KARIBA REDD+ PROJECT MONITORING REPORT 2012-2014

CarbonGreen INVESTMENTS Guernsey

In partnership with the landowners:

Binga RDC

Hurungwe RDC

NyamiNyami RDC

Mbire RDC

Document Prepared By

South Pole Carbon Asset Management Ltd.

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1 PROJECT DETAILS

1.1 Summary Description of Project

The Kariba REDD+ Project is located in northwestern Zimbabwe, partly along the southern shore of Lake Kariba, the largest artificial lake in the world by volume. The project area of 784'987 hectares of forest (consisting of woodland and open woodland) spans four provinces: Matabeleland North, Midlands, Mashonaland West and Mashonaland Central. The project is administered by four Rural District Councils (RDCs): Binga, Nyaminyami, Hurungwe and Mbire.

The project is community-based and consists of implementation of activities in conjunction with the local population. The main causes of deforestation are socio-economic (subsistence agriculture, the collection of firewood and poaching activities) and settlements. Decreasing deforestation will be achieved through a series of activities that are designed to improve significantly the livelihoods of locals, such as improved agriculture, beekeeping, fuelwood plantations and fire management. In addition, a significant (20% of net profit) share of the project's carbon income will be invested in general activities that promote and guarantee project sustainability. The project's Community and Project Sustainability Fund is structured to benefit whole communities, specifically including the poorest members of society. The fund will be used to improve health and education in the project area due to long term activities.

The project area lies within the Zambezian biome of the Zambezi basin.[1] The major ecosystem includes mopane and miombo woodland in several natural, degraded and regeneration stages. The project area is an important wildlife area, showing significant populations of African elephants, lions, impalas, hippos, buffalo, leopard and crocodiles, along with a wide variety of birds, including the IUCN red list vulnerable species Southern Ground Hornbill, Lappet-faced Vulture, and White-headed Vulture.

In the past, the natural resources of the project areas supported significant populations of wildlife, including elephants, which, in turn, supported a variety of tourism and safari activities. However, the economic and political crises over the past decade led to a decrease in tourism. Poaching also escalated in the project area. As a result, wildlife populations have been severely reduced.

There is no significant income to cover the cost of the activities to mitigate deforestation without carbon revenues. In the absence of active protection that creates sustainable economic alternatives for communities, the land in the project area will be cleared for non-sustainable alternative land-use scenarios.

The project boundary includes CO_2 emissions in the project and the baseline scenario and includes the following carbon pools:

[1]Timberlake, J. (2000), Biodiversity of the Zambezi basin. Occasional Publications in Biodiversity No. 9, Biodiversity Foundation for Africa, Bulawayo, Zimbabwe.Availbale online under http://www.biodiversityfoundation.org/documents/BFA%20No.9_Zambezi%20Basin%20Biodiversity.pdf.

- Above-ground (large & small) tree biomass
- Above-ground non-tree (shrub) biomass
- Below-ground (large-and small) tree biomass
- Below-ground non-tree (shrub) biomass
- Standing dead wood
- Long-lived wood products

The carbon pool soil is selected in the project's PD, but is conservatively excluded for this monitoring period. Long-lived wood products have been proven and validated[2] to not occur in the project area and are therefore not monitored. Biomass of large and small trees is not separated as discussed in the PD, section 2.3.

The total GHG emission reduction generated in the monitoring period from 01-07-2012 to 30-06-2014 is 4,850,464tCO_2e.

1.2 Sectoral Scope and Project Type

This is an AFOLU REDD project that aims to avoid mosaic deforestation and degradation. The project is not a grouped project.

1.3 Project Proponent

Organization name	Carbon Green Investments (Guernsey)
Contact person	Robert Hume
Title	Manager
Address	18-20 Le Pollet Street St. Peter Port Guernsey UK, GY1 1WH
Telephone	+263778020539
Email	robert@carbongreenafrica.net

[2] See PD, section 2.4.6.4.

1.4 Other Entities Involved in the Project

Organization name	South Pole Carbon Asset Management (South Pole)
Role in the project	Project Developer South Pole elaborates and oversees the development of appropriate project design and monitoring techniques in line with the guidelines of the VCS and CCBS.
Contact person	Christian Dannecker
Title	Mr
Address	Technoparkstrasse 1 8005 Zurich Switzerland
Telephone	Phone: +41 43 501 35 50
Email	c.dannecker@southpolecarbon.com

Organization name	Carbon Green Africa (CGA)
Role in the project	Project Implementer CGA is a 100% subsidiary of the project proponent Carbon Green Investments. CGA is operating the monitoring and project activities of the Kariba REDD+ Project.
Contact person	Pieter Bezuidenhout
Title	Mr
Address	32 Domboshawa Road, Helensvale, Harare, Zimbabwe
Telephone	+263 774 567 729
Email	pieter@carbongreenafrica.net

1.5 Project Start Date

The project start date is July 1st, 2011.

1.6 Project Crediting Period

The project crediting period is 30 years. The start date of the crediting period is July 1st 2011, the end date is June 30th 2040.

The implementation of the management structure and activities addressing the deforestation drivers (protection plans) began on, as well partially before, July 1st, 2011 together with the associated investments. These investments refer to research, fieldwork and capacities conducted by Black Crystal and Environment Africa and further to management and protection work such as reporting, communication, capacity and control activities. In addition, all bilateral agreement for the verified emission reductions between CGI and the RDC have been signed before the project start date, in March 2011 (for Binga, Hurungwe, Mbire and Nyaminyami). Supporting documentation has been provided separately to the auditor at project validation.

The baseline is reassessed every 10 years after the project start date and during the crediting period and is validated at the same time as the subsequent verification. The baseline will thus be re-assessed latest after June 30th 2021 and re-validated at the same time the monitoring period July 1st 2021 to June 30th 2022 is verified.

1.7 Project Location

The *Kariba REDD+ Project* is located in northwestern Zimbabwe, partly along the southern shore of Lake Kariba, the largest artificial lake in the world by volume. The project area spans four provinces: Matabeleland North, Midlands, Mashonaland West and Mashonaland Central. The project is administered by four Rural District Councils (RDCs): Binga, Nyaminyami, Hurungwe and Mbire. The project is community-based and implements activities in conjunction with the local population. As the affected communities all live within the boundaries of the project area, the project zone equals the project area in this project. A brief description of the four participating RDCs is given below.

Binga

The Binga RDC area is located in the Matabeleland North province. It encompasses a prime wildlife area that includes 22 kilometers of Lake Kariba's shoreline. It serves as a corridor, connecting the Chizarira National Park, the Omay South Wildlife Area and the Matusadona National Park. The resulting area makes for a vast and contiguous wildlife area that is roughly 900'000 ha in size.

Nyaminyami

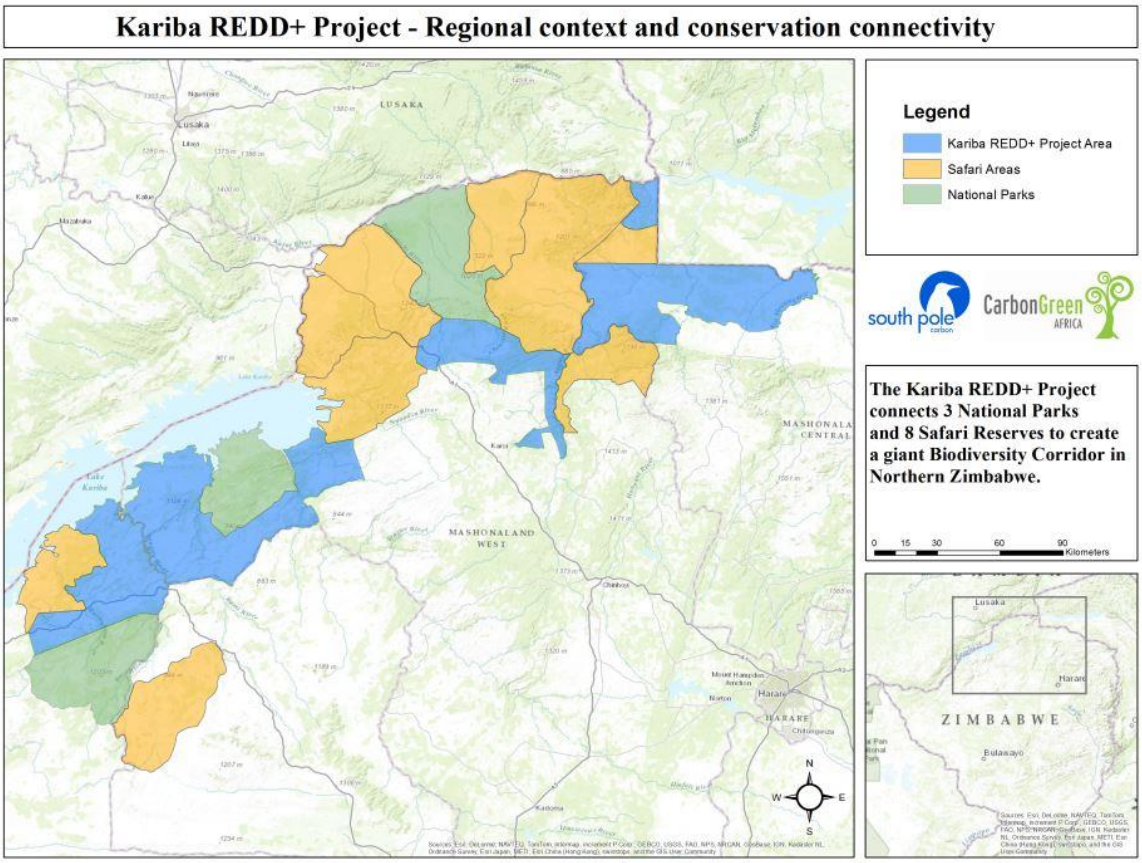
The Nyaminyami RDC area lies in the district of Kariba in the province of Mashonaland West. The Nyaminyami forest connects the Matusadona National Park with the Charara Safari Area. It shares borders with the Binga RDC area. Ecotourism is popular in Nyaminyami, and the most popular ecotourism destination is the shore of Lake Kariba, with its several fishing and safari camps.

Hurungwe

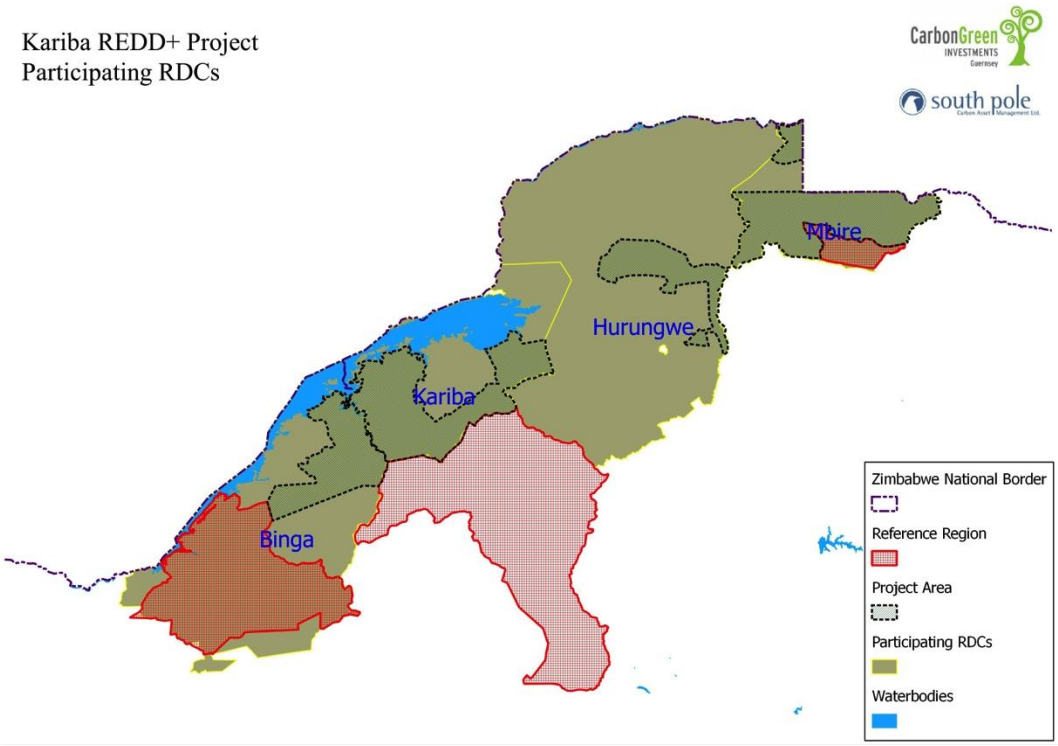
The Hurungwe RDC lies in a remote, rural part of the province of Mashonaland West. It is adjacent to Mana Pools National Park.

Mbire

The Mbire forest area lies within the province of Mashonaland Central. It serves as a stepping-stone between Mana Pools National Park in the northwest and the Umfurudzi Safari Area in the southeast.



Map 1: Location of the project in Zimbabwe



Map 2: Location of the project areas

1.8 Title and Reference of Methodology

VM0009 - Methodology for Avoided Mosaic Deforestation of Tropical Forests, v1.1

1.9 Other Programs

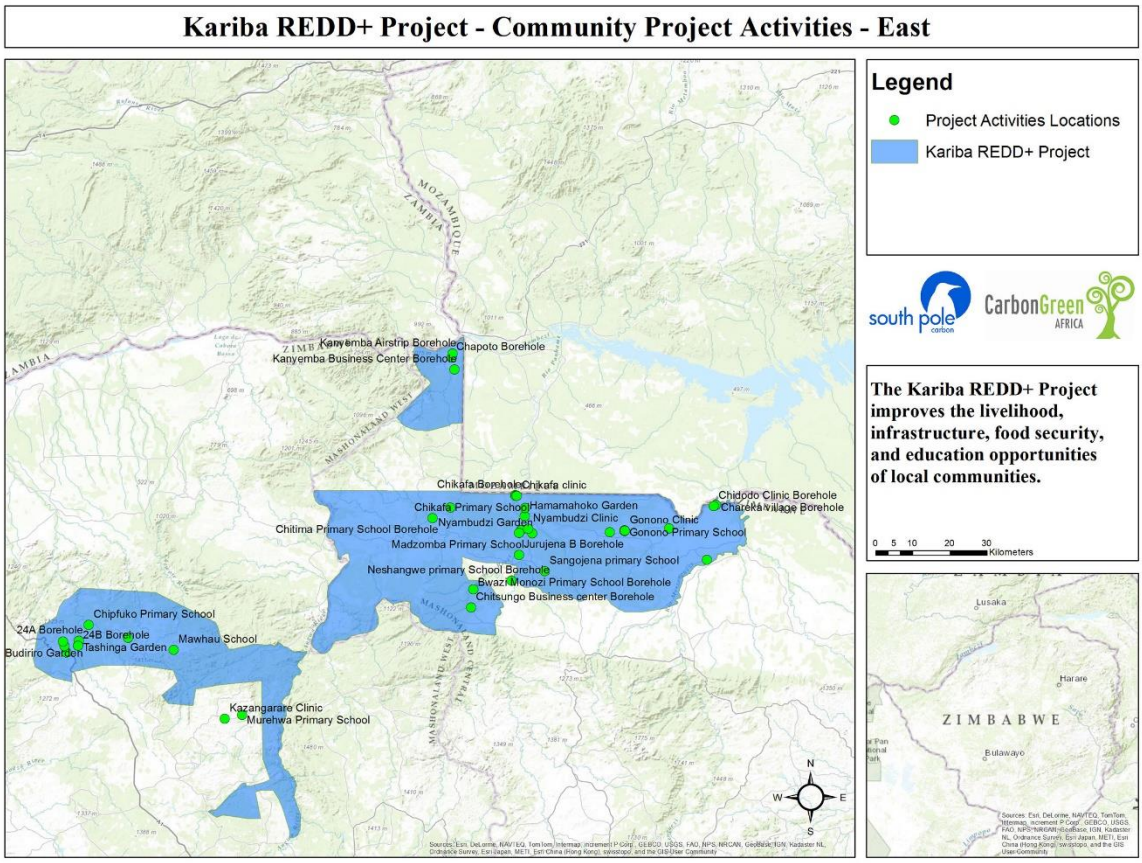
Not applicable. The project does not participate in other GHG or environmental credit programs.

2 IMPLEMENTATION STATUS

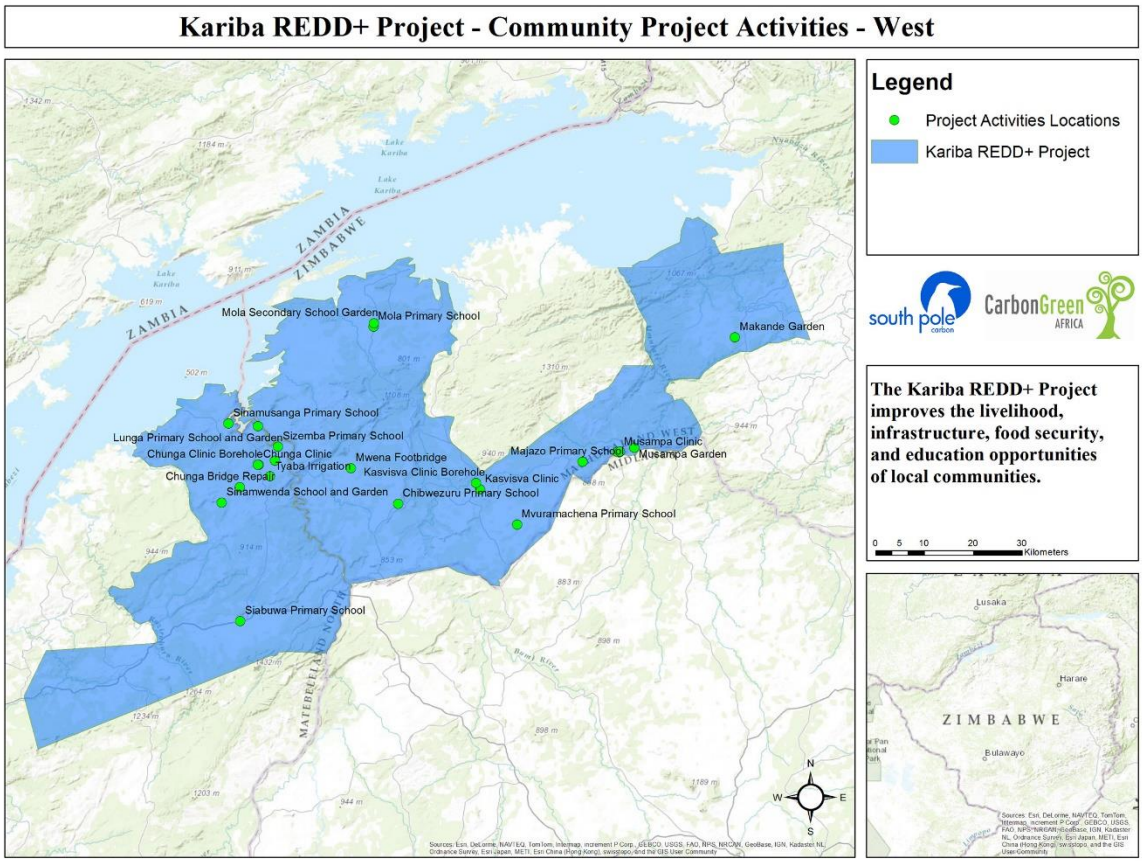
2.1 Implementation Status of the Project Activity

This section is fully taken from the verified CCBS Project Implementation Report (CCBS PIR) provided to the auditor separately and online available[3]. There further information on community survey and safeguards can be found.

[3] https://s3.amazonaws.com/CCBA/Projects/Kariba_REDD%2B_Project/Verification/140707_Kariba+REDD%2B+PIR_V3.pdf



Map 3: Project community activity locations Kariba REDD+ Project - Eastern Part



Map 4: Project community activity locations Kariba REDD+ Project - Western Part

Improved Agriculture

Conservation Farming (CF) was first introduced and implemented in 2012 after conducting numerous inception meetings covering the wards, which were to be started with, followed by a total of 48 workshop/trainings, which included training-of-trainers, and nutritional garden establishment. These workshops were followed by a selection of beneficiaries done entirely by the communities themselves who selected 1'000 beneficiaries across all 4 project areas who were registered to receive sufficient inputs to grow maize, sorghum and cow peas for a 25x25m field.

The first season under CF was seen as a great success with an estimated 20-30% increase in yield across the board. The impact of this activity in the communities in the first season was seen to be very positive as witnessed by a number of community members who were not beneficiaries, also adopting the farming method on their own accord upon seeing the visual difference in quality of crops grown by the CF farmers. Some of the verbalized encouragement of CF which implied profound support to this activity came from one chief who was initially skeptical, but had a change in opinion when he realized the only members of his community who received a decent yield were those farmers who had adopted this CF method of farming and felt that "CF was one of the very means to alleviate the poverty situation within rural communities".

2013 was then the second season of implementing CF and the number of beneficiaries was increased by 40 new community members now giving a total of 1'040 registered beneficiaries. Once again all theses registered beneficiaries we supported with enough inputs to this time increase the field size to 50x50m. It is naturally expected that the quality of the crops will at very least be of the same quality as 2012 or probably better. In total there are now over 1'300 beneficiaries including nutritional gardening.

Photo 1: Harvest in a Community Garden

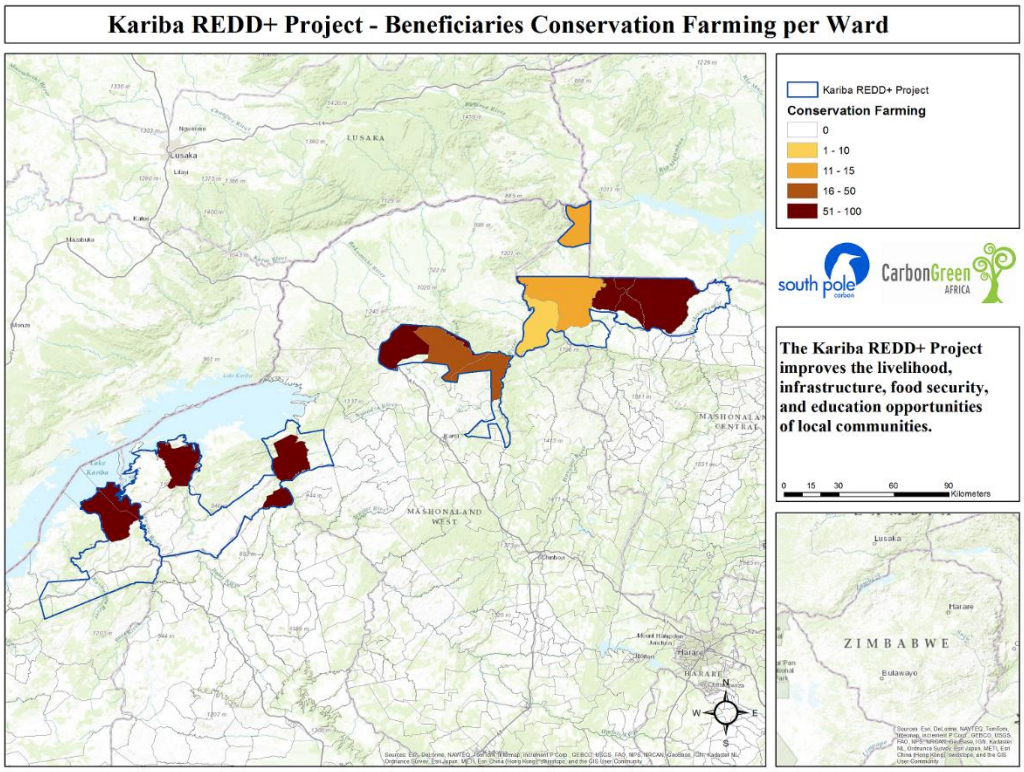
It is the intention of the project to continue expanding this activity to more and more members of the communities with inputs, conduct more training workshops and increase the extension work and support to farmers implementing the CF method as it is recognized as having the potential to impact individual households, improve food security, increase wealth and reduce deforestation through reducing the need to clear more land in search of more fertile soils (shifting agriculture) and assisting in establishing markets for the products.

Photo 2: Award of prizes to champion farmers in Improved Agriculture workshops

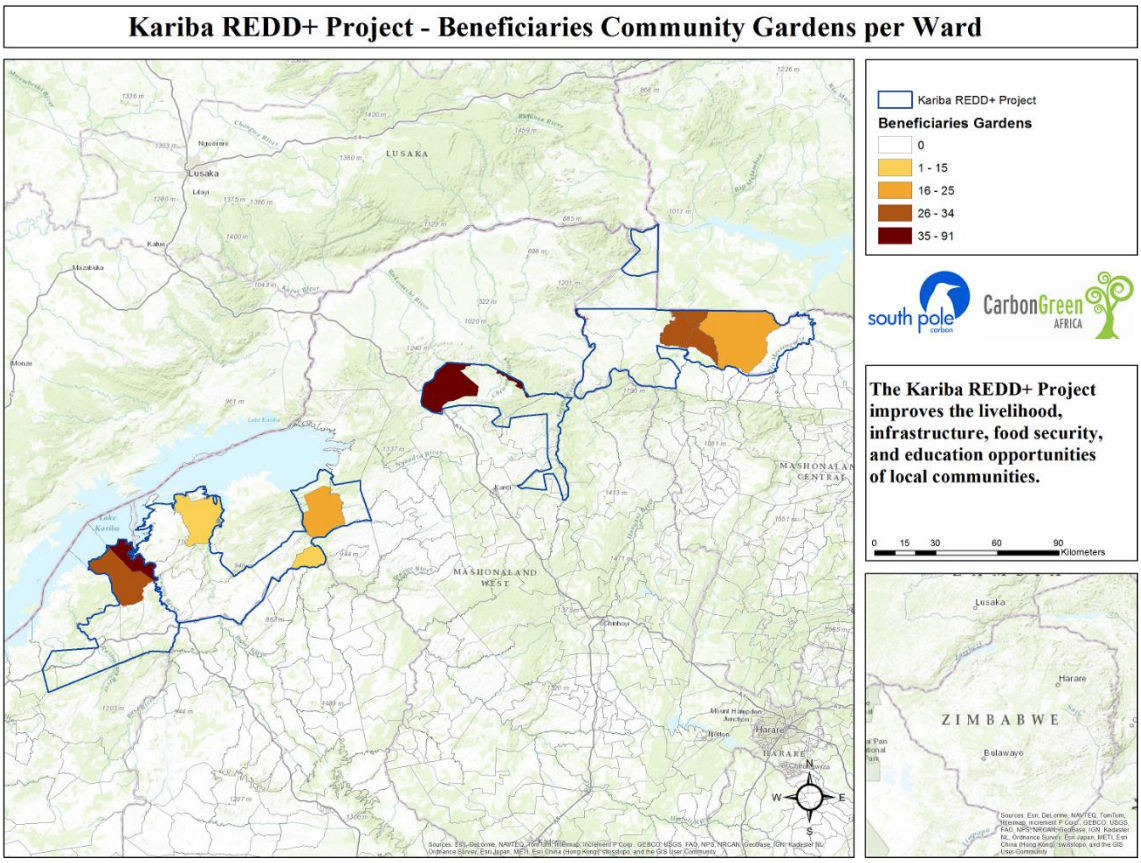
Photo 3: Awareness campaign with schools on environmental education

Photo 4: Awareness campaign with schools on environmental education-2

Photo 5: Borehole recuperation for irrigation by the On the Ground Management Teams and community members



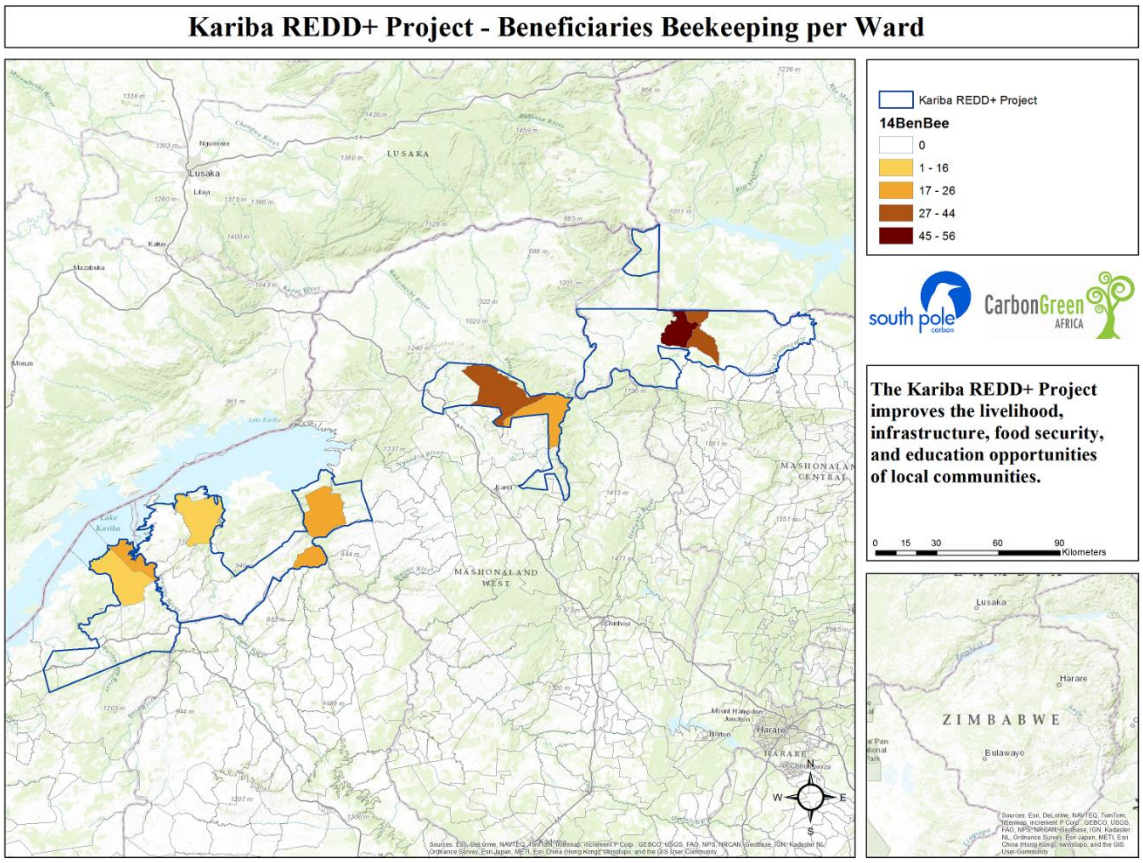
Map 5: Kariba REDD+ Project Beneficiares Improved Agriculture (Conservation Farming)



Map 6: Kariba REDD+ Project Beneficiares Community Gardens

Beekeeping

Beekeeping was recognized during the baseline survey as another activity, which adds value to standing forests and provides the potential for local community members to receive an income without causing deforestation. To date 9 workshops on introduction to beekeeping, hive construction and basic hive management have been conducted. There are over 200 beneficiaries across all four project areas and over 650 beekeeping startup kits handed out (Kenyan Top Bar Hives, KTB). An estimated total of approximately 4'000 kg of honey was produced from 2012 to 2013 which was mostly sold to local markets. Adoption of this activity has been very positive however the number of colonized hives in some areas has been lower than in others and it was realized that this was due to some of the hives 'top bars' not being cut accurately enough during the construction process causing the bees to desert. These hives are all hand made during the training workshops and to rectify this problem we are in the process of re-cutting new 'top bars' and these will be handed out to the beekeepers in time for the next swarming season. The Kariba REDD+ Project aims to continue enhancing this activity through additional trainings, support of materials and assistance in establishing markets for the honey.



Map 7: Kariba REDD+ Project Beneficiares Beekeeping (Apiculture)

Photo 6: Beekeping (Apiculture) workshops

Photo 7: Beekeping (Apiculture) workshop - Demonstration of construction & installation of a higher effective bee hive constructed without tree damage.

Photo 7: Beekeping (Apiculture) workshop - Demonstration of harvest from a higher effective bee hive constructed without tree damage.

Fuelwood Plantations

This activity has not yet been implemented.

Social Forestry

This activity has not yet been fully implemented, although some grass roots research has been done and a number of indigenous trees species have been identified as having the potential of value adding to the communities. A total of roughly 30 traditional shrines has been identified and mapped in the project area.

Fire Management

This has been an important activity since the project start date with 12 fire-fighting training workshops and over 24 community fire awareness meetings having been conducted with the 2013 National fire awareness week having been launched in the Hurungwe project area and 12 community fire-fighting committees formed. These fire-fighting committees have also been supported with fire-fighting suppression tools. In addition to this, CGA has also repaired and maintained in excess of 1'200 km of bush roads in 2012 and 2013 respectively across all four project areas which assist as fireguards. It was also along these same roads for almost the same distance where our early burning (controlled fire burns) was carried out and it was estimated by our OGM that there has been about a 20-25% reduced occurrence of fires. This was estimated by comparing previous years in the same areas where ordinarily the entire areas would have been burnt compared with the witnessed unburned areas since the commencement of this activity. This positive impact was further supported by a safari operator in one of the project areas who notified CGA that he had noticed a remarkable increase in biodiversity particularly in the small mammals, reptiles and insects.

The project aims to continue enhancing this activity through continued road maintenance and early burning, continued fire awareness and firefighting training and support with tools.

Photo 8: Awareness workshop on wildfires (Veld fires) and fire mitigation

Alternative and Sustainable Building Material (Brick Making)

This activity has not yet been implemented.

On the Ground Management Teams (OGM)

The project has four OGM Teams covering the four project areas. Each team has successfully managed to fulfill its obligations as supplied reported to the CGA head office on a regular basis. These obligations include the following:

- Maintenance of boreholes and water pumps provided
- Prevention of fire through means already highlighted under the section on fire management above.
- Maintaining roads for accessibility as already highlighted under the section on fire management above.
- Constantly facilitating the relations to the local authorities.
- Receiving feedback and grievances from the local communities.
- Carrying out the proper monitoring requirements according to the requirements of CCBS and VCS.

- The project aims to enhance the above obligations through increased communications, workshops and awareness to the local authorities and local communities.

  Safety of our field teams is of great importance to us particularly when it comes to anti-poaching or fire fighting. For this the OGM teams conduct their activities with the assistance of the RDC game scouts who have all received training for their positions of employment even before the inception of the project. To date the project has conducted two different trainings, one lasting three weeks and the second training lasting two weeks. A total of 37 people participated in the two trainings. These trainings were basic to intermediate level and included techniques on patrolling and apprehending or arresting, map reading and GPS use, tracking and identification of animals and signs. Fire fighting training was also conducted at ward and village level, where members of the communities received a minimum of 19 trainings across all four RDCs and were taught how to suppress fires and make fireguards. They were also assisted in establishing their own fire-fighting teams with committees. According to the implemented social survey provided in the supporting documents, the project's employees report to be sufficiently trained for their tasks.

  Community and Project Sustainability Fund

  This activity is still being scaled up, however to date 26 schools and 8 clinics have been supported with stationary, exercise books, teaching boards and basic medical supplies to meet the requirements of treating common illnesses and injuries. Research has also been done into environmental conservation teaching material as well as teaching material to deal with illiteracy.

  Newsletter

  Since 2012 the project has been publishing a monthly letter for distribution to the RDC's and local communities. To date 15 issues or 60 newsletters, one per project area per month have been published. These newsletters have covered topics such as general project progress, environmental awareness, grievances if any, vacancies if any and general topics. These newsletters have been published in English, Shona and Tonga and have been distributed to the RDCs and local communities by the CGA OGM teams.

  The Newsletter have been provided to the auditor separately.

2.2 Deviations

2.2.1 Methodology Deviations

Not applicable, none.

2.2.2 Project Description Deviations

Soil carbon stock is not verified in the first or second verification, but could be included in following verification events.

Deviations related to the biomass SOPs[4]:
The SOPs have been slightly updated to give clarifications on procedures already previously applied in the field and to include improvements in the measurment. The original validated version and the updated version of 2014 have been provided to the auditor separately for comparison. The project proponent is now satisfied with the SOPs to include the learning curve from the first to the second monitoring period and is confident that the 2014 version can continue to be in effect for unaltered verification periods unaltered.

Contact info in section 1.4 was updated compared to the validated PDD due to changes in the roles in project implementation. The changes do not affect the effectiveness in implementing the project.

2.3 Grouped Project

N/A. This is not a grouped project.

[4] The SOPs are provided separately in document "140910_Kariba_SOP FOR TREE DATA COLLECTION_2014 version.docx".

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

A list of allometric equations and densities of tree species was provided separately to the auditor at validation stage. The auditor have access to the web-based Monitoring and Verification System (MOVERS) where an updated list of the tree species and the data can be found. The wood densities are needed to convert volume (m^3) to biomass in case the allometric equation only provides results in m^3. As description of the functions of MOVERS are described in an accompanying document (cf. section 6). In case the allometric equation only provides results for the commercial timber (stem wood), a conservative root to shoot ratio is applied to calculate the below-ground biomass.

Data Unit / Parameter:	Below-ground small and large tree biomass (BGLT)
Data unit:	t of dry matter
Description:	The below-ground tree biomass is calculated by applying a root to shoot ratio
Source of data:	The project participants use for all tree species the **Rs** mean value obtained by Ryan et al., 2011 in "Above-and Below-ground Carbon Stocks in a Miombo Woodland Landscape of Mozambique".[5] The **Rs** given on page 426 represent a mean below-ground ratio (t d.m./t d.m.) and is obtained of a similar ecoregion as the project area
Value applied:	0.42
Justification of choice of data or description of measurement methods and procedures applied:	The project participants are using the **Rs** from local sources. The value applies due to similar forest formations in Mozambique and is therefore applicable to the project area.
Purpose of the data	Calculate below-ground small and large tree biomass (BGLT)
Any comment:	

Data Unit / Parameter:	Below-ground non tree biomass (BGNT)
Data unit:	t of dry matter
Description:	The below-ground non tree biomass is calculated by applying a root to shoot ratio.
Source of data:	The project participants use for all tree species the **Rs** mean value obtained by Ryan et al., 2011 in "Above-and Below-ground Carbon Stocks in a

[5] BIOTROPICA 43(4): 423–432 2011. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1744-7429.2010.00713.x/abstract

	Miombo Woodland Landscape of Mozambique".[6] The **Rs** given on page 426 represent a mean below-ground ratio (t d.m./t d.m.) and is obtained of a similar ecoregion as the project area.
Value applied:	0.42
Justification of choice of data or description of measurement methods and procedures applied:	The project participants are using the **Rs** from local sources. The value applies due to similar forest formations in Mozambique and is therefore applicable to the project area.
Purpose of the data	Calculate Below-ground non tree biomass (BGNT)
Any comment:	

3.2 Data and Parameters Monitored

Data Unit / Parameter:	Above-ground small and large tree biomass (AGLT)
Data unit:	t of dry matter
Description:	The above-ground tree biomass is calculated applying allometric relationships.
Source of data:	Above ground woody biomass
Description of measurement methods and procedures to be applied:	Tree species, number of trees (numeric), diameter at breast height (DBH, cm) and tree height (m) of trees located in the permanent sample plot (PSP) are measured.
Frequency of monitoring/recording:	Each monitoring period. At least every five years, which may be accomplished on an intermittently rotating basis.
Value monitored:	Allometric equations are applied. Wood density values are used to convert volume (m^3) to biomass (t.d.m.); biomass is converted to carbon (tC) by a default value of 0.47; and carbon is converted to CO_2e (tCO_2) by a default value of 3.667
Monitoring equipment:	Measuring tape, tree height measuring equipment: clinometers, standard operating procedure, data web-page
QA/QC procedures to be applied:	QA/QC coordinator is CTO of CGI. Before starting the fieldwork, the forestry engineers meet

[6] BIOTROPICA 43(4): 423–432 2011. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1744-7429.2010.00713.x/abstract

	with CGI's CTO in the office of CGI, to schedule the exact monitoring activity. The same engineers are then responsible for the supervision during the monitoring. During the monitoring and after termination of the activity, they report directly to the CTO of CGI, who also checks if the data are reported as outlined in the monitoring plan. In addition, once CGI's CTO does his regular site-visits, he verifies the monitoring activity randomly.
Calculation method:	Allometric relationships
Any comment:	

Data Unit / Parameter:	Above-ground non tree biomass (shrubs) (AGNT)
Data unit:	t of dry matter
Description:	The above-ground non tree biomass is calculated applying allometric relationships.
Source of data:	Above ground woody biomass (shrubs)
Description of measurement methods and procedures to be applied:	Species, number of shrubs (numeric), diameter at breast height (DBH, cm) and height (m) of shrubs located in the permanent sample plot (PSP) are measured.
Frequency of monitoring/recording:	Each monitoring period. At least every five years, which may be accomplished on an intermittently rotating basis.
Value monitored:	Allometric equations are applied. Wood density values are used to convert volume (m^3) to biomass (t.d.m.); biomass is converted to carbon (tC) by a default value of 0.47; and carbon is converted to CO_2e (tCO_2) by a default value of 3.667
Monitoring equipment:	Measuring tape, tree height measuring equipment: clinometers, standard operating procedure, data web-page
QA/QC procedures to be applied:	QA/QC coordinator is the CTO of CGI. Before starting the fieldwork, the forestry engineers meet with CGI's CTO in the office of CGI, to schedule the exact monitoring activity. The same engineers are then responsible for the supervision during the monitoring. During the monitoring and after termination of the activity, they report directly to the CTO of CGI, who also checks if the data are

	reported as outlined in the monitoring plan. In addition, once CGI's CTO does his regular site-visits, he verifies the monitoring activity randomly.
Calculation method:	Size class, standard weight stem / shrub
Any comment:	

Data Unit / Parameter:	Leakage
Data unit:	Biomass / CO_2e
Description:	Represented by forest degradation and deforestation
Source of data:	2.1 ha (145m x 145m) leakage plots monitored using walking transects
Description of measurement methods and procedures to be applied:	2 walking transects per plot to determine anthropogenic clearing relative to intact forest; specific leakage training provided to each team member. The GPS coordinates are taken for each leakage plot.
Frequency of monitoring/recording:	Prior to the end of the first monitoring period in order to estimate the lag period for the leakage model and at every subsequent monitoring period in order to estimate actual emissions due to leakage
Value monitored:	Degradation / deforestation percentage (0%-100%)
Monitoring equipment:	GPS, standard operating procedure
QA/QC procedures to be applied:	QA/QC coordinator is the CTO of CGA. Before starting the fieldwork, the forestry engineers meet with CGI's CTO in the office of CGI, to schedule the exact monitoring activity. The same engineers are then responsible for the supervision during the monitoring. During the monitoring and after termination of the activity, they report directly to the CTO of CGI, who also checks if the data are reported as outlined in the monitoring plan. In addition, once CGI's CTO does his regular site-visits, he verifies the monitoring activity randomly.
Calculation method:	Leakage period, leakage model
Any comment:	Leakage data collected in the (first) monitoring period is used to calculate the leakage lag period

	and build the leakage model, against which empirical measurements of leakage will be compared. Subsequent empirical measurements of leakage are used to calculate leakage deductions. Ex-ante estimates of leakage have no bearing on actual leakage calculations.

Data Unit / Parameter:	Standing Dead Wood (SDW)
Data unit:	t of dry matter
Description:	The standing dead wood biomass is calculated applying allometric relationships.
Source of data:	Standing dead wood biomass
Description of measurement methods and procedures to be applied:	Standing dead trees are conservatively all categorized as decay class II. The carbon stock of standing dead wood is thus estimated as the biomass in the remaining boles only.
Frequency of monitoring/recording:	Each monitoring period. At least every five years, which may be accomplished on an intermittently rotating basis.
Value monitored:	Wood density values are used to convert volume (m^3) to biomass (t.d.m.); biomass is converted to carbon (tC) by a default value of 0.47; and carbon is converted to CO_2e (tCO_2) by a default value of 3.667
Monitoring equipment:	Measuring tape, tree height measuring equipment: clinometers, standard operating procedure, data web-page
QA/QC procedures to be applied:	QA/QC coordinator is the CTO of CGI. Before starting the fieldwork, the forestry engineers meet with CGI's CTO in the office of CGI, to schedule the exact monitoring activity. The same engineers are then responsible for the supervision during the monitoring. During the monitoring and after termination of the activity, they report directly to the CTO of CGI, who also checks if the data are reported as outlined in the monitoring plan. In addition, once CGI's CTO does his regular site-visits, he verifies the monitoring activity randomly.
Calculation method:	Using equation 51 and 52 of the methodology.
Any comment:	

Data Unit / Parameter:	Strata areas a_k
Data unit:	ha
Description:	The area of each stratum is updated at the end of each monitoring period.
Source of data:	GIS analysis based on multispectral satellite imagery.
Description of measurement methods and procedures to be applied:	The approach follows the procedures applied during the initial forest cover stratification (see SOPs of Forest Cover Maps)
Frequency of monitoring/recording:	Each monitoring period.
Value applied:	The distribution and extent of forest strata at the last monitoring event (first monitoring event project start date) serves as the basis for the update.
Monitoring equipment:	GPS – Ground truth points Multispectral imagery from sensor with specifications following requirements of VM0009. GIS & multispectral imagery analysis software.
QA/QC procedures to be applied:	Map Accuracy Assessment via independent validation sub-set of ground-truth data (see SOPs of Forest Cover Maps for details).
Calculation method:	Area calculation in GIS.
Any comment:	The project area (carbon strata) has been re-stratified to accurately capture deforestation not being picked up by the PSP network from 2011-2013 (date of the applied imagery). This re-stratification is optional and conservative as only changes from forest strata (Woodland / Open Woodland) to Non-Forest are possible. No forest degradation is monitored.

3.3 Description of the Monitoring Plan

3.3.1 Overview

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 second monitoring period by sampling 40% of the previously established PSPs. This achieves a target of re-measurement of 20% of all PSPs per year of the crediting period and a complete re-measurment every 5 years as recommend in the VM0009 v1.1. Additionally new 93 Woodland plots were established to follow an issued Forward Action Request (FAR) from thest 1st verification. The new 93 Woodland plots were established in general priority areas for spatial balancing of the monitoring system agreed with the FAR and in areas remaining in the Woodland stratum after the re-stratification (see 3.3.2 below). For the new Non-Forest stratum, 10 new biomass plots were also added.

In the monitoring process, the project team applied the an update version of the validated SOP.[7]

3.3.2 Stratification

In order to most accurately estimate the biomass of the project area taking into consideration reasonable time and expenses, major strata are established. Until this monitoring period the strata were defined as Woodland (WL) and Open Woodland (OWL). In order to conservatively estimate project carbon stocks and Net Emission Reductions (NERs) the project proponent decided to undertake a voluntary, conservative re-stratification. This was done in order to create a more accurate monitoring of change from forest to Non-Forest for the large project area than possible entirely based on PSPs. The Re-Stratification was done re-monitoring the parameter Strata areas a_k as described above by analysis of multispectral satellite imagery of 2013, updating the stratification based on imagery of 2011. Areas mapped as WL or OWL in 2011 but no longer showing traits of forest cover in 2013 were attributed to a new stratum Non-Forest. No increase in WL or OWL area was included in calculations and no change between OWL and WL monitored. The re-stratification only conservatively allowed transition from areas of the WL or OWL stratum to the new Non-Forest stratum. The area of this last stratum is considered temporarily unstocked forest whose biomass development is monitored by new PSPs established during this 2nd monitoring period. The methodology and QA/QC procedures for this re-stratification have been provided to the auditor separately[8].

[7] The updated SOPs are file „140910_Kariba_SOP FOR TREE DATA COLLECTION_2014 version.docx“.

[8] The uploaded file: “140210_Kariba REDD+ - Annex Map training & validation.pdf”

Following this re-stratification, the stratum Woodland accounts for 269,457ha, the stratum Open Woodland accounts for 478,345ha and the stratum Non-Forest accounts for 37,186ha. Stratum areas have been updated in MOVERS to accurately calculate standard error and uncertainty correctly – as provided in the online database and the calculation of emission reductions ("141218_KARIBA ER MP 2_V03.xls").

3.3.3 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 a magnetic marker buried in the ground and by recording of GPS coordinates. 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 sampling error is calculated by using equation 47 of the methodology.

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

- Sample size: Each stratum must contain at least two sample plots. To estimate the number of plots and allocation of those plots to strata that will maximize sampling efficiency based on the amount of information available prior to sampling, the Sourcebook for LULUCF projects is used for guidance.[9] A pilot sample is conducted to initially estimate the mean and standard deviation of carbon stocks in each stratum.
- When arriving to the starting point of the first plot, a permanent marker (magnetic) is buried in the ground.
- Plot size and plot nature: The plot size is chosen based on the experience gained on an initial pilot sampling.
  Biomass plot:
  - 8.9 and 9 m radius circle for trees

[9] This calculation is base on the Sourcebook for LULUCF projects and the following approved methodologies: AR.AM0001, AM0005, AM0006, AR-AM0003, AM0004, AM0007

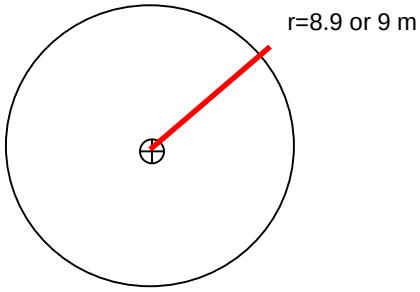


Figure 1: Schematic representation of a sample plot and the clockwise measurement

- In case of thicket woodlands, transects of 6 m x 42 m are implemented.[10]

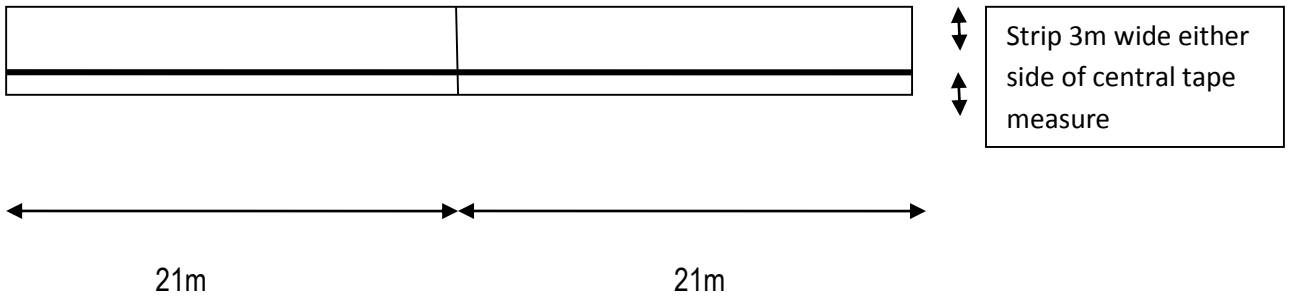


Figure 2: Diagram of transect plot. The centre point is marked.

- Woody plant data are recorded include the species (scientific name), circumference (measured in cm) at breast height and height (measured in m).

Leakage plots are assessed differently than both biomass plots. They are located in the reference area/leakage area, and necessarily placed in random spatial locations. They therefore cannot be conspicuously marked like the biomass plots. Within the leakage area, a sample of plot locations are randomly selected with uniform probability with a sample size determined by equation 10 of the methodology or based on the Sourcebook for LULUCF projects. The dimension (2 square ha; 145m x 145m) of all plots will be 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. Record factors (i.e. 0.2, 0.4, etc) corresponding to degradation is applied (for further detail please refer to PD section 3.3.4). The leakage plot is recorded in a GIS system.

The Kariba REDD+ Project implemented a total of 50 leakage plots following its SOPs for leakage plots following the requirements of VM0009 v1.1.

So far no systematic variations potentially present in the project area due to topography, management history, or other factors have been identified. In case systematic variation is identified

[10] Whenever possible, transect plots are implemented making cruise lines run perpendicular to slopes, rather than along contours

in the future, it will be documented in the monitoring report how the sampling design avoids bias that may result from these systematics.

The sampling teams have been specially trained for each monitoring activity described above. The forest inventory manual has been provided separately to the auditor in its updated form.

3.3.4 Organizational Structure

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

The project entity implemented procedures that ensure independent verification. Should there be differences in the electronic and paper based formats, these are clarified in the terms defined and procedures followed. Particular attention has been 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, had at least two members. Additional persons may be included to improve performance of the field crews when conditions require greater resources. If necessary some in the field crews were hired locally and acted as guides in the field.

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

The responsibilities of each crew member has been 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 administers 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 have been 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.

3.3.5 Data Collection and Storage

The personnel involved in the measurement of carbon pools have been fully trained in field data collection and analysis by the technical manager. SOPs[11] have been developed for each step of

[11] SOPs are provided separately in document "140910_Kariba_SOP FOR TREE DATA COLLECTION_2014 version.docx".

the field measurements and followed so that measurements are comparable over time. If different interpretations of the SOPs exist among the sampling teams, they have been 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 is used. All data sheets included a field to record crew composition. Communication between all personnel involved in measuring and analyzing data took place to resolve any apparent anomalies before final analysis of the monitoring data has been completed. If there were any problems with the monitoring plot data that cannot be resolved, the plot has not been used in the analysis. Additionally, field data have been 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 length of the project and the speed at which technology changes data archiving will be an essential component of the project. Data are 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. Furthermore the Monitoring and Verification System (MOVERS) is used for obtaining, recording, compiling and analyzing data relevant for the project. 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. An access to MOVERS has been provided to the auditors.

3.3.6 Quality Assurance (QA)/Quality Control (QC)

The project follows 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:[12,13,14]. The plan that describes specific QA/QC procedures is as follows:[15,16]

- Standard Operating Procedures (SOP)[17] are used for field data measurements.
- Training courses are 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 are 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. Following the requirements in VM0009 v1.1 section 13.10 a check cruise has been established. In accordance with the guidance from the LULUCF Sourcebook (Pearson et al. 2005) 10% biomass sample plots measured in the 2nd monitoring period were subject to remeasurement by a different field crew with the same level of training, following the same SOPs.

[12] IPCC GPG for LULUCF; Chapter 5.5 Quality assurance and quality control

[13] IPCC GPG and Uncertainty management in National GHG Inventories; Ch. 8 QA and QC

[14] IPCC GPG for LULUCF; Chapter 3.2 Forest land

[15] IPCC GPG for LULUCF; Chapter 5.5 Quality assurance and quality control

[16] IPCC GPG and Uncertainty management in National GHG Inventories; Ch. 8 QA and QC

[17] SOPs are provided separately in document "140910_Kariba_SOP FOR TREE DATA COLLECTION_2014 version.docx".

Data collection is an ongoing process. A centralized data system such as an online server-based and backed-up MOVERS is therefore used. The integration of carbon-credit centered monitoring activities into one central platform contributes significantly to increasing efficiency and decreasing the amount of errors.

The project proponent CGI is managing the project and is responsible for the centralized documentation of all project planning and implementation. QA/QC procedures have been implemented to ensure that biomass, soil and leakage plots are measured and monitored precisely, credibly, verifiably, and transparently. CGA ensured that the QA/QC plan is developed and implemented, coordinated QA/QC activities, and is responsible for documenting QA/QC procedures. For this purpose CGA designated its CTO Pieter Bezuidenhout as a QA/QC coordinator.

3.3.7 Allometric Equations

The project applies allometric equations from peer-reviewed literature that are similar to the project location and the location in which the equations was derived 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 specific default values are used for calculating the below ground biomass. A list of allometric equations has been provided separately to the auditor at validation stage.

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. 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 are 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 equation 62 of the methodology.

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

The carbon stock in standing dead wood in a plot is calculated using equation 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).

For conservativeness, all deadwood is assumed to be part of decay class II. DBH and height are measured on each dead tree. The volume of each dead tree is then estimated as a cone. The carbon stock for each plot is calculated using the equation 45 where equation 51 is applied for calculating the carbon stock per tree and equation 52 for calculation of the carbon in the stratum. Refer to the supporting document “130225_SDW.docx” for further reference and justification.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The cumulative deforestation model of the Kariba REDD+ Project predicted for the end of the 2nd monitoring period (June 30th 2014) a cummulative forest carbon stock loss of 9.56%. Subtracting the loss predicted for the previous, concluded 1st monitoring period, the loss of the 2nd monitoring period is 6.38%.

Due to the re-stratification 37,186ha of Open Woodland and Woodland were assigned to the Non-Forest stratum. Following the biomass sampling, the Non-Forest stratum has no significant woody biomass and is conservatively taken has zero biomass. Therefore this stratum also has no baseline emissions.

The baseline emissions are summarized in the table 5 below.

Table 5: Overview of Baseline Emissions.

Stratum	Total baselines emissions [tCO_2e]
Open Woodland	4,863,158
Woodland	1,016,977
Non-Forest	0
TOTAL	**5,880,135**

The confidence deduction for this monitoring has been calculated according to Equation 35 based on the average uncertainty (Equation 36) and accounts for 0 tCO2e.

4.2 Project Emissions

Emissions from burning: No emissions from the burning of woody biomass as a result of project activities in the project area have occurred. The project activities do not encourage increased burning of woody biomass. Very much to the contrary, reduced burning, firefighting training and cold burning of non-woody biomass to avoid serious woody-biomass burning are integral parts of the project.

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. A significant forest fire would change the detected landcover from forest to non-forest in the deforestation monitoring (see parameter in section 3.2). No major forest fires other than those listed in the deforestation results were detected in the monitoring period.

Event number	Date	Woody biomass consumed in tonnes
N/A	N/A	N/A
	TOTAL	0

4.3 Leakage

The project monitored 50 leakage plots and resolved [Eq. 33] to calculate the leakage factor[18].

The project remains convinced that its leakage mitigation and management strategies are fully adequate and effective. Further we topically defend that there is no causal relationship between observed degradation in the monitored leakage plots and the project activities. In our expert opinion all forest degradation observed in the leakage plots is either due to unrelated, baseline activities in the leakage area not increased by activities in the project area and forest degradation due to natural causes such as elephant damage, induced by increased population levels in the region due to the anti-poaching activities of the project proponents.

Still, in order to formally comply with the calculation approach of VM0009 v1.1 we estimate a leakage factor of ~0.018 or ~1.8%. Therefore the calculated leakage emissions amount to 106,102 tCO_2e [Eq. 22] and are deduced from Net Emission Reductions (NERs) calculated in [Eq. 34].

We re-iterate that this reduction is over-conservative in our view as we see no evidence for actual displacement of baseline activities from populations affected by project activities, but rather unrelated forest use by different populations and natural causes.

[18] Provided to the auditor as "140928_Leakage plots_MP2_FR.xlsx" separately.

4.4 Summary of GHG Emission Reductions and Removals

Net GHG Emission Reductions and Removals (NERs) are calculated using Eq. 34. The below table summarizes all components of Eq. 34. The total amount of VCUs is separated by 25% into vintage year 2012, 50% into vintage year 2013 and 25% into vintage year 2014. Vintage year 2012 consist of the period of July 1st to December 31st 2012, vintage year 2013 consist of the period of January 1st to December 31st 2013 and vintage year 2014 consist of the period of January 1st to June 30th 2014of the following year.

Table 6: Calculation of NERs..

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Buffer credits (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Vintage 2012	1,470,034	0	26,443	230,974.5	1,443,590
Vintage 2013	2,940,067	0	52,887	461,949	2,887,181
Vintage 2014	1,470,034	0	26,443	230,974.5	1,443,590
Total	**5,880,135**	**0**	**105,773**	**923,898**	**5,774,362**

We add columns to the table in the VCS Monitoring Report Template v3.3 according to the requirements.

The calculated total AFOLU Non-Permanence Risk Assessment is 16%.

Net GHG emission reductions or removals are calculated by solving equation 34 of VM0009 v1.1.

5,774,362 tCO_2e ($C^{[m]}$) = 5,880,135 tCO_2e ($C^{[m]}_{BE}$) – 0 tCO_2e ($C^{[m]}_{U}$) – 0 tCO_2e ($C^{[m]}_{PE}$) - 105,773 tCO_2e ($C^{[m]}_{LE}$)

All equations leading up to eq. 34 are solved in the provided supporting document “150331_KARIBA ER MP 2_V04.xlsx”.

As per clarification of the VCSA eq. 34 represents also the net carbon stock change for the basis of the buffer tool.

Net VCUs to which the project is eligible after deduction of the buffer credits are shown in the table below.

$C^{[m]} = C_{BE}^{[m]} - C_{U}^{[m]} - C_{PE}^{[m]} - C_{LE}^{[m]}$		[34]
Variables	$C^{[m]}$ = net GHG Emission Reductions and Removals (NERs) for monitoring period $[m]$ $C_{BE}^{[m]}$ = estimated baseline emissions for monitoring period $[m]$ $C_{U}^{[m]}$ = confidence deduction for monitoring period $[m]$ $C_{PE}^{[m]}$ = estimated project emissions for monitoring period $[m]$ $C_{LE}^{[m]}$ = estimated emissions from leakage for monitoring period $[m]$	
Section References	11, 11.1, 11.3	
Comments	This equation estimates total net GHG Emission Reductions and Removals (NERs) for monitoring period $[m]$	

Table 7: Eligible VCUs

Total net VCUs to project proponent in tCO_2e	**4,850,464**
Net VCUs to project proponent in tCO_2e, vintage 2012	1,212,616
Net VCUs to project proponent in tCO_2e, vintage 2013	2,425,232
Net VCUs to project proponent in tCO_2e, vintage 2014	1,212,616

5 ADDITIONAL INFORMATION

Accompanying documents:

- Calculation of emission reductions (“150624_KARIBA ER MP 2_V05.xlsx””)
- Stratification shapefile (“Kariba_Stratification2013_2nd_submission.shp”)
- CDM and Leakage Model (“130621_CDM and Leakage Model_V3.xlsx”)
- Leakage plot data and leakage factor calculation (“Leakage plot data and leakage fact)
- Leakage plot SOPs (“121130_SOP leakage area data collection.pdf”)
- SOPs version 2012 (“120429_PROCEDURE MANUAL FOR TREE DATA COLLECTION FINAL.pdf”).
- Updated SOPs version 2014 (“140910_Kariba_SOP FOR TREE DATA COLLECTION_2014 version.docx”)
- Non-Permanence Risk report for verification (“150331_Kariba_AFOLU_Risk Report_V2”)
- Non-Permanence Risk Calculation tool (“150331_Kariba_VCS Risk Report Calculation_V2”)
- Applied method for re-stratification and landcover maps (“140210_Kariba REDD+ - Annex Map training & validation.pdf”)
- List of allometric equations (“130401_Allometric eqns for auditors_v3.xlsx”)
- Description of functioning of MOVERS (“130328_MOVERS Kariba_V2.docx”).
- Data storage, allometric equations and calculations on MOVERS (access is provided to the auditors)
- Explanations to the Longevity of the project (“150401_Kariba_Explanations to Longevity.docx”)