<td>Litter</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Standing dead wood</td>
<td>Optional</td>
<td>Yes</td>
</tr>
<tr>
<td>Lying dead wood</td>
<td>Optional</td>
<td>No</td>
</tr>
<tr>
<td>Soil</td>
<td>Optional</td>
<td>Yes</td>
</tr>
<tr>
<td>Long-lived wood products</td>
<td>Yes</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Lying dead wood counts for considerably less than 5% of the total project benefit for the project lifetime and has therefore been conservatively excluded.

For additional information on carbon pools selected, please refer to VCS PDD, section 2.3 “Project Boundary”.

**Monitoring plan**

The procedures described in this section refer to the data needed to calculate the total carbon stock in selected pools within the project area and their uncertainty. These procedures are used both for establishing the initial carbon stock within the project area and the carbon stock at each monitoring event. The project employs permanent sample plots (PSP) coupled with allometric equations for estimating carbon stocks in trees. Non-tree biomass and standing dead wood are also measured in the PSP, while carbon pools of lying dead wood is conservatively omitted. Soil carbon is estimated using soil samples collected. These sampling procedures are designed to detect both increases in carbon stocks, such as those that occur as a result of forest growth, and decreases in carbon stocks, such as changes that may take place as a result of degradation or natural disturbance events.

Carbon stocks are estimated for the first monitoring period by sampling all plots in all strata. After the first monitoring period, all plots and all strata will be re-measured at least every five years. All SOPs mentioned in the VCS PD refer to the process of data collection and are available under Supporting documents, SOPs folder.

**Stratification**

In order to most accurately estimate the biomass of the project area taking into consideration reasonable time and expenses, major strata are established. The strata are defined as Woodland (WL) and Open Woodland (OWL). The project area contains 784’987 ha of forest land and is split into four Rural District Councils (RDCs): Binga (157’652 ha), Hunrungwe (131’480 ha), Mbire (269’513 ha) and Nyaminyami (226’341ha). The stratum Woodland accounts for 269’457 ha and
the stratum Open Woodland accounts for 478'345 ha.

**Sampling, sample size and plot size**

Sampling: PSP are used to measure changes in carbon stocks in conjunction with the baseline models to quantify the net GHG emissions or removals as a result of project activities. The measurements reflect changes due to natural processes such as growth and mortality, and changes due to human activities, such as management, harvest and degradation. Plots are marked permanent with standard metal fencing that is hammered into the ground. In cases where obstacles (tree, rock, river etc.) obstruct a particular location, the permanent marker is placed as close as possible to the starting point of the plot and notes are made on the field data sheet. The following systematic random plot sampling technique is implemented:

- Coordinates are provided to the sampling teams at random plot location. Plots are distributed over the area of each stratum in a random fashion using the “QuantumGIS tool Random Points”. The area of each stratum classified in the most recent classification is transformed to a disjunctive shapefile polygon. The number of points necessary calculated is distributed in that polygon via “QuantumGIS tool Random Points”. This is valid for biomass, ground truth and leakage points.

- As many more ground truth points are needed for remote sensing classification for forest cover map creation than biomass or soil sample points, the ground team was also advised to measure as many points as possible of clear landcovers in a random, but opportunistic fashion due to the large extent of the area and time constraints. Next to random points selected for landcover ground truth, additional points were often measured close to access ways like roads. These were purely additional to the number of random points needed to fulfill calculated statistical representativeness and done to broaden the sample base in a resource efficient way (e.g. on return to the camp). Measurement of all ground truth points followed requirements of minimal homogeneous area of one hectare and distant at least 300m.

The sampling error is calculated by using equation 47 of the methodology.

To sample soil, coordinates of random biomass plot locations are used. The following procedure is applied:

- The plot teams use their GPS to find the plot center. Two subsamples are taken on each random sample plot. The two subplots are assessed separately. For further information, please refer to Supporting documents, SOPs, Tree and soil SOPs, file “SOPs Tree and soil collection”.

To sample biomass, coordinates of random biomass plot locations are used. For further information, please refer to Supporting documents, SOPs, Tree and soil SOPs, file “SOPs Tree and soil collection”.

Leakage plots are assessed differently to biomass and soil plots. They are located at random locations in the leakage area. They therefore cannot be conspicuously marked like the biomass plots. The dimension (2.1 ha; 145m x 145m) of all plots is the same. The proportion of degradation
is determined by the observed above-ground biomass that is absent as evidence by presence of stumps for each plot area. A factor corresponding to degradation and deforestation is determined for each plot. The leakage plot is recorded in a GIS system. A Standard operating procedure for leakage plots is applied.

For the observation of the proportion of deforestation and degradation on leakage plots, the following ordinal scale is used: Record a factor (0.2, 0.4, etc.) corresponding to the observed above-ground biomass that is absent due to human activity as evidenced by presence of stumps for each plot area. For further information on leakage monitoring, please refer to Supporting documents, SOPs, Leakage SOP, file “SOP Leakage area data collection”.

So far no systematic variation potentially present in the project area due to topography, management history, or other factors have been identified. In case systematic variation is identified in the future, it will be documented in the monitoring report how the sampling design avoids bias that may result from these variations.

The sampling teams have been specially trained for each monitoring activity described above. This is an ongoing effort.

Organizational structure

Collecting reliable field measurements is an important part of quality assurance (QA). SOPs are followed to collect reliable data and to ensure credibility in the estimation of the baseline, project emissions, leakage, and GHG removals.

The project entity implements procedures that will ensure independent verification. Should there be differences in the electronic and paper based formats, these will be clarified in the terms defined and procedures followed. Particular attention shall be paid to monitoring and measurement errors. This issue will be addressed through mandatory data checks and training of sampling teams.

Field crew composition: the forest inventory field crews, taking into account the amount of information to be collected and the tasks of each individual, should have at least two members. Additional persons may be included to improve performance of the field crews when conditions require more resources. It is desirable that some in the field crews are hired locally and act as guides in the field.

One of the crew members must be experienced in tree species identification, or must be familiar with methods of plant collection and identification using taxonomic keys.

The responsibilities of each crew member must be clearly defined. Their tasks are proposed as follows:

- The crew leader is responsible for organizing all the phases of the fieldwork, from the preparation to the data collection. He/she has the responsibility of contacting and maintaining good relationships with the community and the informants and has a good overview of the progress achieved in the fieldwork. He/she will administer the location of plots; take care of logistics of the crew by organizing and obtaining information on accommodation facilities; recruit local workers; organize access to the plots; interview external informants and local people; ensure field forms are properly filled in and collected.
data are reliable; organize meetings after fieldwork in order to sum up daily activities; and implement field worker safety measures.

Training of the crews on the survey methodology are undertaken at the beginning of the fieldwork in theoretical and practical sessions during which techniques of different forest and tree measurements, tally of data and techniques.

Data collection and storage

The personnel involved in the measurement of carbon pools will be fully trained in field data collection and analysis by the technical manager. SOPs exist for each step of the field measurements and followed so that measurements are comparable over time. If different interpretations of the SOPs exist among the sampling teams, they will be jointly revised to ensure clearer guidance.

Proper entry of data is required to produce reliable carbon estimates. Therefore a web-based data entry form for all those data measured in the field required by the methodology will be used, except for soil. All data sheets will include a “Data recorded by” field. Communication between all personnel involved in measuring and analyzing data will take place to resolve any apparent anomalies before final analysis of the monitoring data can be completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot will not be used in the analysis. Additionally, field data will be reviewed by the technical manager or a team leader of the sampling team to ensure that the data are accurate and analyses are realistic.

Due to the long duration of the project and the speed at which technology changes, data archiving will be an essential component of the project. Data will be archived in several forms: All original field data sheets are saved and in addition copies of the original data sheets are stored in another file as backup. All documents are stored in the office of CGI. Further more the Monitoring and Verification System (MOVERS) is used for obtaining, recording, compiling and analyzing data relevant for the project, except for soil. MOVERS is a centralized online data system, which is server-based and backed-up and serve as the project’s GHG information system. All data are therefore kept in a secure and retrievable manner for at least two years after the end of the crediting period.

Quality assurance (QA)/ Quality control (QC)

The project will follow the IPCC GPG of using two types of procedures in order to ensure that the inventory estimates and their contributing data are of high quality. The plan that describes specific QA/QC procedures is as follows:

- Standard Operating Procedures (SOP) will be used for field data measurements.
- Training courses will be held for all relevant personnel on all data collection and analysis procedures.
- To reduce uncertainty in leakage measurement a field protocol for sampling forest degradation and trainings are implemented.
- Steps will be taken to control for errors in the sampling and data analysis to develop a credible plan for measuring and monitoring carbon stock change in the project context. To
verify that biomass plots have been installed and the measurements taken correctly, randomly selected plots will be re-measured by a team leader with a team not involved in the initial measurement sampling.

Data collection is an ongoing process. The sample size has to be updated when more data are available and added to the database. A centralized data system such as the online, server-based, backed-up MOVERS is therefore used, except for soil. The complete carbon asset monitoring and verification process is complex. There is substantial risk in mandatory reporting data being lost, incorrect, or even having not been collected by the implementation team. This results in reduced and delayed issuance of carbon credits, excessive workloads on project staff and high associated costs. The integration of carbon-credit centered monitoring activities into one central platform contributes significantly to increasing efficiency and decreasing the amount of errors.

CGI, the implementing organization, is managing the project and will be responsible for the centralized documentation of all project planning and implementation. QA/QC procedures is implemented to ensure that biomass, soil and leakage plots are measured and monitored precisely, credibly, verifiably, and transparently. CGI will ensure that the QA/QC plan is developed and implemented, will coordinate QA/QC activities, and is responsible for documenting QA/QC procedures.

*Allometric equations*

The project applies allometric equations from peer-reviewed literature that are derived from similar project locations in terms of climatic, edaphic, geographical and taxonomic conditions. When possible, species-specific equations are used from similar locations such as Zimbabwe itself, Tanzania, South Africa, Botswana and Mozambique. If the allometric equations include only above ground biomass, species or forestry type default values are used for calculating the below ground biomass.

All data such as field data, equations, densities and root-shoot-ratio are uploaded to the centralized data system MOVERS during the monitoring and verification stage of the project, except for soil. All calculations are then processed automatically; firstly on a plot basis implemented for each strata also by calculating the carbon sequestered in the soil based on the soil plots, these values will be extrapolated to the total amount of ha (per stratum) and then summed up. The total carbon stock for the project area is calculated by using eq. 62 of the methodology.

The carbon stock per unit area in each plot is calculated using eq. 45 and eq. 54 for shrubs, the predicted carbon stock for the large and small trees is calculated from eq. 50 of the methodology. The total carbon stock in above-ground large, small and non-tree biomass is calculated from eq. 44, the standard error of the carbon stock in above-ground large, small and non-trees follows eq. 47 of the methodology. The same equations apply for the calculation of the below-ground large and small-tree biomass. For non-tree biomass eq. 64 is applied and for the estimation of the standard error of the below-ground biomass eq. 65 is used.

The carbon stock in standing dead wood in a plot is calculated using eq. 66 of the methodology. Same equations as above are applied for calculating the total carbon stock in standing dead wood (44) and the standard error of the carbon stock in standing dead wood (47).
The carbon stock of standing dead trees in decay class I is estimated using the same equations developed for live trees (45 and 50).

The carbon stock of standing trees in decay class II is conservatively estimated as the biomass in only the remaining bole. DBH and height are measured on each tree in decomposition class II. The volume of each dead tree is then estimated as the frustum of a cone. The carbon stock for each plot is calculated using eq. 45 where eq. 51 is applied for calculating the carbon stock per tree and eq. 52 for calculating the carbon in the stratum.

Uncertainty

To ensure that carbon stocks are estimated in a way that is accurate, verifiable, transparent, and consistent across measurement periods, the project proponent established SOPs to ensure data quality. In order to guarantee a high quality and reliability of the data, the following additional measures are taken:

- Comprehensive documentation of all field measurements carried out in the project area. This document is detailed enough to allow replication of sampling in the event of staff turnover between monitoring periods. Training procedures are implemented for all persons involved in field measurement or data analysis. Both, scope and date of all training is documented.

- A protocol for assessing the accuracy of plot measurements uses a check cruise and a plan for correcting the inventory if errors are discovered. Protocols for assessing data for outliers, transcription errors, and consistency across measurement periods are implemented and constantly extended once monitored data have been taken and analyzed at monitoring and verification stage of the project. Based on the gained experience in the field threshold values are introduced in the MOVERS for indicating irregularities such as outliers (e.g. if a team member inserts a tree height of 60 meter, the system will indicate an error, which is most probably ascribed to a decimal-error).

- Data sheets are safely archived for the life of the project. Data stored in electronic formats are backed up.

The uncertainty of the total carbon stocks and soil carbon model is determined at monitoring and verification stage using eq. 46, eq. 47, eq. 63, eq. 67 and eq. 36 of the methodology. The confidence reduction is determined from eq. 35.

The standard error of the total carbon stock for the project area is estimated by combining the standard errors of the required and selected optional pools by using eq. 63 of the methodology. The percent uncertainty of the total carbon stock is further calculated by using eq. 67 of the methodology.

For additional information regarding climate impact monitoring, please refer to VCS PDD, section 4 “Monitoring”.

**CL3.2 Commit to developing a full monitoring plan within six months of the project start date or within twelve months of validation against the Standards and to disseminate this plan and the results of monitoring, ensuring that they are made publicly available on the internet and are communicated to the communities and other stakeholders.**

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The monitoring plan is available under VCS PDD section 4.2. The results of this plan is available under VCS Monitoring Reports. Two VCS verifications and validation were complete. In addition, the community members and stakeholders are aware of the results from monitoring as for every CCBS verification, the original in English and a summary of the monitoring and implementation report is translated into the local language and made available through the CCBS website and through the local RDC offices.