KARIBA REDD+ PROJECT

In partnership with the landowners:
Binga RDC
Hurungwe RDC
NyamiNyami RDC
Mbire RDC

Technical Assistance Provided by:

Project Title	*Kariba REDD+ Project*
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PROJECT DETAILS

1.1 Summary Description of the 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 project, which started on July 1st, 2011 will generate a total of around 196,513,929 emission reductions from the reduction of deforestation. Additional carbon benefits resulting from stopping degradation will not be claimed. 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 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. 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 offset 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.

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[1]Timberlake, J. (2000), Biodiversity of the Zambezi basin. Occasional Publications in Biodiversity No. 9, Biodiversity Foundation for

http://www.biodiversityfoundation.org/documents/BFA%20No.9_Zambezi%20Basin%20Biodiversity.pdf.

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

Carbon Green Investments (Guernsey)
18-20 Le Pollet Street
St. Peter Port
Guernsey
UK, GY1 1WH

1.4 Other Entities Involved in the Project

Entity Involved	Contact Information	Roles/Responsibilities
South Pole Carbon Asset Management (South Pole)	Technoparkstrasse 1 8005 Zurich Switzerland Phone: +41 43 501 35 50 Fax: +41 43 501 35 99 www.southpolecarbon.com	South Pole elaborates and oversees the development of appropriate project design and monitoring techniques in line with the guidelines of the VCS and CCBS. South Pole is a globally active carbon project developer and consultant with a long and successful track record working on forestry-based carbon projects. In 2011 and 2012, South Pole was elected the Best Project Developer of the Voluntary Carbon Markets.[2]
Environment Africa (EA)	www.environmentafrica.org	EA implements activities that protect forested wilderness areas. EA is an NGO working in Southern Africa, which contributes its expertise and experience to the community engagement side of the project.
Black Crystal Consulting (Black Crystal)	http://blackcrystal.co.zw/	Black Crystal supports the biodiversity component of the project and is involved in the on-the-ground assessment of carbon stocks. It is a Zimbabwean environmental consultancy agency with a long track

[2]http://envirofinance.wordpress.com/2011/02/11/whatever-happened-to-jp-morgan/

		record in working with natural resources in Zimbabwe and neighboring countries.

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 and the end date is June 30th 2041.

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 provided by Black Crystal and Environment Africa, as well as further management and protection work such as reporting, communication, capacity building and control activities. In addition, all bilateral agreements for the verified emission reductions between CGI and the RDC were signed, before the project start date, in March 2011 (for Binga, Hurungwe, Mbire and Nyaminyami). Supporting documentation has been provided separately to the auditor.

The baseline is reassessed every 10 years after the project start date and during the crediting period (new baseline starting on July 1st 2021 and then again on July 1st 2031) and is subsequently validated at the same time as the following verification. Each monitoring period will cover no more than five years (cf. VM0009 v1.1, p. 15). The second monitoring is scheduled to cover the period from July 1st 2012 to June 30th 2014. The consequent monitoring periods are anticipated to cover one or two years each, but in no case more than five years.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project	
Large project	X

Table 1: Total project area (ha) split into regions, WL an OPW

Project area (ha)	Woodland (WL)	Open Woodland (OWL)	Total
Binga	55,749	101,903	157,652
Hurungwe	64,087	67,393	131,480
Mbire	46,287	223,226	269,513
NyamiNyami	109,936	116,405	226,341
Total	**276,059**	**508,928**	**784,987**

The table below summarizes the estimated emission reductions for both biomass and soil emissions. The year indicates the year in which the monitoring period ends. E.g. the emissions reductions achieved in monitoring period 1 (July 2011- June 2012) are reflected here as year 2012 for simplicity.

Years	Estimated GHG emission reductions or removals (tCO_2e)
2012	6,896,913
2013	7,030,303
2014	7,187,083
2015	7,365,343
2016	7,414,472
2017	7,431,841
2018	7,423,208
2019	7,393,285
2020	7,345,932
2021	7,284,309
2022	7,211,002
2023	7,128,129
2024	7,037,423
2025	6,940,306
2026	6,837,939
2027	6,731,274
2028	6,621,089
2029	6,508,024
2030	6,392,599

2031	6,275,243
2032	6,156,306
2033	6,036,074
2034	5,914,783
2035	5,792,623
2036	5,669,753
2037	5,546,302
2038	5,422,374
2039	5,298,056
2040	5,173,419
2041	5,048,521
Total estimated ERs	**196,513,929**
Total number of crediting years	**30**
Average annual ERs	**6,550,464**

1.8 Description of the Project Activity

The project will lead 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 projects crediting period, as well as the project activities, is set at 30 years, starting from July 1st, 2011 and ending on June 30th, 2040.

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. 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* will promote 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 will be held following the FAO's Farmer Field School approach.[4] Inputs such as tools and seeds will be provided.

Where tobacco cultivation is a major driver of deforestation (mainly in the Hurungwe RDC) the project will promote the use of alternative high-value crops such as garlic and chili. This will reduce the demand for wood used in the tobacco curing process. Chili and garlic will be promoted by the provision of seeds and tools as well as training on cultivation, marketing, and how to minimize post-harvest losses.

To further increase agricultural production, community gardens will be established. This will be 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 are expected to contribute significantly to food production, thus reducing pressure on the forest from the expansion of subsistence farming. Where necessary, boreholes will be newly 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. Selected wards in the *Kariba REDD+ Project* RDCs will pioneer the beekeeping project activity and will act as reference wards during a scaling-up phase that will involve all of the wards. On the ground, beekeeping activities include workshops on the construction of beehives and assistance in processing and marketing the produced honey within regional markets. A processing center will be set up in the medium term of 3-5 years. The project partner, Environment Africa, is experienced in promoting sustainable honey production, constructing processing centers for honey and marketing honey.

From the perspective of locals, beekeeping will increase 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. Beehives 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 USD/year. The honey-processing centres can add further value to beekeeping through the production of wax and candles, and more efficient honey extraction can be achieved with a honey extractor.

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 will aim to create an alternative source of fuelwood for tobacco curing and household use. In the Hurungwe district, the project will work with the tobacco

[4]http://www.fao.org/nr/land/sustainable-land-management/farmer-field-school/en/.

companies. These companies will provide seeds of the fast-growing eucalyptus tree (*Eucalyptus robusta*, *E. tereticornis)* but will not provide other necessary hardware (e.g. planting pockets) and training on how to do the nurseries, planting and management of the trees.

The project will also promote 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 will be 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.

Social Forestry – Indigenous Knowledge Systems

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 will be recognized and mapped. This will enhance the conservation efforts of the forest resources. The mapping exercise will also highlight areas with abundant non-timber forest product resources that the communities consider for income generation. These include fruits, murara and thatch grass. The communities will be trained in sustainable harvesting, processing and marketing. This will enhance conservation because the communities will get more tangible benefits from their resources.

Picture 1: Community Mapping in NyamiNyami RDC during Participatory Rural Appraisal (PRA) in preparation of project activities

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) will be established and maintained by setting controlled fires at the start of the dry season to avoid the spread of high-dry-season fires. Firebreaks will be intermittently established at the eastern/southern side of roads and, in the following year, on the western/northern side of roads. The controlled fires burn the vegetation covering the soil, but not the trees ("cold fires", see Picture 2). Fire management will reduce the degradation of the forest, allow the forest to recuperate[5] and stop and reverse (slowly) soil carbon loss. To maximize carbon benefits of fire management, fire management should begin in areas with carbon-rich soils and in areas with fairly non-impacted forestlands. 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.[6] Controlled burning will be carried out by the project's on-the-ground-management teams (see below).

Additionally, awareness campaigns will be done and other training on fire making, fire fighting and management will be conducted.

[5]Miombo species are known to be able to survive the destruction of their aboveground parts (Chidumayo, 1997; Frost, 1996; Nyerges, 1989; Robertson, 1984). They are generally good at re-sprouting and can reproduce from root suckers; 15 years of mattocking were required to kill Brachystegia spp. (Robertson, 1984). Re-sprouting is a common response to destruction by fire.

[6]E.P.S. "Fire: controlled burning explained (cold burn)"

Picture 2: Road serving as a fire break and on left side vegetation after “cold fire” with undergrowth gone as fire-fuel but trees still alive

Alternative and sustainable building materials (brick making)

The local communities typically use wood to build their huts or burn bricks from clay soil, which also requires substantial amounts of wood. This results in more deforestation and degradation of forest resources. The project will promote the Hydraform technology as an alternative, which requires less wood resources. To get this project activity started, a Hydraform molding machine is purchased and will be used for the project. This will be run by local youths, thereby creating new income generation opportunities.

On the Ground Management teams

The *Kariba REDD+ Project* will be present within the local communities via its on-the-ground-management (OGM) teams. OGM teams will 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 will be recruited locally. CGI will have a strong influence on the selection of team leaders, to ensure their reliability. There will be one OGM team per RDC, where they have a steady office/camp that will also serve as a contact point for the local population. The OGM teams will be 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 (see above),
- 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.

Community and Project Sustainability Fund

A significant 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 is being undertaken on communal lands and as such it is imperative that the people within these communities can improve their livelihood security via the project. The project proponents feel that this aspect of the revenue distribution is of utmost importance. A Board will decide upon the use of the Community and Project Sustainability Fund's resources. The Board will be comprised of Carbon Green Africa (CGA) Trust[7] members in conjunction with selected members of the Community and Council from each RDC. Oversight will be given by CGI to ensure all VCS criteria are met and funds are reaching their required targets.

The fund will be used to improve health and education in the project area (see below).

Health

Health improvements will include the following:

- Targeted clinics will have all required improvements made and basic amenities will be brought up to an acceptable standard. New buildings will be constructed where applicable.
- Availability, quality and number of healthcare practitioners per clinic will be assessed and salaries of the practitioners will be reviewed and subsidized where required.
- Targeted clinics will be stocked with required basic drugs and dressings etc. so that the majority of common illnesses/injuries can be treated immediately.
- A "Healthcare Officer" will be appointed to assess, monitor and manage this initiative. The Healthcare Officer will report to Board of Community Fund who will direct funds accordingly.

Education

Education improvements will include the following:

- Targeted schools will have all required improvements made, and basic amenities (e.g., roofing, desks, windows, stationary, books, food) will be brought up to an acceptable standard. New buildings will be constructed where applicable.
- Numbers, distribution and salaries of teachers will be assessed and subsidized when necessary, ensuring an acceptable pupil/teacher ratio.
- Targeted schools will have a bursary initiative to subsidize all pupils' fees. For example, the Community Fund will pay some pupils' fees, enabling many children to come to school that might not be able to come otherwise due to financial constraints. In turn this will relieve families of financial pressure associated with sending their children to school and will maximize attendance.
- Climate change and environmental conservation topics will be added to the curriculum and careers within the sector/project will be encouraged after leaving school.

[7] Carbon Green Africa (CGA) is the name of the local trust that will receive the net revenue on the sale of the VERs, distribute it accordingly as per Revenue Distribution Agreement and ensure all is done in a fair manner, including overseeing Community and Project Sustainability Fund. Board members will include two CGI members, a local lawyer and local/regional climate change representatives. A scheme representing the CGA trust's structure is provided to the auditor.

- In order to assess and monitor, an "Education Officer" will be appointed to manage this initiative. The Education Officer will report to the Board of the Community Fund who will direct funds accordingly.

Newsletter

During the project lifetime, Carbon Green Investment (CGI) will publish a newsletter, which is foreseen to be issued on a quarterly basis. The newsletter will be in English as well as the local languages, Shona and Tonga. Topics covered by the newsletter will include the following:

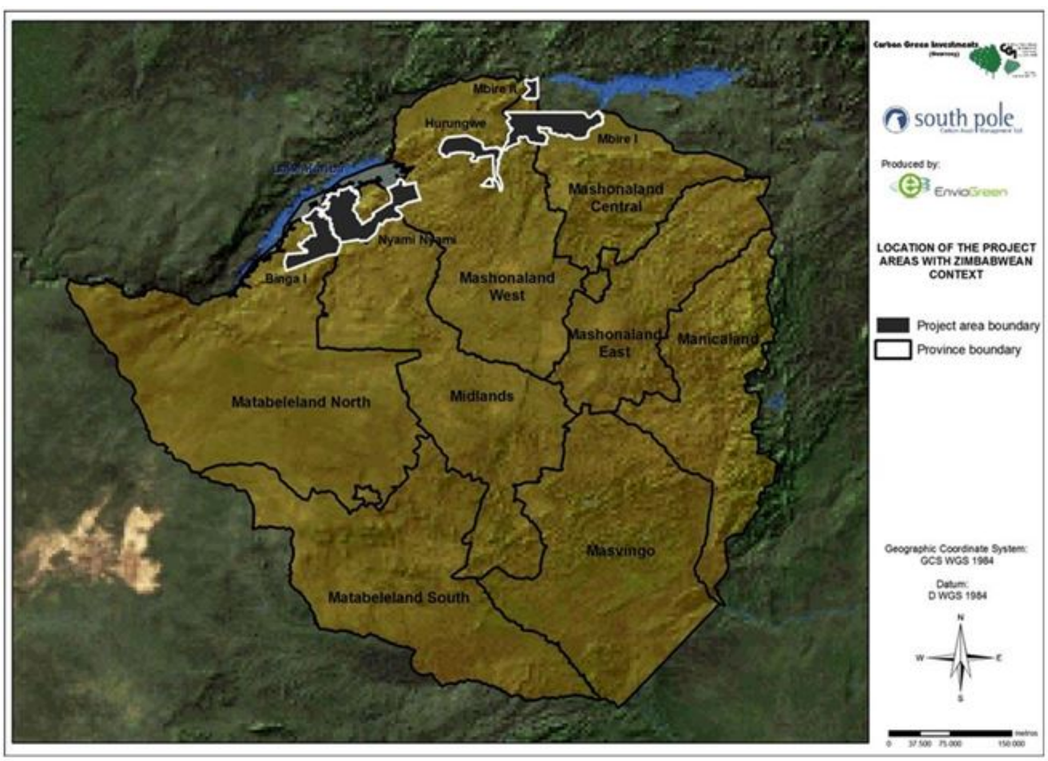
- General information and progress of the project
- Topics of environmental awareness and education
- Grievances regarding the project and responses by CGI
- Job advertisements as part of the project's local recruitment procedure
- Other topics to be agreed upon in cooperation with the local RDC administration

The newsletter will be printed in Harare (the capital city of Zimbabwe) and delivered via the OGM teams. It will be made available in the RDC offices, and in central points in each ward, such as schools and clinics.

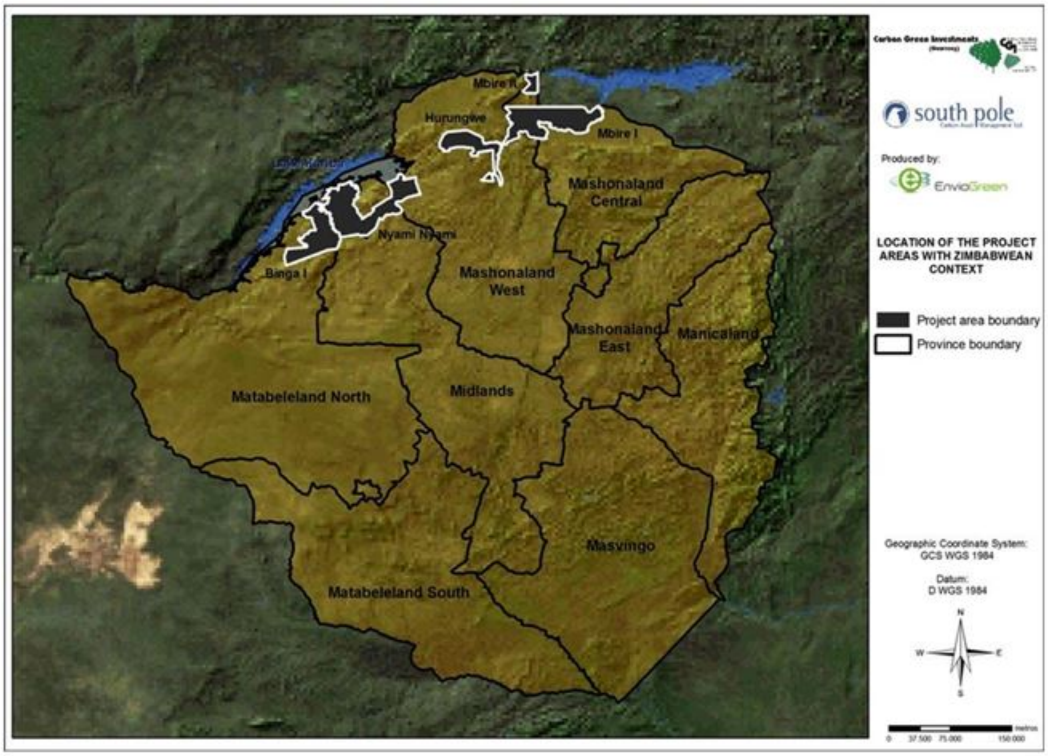
A detailed yearly work plan and budget allocation has been provided separately to the auditor.

1.9 Project Location

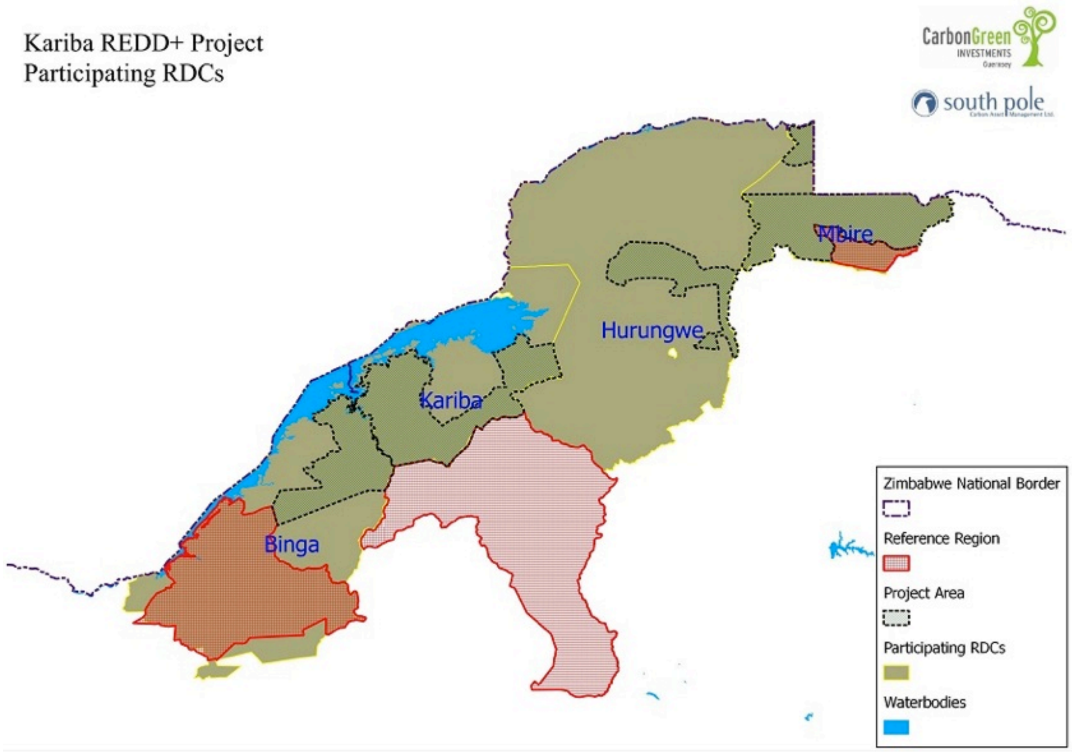
The Kariba REDD+ Project is located in northwestern Zimbabwe, partly along the southern shore of Lake Kariba, the largest artificial lake in the world by volume. The project area spans four provinces: Matabeleland North, Midlands, Mashonaland West and Mashonaland Central. The project is administered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



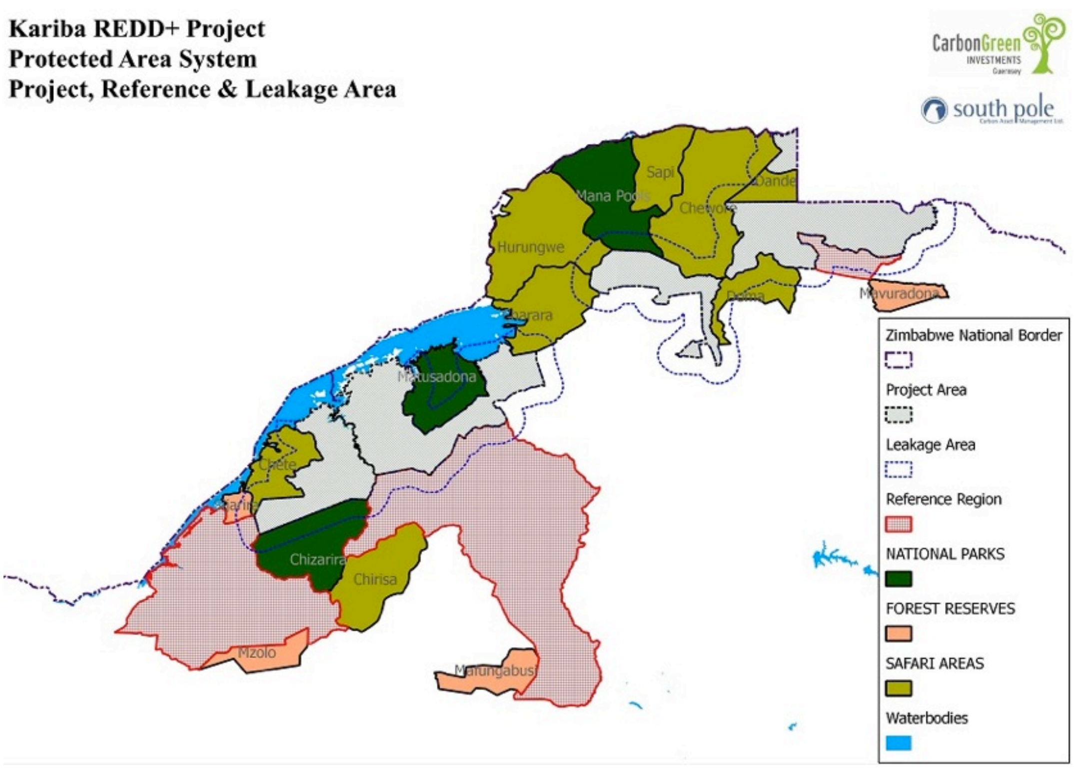
Map 1 and Map 2). The project is community-based and implements activities in conjunction with the local population. As the affected communities all live within the boundaries of the project area, the project zone equals the project area in this project. A brief description of the four participating RDCs is given below.



Map 1: Location of the project in Zimbabwe



Map 2: Location of the project area, and reference area and participating RDCs with names in blue.



Map 3: Project, Reference and Leakage area with protected area system of the region.

Binga
The Binga RDC area is located in the Matabeleland North province. It has a forest cover of 157'652.5 hectares and 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 covers 226'341.46 ha and 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 and has a forest cover of 131'480.28 ha.

Mbire
The Mbire forest area covers 269'513.1 ha 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.

Detailed maps and KML file of Woodland and Open Woodland distribution in the project area have been provided separately to the auditor.

1.10 Conditions Prior to Project Initiation

Background information
Zimbabwe's only president dominated the country's political system since independence in 1980. The governments land redistribution campaign, which began in 2000, caused an exodus of commercial farms, crippled the economy, and ushered in widespread shortages of basic commodities. The government's land reform program, characterized by chaos and violence, has badly damaged the commercial farming sector - the traditional source of exports and foreign exchange and the provider of 400'000 jobs - turning Zimbabwe into a net importer of food products.[8]
Zimbabwe's protracted socio-economic crisis has taken a toll on the country's agricultural sector, hitting the poorest farmers the hardest. About 70 per cent of the population makes a living from agriculture. However, steep declines in production over the years, brought on by the high cost and shortage of inputs, adverse weather conditions and policy constraints, have seen farmers' earnings dwindle and food insecurity rise. Commercial farms were producing just one-tenth of what they produced in the 1990s, due in part to land reform policies, while communal farms,

[8]CIA world factbook, Zimbabwe: https://www.cia.gov/library/publications/the-world-factbook/geos/zi.html

which once grew the bulk of the country's maize, were only producing about one-quarter of the typical output some years ago.[9]

Inflation, which reached a record high in 2008, made it difficult for many people to buy basic commodities. The annual rate of inflation has since dropped to zero following the government's decision in March 2009 to adopt the South African rand and the US dollar over the local currency.[10] Until early 2009, the Reserve Bank of Zimbabwe routinely printed money to fund the budget deficit. The power-sharing government formed in February 2009 has led to some economic improvements, including the cessation of hyperinflation by eliminating the use of the Zimbabwe dollar and removing price controls.[11] But, still, many urban and rural households are not able to afford the food they need. Findings from the latest report from the Zimbabwe Vulnerability Assessment Committee show that the number of people requiring food assistance during the January-March 2010 lean season was 2.17 million.[12]

The food shortages in Zimbabwe create pressure on forests as well as unproductive lands, a substantial portion of which may have been irreversibly damaged. Between 1990 and 2010, Zimbabwe lost an average of 327'000 ha, or 1.48% per year. In total, between 1990 and 2010, Zimbabwe lost 29.5% of its forest cover, or around 6'540'000 ha.[13]

Land use

Please refer to section 2.4 Baseline of the present document.

Project area

The Project area is the forest cover of the most recent remote sensing imagery at project start date analyzed of the RDCs Binga, NyamiNyami, Hurungwe and Mbire. It is stratified into Woodland and Open Woodland.

The project area lies within Zimbabwe's Natural region IV, which is a semi-extensive farming region covering about 38% of Zimbabwe. Low and seasonal rainfall with periodic dry spells make crop production risky except in specific localities where drought-resistant crops are grown (typically as a side-line).[14]

Forest areas are transformed for agricultural purposes (subsistence agriculture), further deforestation and degradation occur because of the use of fuelwood for households and tobacco curing, timber for poles used in the construction of homes, garden fencing and fires.[15] Fires are frequent and often occur between June - October. Fires result in the loss of the forest in those non-agricultural areas that are still accessible to hunter-poachers. Within the project area, there is almost no dense city-like concentration of population; rather, more than 95 per cent of the inhabitants are rural dwellers, living on their farms, which are widely distributed over the area.

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[9] FAO country information Zimbabwe: http://www.fao.org/isfp/country-information/zimbabwe/en/

[10] FAO country information Zimbabwe: http://www.fao.org/isfp/country-information/zimbabwe/en/

[11] CIA world factbook, Zimbabwe: https://www.cia.gov/library/publications/the-world-factbook/geos/zi.html

[12] FAO country information Zimbabwe: http://www.fao.org/isfp/country-information/zimbabwe/en/

[13] http://rainforests.mongabay.com/deforestation/2000/Zimbabwe.htm

[14] http://www.fas.usda.gov/pecad2/highlights/2004/06/zimbabwe/images/aez_zimababwe.htm

[15] Environment Africa: Kariba REDD Baseline Report, 2011

Poaching, especially of black rhinos and elephants, is a continuing problem and has resulted in severe losses of animals despite protection efforts.[16]

Several wildlife species are perceived as pests by farmers and are frequently eliminated on private lands. Livestock farmers have, for example, eradicated the African wild dog from large areas. The Aardvark (*Orycteropus afer)* is routinely exterminated on agricultural land. Leopards are normally not tolerated by livestock farmers, although that situation may be different in places where safari tourism is allowed.

Use of resources for subsistence by expanding rural populations is placing substantial strain on the ecoregion. Almost all (98 per cent) of the people living in the project area depend on fuelwood for cooking, heating and lighting.[17] Overgrazing by communal livestock is causing damage to ecosystems in Zimbabwe. Hunting for bush meat was once conducted primarily for subsistence and cultural traditions. Now, the trade is becoming commercialized and urbanized, often catering to the urban market. Other species are used for traditional medicine. For example, the scales of the Ground Pangolin (*Manis temminckii*) are used as love charms.

Between 2001 and 2003 the government of Zimbabwe enticed large numbers of people to move from their villages to commercial farms. The farms were portrayed as “new homeland” and a promise of agricultural finance was made by the government. Financial backing for the project never materialized. Several years later, hyperinflation surfaced. In the end, most people left the commercial farms and moved back to their villages. Hyperinflation led to the loss of jobs as many people could no longer afford to live in the towns. This caused many people to move to rural areas and forced them to become self-sufficient. That caused an expansion of subsistence agriculture and led to the clearing of more land. Now, with a USD economy in place, many people avoid working in towns and prefer instead to engage in small-scale farming in their home areas (from an economic point of view, they see this as their best option).

Geology

The project area is dominated by late/mid to pre-Cambrian formations, Triassic grits and sandstones, and intrusive granites and gneisses. Common commercial mineral resources include gold and copper. Diamonds and limestone are found in the sandstone formations. The geomorphology of the area is characterized by flat or undulating plains with granodiorite intrusions that often rise up above the woodland and take the shape of rounded hills (also known as dwalas or inselbergs[18]).

Soils

Soils are derived from the underlying geology, although there are some colluvial deposits along the base of the Zambezi River escarpment, and narrow strips of alluvium along the banks of the larger rivers. In the west, around the town of Binga, the soils are formed from the sandstones and quartzite of the Triassic, Permian, and to a lesser extent, the Cretaceous and Umkondo

[16] http://rainforests.mongabay.com/deforestation/archive/Zimbabwe.htm

[17] Environment Africa: Kariba REDD Baseline Report, 2011

[18] http://www.worldwildlife.org/wildworld/profiles/terrestrial/at/at0719_full.html

formations. These soils belong to the Siallitic group of the Calcimorphic order, meaning they are unleached soils with large reserves of weatherable minerals, and sometimes with calcareous accumulations in the sub soil.[19] The soils are moderately shallow to moderately deep, fine-to-medium-grained loamy sands. There are also isolated patches of deep sands with <10% silt and clay in the upper 2m of the soil with very little reserves of weatherable minerals. South of Binga, along the base of the Chizarira escarpment, are deep, medium-heavy-textured, dark brown colluvial soils (clays and silts), usually with a calcareous layer below 120cm depth. Where Karro mudstones form the underlying rock, the soils are greyish-brown, sandy-clay loams in which saline areas often occur. Moving east towards Sengwa, the soils become very shallow lithosols, typically <25cm deep, laying over weathering rock or gravel with patches of deep, heavy-textured clays.

Moving east, much of Nyaminyami has sandstone / quartzite derived siallitic soils. The GacheGache area has patches of heavier clay soils overlain in places by colluvial and alluvial quarzitic sands. The western part of Hurungwe is covered with shallow lithosols derived from phillites and quartzites. Further east, the soils are kaolinitic, where the clay fraction is predominately kaolinite and there may be free oxides of iron and aluminum, particularly in depressions and seasonal wetlands. These soils are moderately shallow to moderately deep brown-reddish brown fine-medium grained sandy loams over sandy clay loams formed from gneisses. These soils have better agricultural potential than those in the east.

Mbire soils are a combination of sandy siallitic soils with areas of nitric / sodic soil. Natric or sodic soil contain significant amounts of exchangeable sodium within 80cm of the surface. The sodium ions de-stabilise the clay lattice and these soils are extremely susceptible to erosion once the A horizon is removed. Soil capping is common.

Climate

According to the World Map of Köppen-Geiger Climate Classification[20], the project area includes three different classes: Aw (equatorial winter dry), Cwa (warm temperate, winter dry, hot summer) and BSh (arid, steppe, hot arid). It is a typical continental / east coast climate, with summers that are humid due to unstable tropical air masses or onshore trade winds. The annual rainfall ranges between 731 mm and 804mm (see Table 2, p. 18). Average mean temperature is 31°C with a monthly average minimum in July of 26°C and average maximum in October of 36°C. Yearly average relative humidity is 61 per cent. The general climate of the Zambezi Valley is hot and dry with a short rainy season from November to April. Evapotranspiration is high and exceeds rainfall in most months, except in December, January and February in the middle of the rainy season. The rainy season is the only time that underground water aquifers can be replenished. In terms of general land classification, the eastern parts of the project area (Binga, Nyaminyami) fall under "Extensive Farming Region" where the "rainfall is too low and erratic for the production of even drought resistant fodder and grain crops." Given the rainfall amount and pattern, the only sound farming system is cattle/game ranching. Towards the western parts of the project area

[19] Surveyor General, 1979, Provisional soil map of Zimbabwe Rhodesia. Available online under http://eusoils.jrc.ec.europa.eu/esdb_archive/eudasm/africa/maps/afr_zw2006_so.htm

[20] http://koeppen-geiger.vu-wien.ac.at/present.htm#maps

(Hurungwe, Mbire) annual precipitation is higher and allows semi-extensive and semi-intensive farming.[21]

Table 2: Annual rainfall in mm at different location in the project area and the reference area[22]

Project Area	Town	Rainfall (mm)
Hurungwe	Makuti	788
Mbire	Karoi	804.1
Nyaminyami	Kariba	765.5
Binga	Binga	731.7
Reference area	Gokwe	762.7

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

Zimbabwe has signed the Kyoto Protocol and has a Designated National Authority (DNA). However, to date, Zimbabwe has hosted neither a CDM project activity nor a carbon project related to the voluntary carbon market. Zimbabwe is also not yet a part of the UN-REDD process.[23]

The Forest Act and the Communal Lands Forest Produce Act (CLFPA)[24] are the principal pieces of legislation that govern the exploitation and protection of forest and woodland resources in Zimbabwe. The CLFPA was established in 1987 and gives inhabitants of communally-owned land (such as RDCs) the right to exploit the forest products. It is also explicitly referred to in the Rural District Council Act (see section G1.6).

Forestry Act: This act was created specifically to deal with Zimbabwe's forests and was designed with the intention of preserving such forests, aiming to deal with issues such as sustainability, agriculture and settlement and creating penalties for any breaches of its regulations. The act applies to forestry reserves only; it is, therefore, not of relevance to the project.

Natural Resources Act: This act was created with the intention of giving general guidelines on the management of natural resources within Zimbabwe and refers to other acts to deal with specific respective resources.

Environmental Management Act: This act was designed to oversee all other acts that make reference to matters of the environment, such as the Natural Resources Act or the Mines and Mineral Act. For example this act was designed to ensure that Environmental Impact Assessments are carried out when relevant (not relevant to this project).

[21] Surveyor General of Zimbabwe, 1984. Natural regions and farming areas. Available online at http://eusoils.jrc.ec.europa.eu/esdb_archive/eudasm/africa/maps/afr_zw2012_sm.htm.

[22] http://www.climate-charts.com/Countries/Zimbabwe.html

[23] http://www.un-redd.org/AboutUNREDDProgramme/tabid/583/Default.aspx

[24] http://faolex.fao.org/docs/pdf/zim8819.pdf

Rural District Councils Act: This act contains information that states that the Rural District Councils have complete mandate over any proceedings that occur within their lands. The council has the power to sign contracts and agreements with project developers. The act is of certain relevance for the project since all activities have to be approved by the relevant council (relevant to this project).

Traditional Leaders Act: This act was implemented to ensure that the various indigenous tribes and leadership thereof maintained their cultural identity and authority. Traditional rules, myths and beliefs have to be respected within the project area.

Labour Relations Act: This act was designed to regulate the general terms and conditions of employment in order to protect both the employer and employee and to ensure both parties fulfill their obligations.

Communal Land Act: This act was developed for the communal areas that are overseen by Chiefs and Headmen; the act operates in conjunction with the Traditional Leaders Act and The Rural District Council Act.

The Ministry of Environment and Natural Resources, through its line of parastatals (the Forestry Commission, the Environmental Management Agency and the Department of National Parks and Wildlife Management), is the major player in forest biodiversity management. Other sectors such as agriculture, construction and water have both direct and indirect impacts on forest resources. However, there is no formal cooperation between the two sectors as the role of trees and woodland is not clearly defined in Zimbabwe's agricultural policy. Zimbabwe is a signatory to a number of international conventions but has, in the past, had difficulties attracting funding sources to implement related obligations or compromises. To date, Zimbabwe has not started formal preparations for a REDD+ mechanism.

The project will comply with all project-related laws and acts. The implementation of the project activities will not lead to the violation of any applicable law, regardless of whether or not the law is enforced.

1.12 Ownership and Other Programs

1.12.1 Right of Use

No national, explicit laws on REDD or carbon ownership exist in Zimbabwe. The RDCs have, jointly with the management of all soil and above-soil natural assets including trees and biomass, the right to environmental goods and services in the area.[25]

While no explicit carbon rights are established, the Rural District Council Act declares the RDC's right to "take measures for the conservation or improvement of natural resources" (Section 6) and furthermore to be funded by "amounts received by the council in terms of the Communal Land Forest Produce Act" (Section 118g). Therein, it is stated that: "The inhabitants of any Communal

[25] Please refer to the CCBS PDD "Kariba REDD+ Project" to sections G1.6 (Rural District Council Act: http://www.parlzim.gov.zw/index.php?option=com_content&view=article&id=116&Itemid=36) and G5.1 (Communal Lands Forest Produce Act)

Land shall have the right, within that Communal Land, to exploit for their own use any forest produce" (Section 4 (1)).

The project's agreements with each RDC in the project area transfer the carbon rights to the project proponents. The contracts establish the *Kariba REDD+ Project* as the common project of the project proponent and the local RDCs. The contracts give CGI the rights to develop, establish and market the project with support of the RDCs and establish benefit sharing of the carbon revenues. The benefit sharing mechanism is described in a separate document.[26] Copies of the contracts are separately provided to the auditor.

1.12.2 Emissions Trading Programs and Other Binding Limits

N/A: The only emissions trading program Zimbabwe signed and ratified in June 30th of 2009 is the Kyoto Protocol. REDD is not a Annex 1 country of the Protocol, therefore emission reductions generated by the project will not be used for another emission trading program.

1.12.3 Participation under Other GHG Programs

The project is not seeking registration under any other GHG program.

1.12.4 Other Forms of Environmental Credit

The project is not seeking to generate any other GHG-related environmental credits other than Verified Carbon Units.

1.12.5 Projects Rejected by Other GHG Programs

N/A: The project has not been rejected, or applied for another GHG program.

1.13 Additional Information Relevant to the Project

Eligibility Criteria
The project is not a grouped project.

Leakage Management
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*.[27]

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 totaling 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.

[26] "130816_Kariba Benefit sharing.pdf", commercially sensitive information.

[27] See Wunder, S., How do we deal with leakage? In: Angelsen, A. (ed.) 2008, Moving ahead with REDD: Issues, options and implications. CIFOR, Bogor, Indonesia.

- 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, will 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 (see section 1.8 of the present document). 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 will be 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 will be 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.

Commercially Sensitive Information
The following supporting documents are commercially sensitive:

- “130816_Kariba Benefit sharing.pdf”

- „Cash Flow 2012-2041.pdf“

Further Information
N/A

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

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

2.2 Applicability of Methodology

Applicability condition 1:

This methodology was developed for avoiding deforestation and assumes that degradation and deforestation occur as a result of land use conversion to agriculture for the cultivation of non-perennial (annual) crops rather than for commercial timber harvest. This methodology may be used if all the drivers and agents of deforestation are consistent with those described in section 6 of this methodology.

Justification 1: The drivers and agents of deforestation are consistent with those described in section 6 of the methodology. Deforestation agents are members of the communities and local poachers who are causing fires. Deforestation is mainly driven by socio-economic interests and because of the need for woody construction material for settlements. For further details, please refer to section 2.4 of the present document.

Binga: The main crops are maize and millet, while some areas also produce cotton, cassava and groundnuts. Irrigation schemes are few. Cattle and goats are reared. Traditional fishing helps in providing additional food.

Hurungwe: The main crops grown in the area are maize, tobacco, cotton, groundnuts, sunflower and soybeans. The district has established and functional irrigation schemes. Livestock reared by the communities include cattle, goats, donkeys, sheep, pigs and horses.

Mbire: The main crops are maize, sorghum, millet, cowpeas, pumpkins, bananas, cotton and vegetables. Cattle, goats, sheep, pigs, poultry and donkeys are reared. Farmers also do a lot of fishing in the Zambezi, Manyame, Msengezi and Angwa rivers.

Nyaminyami: The main crops grown are sorghum, millet, maize cotton and vegetables. Cattle, donkeys, goats, sheep and chicken are also reared. In addition, farmers are also fishing.

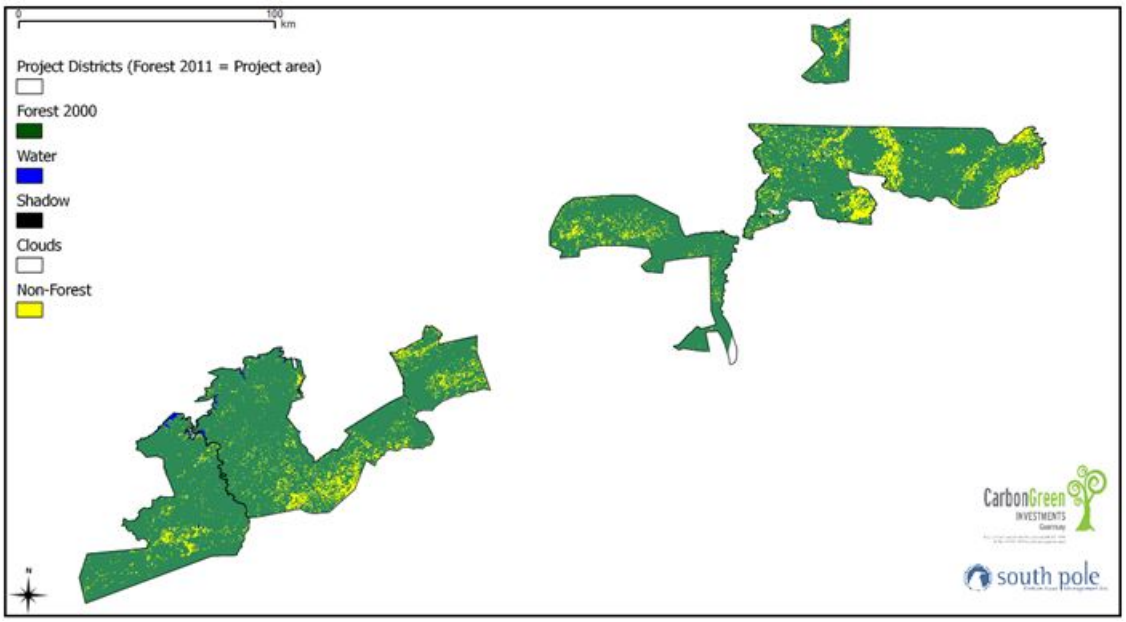
Applicability condition 2:

Agriculture in the reference and leakage areas is permanent and cultivation activities do not shift.

Justification 2: There is no shifting cultivation in the area. Lands in the project, reference and leakage area will not return to forest land after being left fallow. This is primarily due to crop rotation. Any coppicing is constantly cut out until all below ground biomass dies out, the stumps are burnt to below ground level.

The fact that the land will not return to forest is further supported by the Communal Lands Act. In PART III, Section 8, subsection 2b it is stated that the RDC shall grant consent to persons who according to the customary law of the community have traditionally and continuously occupied and used land in the concerned area. Therefore, once land has been allocated to a family it remains so in perpetuity and is therefore continuously under agricultural or other anthropogenic use, and will not convert to forest. The Communal Lands Act has been provided separately to the auditors.

Applicability condition 3:
Forestland in the project area qualifies as forest as defined by FAO 2010 or under the definition of forest set by the residing designated national authority (DNA) of the project country, when it has resided as forest for a minimum of 10 years prior to the project start date (VCS, 2008).
Justification 3: Forestland in the project area qualifies as forest as defined by FAO 2010, since there is no host country DNA forest definition, given that the forest is or has the potential to grow in-situ to more than 5 meters of height and has a canopy cover above 10 percent. We provide below the output of our classification from satellite imagery from 2000 depicting distribution of forest (including Open Woodland and Woodland) in the project area. Woodland is a forest classification commonly used in the project area. Supporting documentation has been provided separately to the auditor.



Map 4: Kariba REDD+ Project area in 2000 from satellite classification (see SOPs for Forest Cover Maps)

Applicability condition 4:
No biomass is harvested for use in long-life wood products in the project area under the with-project scenario. Therefore, carbon sequestered in long-life wood products under the project during any monitoring period may be counted as zero.
Justification 4: No carbon contained in products derived from harvested wood, including logs and the products derived from them such as sawn timber and plywood, is assumed to remain sequestered throughout the lifetime of the project crediting period.

Applicability condition 5:
If the soil carbon pool is selected and the default mean rate of soil carbon loss is selected, then the project must be located in a tropical or semi-arid tropical region.
Justification 5: The project is located in a tropical or semi-arid tropical region. At this stage a default value is applied for soil carbon loss, further local scientific studies are implemented to obtain a project-specific carbon loss rate during monitoring and verification.

Applicability condition 6:
Foreign agents of deforestation, if any, are unlikely to shift their activities outside the leakage area.
Justification 6: There are no foreign agents of deforestation.

Applicability condition 7:
The project area shall not contain organic or peat soils.
Justification 7: There are no organic or peat soils in the project area, not even in Zimbabwe.[28] The project area contains the following soil types[29]:
2: On permian, triassic grits, sandstone, and related colluvium in the Zambezi valley: under high deciduous woodland of Colophospermum mopane or mixed Acacia, or thicket of medium-to-low rainfall and very hot temperature. Under mixed Acacia or thicket: Fine to medium grained sandy-soils, deep and well drained. Under scrub C. mopane: medium to coarse grained sands, calcareous, very shallow and eroded. Under well-grown C. mopane: usually deep, alkaline, usually sodium-dominated clays.
14: On paragneiss and umkondo sediments: mainly under highly deciduous mixed bushland of low or medium-to-low rainfall and mainly hot temperature. On basic gneisses: brown, slightly reddish, sandy loams; over reddish brown or red sandy clay loams or sandy clay, slightly acid, usually shallow. With decreasing basicity of gneisses, and on Umkondo sediments, soils intergrade to, or resemble, soils on granite under low rainfall.
16: On granite: under highly deciduous mixed woodland or occasionally bushland with mainly low rainfall and hot temperatures. Brown, medium or coarse grained, slightly acid sands; shallow. Where basic inclusions occur in granite, soils become redder and loamier with depth.
The "Soil Map of Southern Rhodesia" has been provided separately to the auditor.

Applicability condition 8:
A reference area can be delineated meeting the requirements described in section 6.3.1 of this methodology, including the minimum size requirement.
Justification 8: The reference area has a size of 206 percent of the project area, has 100.67 percent of the size of the forest in the project area, and meets the similarity conditions (please refer to section 2.4).

Applicability condition 9:
As of the project start date, historic imagery of the reference region exists with sufficient coverage to meet the requirements of section 6.4.2 of this methodology.
Justification 9: Historic imagery with minimum cloud cover from five time steps was chosen. Every point has double coverage (being at least observable in two of the five images).

Applicability condition 10:
Project activities are planned or implemented to mitigate deforestation by addressing the agents and drivers of deforestation as described in section 10.1 of this methodology.
Justification 10: Project activities are implemented by addressing the agents and drivers of deforestation as described in section 2.4 (results PRAs). For further details on activities please

[28] Wetlands International: To the Subsidiary Body for Scientific and Technological Advice (SBSTA), table 2: Developing countries arranged to area of forested peatland, 28 February 2012

[29] Soil Map of Southern Rhodesia, Federal Ministry of Agriculture, Salisbury, by R. G. Thomas and B. S. Ellis, 1955

refer to section 1.8 of the present document. A detailed yearly work plan and budget allocation has been provided separately to the auditor.

Applicability condition 11:
The project proponents have access to the leakage area to sample forest degradation.
Justification 11: There is ground access to the leakage areas for teams to enter and sample forest degradation. Ground monitoring of leakage plots has been implemented following requirements of VM0009 v1.1 in sample size and sampling plan.

Applicability condition 12:
If the lag period for the cumulative leakage model is estimated after the project start date but before the end of the first monitoring period (see section 4.2 of the present document), then activity-shifting leakage has not occurred prior to the estimation of the lag period.
Justification 12: The lag period for the cumulative leakage model will be estimated after the project start date but before the end of the first monitoring period, it is assumed that no activity- shifting leakage will occurred prior to the estimation of the lag period.

Applicability condition 13:
Project areas shall not include land designated for legally sanctioned logging activities.
Justification 13: No land within the project area is designated for legally sanctioned logging activities. Confirmation letters from each RDC have been provided separately to the auditor.

2.3 Project Boundary

Greenhouse gases: The dominant method of deforestation in the *Kariba REDD+ Project* is conversion to subsistence agriculture by slash and burn techniques. As such, only Carbon Dioxide (CO_2) was selected as a source for greenhouse gas emissions in the project. Although Methane (CH_4) and Nitrous Oxide (N_2O) are also greenhouse gases, they are conservatively excluded from this project as per the methodology in section 5.3

Table 3: List of included greenhouse gases.

<table>
<tr><th colspan="2">Source</th><th>Gas</th><th>Included?</th><th>Justification/Explanation</th></tr>
<tr><td rowspan="4">Baseline</td><td rowspan="4">Deforestation</td><td>CO_2</td><td>Yes</td><td>Included inline with the methodology</td></tr>
<tr><td>CH_4</td><td>No</td><td>Conservatively excluded inline with the methodology</td></tr>
<tr><td>N_2O</td><td>No</td><td>Conservatively excluded inline with the methodology</td></tr>
<tr><td>Other</td><td>No</td><td>Conservatively excluded inline with the methodology</td></tr>
<tr><td rowspan="3">Project</td><td rowspan="3">Deforestation & Degradation</td><td>CO_2</td><td>Yes</td><td>Included inline with the methodology</td></tr>
<tr><td>CH_4</td><td>No</td><td>Conservatively excluded inline with the methodology</td></tr>
<tr><td>N_2O</td><td>No</td><td>Conservatively excluded inline with the methodology</td></tr>
</table>

Source		Gas	Included?	Justification/Explanation
		Other	No	Conservatively excluded inline with the methodology

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

Table 4: List of included carbon pools.

Pool	Required	Included in Project?	Justification
Above-ground large tree biomass	Yes	Yes	Major pool considered
Above-ground small tree biomass	Yes	Yes	Major pool considered
Above-ground non-tree biomass	Optional	Yes	Major pool considered
Below-ground large tree biomass	Optional	Yes	Major pool considered
Below-ground small tree biomass	Optional	Yes	Major pool considered
Below-ground non-tree biomass	Optional	Yes	Major pool considered
Litter	No	No	Conservatively excluded
Standing dead wood	Optional	Yes	Major pool considered
Lying dead wood	Optional	No	Conservatively excluded
Soil	Optional	Yes	Major pool considered
Long-lived wood products	Yes	Yes	N/A

Lying dead wood counts for considerably less than 5% of the total project benefit for the project lifetime and has therefore been conservatively excluded. The de minimis calculation has been provided separately to the auditors.

Expert knowledge from the agents of deforestation and cultural practices in the project area indicate that community members invariably burn all stumps in the process of clearing land for agriculture. We therefore do not differentiate large trees (which in reality are medium trees but are counted in the large tree carbon pool category as medium trees are not addressed in the methodology) from small trees for this project, and assume that all stumps (below-ground large tree biomass) are burned during agricultural conversion.

Based on the ex-ante estimates no carbon pool is expected to increase in the baseline, emission sources from litter and lying dead wood are conservatively excluded. The ex-ante calculation has been provided separately to the auditor.

2.4 Baseline Scenario

2.4.1 Obvious agents and drivers of deforestation

A participatory rural appraisal has been conducted to determine the deforestation agents and drivers.

2.4.2 Participatory rural appraisal

A participatory rural appraisal was conducted during May 14th-23rd, 2011. Four teams were involved, one team for each project area. The objectives of the study were:

- To identify the agents and drivers of deforestation,
- To collect demographic information for the project area,
- To identify and prioritize urgent environmental and development challenges faced by communities within the project area,
- To identify possible intervention activities and suggest possible intervention mechanisms that the *Kariba REDD+ Project* could adopt to assist these communities,
- To collate information on other development players within the area and the current initiatives they are involved in.

The study was cross sectional and sought to establish current livelihoods of households in the project sites and identify current agro-ecological farming practices and crops grown in the area. The collected information forms the base for the project activities to be implemented to reach the identified deforestation agents and drivers.

Copies of the questionnaires are provided separately to the auditor.

Table 5: Location, sample size, type and number of the survey:

District	Wards (with Ward number where applicable)	Number of FGDs	Number. of participants in the Focus Group Discussions (FGD)	Number of Individual Households Questionnaires (HH)	Schools Questionnaire
Hurungwe	Zebra Downs (3) Nyamakate (7) Chundu (8) Kazangarare (9)	4	160	103	13
Mbire	Chisunga (2), Kanyurira (11), Chiriwo/Gonono (4), Kanongo (3) and Chikafa (12)	5	200	98	9
Binga	Karungwizi, Sinampande, Tyunga, Nebusenga	4	240	92	10
Kariba-Nyaminyami	Mola 4,Gatchegatche 2, Molar3, Jongola,Mayovhe	5	200	79	8

2.4.2.1 Analysis of agents of deforestation[30]

Table 6: Agents of deforestation in Binga

Agents of deforestation (by rank)	Number of responses (PRA)	Description of agents (including statistics and their source)	Mobility of agent	Activities to mitigate deforestation (for each agent)
1. Community members constructing houses	122	Baseline survey (Focus group discussions and Household interviews)	Low	- Alternative and sustainable building materials (brick making) - Plantations (timber for constructions)
2. Community members clearing land for new fields	68	Baseline survey (Focus group discussions and Household interviews)	Low	- Improved Agriculture and resuscitation of irrigation schemes - Implementation of agroforestry techniques - Beekeeping - Improvement of the education due to on the ground management teams and the newsletters - Community and project sustainability fund
3. Community members causing fires	50	Baseline survey (Focus group discussions and Household interviews)	Low	- Fire management - Beekeeping - Improvement of the education due to on the ground management teams and the newsletters (e.g. law-enforcement of anti-poaching)
Totals	240			

[30] Deforestation Agents: People or groups of people responsible for deforestation

Table 7: Agents of deforestation in Hurungwe

Agents of deforestation (by rank)	Number of responses (PRA)	Description of agents (including statistics and their source)	Mobility of agent	Activities to mitigate deforestation (for each agent)
1. Community members using firewood for curing of Tobacco	88	Baseline survey (Focus group discussions and Household interviews)	Low	- Plantations (fuelwood) - Promotion of alternative cash crops such as garlic and chilli
2. Community members constructing houses and clearing land for new fields	43	Baseline survey (Focus group discussions and Household interviews)	Low	- Alternative and sustainable building materials (brick making) - Plantations (timber for constructions) - Improved Agriculture and resuscitation of irrigation schemes - Implementation of agroforestry techniques - Beekeeping - Improvement of the education due to on the ground management teams and the newsletters - Community and project sustainability fund
3. Community members using more wood constructing homes	20	Baseline survey (Focus group discussions and Household interviews)	Low	- Alternative and sustainable building materials (brick making) - Plantations (timber for constructions)
4. Community farmers causing fires	9	Baseline survey (Focus group discussions and Household interviews)	Low	- Fire management - Beekeeping - Improved agriculture - Improvement of the education due to on the ground management teams and the newsletters (e.g. law-enforcement of anti-poaching)
Total	160			

Table 8: Agents of deforestation in Nyaminyami

Agents of deforestation (by rank)	Number of responses (PRA)	Description of agents (including statistics and their source)	Mobility of agent	Activities to mitigate deforestation (for each agent)
1. Community members clearing land for new fields	131	Baseline survey (Focus group discussions and Household interviews)	Low	- Improved Agriculture and resuscitation of irrigation schemes - Implementation of agroforestry techniques - Beekeeping - Improvement of the education due to on the ground management teams and the newsletters - Community and project sustainability fund
2. Community members using more wood constructing homes	59	Baseline survey (Focus group discussions and Household interviews)	Low	- Alternative and sustainable building materials (brick making) - Plantations (timber for constructions)
3. Poachers causing fires	10	Baseline survey (Focus group discussions and Household interviews)	Medium to High	- Improvement of the education due to on the ground management teams and the newsletters (e.g. law-enforcement of anti-poaching) - Anti-poaching patrolling
Total	200			

Table 9: Agents of deforestation in Mbire

Agents of deforestation (by rank)	Number of responses (PRA)	Description of agents (including statistics and their source)	Mobility of agent	Activities to mitigate deforestation (for each agent)
1. Community members clearing land for new fields	111	Baseline survey (Focus group discussions and Household interviews)	Low	- Improved Agriculture and resuscitation of irrigation schemes - Implementation of agroforestry techniques - Beekeeping - Improvement of the education due to on the ground management teams and the newsletters - Community and project sustainability fund
2. Community members using more wood constructing homes	73	Baseline survey (Focus group discussions and Household interviews)	Low	- Alternative and sustainable building materials (brick making) -Plantations (timber for constructions)
3. Poachers causing fires	16	Baseline survey (Focus group discussions and Household interviews)	Medium	- Improvement of the education due to on the ground management teams and the newsletters (e.g. law-enforcement of anti-poaching) - Anti-poaching patrolling
Total	200			

All the activities are legally permitted. No external agents of deforestation are expected.

2.4.2.2 Analysis of drivers of deforestation

Table 10: Ranking of drivers of deforestation in Binga (B), Hurungwe (H), Nyaminyami (N) and Mbire (M)

Drivers[31] by rank	**Number of responses (PRA)**				**Statistics about the driver and their sources**	**Activities to mitigate deforestation (for each driver)**
	B	**H**	**N**	**M**		
1.Socio-economic (mainly subsistence agriculture, additionally firewood and poaching activities)	179	123	167	122	- Baseline survey (Focus group discussions and Household interviews)	- Improved Agriculture (education e.g. promotion of alternative cash crops such as garlic and chilli which have less environmental degradation effects and have good market prices) and resuscitation of irrigation schemes - Beekeeping - Plantations (fuelwood) - Fire management - Community and project sustainability fund - Improvement of the education due to on the ground management teams and the newsletters (e.g. law-enforcement of anti-poaching) For further details of the project activities please refer to section 1.8.
2.Geographical - Settlement	61	37	33	78	- Baseline Survey (Focus group discussions and Household interviews)	- Alternative and sustainable building materials (brick making) -Plantations (timber for constructions) - Improvement of the education due to on the ground management teams (e.g. law-enforcement) - Beekeeping - Community and project sustainability fund For further details of the project activities please refer to section 1.8.
Total	240	160	200	200		

No external agents of deforestation are expected. The baseline will be reassessed every 10 years.

[31]Deforestation Drivers: Geographic, climatic or other physical, social and/or economic conditions that cause deforestation

2.4.3 The reference region

2.4.3.1 Delineation of the reference area

The reference area for the *Kariba REDD+ Project* has an area of 1'907'410 ha of which 802'192.05 ha were forested in 2011 (see Maps 11 & 12 for land use). The reference area was chosen to specifically address the behaviour of the local agents of deforestation, as well as the drivers of deforestation taking into consideration similar socioeconomic and cultural conditions. For the identification of the reference area, knowledge from experts was used, such as from the social and environmental scientist Ngonidzashe Mararike, founding consultant of Black Crystal Consulting. The Black Crystal Capability Statement, which contains summary CV's of the consultants, is provided separately to the auditor.

The reference area is community owned lands – RDC lands - and has therefore comparable protection status, poverty level and land rights as the project area. [32] Both project and reference areas are populated almost entirely by local inhabitants engaging in subsistence farming practices. Deforestation for land conversion is prevalent but wood removal is limited, as the dominant species (*Acacia / Commiphora*) are not commercially viable. For this reason, the main agents and drivers of deforestation of the project area (refer to Table 6 through Table 11 of this section) are applicable for the reference area. Academic literature supports the similarity of deforestation agents in the reference area and the project area. A peer-reviewed study reports the following major causes of deforestation, as assessed by a PRA South Gokwe (part of reference area): opening land for agricultural production, harvesting of building materials and extraction of firewood.[33]

Please see the Adaptive Management Plan separately provided to the auditors for a detailed description of local social order and nobilities of agents of deforestation, which are equal for all communal lands in northern Zimbabwe, including the reference area and lands adjacent and agents of deforestation with usufruct rights on the project area.

The Rural District Council and basic community structure is as shown below.

[32] A land classification map supporting this is provided separately to the Auditors, source is http://eusoils.jrc.ec.europa.eu/esdb_archive/EuDASM/Africa/maps/afr_zw2002_2lu.htm.

[33] Mapedza et al. 2003: An investigation of land cover change in Mafungautsi Forest, Zimbabwe, using GIS and participatory mapping

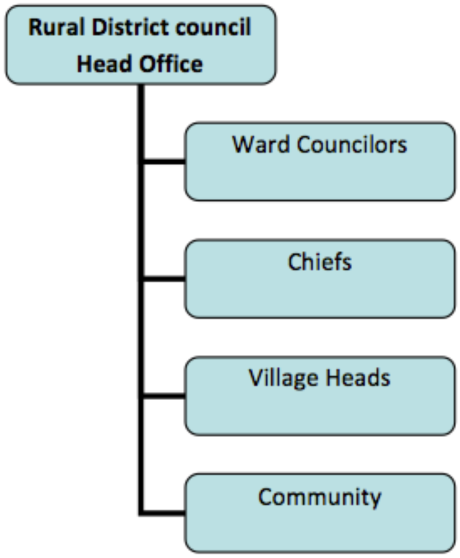


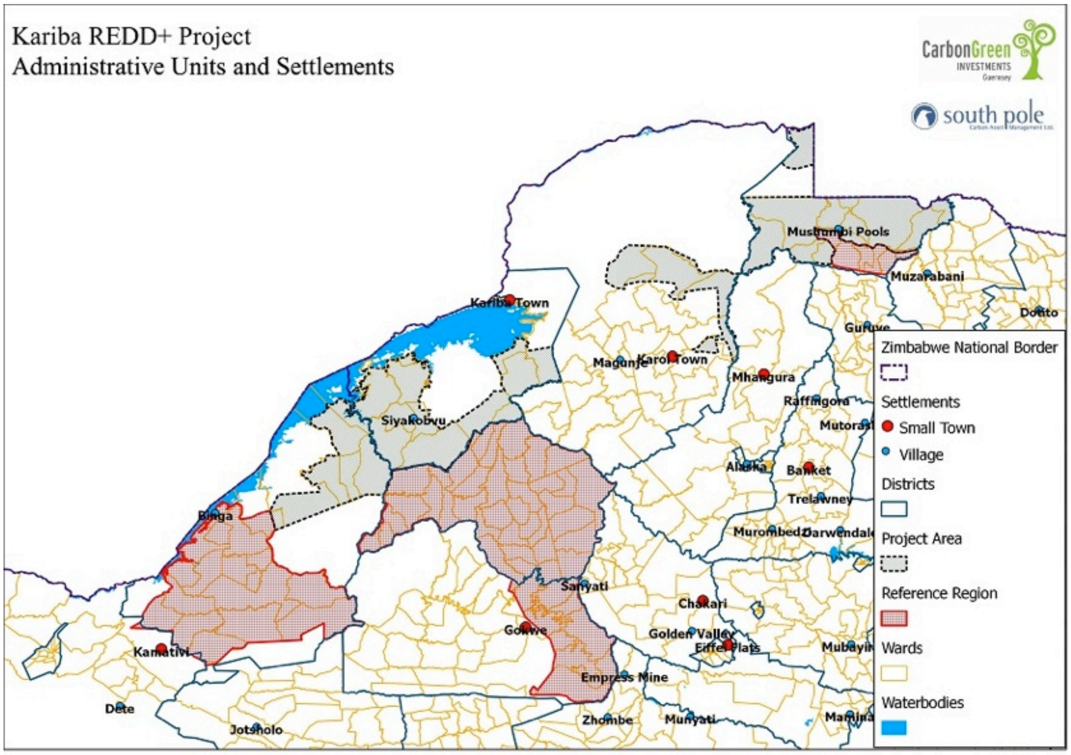
Figure 1: Structure of RDC and local communities.

The purpose of the Rural District Council is to act on behalf of the communities with regards to development and the general well being of the communities within the given district. The general reporting procedure in the communities follows the structure laid out above. Where the communities usually engage their respective village heads and councillors, there is also a direct channel to the council head office or chief. When there is general community issues regarding development or grievances which need discussing, it is usually done through an organized meeting at the ward level headed by the ward councillor. Attendees to these meetings are the chiefs, village heads, members of the community, CGA and EA. The points of discussion are then taken to the council head office where decisions are made accordingly.

Communities also have a direct channel to the CGA area manager, liaison officer, Environment Africa officer and Council as part of the daily interaction with all these entities. The way these channels are used in the area is extremely efficient and any type of news travels fast.

Please see Map 2 for the location of the reference area in relation of the project area.

Map 5 shows the relevant districts in relation to the Zimbabwean national territory and settlements of the region. Although the project area is only made-up of RDCs, clearly urban towns like urban Kariba and urban Karoi (Hurungwe RDC) increase demand for agricultural products around the project area. As VCS project area is forest only, it was logical to include a reference area partially impacted by an equivalent urban center, that of urban Gokwe South, to match the land use pressure exhibited by urban Kariba and urban Karoi on the project area.



Map 5: Rural (grey) and Urban District Councils (red) containing project area (black outline) and reference area in Zimbabwean territory (light brown).

To be able to compare socioeconomic similarities of the reference area with the project area we provide Table 11 with population density per km^2. Please note that population data are only available on RDC level, which contain the forest of the project area, the reference area and also areas part of neither. As no census has been undertaken in Zimbabwe since 2002, we are providing this and historical data from 1992. Rural and Urban District Councils are joined in the official statistics, where Karoi is added to Hurungwe RDC.

Table 11: Population data of districts which contain project area and reference area[34]

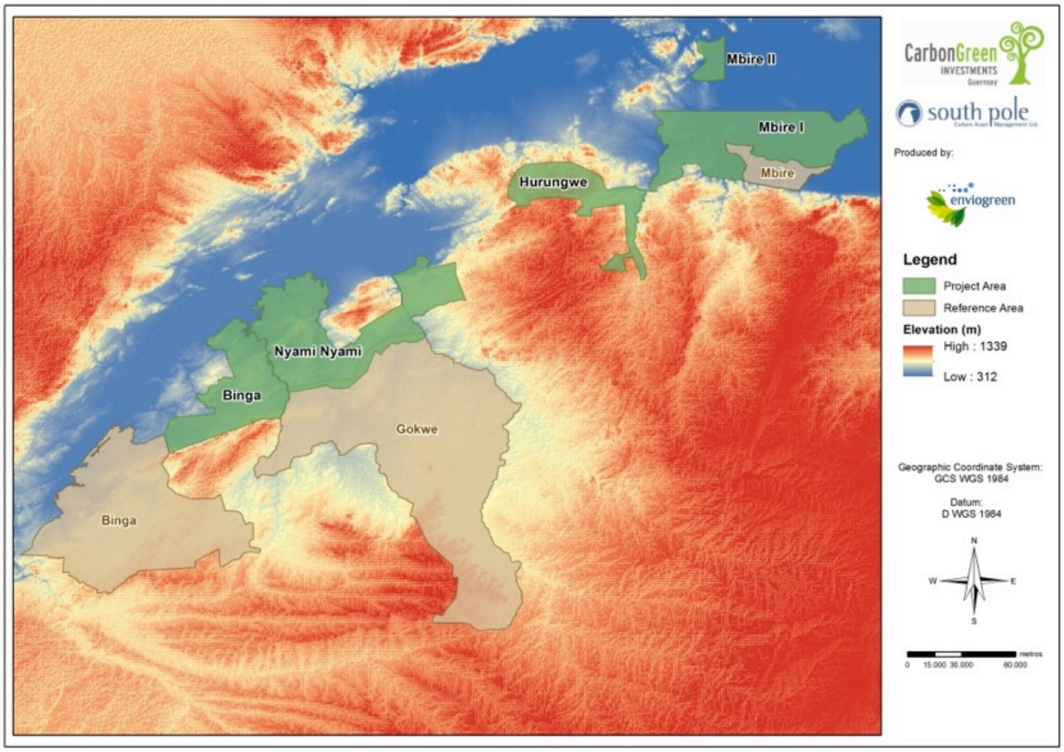
	Census 1992	Census 2002	Growth rate p.a. (%)	RDC Area (km^2)	pop density 2002 (inh./km^2)	A) project area	B) reference area	C) urban city
Gokwe North	N/A*	214'652	~2.63*	7'269.32	29.5		X	
Gokwe South	N/A*	294'627	~2.63*	11'123.69	26.5		X	X
Binga	87'802	118'842	3.54	13'328.91	8.9	X	X	
Kariba	48'756	58'864	2.07	8'191.18	7.2	X		X
Mbire	N/A**	116'062**	Guruve**: 3.63	4'705.90	24.7**	X	X	
Hurungwe	246'902	309'821	2.55	19'863.57	15.6	X		X

* Gokwe was separated only after 1992. 1992 population of all Gokwe was 403'136.

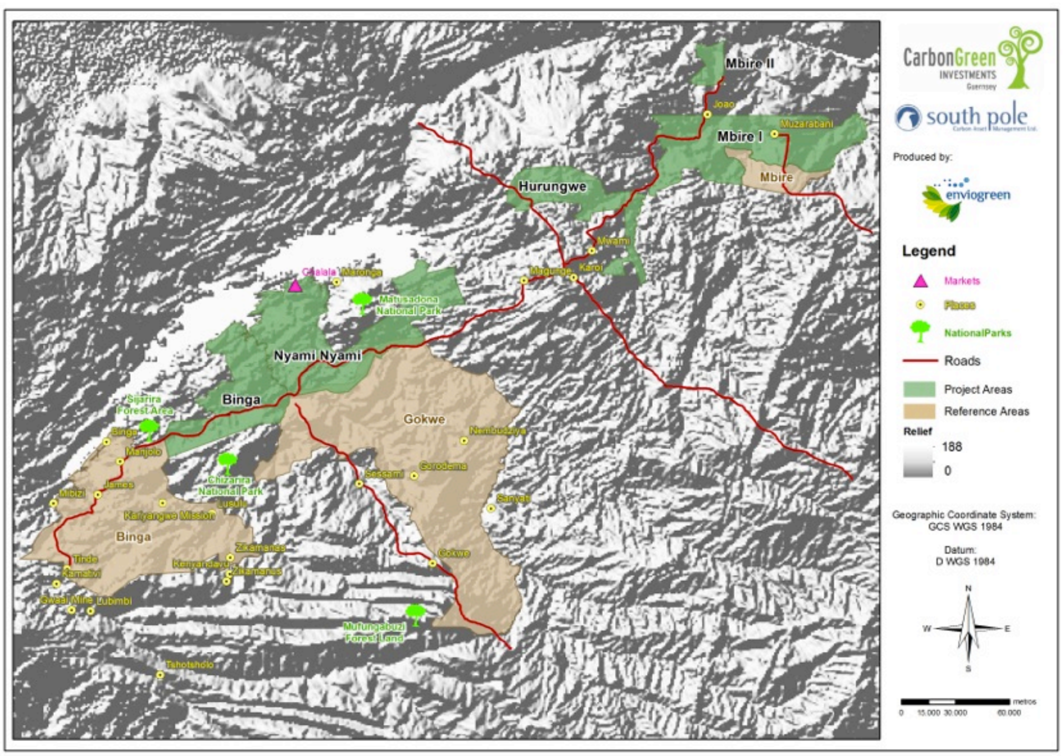
** Mbire did not exist before 2002 and population data is from 2010 Mbire Natural Resource Management Plan. From 1992 to 2002 Mbire was part of the RDC Guruve whose population rose from 135,637 to 184,828.

We can conclude from the 1992 to 2002 census data that all districts, containing project areas or reference areas, experienced population growth between 2 and 4 % per year from 1992 to 2002.

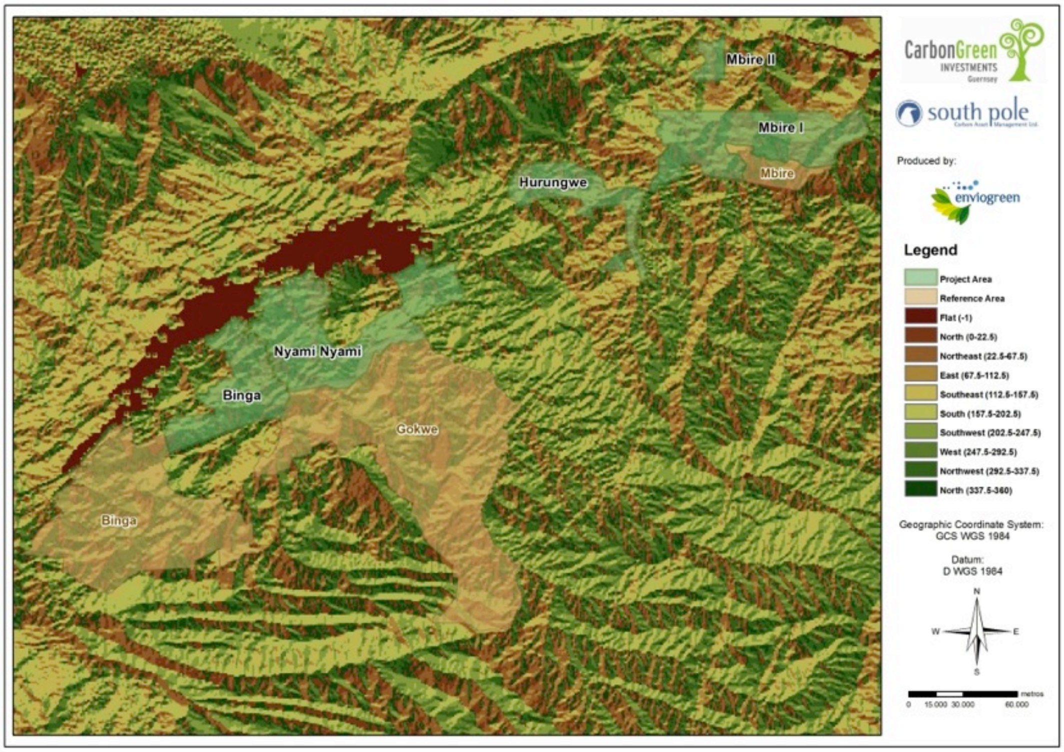
[34] Zimbabwe census data: http://www.geohive.com/cntry/zimbabwe.aspx



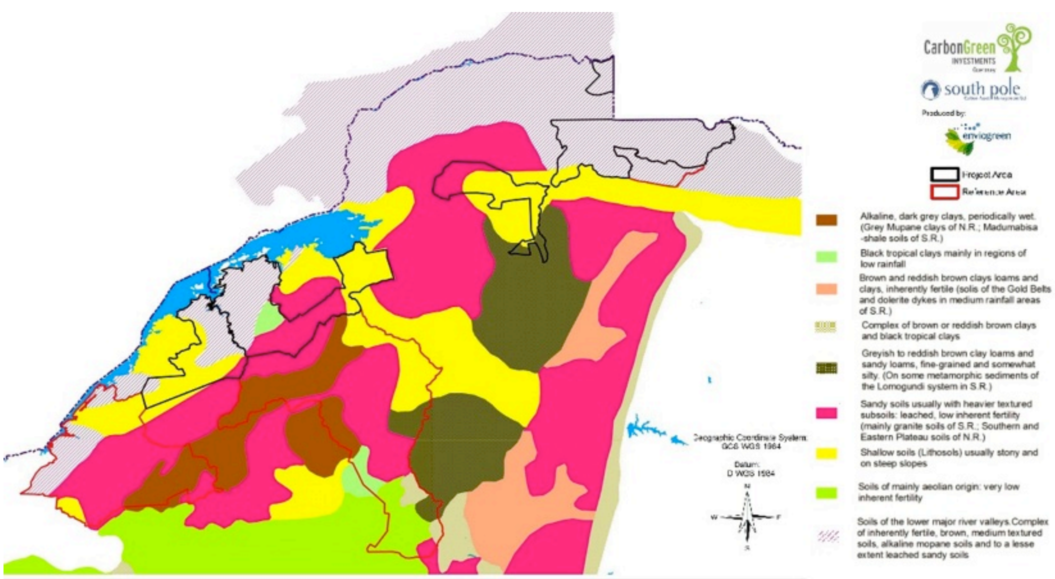
Map 6: Elevation project area and reference area



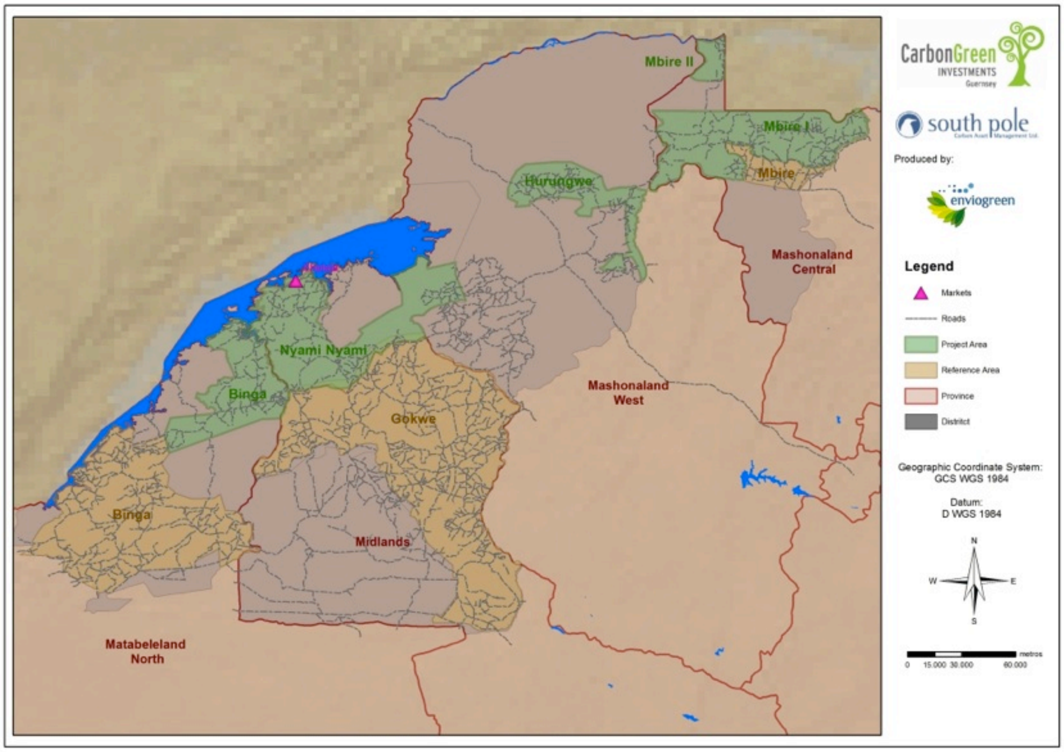
Map 7: Relief of project area and reference area



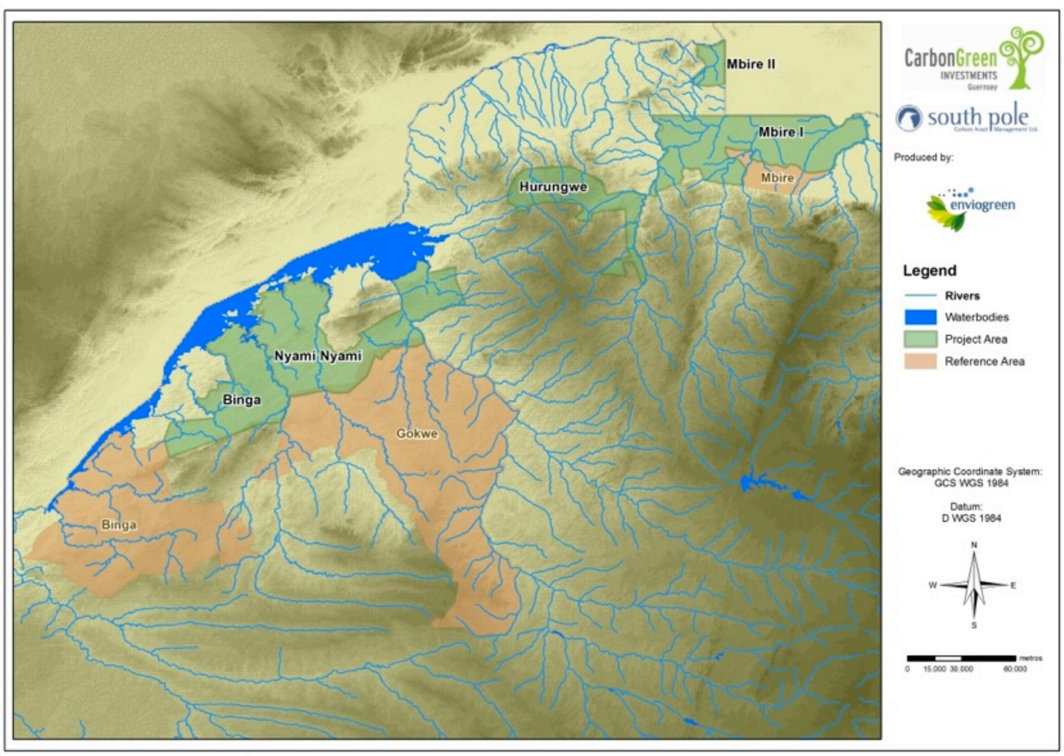
Map 8: Aspect of project area and reference area



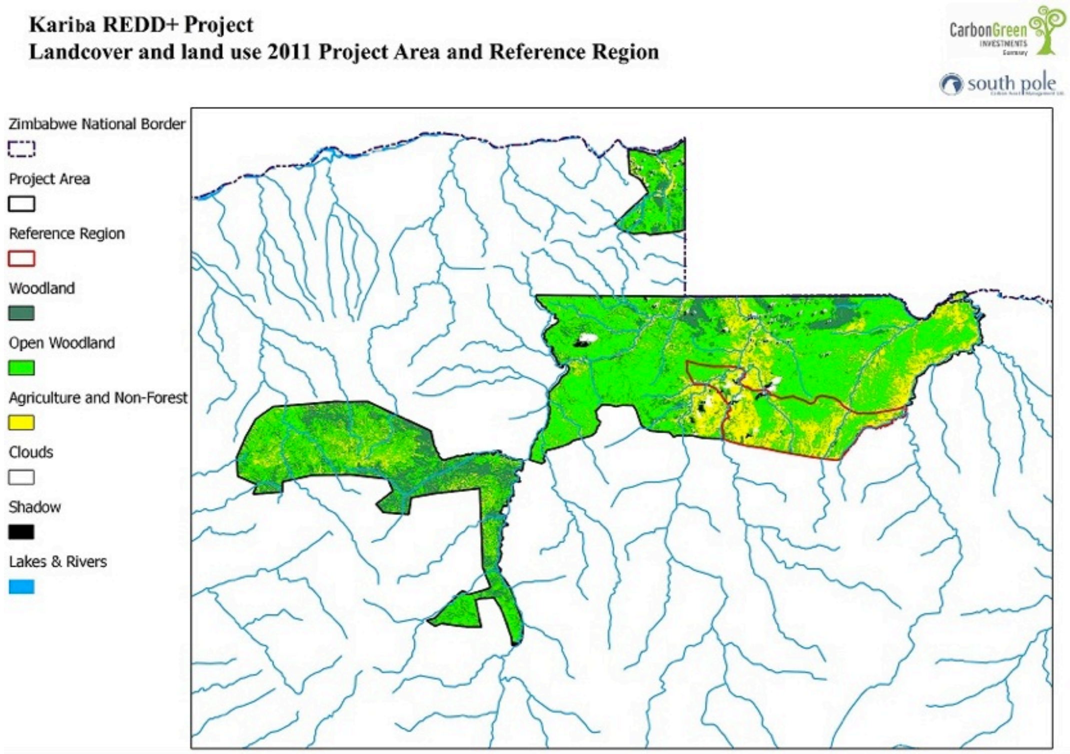
Map 9: Soils of project area and reference area



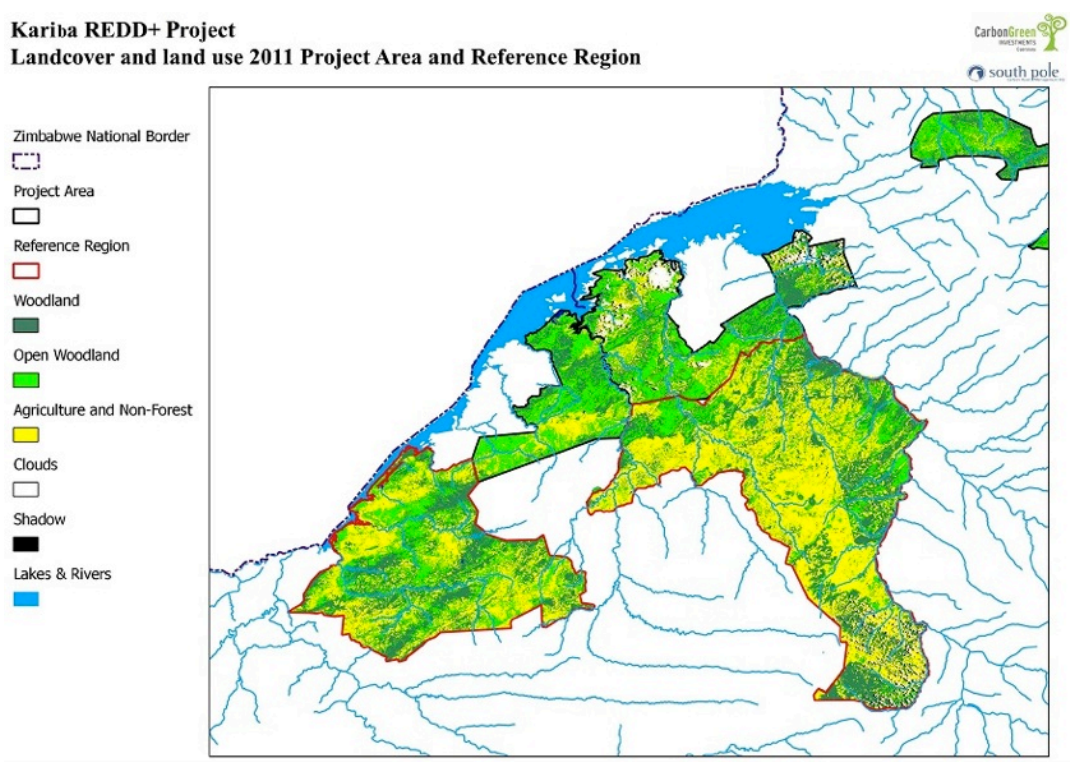
Map 10: Roads mapped by project proponent using GPS Tracks and high-resolution imagery



Map 11: Rivers and water bodies of the project area and reference area



Map 12: Land use 2011 of of project area and reference area (Eastern Part).



Map 13: Land use 2011 of of project area and reference area (Western Part).

The north-west of Nyaminyami was covered by two different satellite images from two different dates in 2011. This explains why cloud and forest cover form a distinct break line.

Narrative describing the rationale for selection of the reference area boundaries:
The Reference area boundaries were chosen to address the behaviour of the agents of drivers of deforestation in the *Kariba REDD+ Project*. The reference area are bounded by *Chizarira National Park* and *Sijarira Forest Area* to the west, *Matusadona National Park* to the North, Mafungabusi Forest Land to the south and group-owned ranches on all other boundaries.

The area was chosen to incorporate a region that has witnessed a typical pattern of deforestation in the main ecosystem. The selected area is near several national parks. We are confident that by studying the area delineated as the reference area for this project, the culture and behaviour of the agents and drivers of deforestation will be fully captured.

Table 12: Topographic and vegetation type characteristics of project area and reference area

Project area parts (forest 2011 only)	**Mean elevation (m)**	**% Open Woodland**	**% Woodland**
Hurungwe	1'017.62	52.15%	47.85%
Nyaminyami	677.81	49.60%	50.40%
Mbire	432.29	82.70%	17.30%
Binga project	673.88	34.88%	65.12%
All project area joined	**654.51**	**57.55%**	**42.45%**
Reference area Parts (forest and non-forest)			
Mbire reference	428.27	86.06%	13.94%
Gokwe	938.21	36.64%	63.36%
Binga reference	834.13	51.00%	49.00%
All reference area joined	**681.37**	**44.25%**	**55.75%**

People have no problem reaching higher lying ground by foot. Villages serve as starting points for land use in the project area and the reference region. Even though the reference regions are at higher elevations, all reference regions and project areas have similar accessibility as all are equivalently level. No steep slopes or gorges prohibit humans from access by foot.

The distribution of Open Woodland and Woodland is close to 50 % in both project and reference areas, with a stronger dominance of Open Woodland (7.55 % from equilibrium) in the project area and more Woodland in the reference area (5.75 % from equilibrium).

We consider the overall topography and ecosystem conditions in the project and reference areas to be very similar. Minor differences exist which are natural to any landscape matching process that has to fulfil a multivariate system of requirements including legal status and socio-economics.

To further demonstrate socio-economic similarity between reference and project area, refer to Table 13 below, where 2011 province level data is displayed for the relevant provinces. Average monthly expenditure range is USD 31-53 per household. The Midlands province, which includes only reference area and not project area, shows average expenditures of USD 44 per household, which is almost exactly the average of the other three provinces (USD 44,67/HH) which contain project and reference regions. Also, in terms of the relative contribution to the household income, the four provinces are very similar.

Table 13: Socio-economic parameters in project and reference area at province level

Province	Average monthly expenditure (USD/HH)	Top four sources of income	Relative income from			
			Vegetable production	Food crop production	Livestock production	Cash crop production
Matabeleland North (project & reference area)	31	Casual labour, Remittances, Livestock, Food crops	11.3%	25.8%	29.1%	1.5%
Mashonaland West (project &reference area)	50	Casual labour, Food crops, Vegetables, Cash crops	25.4%	42.7%	12.5%	25.4%
Mashonaland Central (project & reference area)	53	Casual labour, Food crops, Cash crops, Vegetables	22.4%	29.2%	13.6%	26.4%
Midlands (reference area)	44	Casual labour, Food crops, Vegetables, Remittances	31.5%	36.7%	16.8%	14.0%

Source: Zimbabwe Vulnerability Assessment Committee (2011): Rural Livelihoods Assessment July 2011 report, Harare, Zimbabwe. Available online under: http://www.acwg.co.zw/index.php?option=com_phocadownload&view=category&download=171:zimvac-report-2011&id=15:documents. An electronic copy is provided separately to the auditors.

Detailed maps and KML files with reference area of Woodland and Open Woodland distribution in project areas have been provided to the auditor. The reference area has, at project start, a forested area of 790’711 ha versus 784’987 ha of the project area.

2.4.3.2 Defining the reference period

The reference period is defined by the first and the last historic image used for establishing historic land use and land cover change. The reference period begins on 05.04.2000 and ends on 30.05.2011.

Historic Imagery Dates					
Path_Row_Year	Date	Sensor	Provider	Reference area	Project area
170_71_2000	23.04.2000	LS7 ETM+	USGS	x	x
170_71_2003	02.05.2003	LS7 ETM+	USGS	x	x
170_71_2006	24.04.2006	LS7 ETM+	USGS	x	x
170_71_2009	26.05.2009	LS5 TM	USGS	x	x
170_71_2011	14.04.2011	LS5 TM	USGS	x	x
171_71_2001	06.07.2001	LS7 ETM+	USGS		x
171_71_2011	14.04.2011	LS5 TM	USGS		x
171_72_2000	01.06.2000	LS7 ETM+	USGS	x	x
171_72_2003	07.04.2003	LS7 ETM+	USGS	x	x
171_72_2006	15.04.2006	LS7 ETM+	USGS	x	x
171_72_2009	01.05.2009	LS5 TM	USGS	x	x
171_72_2011	16.02.2011	LS5 TM	USGS	x	x
171_73_2000	01.06.2000	LS7 ETM+	USGS	x	x
171_73_2003	22.03.2003	LS7 ETM+	USGS	x	x
171_73_2006	15.04.2006	LS7 ETM+	USGS	x	x
171_73_2009	17.05.2009	LS5 TM	USGS	x	x
171_73_2011	16.02.2011	LS5 TM	USGS	x	x
172_72_2000	01.06.2000	LS7 ETM+	USGS	x	x
172_72_2003	30.04.2003	LS7 ETM+	USGS	x	x
172_72_2006	22.04.2006	LS7 ETM+	USGS	x	x
172_72_2009	24.05.2009	LS5 TM	USGS	x	x
172_72_2011	30.05.2011	LS5 TM	USGS	x	x
172_73_2000	05.04.2000	LS7 ETM+	USGS	x	x
172_73_2003	30.04.2003	LS7 ETM+	USGS	x	x
172_73_2006	22.04.2006	LS7 ETM+	USGS	x	x
172_73_2009	24.05.2009	LS5 TM	USGS	x	x
172_73_2011	30.05.2011	LS5 TM	USGS	x	x

Table 14: Historic image dates covering project and reference area

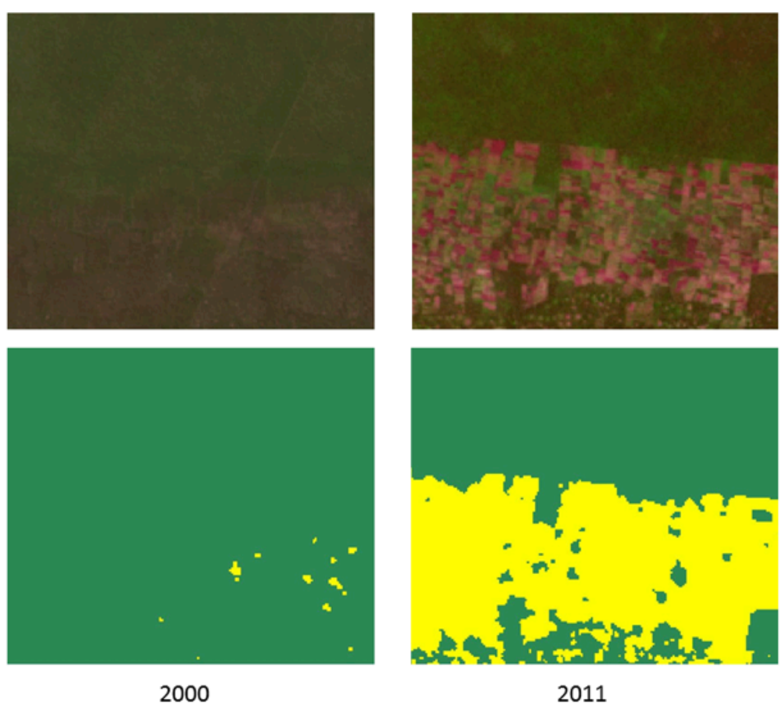
The reference period spans the first classified remote sensing image of 2000 until the last of 2011. The historic reference period spans the period of most important historic events in the region. Additionally, to be complete we looked for additional satellite images available with wide coverage of a large area at feasible costs – only Landsat 5 TM and Landsat 7 ETM+ imagery fulfill these criteria. The Kariba REDD+ Project utilized all available images of these sensors with less than 50 per cent cloud cover over the reference area within the last 15 years prior to project start. This, and the fact that important historic events in the reference period (see below) are covered from 2000 to 2011, makes the established reference period the only viable option.

Important historic events in the reference region (and national context):
Land use and land-use change patterns over the reference region are closely linked to the national economy and the agricultural land reform started by the government in the year 2000 (for

further details please refer to section 1.10).

The reference period therefore covers four sub-periods: a sub-period dominated by high deforestation rates caused by a shift back to rural subsistence agriculture (2000-2003), a period of low deforestation rates due to reduced population pressure because of emigration (2004-2006) and also low image visibility (Landsat 7 ETM+ SLC-off), a third (2007-2009) and forth period (2010-2011) of increases close to the multi-annual average (2010-2011). Please see the additionally provided to the cumulative deforestation model for details on observed historic deforestation in the reference region. Obviously, the exact limits of our observation sub-periods are determined by Landsat image availability (see explanation above) and historic trends might have already before the end of one sub-period. But such effects are generally averaged-out by fitting the cumulative deforestation model over the entire reference period. The sub-periods did not enter the cumulative deforestation model but only serve to relate to historic events in the reference period.

As re-immigration into the reference area and close to the project area is slowing down but has not yet fully stopped and high population growth rates above 2 per cent per year persist, we have confidence that the average deforestation rate established over the entire reference period is a realistic predictor for future deforestation (at least for the next 10 years until a baseline revision is required in any case).



Picture 3: Landsat 5 TM image RGB 543 (above) and Forest / Non-Forest classification (below). This classification is only used to show that forests in monitored have >10 years (2000) and to establish 2011 forest stratum distribution.

2.4.4 The cumulative deforestation model

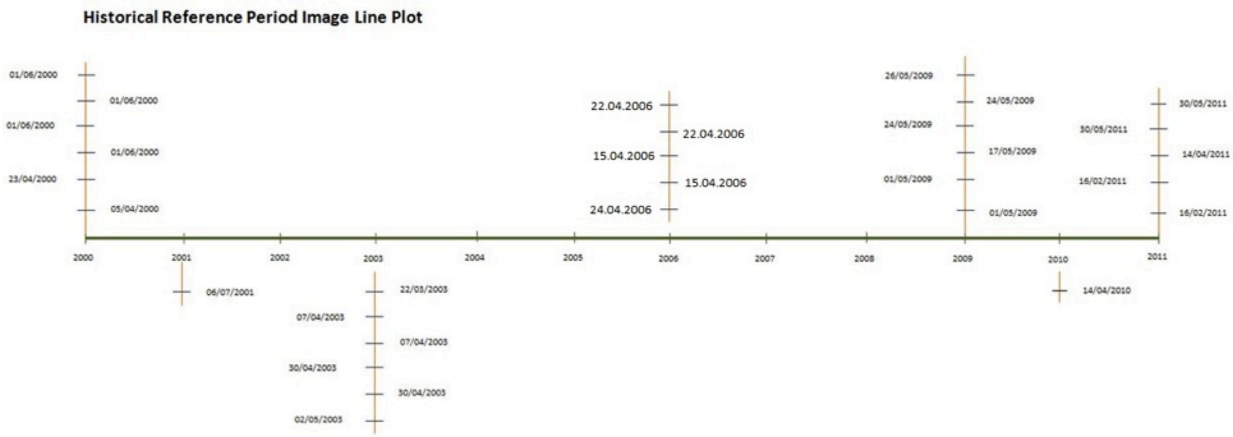
VM0009 page 37ff states: “The model is constructed in three sequential steps: First, deforestation in the reference area is observed in historical, imagery over the reference period. Second, the model is fit using standard statistical software and finally, the uncertainty in the model is estimated.”

For observing deforestation in the reference area, the Kariba REDD+ Project followed the requirements of section 6.4.2 and 6.4.3 by “aligning a dot grid of points over the reference area using a GIS.” (page 38) and "A pilot sample of points is distributed across the reference area either randomly or systematically on a grid to estimate the ultimate sample size required to fit the cumulative deforestation model” (page 39).

All images have been spatially registered to the same coordinate system with accuracy less than 10 per cent Root Mean-Squared Error (RMSE) on average across all images. The spatial registration for all imagery is the WGS84 / UTM 35S coordinate system, which is the standard coordinate system for all Landsat images product of US Geological Service (USGS) distribution center GloVis.[35] USGS standard terrain correction co-locates imagery into exactly the same position with a maximum of one pixel deviation (normally zero), which is below 10 per cent RMSE spatial location error. To provide empirical evidence that spatial registration follows VM0009 requirements, a RMSE control point selection was performed and results are given below. For details on the method, please see the additionally provided document “120816_RMSE_Analysis_Kariba” as well as location and RMSE tables for each image.

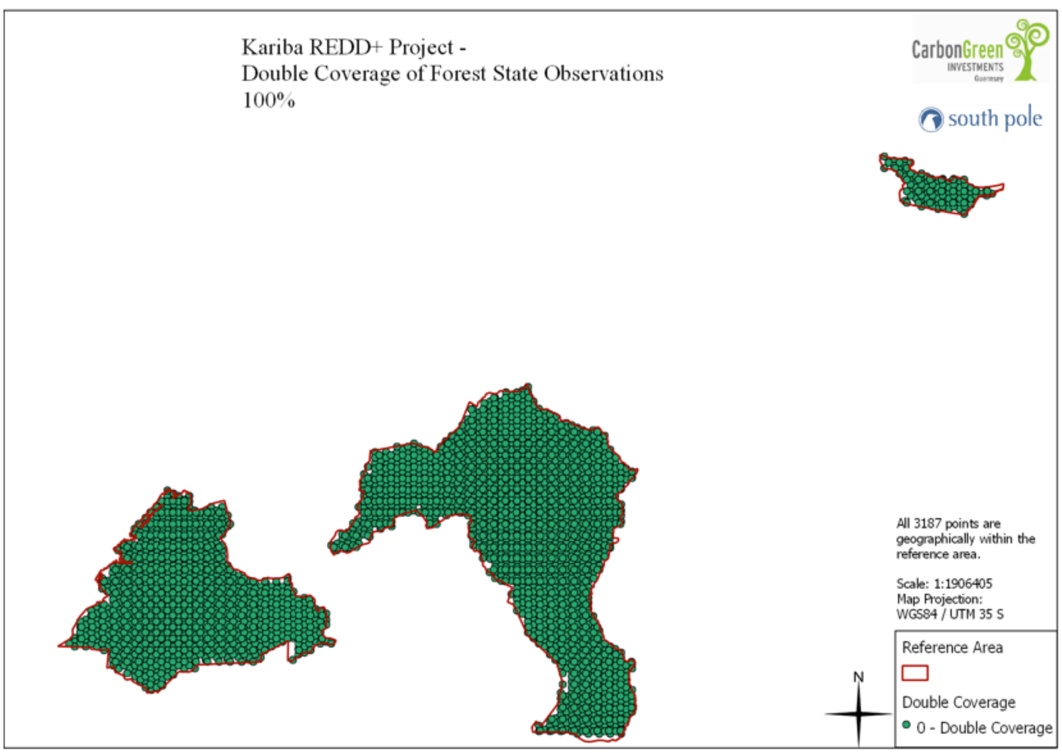
Sub-Region	Comparison Pair	**RMSE offset %**	Sub-Region	Comparison Pair	**RMSE offset %**
Nyami-Gokwe	2000-2003	0.016548			
Nyami-Gokwe	2003-2006	0.018345			
Nyami-Gokwe	2006-2009	0.389011			
Nyami-Gokwe	2009-2011	0.034406			
Binga	2000-2003	0.027773	Mbire	2000-2003	0.018172
Binga	2003-2006	0.17454	Mbire	2003-2006	0.062866
Binga	2006-2009	0.027782	Mbire	2006-2009	0.071196
Binga	2009-2011	0.016050	Mbire	2009-2011	0.036789

35 http://glovis.usgs.gov/



We collected, for all the project area and reference region of the Kariba REDD+ Project, five image time-steps – 2011, 2009, 2006, 2003, 2000. The analysis thus spans over 11 years and our most recent image is two months older than the project start date in 2011. Wet-season imagery is crucial in our dry forest context as forests lose foliage in the dry season and contrast for classification becomes too low.

Historical imagery with spatial resolution of 30m for the reference and project areas has been used to assess deforestation.



Map 14: Location of point locations for observing forest state and double coverage.

Double coverage was analyzed and 100% of all points have double coverage.

2.4.4.1 Determining sample size

To determine the final sample size of the observations of forest state first a pilot sample of 327 points were distributed over the reference area in a regular grid with random origin, using the WWC toolbar. The calculation of the σ_{DF} of the pilot sample resulted in the value 0.360001552 by [eq. 17], which resulted in a final m_{DF} of 3177 by [eq. 6]. 3187 points were distributed in adding systematic grids (see section 2.6). Thus, 15935 observation states were interpreted over the five time steps.

2.4.4.2 Discarded sample points

Only points being classified as forest state in the first time step t_{-11} (2000) are included in the analysis of proportion of deforested area. Therefore 1116 points being sampled as non-forest in 2000 have been discarded.

2.4.4.3 Minimizing Uncertainty

The interpretation guide applied was designed to minimize the error of falsely marking a change from forest to non-forest state. It follows three main principles:

1. Consistency with VM0009 v1.1 requirements.

2. Internal consistency how interpretation was applied over space and time.

3. Maintain conservativeness in the effect on the CDM as a REDD+ baseline.

The observation of forest states via visual interpretation of multi-spectral imagery requires a fine-tuned eye and a set of rules. Therefore, to reduce uncertainty, a single interpreter did the entire classification, while a second one reviewed it. The first interpreter has extensive ground experience in the region. All available VM0009 PDs were reviewed in order to learn from earlier successful projects how best to classify forest state observations. Digital communication on the subject occurred with VM0009 methodology developers. 639 ground truth points taken in the field were visualized over the imagery to train the interpreters on Forest / Non-Forest. As an additional QA/QC method Google Earth high resolution imagery was additionally consulted for the years 2006, 2009, and 2011. Various corrections were undertaken due to comments of the second interpreter and the high resolution imagery.

Below the set of rules or ‘SOPs for forest state observations’ are outlined. We deliver a set of screenshots with specific commented situations and examples how rules were applied. Shapefiles of all classified point grids and original multispectral imagery are provided to the auditor.

Forest state observation interpretation

The standard image stretch for the Landsat imagery was RGB 543 ArcGIS 0.5 percent. It creates a visualization very similar between different scenes with clear traits of Forest / Non-Forest.

TasseledCap image was tried but not utilized in the end. The information reduction towards the greenness component made dry open forests with little leaves appear too similar to non-forest. Therefore, the use would not have been conservative in the sense of VM0009, where “It is always conservative to interpret forest state as present rather than absent” (page 40).

VM0009 v.1.1 asks the interpreter to take into account the imminent context of the pixel an observation point falls in. As a systematic rule, a 3x3 window of pixels around a point was classified as unit of observation.

VM0009 v.1.1 states that it is conservative to assume forest state as present (page 40). Given the nature of the monitored forest strata including very Open Woodland (till 10% canopy cover at 5m) and the dry deciduous nature of many Zimbabwean forest ecosystems, the interpretation category of forest state was chosen broadly while non-forest had to display very distinct traits of bare soil signal (pinkish-red) or low perennial vegetation (homogenous light green) in image stretch RGB 543 ArcGIS 0.5 percent.

Due to the year-long experience on Landsat and high resolution Google Earth imagery in the area, some special cases of dark-green non-forest vegetation (irrigation, Gokwe South) were taken into consideration at inception of the work. These areas on a specific plateau are stable since 2000 and did not expand.

In case of doubt, like mixed pixels, the histogram equalize stretch was used, which creates strong contrasts. Zooming out, clear forest / non-forest areas nearby were identified. Did the pixel change under histogram equalize more towards appearing like a forest area, it was registered as such and vice versa.

Old Non-Forest / Regeneration

There are several points that display clear Non-Forest traits in earlier years of observation like 2000 and 2003, but display traits with high forest probability in later years. The project proponent believes that a good quantity of these probably represent forest regeneration back to Open Woodland, as Non-Forest observed in 2000 can be in active regeneration already while still not reaching the Open Woodland threshold. Due to various agronomic and ecologic reasons (especially incomplete field clearing, fire resistance and sprouting from rootstock) it is estimated by the field team that regeneration time from Non-Forest with shrubs to Open Woodland can be < 10 years.

Still, VM0009 v1.1 does not allow for a quantification of this phenomenon in forest state observations. A Non-Forest point reverting to forest is treated as “unlikely” or “erroneous point” and discarded (see section 2.4.4.2). Interpreting changes from Non-Forest to Forest state is not incorporated into the CDM as lowering the proportion of deforested area. Therefore the project proponent conducted a review of all points with this behavior and decided to treat all points that were classified as Non-Forest at some point as Non-Forest henceforth till the end of the reference period. This does not affect the observation weights or proportion of deforested area and is therefore in line with VM0009 v1.1.

After all 3187 points per year of the final grid were classified, the unlikely forest state transitions were assessed and revised. In the end no unlikely transition remained so no sample points had to be removed.

2.4.4.4 Model fitting and selection

To fit the Cumulative Deforestation Model, eq. [7] and eq. [16] have to be solved, fitted with the observed increased of the proportion of deforested area observed from the of forest state transition sample points over time in reference period. For eq. [7] socioeconomic covariate date are collected to estimate the linear predictor.

The methodology assumes that deforestation is logistic when bounded by the reference area or project area. Specifically, it assumes that deforestation over time exhibits the implicit form defined by equation [16]. Besides, deforestation is bounded because for any finite area of land, there can only be complete forestation or deforestation (a ratio from zero to one in-between) at the extremes. In this case we know in terms of proportions the maximum potential accumulated land that can be deforested is 1.

In either form, the functional relationship between deforestation and time could be improved by applying some autoregressive parameters to the exponential term t or parameters such as population density, gross product, exports or agricultural prices. The parameter vector θ included in equation [16] represents the aforementioned numeric covariates to deforestation which were identified according to data availability of possible covariates identified for the project area.
Very little historic socioeconomic data for the project area exist. The *Kariba REDD+ Project* collected a volume of socioeconomic data, but we could not find historic information on agricultural production (e.g. output of tobacco or brick making) in order to correlate a trend with the observed deforestation in the reference period.

The Kariba REDD+ Project staff searched extensively for multi-annual socio-economic data relevant to land-use and the reference region. Two major obstacles were encountered:

1. Information was either a single data point, not multi-annual and did not serve to construct a co-variate.

2. Information was obviously incomplete or even manipulated due to turbulent socio-economic circumstances in the last ten years.

“It is important to know that in almost every case there were no records available and when we did receive some information, it was often unreliable. Basically due to the economic and political circumstances responsible recording entities were just simply not keeping records or [they were] unreliable. It is also important to understand that much of this type of information is simply not available at ward or district level.” – The Kariba REDD+ Project coordinator in Zimbabwe.

The following institutions, organizations and databases were approached and consulted in an extensive eight month data-mining effort:

1) All socio-economic data was requested initially directly from the relevant RDC’s

2) Recent published literature from the Zimbabwe Statistics department (Zimstats) and Zimbabwe National Census offices was purchased, but most of their information is outdated.

3) Several website[36] searches were done including world recognized sites such as FAO, UNDP, WHO, UNICEF, The Red Cross etc.

4) We also had meetings with the Cotton Marketing Board, Tobacco Industry Marketing Board, Commercial farmers Union, Agritex, Grain Marketing Board, Zimbabwe National water Authorities for national figures on the main crops grown in the project areas.

None of these sources delivered significant information with decent reliability, applicable to the entire reference region or with multi-annual records.

The only reliable, multi-annual data found on the district level applicable to the reference region was the official population census between 1992 and 2002[37]. This data was selected as covariate in the equation [7] of the methodology. We followed the VM0009 requirement: "Covariate data are collected for each state at each time period for which there exists imagery. As such, covariate data may need to be interpolated from their sources (e.g. census data that may only be collected once every ten years). These data are used to estimate the linear predictor [7] where is the parameter vector. "(page 42)

Equation 7 was fitted using a multiple linear regression with an initial weight vector that corrects for spatial and temporal artifacts from sampling historic imagery. Given all possible covariates the methodology suggests to select the best subset of covariates using AIC as a measure of fit. In the case of this project, there is only a covariate used (population). An AIC criterium was not necessary to select the best subset of covariates.

The population data used as an input in our first attempt to resolve eq. [7] with the interpolated years was provided to the auditors separately.

This linear predictor given time and population uses the eq. [7] multiple linear regression that describes the relationship between "Proportion of area deforested" and 2 independent variables: time (t) and population (x). The equation of linear predictor η is:

$$\eta = 0.261 + 0.0217t + 2.095e^{-10}x \quad (0)$$

However in determining whether the model can be simplified, a highest P-value was found on the independent variable, x, of 0.9842. Since the P-value is greater or equal to 0.05, the covariate of population is not statistically significant at the 95.0 per cent or higher confidence level.

[36] http://www.ruralpovertyportal.org/web/guest/country/statistics/tags/zimbabwe
http://www.wfp.org/node/3586/2128/284031

[37] Smallest unit for which data are given are districts, which sometimes include reference area and project area (e.g. Mbire).

Basis for the data are Zimbabwean census data published by The Zimbabwe National Statistics Agency (ZIMSTAT).

Consequently, population can be removed from the eq. [7] and the model. Thus, the adapted regression to calculate the linear predictor η is only based on the increasing "Proportion of deforested area" fitted against time t.

To differentiate from the equations of methodology VM0009 we use roman enumeration.

$\eta = 0.261 + 0.0217t$ (I)

This model had a statistically significant relationship between the variables at the 95.0% confidence level with a R^2= 97.19% and AIC[38]=-10.54, which is better than the equation´s form including the population data (0) and was therefore selected as the final linear predictor η without the inclusion of scarce and unsecure census data. The same pattern was found and solution applied by earlier validated VM0009 projects.

In VM0009, the model defined by equation [16] is fit using iteratively reweighted least squares (IRLS) with initial weights w, the observation weights, and given the observed covariates and states 0 in vector format. IRLS is used to find the maximum likelihood estimates of a generalized linear model, and in robust regression to find an M-estimator, as a way of mitigating the influence of outliers in an otherwise normally-distributed data set. For example, it will minimize the least absolute error rather than the least square error. One of the advantages of IRLS over linear and convex programming is that it can be used with Gauss–Newton and Levenberg–Marquardt numerical algorithms[39].

In our case, we used an IRLS method with the Levenberg-Marquardt (LM) algorithm. LM is an iterative technique that locates the minimum of a multivariate function that is expressed as the sum of squares of non-linear real-valued functions. It has become a standard technique for non-linear least-squares problems, widely adopted in a broad spectrum of disciplines. Like all non-linear optimization methods, LM is iterative: initiated at the starting point and producing a series of vectors that converge towards a local minimized parameter for the function[40].

The increase in proportion of deforested area over time and its accumulation allows us to determine the total loss of forest cover at any time t.

Transformation of equation 16:

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[38] Técnicas de predicción con aplicaciones en Ingeniería
Manuel R. Arahal,Manuel Berenguel Soria,Francisco Rodríguez Díaz. 2006. http://books.google.com.ar/books?id=6XPwOImLISEC&pg=PA137&lpg=PA137&dq=CRITERIO+DE+AKAIKe+PARA+UN+MODELO&source=bl&ots=PACNHr_RX7&sig=7OOGqsd_MUIMJz2FFwbF2u4mRrs&hl=es&sa=X&ei=BigEUOGYNIG36wHO1qXoBg&ved=0CFUQ6AEwBw#v=onepage&q&f=false. $AIC = Ln((1 + \frac{2n}{N}) \times MSE)$ Where, n=number of parameters (3), N=number of data(45), MSE=mean square error(0.00017)

[39] http://en.wikipedia.org/wiki/Iteratively_reweighted_least_squares

[40] Manolis I. A. Lourakis. 2005. A Brief Description of the Levenberg-Marquardt Algorithm Implemened by levmar. Institute of Computer Science Foundation for Research and Technology - Hellas (FORTH) Vassilika Vouton, P.O. Box 1385, GR 711 10 Heraklion, Crete, GREECE. Available in: http://www.ics.forth.gr/~lourakis/levmar/levmar.pdf

$$F_{DF}(t,\eta) = \frac{1}{1+exp^{(-\eta(t,\theta))}} \quad \text{(II)}$$

Equation 16 of the methodology

$$F_{DF}(t,\eta) = \frac{1}{1+exp^{-(\alpha+\beta t)}} \quad \text{(III)}$$

As population was found an insignificant factor, θ can be eliminated and $\eta = \alpha + \beta t$ put directly

$$F_{DF}(t,\eta) = \frac{1}{1+exp^{-(\alpha)}\ exp^{-(\beta t)}} \quad \text{(IV)}$$

As α is constant in [7] it can be directly resolved with *exp* to form *b*

Where $e^{-(\alpha)} = b$ is a constant value. Finally

$$F_{DF}(t,\eta) = \frac{1}{1+b\ exp^{-(\beta t)}} \quad \text{(V)}$$

The equation was re-parameterized using $exp^{-(0.261)}$ and β (0.0217) estimated in equation 7 as starting values in the automatic iteration process with the aim of getting a more stable model.

Filling in our linear predictor η and the automatically calculated integration constant *b* we receive the final equation for the logistic cumulative deforestation model

$$F_{DF}(t) = \frac{1}{1+2.60597*\exp[-0.17428*t]} \quad \text{(VI)}$$

This re-parametrized model had a statistically significant relationship between the variables at the 95.0% confidence level with a R^2= 92.73% and AIC[41]=-7.290.

The only difference from the original equation is the elimination of the parameter vector $\boldsymbol{\theta}$ because it also did not enter eq. [7] significantly, which had been implemented by earlier validated VM0009 projects as well. *b* is an integration constant calculated from the input data in the STATGRAPHICS CENTURINO XV software package to make logistical models more stable. It is not influenced by the project proponent and helps to calculate stable model iterations. Please see the list of variables used to determine the uncertainty on the cumulative deforestation model in section 2.4.4.4 below for details.

The linear model $F_{DF}(t)$ = 0.03188 * t (cf. figure 2) predicts deforestation consistently more conservatively than the logistic function and is selected as the cumulative deforestation model for the Kariba REDD+ Project.

A graph of the selected linear rate compared to the logistic model from the project start date to end date is presented below to illustrate that the linear rate is conservative.

[41]Ibid. $AIC = Ln((1+\frac{2n}{N})\times MSE)$ Where, n=number of parameters (2), N=number of data (11), MSE=mean square error (0.00050).

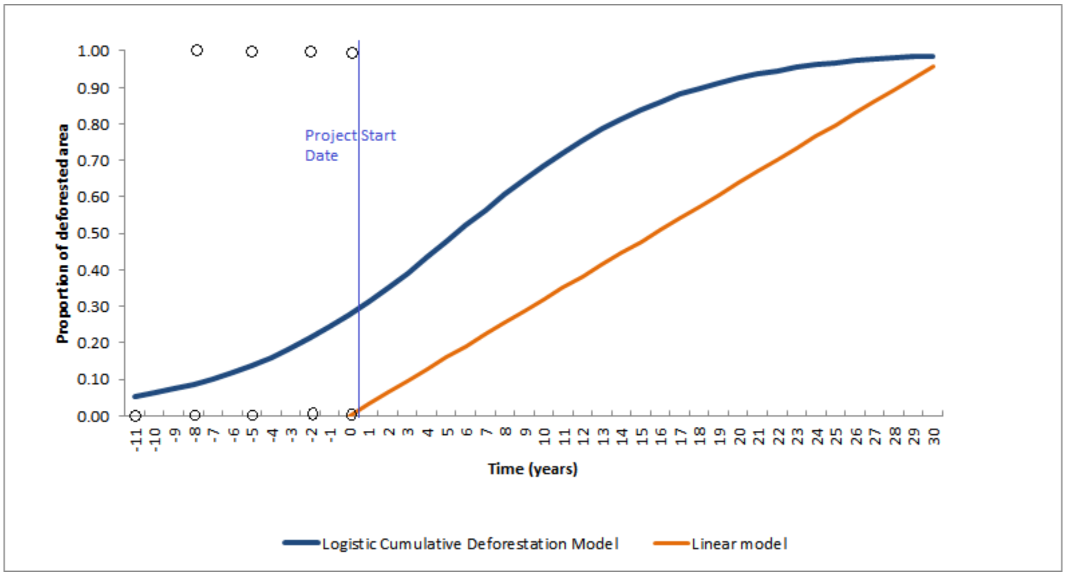

Figure 2: Proportion of deforested area estimated by logistic function fitted by equation [16], and by the selected linear CDM. The project start (year 0 on x axis) is 2011.

2.4.4.5 Predicting cumulative deforestation

The following table summarizes the predicted cumulative deforestation, based on the selected linear rate described above. The predicted value of F_{DF} at the end of the first monitoring period is 0.03188.

Table 15: Cumulative predicted deforestation at end of monitoring periods.

Year	Cumulative deforestation (F_{DF})
2011	0.00000
2012	0.03188
2013	0.06377
2014	0.09565
2015	0.12754
2016	0.15942
2017	0.19130
2018	0.22319
2019	0.25507
2020	0.28695
2021	0.31884
2022	0.35072
2023	0.38261
2024	0.41449
2025	0.44637
2026	0.47826
2027	0.51014
2028	0.54203
2029	0.57391
2030	0.60579
2031	0.63768
2032	0.66956
2033	0.70144
2034	0.73333
2035	0.76521
2036	0.79710
2037	0.82898
2038	0.86086
2039	0.89275
2040	0.92463
2041	0.95652

2.4.4.6 Estimating uncertainty of the cumulative deforestation model

From the determination of the historic deforestation in the reference area and application of eq. [17], the following parameters for the calculation of the uncertainty are derived[48]:

$\sum_{i \in j} W_i \times O_i$	0.1530444
σ_{DF}	0.3600155
n_{DF}	9902

Applying these parameters to eq. [15], we receive the Uncertainty of the Cumulative Deforestation Model (U_{DF}):

$$U_{DF} = 0.0463 = \frac{0.3600155 * 1.96}{\sqrt{9902} * 0.1530444}$$

2.4.5 Soil carbon loss

2.4.5.1 Background

Deforestation strongly impacts the soil carbon content in woodland ecosystems, also in Southern Africa.[49] Therefore, soil carbon is selected as a modeled and monitored carbon pool on the Kariba REDD+ Project. Soil carbon is sampled down to a profile depth of 30 cm, for two reasons:

- The basic local agricultural practices typically only affect at maximum the highest 25 cm of the soil profile,
- A study shows further loss of carbon as a consequence of deforestation in deeper layers of the soil profile, so our approach is conservative[50]

Soil sample plots are aligned with biomass sampling loss, in order to allow for an efficient work process. For each biomass sampling plot, a soil sample is taken, consisting of two sub-samples. For circular biomass sampling plots, soil sub-samples are taken directly adjacent to the biomass sampling plot, both in northern and southern directions. For transect biomass sampling plots, each soil sub-sample is taken at the two shorter ends of the transect. For each sub-sample, values are gathered separately. The mean value of the two sub-samples is then established prior to data analysis. This measure is taken in order to increase the reliability of the sampling process.

PD requirements 1 (a map of the reference area showing the locations of the farms selected for sampling) and 3 (a table with the collected data including bulk density, soil carbon, proportion of soil carbon lost, in line with requirements of the IPCC[51] and the methodology) will be provided upon the first verification where soil is an included carbon pool.

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[48] See the separately provided spreadsheet „130802_Forest state observations full sample.xlsx".

[49] Walker, S.M. & P.V. Desanker (2004) The impact of land use on soil carbon in Miombo Woodlands of Malawi. Forest Ecology and Management 203: 345-360

[50] Walker, S.M. & P.V. Desanker (2004) The impact of land use on soil carbon in Miombo Woodlands of Malawi. Forest Ecology and Management 203: 345-360

[51] IPCC (2003) GPG LULUCF, section 4.3.3.5.4. http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp4/Chp4_3_Projects.pdf.

2.4.5.2 Description of Soil Types

For detailed information on soil, please refer to section 1.10 on the conditions prior to project initiation.

2.4.5.3 Minimizing uncertainty

A Standard Operation Procedure (SOP) has been developed, which is to be followed while working in the field. A copy of the SOP is provided to the Auditor. The field team is instructed on how to apply the SOP on the ground and any perceived ambiguities are solved before the beginning of the field campaign. Following a strict SOP, together with consistent field staff ensured a high accuracy and comparability between the different collected soil samples.

Carbon content of the samples is analyzed in the Chemistry & Soil Research Laboratory of the Department for Research & Specialist Services of the Ministry of Agriculture in Harare, which has established relations with Black Crystal Consulting and a solid track record in laboratory analysis work. Organic Carbon is estimated using the Walkley-Black method.[52] In order to allow a streamlined data handling process and save data storage, the soil carbon values are stored in the Monitoring and Verification System (MOVERS) online tool. A guest login to MOVERS is provided to the auditors. Two sub-samples are collected per sampling plot and consolidated after lab analysis in order to reduce uncertainty from heterogeneous soils. The samples are consolidated only after lab analysis to allow for a quality check on the received laboratory results. Data pairs from two sub-samples with highly different results will be followed-up on and laboratory test can be repeated.

The field data will be used to calculate the carbon stocks by applying to following equations:

- Equation 60 to calculate the corrected bulk density for each plots
- Equation 61 to calculate the soil carbon stock per unit area
- Equation 44 to calculate the total carbon stocks
- Equation 46 to estimate the variance within each stratum
- Equation 49 to estimate the standard error of the total soil carbon stock

2.4.5.4 Model fitting

We apply the conservative default value for the carbon loss rate of λ = 0.20, which is provided in the methodology and based on literature review for tropical systems.

2.4.5.5 Predict soil carbon loss

Deforestation and agricultural land use of miombo woodlands leads to a strong decrease in the soil carbon, which has been described by Walker & Desanker (2004)[53]. There, the carbon density in miombo woodlands is given as 82.5 tC/ha or 302.6 tCO_2/ha and the carbon density for agriculture is given as 49.0 tC/ha or 179.8 tCO_2/ha.

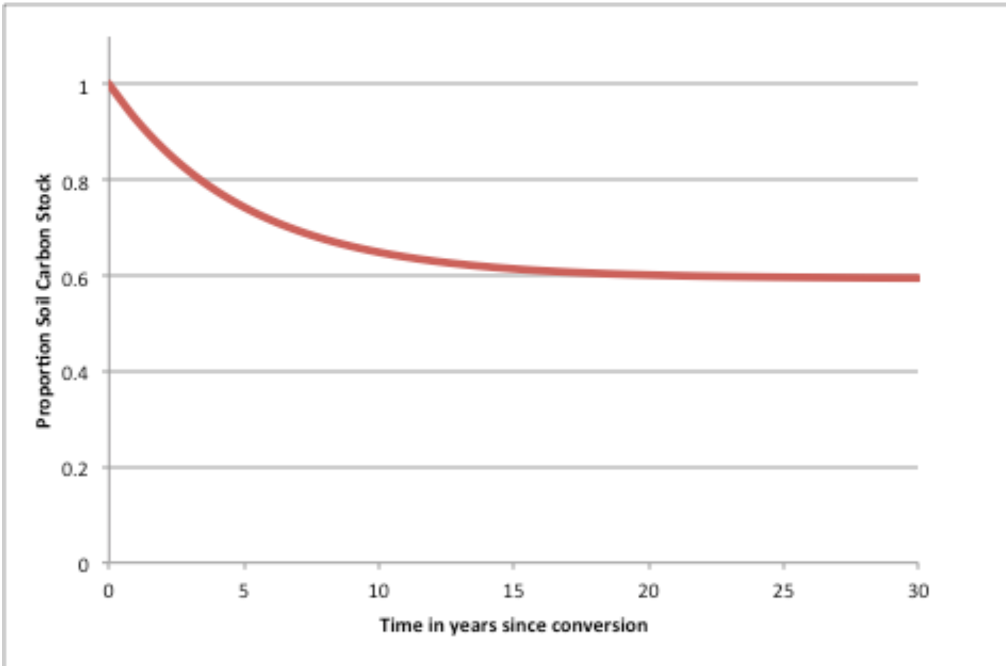
The soil carbon loss model will be updated with real value measured in the field after the first monitoring period where soil carbon is a selected carbon pool. As an ex-ante estimate, the

[52] For further information please refer to http://aesl.ces.uga.edu/protected/methods/details/stl-soil/12.html.

[53] Walker, S.M. & P.V. Desanker (2004) The impact of land use on soil carbon in Miombo Woodlands of Malawi. Forest Ecology and Management 203: 345-360

literature value by Walker & Desanker (2004) can be used to estimate the maximum proportion of soil carbon lost over time l_{max} as l_{max} = 0.41.

The below graph shows the resulting theoretical model, based on equation 13.[54] The empirically measured model will be provided at the first verification where soil carbon is a selected carbon pool.



[54] The calculations are available in the spreadsheet „“130722_Soil carbon model ex_ante.xlsx“ in the supporting documents.

2.4.5.6 Estimating uncertainty in the soil carbon loss model

Uncertainty is estimated according to eq. 19 of the methodology:

$$U_{SCL} = 1.96 \times \hat{\sigma}_{SCL} \times \left[\sqrt{n_{SCL}} \times \frac{1}{n_{SCL}} \sum_{i \in \mathcal{A}} y_i \right]^{-1}$$		[19]
Variables	U_{SCL} = estimated uncertainty of the soil carbon loss model $\hat{\sigma}_{SCL}$ = the estimated standard deviation of soil carbon stocks in the reference area n_{SCL} = the actual sample size used to estimate the maximum soil carbon loss proportion in the reference area, equal to $\#(\mathcal{A})$ y_i = the soil carbon stock of the i^{th} measurement in the reference area (in tonnes per unit area) $a_{project}$ = total project area $\mathcal{A}$ = the set of all sampled farms in the reference area used to estimate the maximum proportion of soil carbon loss	
Section References	6.5.7	
Comments	Estimated uncertainty of the soil carbon loss model This assumes a normal approximation. This is derived from the standard error of the mean estimated carbon stock in the reference area at the 95% confidence level divided by mean carbon stock in the reference area.	

The parameters of eq. 19 will be provided upon first verification where soil carbon is an included carbon pool.

2.4.6 Baseline scenarios for selected carbon pools

2.4.6.1 Scenario for above and below-ground small/large trees and non-trees

The Dry Land Forest of the project area as well as the surrounding reference / leakage area is characterized by small-to-large sized trees (which in reality are medium trees but are counted in the large tree carbon pool category as medium trees are not addressed in the methodology). The above and below-ground portion of small/large trees and non-trees are assumed to be removed, burned or converted to fuelwood. When forest land is converted to agriculture all the larger trees - with the exception of Baobabs, which have cultural values[55] - are chopped by axe and burned at the base until the tree eventually falls over. The fire smolders into the stump down below the ground surface destroying the main root system. Any coppicing is repeatedly chopped or burned so that remaining biomass dies out. Also any seedlings from seeds blown in are weeded out. The OGM team leaders have a combined experience of 30 years in the project areas and have not seen any stumps in a field. We therefore do not differentiate large trees from small trees for this project. As a result we contend that it is common practice in this region to burn the stumps out, and therefore we select 100 per cent as the proportion of below ground biomass removed from large trees.

2.4.6.2 Scenario for standing deadwood

Standing deadwood is assumed to be completely removed, burned or converted to fuelwood as a result of land conversion to agriculture. Standing dead trees are categorized into two decomposition classes: trees with branches and twigs that resemble live trees (class I), and trees that show loss of twigs, branches or bole mass (class II). The carbon stock of trees in decay class I is estimated using the equation developed for live trees. The carbon stock of decay class II is estimated as the biomass in the remaining bole only.

2.4.6.3 Scenario for lying dead wood

Lying deadwood is conservatively excluded. Please refer to section 2.3 for further details.

2.4.6.4 Scenario for wood products

There is no harvest of commercial timber from the project area in the Baseline, nor for wood carving, furniture etc. The only potential harvest of wood products under the baseline would be for building materials for local village huts. For example in Binga the community members indicated that they used an average of 80 poles to build one hut and a household had an average of four such houses. Structural material of the houses has to be replaced frequently (on average every 3 years) due to the environmental influences such as termites.[56] No carbon proportion remains therefore in long-life wood products.[57]

2.4.7 Baseline Re-evaluation

This PD was written at the beginning of the project. This section is not yet applicable.

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[55] Chiefs are traditionally buried in a Baobab tree. In addition the wood has a low energy content and is therefore not used as fuelwood

[56] Environment Africa: Kariba REDD Baseline Report, 2011

[57] VM0009, Long-Lived Wood Products: Products derived from wood harvested from a forest, including logs and the products derived from them, such as sawn timber and plywood that are assumed to remain sequestered throughout the lifetime of the project crediting period.

2.5 Additionality

Within the project area none of the proposed project activities (please refer to section 1.8 of the present document) violate any law, even those laws that are not enforced. For more information, please refer to section 1.11 of the present document.

1. Identification of alternative land use scenario:
   a) Subsistence and small-scale farming: Conversion of forestland to cropland or grazing land, fuelwood collection for tobacco curing.[58] This is the most likely baseline scenario.
   b) Logging of timber for local and domestic use (wood constructing homes, fuelwood).[59] This is the second most likely baseline scenario.
   c) Project activities on the land within the project boundary performed without being registered as the VCS AFOLU project: Currently no significant project activities in the project areas exist, no NGO program is conducted. In the past there have been some safari operations in Mbire, Nyaminyami, Hurungwe and Binga under the CAMPFIRE program. In Binga the safari operations collapsed completely due to the loss of wildlife from poaching, which also affected heavily the other project areas.

For further information please refer to section 2.4

2. Consistency of credible land uses with enforced mandatory laws and regulations:
The baseline scenario of subsistence and small-scale farming as well as the use of timber for local and domestic use represent legal land uses and is therefore credible. Rural district council by-laws are in place to address the land use of communal and town land as well as the indication of conservation areas. The council has thereby the power to prepare a land-use plan indicating lands proposed for livestock farming, agricultural activities, land protection and conservation measures etc. There are no super-ordinated regulations in place that protect the wildlife corridors.

3. Investment analysis – simple cost analysis
The project activities to mitigate deforestation in the area (see section 1.8 of the present document) cost the project proponent a significant amount of money annually.[60,61] There exists no significant income to offset these costs without carbon revenues (some income is generated from rudimentary tourism). In the absence of the active protection, both physical and that created by partnering with the communities to create economic alternatives, the land in the project area will be cleared for the alternative land-use scenarios identified in section 2.4 of the present document. This was, in fact, the case prior to the project's arrival. The baseline scenarios do not face any economic barriers.

4. Common practice analysis/barrier analysis

[58] Environment Africa: Kariba REDD Baseline Report, 2011

[59] Environment Africa: Kariba REDD Baseline Report, 2011

[60] A financial plan of the project is provided to the auditor.

[61] In 2009 the management of Songo resulted in a loss of USD 7'500 (Restoration and Rebuilding of Conservation within Zimbabwe. Songo Wildlife Management Area).

It is common practice to protect wilderness areas in Africa and to provide sustainable development support for rural African communities. Governments and/or donor agencies normally fund these activities, and do not expect financial return from the project activities, especially activities outside of National Parks. It is not common practice for private companies that are not donor funded, such as the present project proponent, to protect forested wilderness in Africa for financial return in the absence of AFOLU revenues, especially outside of the National Parks. The project activities that are described in section 1.8 of the present document are designed to address the deforestation drivers identified in the Baseline Report elaborated by Environment Africa in 2011. The project proponent's project is the first AFOLU Carbon Project Activity of its type in Zimbabwe, and one of the very first in Africa.

The project can therefore be classified as not being common practice. No similar activities to the project activities have been implemented previously or are currently underway.

In summary;

- The CGI *Kariba REDD+ Project* is not the only credible alternative land use consistent with enforced mandatory applicable laws,
- One of the alternative land uses, that of subsistence and small-scale farming (in the form of conversion of forestland to cropland or grazing land, fuelwood collection for tobacco curing) is by far the most likely baseline land use,
- The *CGI Kariba REDD+ Project* passes the investment analysis test as it is not a financially viable land use without the AFOLU VCS project revenues, and
- The project activities are not common practice.

Therefore the project is additional according to the rules of VT0001 Tool for the Demonstration of Additionality in VCS AFOLU Project Activities.

2.6 Methodology Deviations

Creation of the point grid

When creating the grid with random origin of point locations for observing forest state, the project proponent encountered an error in the GIS tools designed to support the development a VM0009 CDM. The error did not allow for creating grids of >700 points necessary for the final sample. Thus the project proponent created 6 sub-grids with regular spacing and random origin to merge them in order to obtain a sample size ≥ m_{DF} [eq.6 from pilot sample]. In order to have no observation locations coincide within the same 3x3 pixel window (30m pixel size) interpreted as a point's context (see section 2.4.4.3) all points of a sub-grid were selected and moved in their entirety in order to form a as close-as possible regular merged grid. This was done without respect to the multi-temporal, multispectral imagery and for the entire reference area at once. As the regular spacing could not be maintained equal in all sub-grids, the spacing of points in the final merged grid of 3187 points is no longer regular, but altering. Still, each point is member of a systematic sub-grid with regular spacing moved only it its entirety. As each sub-grid was created with a random origin and the entire sub-grid was always moved in entirety, no bias could potentially have been introduced. No two points share pixels of the same 3x3 pixel window for context interpretation. The location of each point is not related to the phenomenon monitored – the multispectral imagery and its shown landcover.

Selection of co-variates in eq. 7

No covariate was included in eq. 7. Given the limited database in the area, only population was available as a potential covariate. The effect of population was highly insignificant (p=0.98), thus population was not used in eq. 7 and the CDM was re-modeled without any covariates.

The form of equation 7 is estimated using a multiple regression analysis. The general form of a multiple regression is given by equation (a)

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_nx_n + e \quad (a)$$

This equation separates each individual independent variable from the rest, allowing each to have its own coefficient describing its relationship to the dependent variable. In significance testing each independent variable has a number attached to it in the regression results its "p-value" or significance level. The degrees of freedom used to calculate the p-values is given by the Error DF from the ANOVA table. The P values tell us whether a variable has statistically significant predictive capability in the presence of the other variables, that is, whether it adds something to the equation.

In some circumstances, a non-significant p-value might be used to determine whether to remove a variable from a model without significantly reducing the model's predictive capability. For example, if one variable has a non-significant p-value, we can say that it does not have predictive capability in the presence of the others, then it can be removed, and refit the model without it. These p-values should not be used to eliminate more than one variable at a time, as was our case when we only use it to evaluate the covariate significance in the model. p-value of 0.05 means that there is a 5% chance that the relationship emerged randomly and a 95% chance that the relationship is real. As the p-value of population as a covariate is 0.98, the effect of population has a 98 % chance of being a random relation and a 2 % chance of being real. It is therefore common in multi-regression statistics66 67 to eliminate such a term from a multi-regression analysis - even if the AIC of eq. [7] without covariate is slightly lower (AIC=10.54 with population as covariate, AIC=10.67 without population as covariate).

[66] Paul D Allison. 1999. Multiple regression a primer (pg 15-16)

[67] Cohen et al. 2003. Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences. Pg 15

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

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 depicted in the table in Section 2.3 are determined at the verification stage. It should be noted that it is not mandatory to measure ex-ante carbon stocks in the project area according to the applied methodology. The ex-ante estimates of the net carbon benefits of the project are only required to determine whether decreases in carbon pools or increases in GHG emissions are insignificant and need not be measured and monitored.

Carbon Pool	Total baseline emissions in tCO_2
Tree aboveground biomass	98,948,661
Tree belowground biomass	41,558,432
Non-tree aboveground biomass	839,586
Non-tree belowground biomass	352,621
Standing deadwood	226,858
Soil organic carbon	54,587,771
Total	**196,513,929**

Table 16: Estimated baseline emissions for selected carbon pools over total project crediting period.

A spreadsheet with the complete GHG emission analysis for the entire project crediting period is provided separately to the auditor[68].

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.

[68] "130813_KARIBA ER Calc_Ex-ante_V5.xlsx"

- 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.

3.2 Project Emissions

Project emissions for any monitoring period 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 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.

3.3 Leakage

3.3.1 Leakage Mitigation Strategies

No leakage of emissions is expected from the *Kariba REDD+ Project*. Please refer to section 1.13 of the present document.

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 (see section 3.3.3).

3.3.2 Delineating the Leakage Area

The leakage area:
1. Is in the same general region as the project area, and adjacent to the project area:
In the case any leakage occurs it would affect the nearest neighboring areas only, due to the low mobility of the local population and the main driver of deforestation: subsistence agriculture. It is highly unlikely that people are willing to walk further than 2-3 km to maintain their crops (for further information about deforestation drivers and agents please refer to section 2.4 and 1.13). However, in order to fulfill the requirement of at least equal forest area in the leakage belt as in the project area, we choose a 10 km leakage belt only including Zimbabwean territory (north of the Mbire project area lies the border with Mozambique).

2. Has the size of the forested portions of the project area:

The leakage area (entirely forested at project start date) has an area of 841'823.89 ha. Shapefile and KML file have been provided separately to the auditors.

3. Partially overlaps with the reference area.

4. Is entirely forested as of the project start date July 1st 2011.

5. Landscape configuration including the following:
a. Topographic constraints to deforestation

Baseline agents walk to agricultural fields by foot. Terrain in the leakage area is similar as in the project areas. As explained in section 2.4.3, there is no terrain too steep for humans to walk and access by foot. Therefore, it can also be seen from map 6 that no topographic constraints exist in the leakage area:

b. Land use and/or land cover constraints to deforestation:
The entire leakage area is forested and therefore no land use and/or land cover constraints to deforestation exist.

c. Access points that may constrain deforestation:
As stated above the leakage area was specifically chosen because of its equal accessibility to agents and drivers of deforestation.

d. Areas of limited soil productivity:
The entire leakage area is forested and therefore no areas of limited soil productivity exist.

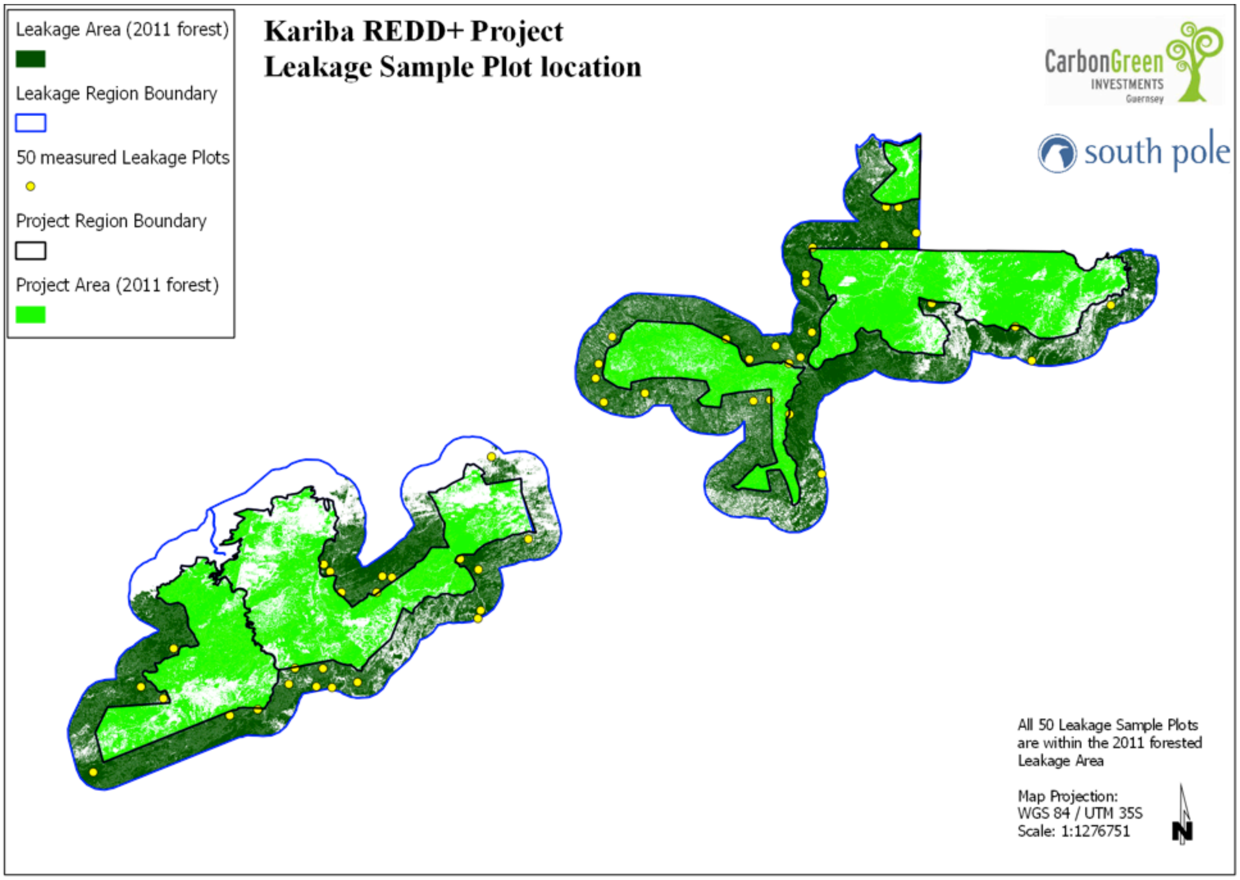
e. Ownership/tenure boundaries that constrain deforestation (government holdings, private holdings and reserves).
The leakage area consists of community lands, national parks and safari game reserves. The reasons for including protected areas that border the project area into the leakage area are the following:

- *De facto* these protected areas do not constrain deforestation. Evidence of officially tolerated squatter invasions into protected areas bordering the project has been provided (Chronicle, 29th of March 2012, provided separately to the auditors).

- As the local population affected by project activities generally does not possess means of transport, agricultural clearing in forest areas >2-5 km from their village is not feasible and also has never been noticed. Still, to be safe we include a 10 km leakage belt which contains as much forest as the project area.

- Thus, the only forests under effective risk of leakage are those close by to the project area including those in *de jure* protected areas.

The Kariba REDD+ Project is convinced that leakage into protected areas presents far more real risk than leakage into forests at >10 km distance. Leakage into protected areas must be avoided and therefore inclusion of these areas into monitoring and leakage management activities is crucial.



Map 15: Map showing leakage area (forested at 2011)

6. The leakage area must be as constrained by landscape configuration as the project area.
The leakage area is as constrained by landscape configuration as the project area, which was demonstrated 5 a-e.

Please note: In case any leakage occurs it would affect the nearest neighboring areas only, due to the low mobility of the local population (deforestation driver). This is why a leakage belt around the project areas has been chosen. Refer to map 15 for a representation of 10 km belt around the project area RDCs which includes the 841'823.89 hectares of the leakage area. The forested leakage area is the forest at 2011 within the blue-dotted belt around project area.

3.3.3 Leakage Model

The leakage model, F_{LE} (t, η , δ_{LE}), is calculated according to eq. 8 as an adapted version of the logistic cumulative deforestation model made from observations in the reference region (see section 2.4.3) and results of the first monitoring of the leakage area. The CDM's prediction of annually added proportion of deforested area is adjusted by the lag parameter δ_{LE} to form the leakage model.

The required sample size for leakage plots m_{LE} is calculated by applying eq. 10 to the standard deviation of the state observations used to fit the CDM, σ_{DF}. In our case this results to

$$\widehat{m}_{LE} \geq \left(\frac{\hat{\sigma}_{DF} * 1.96}{0.1}\right)^2 = \left(\frac{0.3600 * 1.96}{0.1}\right)^2 49.788$$

Therefore a total of 50 leakage sampling plots have been implemented in the first monitoring period, following the approach described in section 4. Map 15 shows the location of the implemented leakage plots in the leakage area.

The results[69] of the first monitoring of the leakage plots are shown Table 17.

Table 17: Results from the first monitoring of the leakage sampling plots, used to determine the leakage model.

Leakage Factor	**Number of sampling plots**
0	38
0.2	7
0.4	3
0.6	0
0.8	2
1	0
Total number of plots	**50**
Observed degradation $\hat{d}_0$	**0.084**

Based on the results, the lag parameter of the leakage model is calculated[70] based on eq. 9 as to:

$$\hat{\delta}_{LE} = \log(\hat{d}_t) + \log(1 - \hat{d}_t) + \hat{\alpha} + \widehat{\boldsymbol{\Theta}}\boldsymbol{x}^{\boldsymbol{T}} = \log(0.084) + \log(1 - 0.084) + (-0.9578) = -2.072$$

The leakage model according to eq. 8 is thus:

[69] For detailed information, please refer to the spreadsheet „130802_Leakage plots and lag factor_V5.xls“, provided in the supporting documents.

[70] Ibid.

$$F_{LE}(t, \eta, \delta_{LE}) = \frac{1}{1 + 2.60597 * \exp[-0.174 * t - (-2.072)]}$$

The leakage model is plotted in Figure 3 along with then logistic cumulative deforestation model.

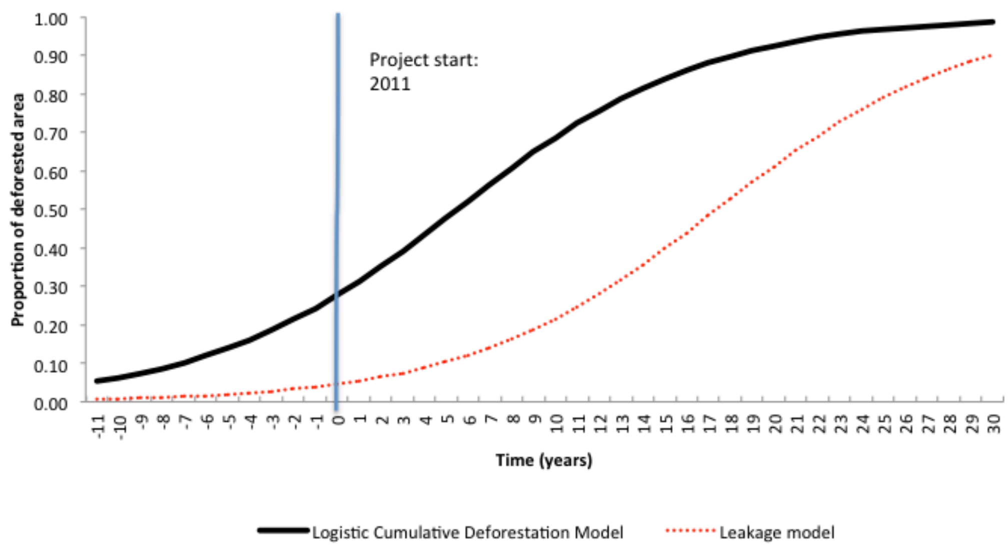


Figure 3: Leakage Model and Logistic Cumulative Deforestation Model.

The leakage model will be updated when the baseline is re-evaluated (cf. section 1.6).

3.3.4 Estimating the Leakage Factor and Emissions from Leakage

The mean observed deforestation and degradation in the first monitoring is 0.084 and was used to fit the leakage model. All sampled plots showed a value ≤ 0.8, therefore it can be assumed that no leakage occurred since the project start date (cf. section 10.3.3 of the methodology).

At future monitoring periods, all 50 leakage plots will be re-measured as described in section 4.3.

Based on field measurements, the leakage factor will then be calculated using eq. 33. Leakage emissions are calculated by using eq. 32.

3.4 Summary of GHG Emission Reductions and Removals

The ex-ante estimate of the gross total NERs generated by the project is 196’513’929 tons CO_2e. The temporal evolution is shown in Table 18. The total GHG Emission Reductions and removals (NERs) are calculated according to eq. [34] of the methodology .Based on a risk buffer allocation of 16.5% (cf. Annex), an estimated total of 32’424’798 NERs will be allocated to the VCS buffer pool, which results in 164’089’131 Net Total NERs over the total project crediting period.

For a separation of the baseline emissions into the selected carbon pools, refer to Table 16 and the ex-ante calculations in the spreadsheet provided separately.[71]

Table 18: Ex-ante calculation of baseline emissions/removals, project emissions/removals, leakage emissions and net emission reductions and removals. The year indicates the year in which the monitoring period ends. E.g. the emissions reductions achieved in monitoring period 1 (July 2011- June 2012) are reflected here as year 2012 for simplicity.

Years	Estimated baseline emissions or removals (tCO_2e)	Confidence deduction (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2012	6,896,913	0	0	0	6,896,913
2013	7,030,303	0	0	0	7,030,303
2014	7,187,083	0	0	0	7,187,083
2015	7,365,343	0	0	0	7,365,343
2016	7,414,472	0	0	0	7,414,472
2017	7,431,841	0	0	0	7,431,841
2018	7,423,208	0	0	0	7,423,208
2019	7,393,285	0	0	0	7,393,285
2020	7,345,932	0	0	0	7,345,932
2021	7,284,309	0	0	0	7,284,309
2022	7,211,002	0	0	0	7,211,002
2023	7,128,129	0	0	0	7,128,129

[71] “130813_KARIBA ER Calc_Ex-ante_V5.xlsx”

2024	7,037,423	0	0	0	7,037,423
2025	6,940,306	0	0	0	6,940,306
2026	6,837,939	0	0	0	6,837,939
2027	6,731,274	0	0	0	6,731,274
2028	6,621,089	0	0	0	6,621,089
2029	6,508,024	0	0	0	6,508,024
2030	6,392,599	0	0	0	6,392,599
2031	6,275,243	0	0	0	6,275,243
2032	6,156,306	0	0	0	6,156,306
2033	6,036,074	0	0	0	6,036,074
2034	5,914,783	0	0	0	5,914,783
2035	5,792,623	0	0	0	5,792,623
2036	5,669,753	0	0	0	5,669,753
2037	5,546,302	0	0	0	5,546,302
2038	5,422,374	0	0	0	5,422,374
2039	5,298,056	0	0	0	5,298,056
2040	5,173,419	0	0	0	5,173,419
2041	5,048,521	0	0	0	5,048,521
Total	**196,513,929**	**0**	**0**	**0**	**196,513,929**

In the event that the quantified NERs for any monitoring period are negative as a result of carbon stock losses, the project proponent will follow the VCS procedures for reversals as set out in the latest version of the VCS. If after baseline re-evaluation, a new cumulative deforestation model falls below the old model, this would not constitute a reversal. Rather if credits were generated from avoided deforestation prior to baseline re-evaluation at a level greater than predicted by the new baseline model after baseline re-evaluation, then the project proponent will not generate any new credits from avoided deforestation until the new cumulative deforestation model reaches the previous level of predicted deforestation that generated these credits.

At the end of the project crediting period, the project proponent must estimate the final level of cumulative deforestation using the most current baseline model and use this estimate to quantify the total number of cumulative credits per eq. [34] (see above). If this estimate is greater than the number of credits issued during the project crediting period, then this difference will be subtracted from the buffer pool.

4 MONITORING

4.1 Data and Parameters Available at Validation

A list of parameters available at validation is provided in Annex 3, provided separately.

4.2 Data and Parameters Monitored

All variables and parameters referred to in Annex B of VM0009 that are not available at validation are monitored as required by the methodology.

4.3 Description of the Monitoring Plan

4.3.1 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 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 PD refer to the process of data collection.

4.3.2 Stratification

In order to most accurately estimate the biomass of the project area taking into consideration reasonable time and expenses, major strata are established. 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 276’059 ha and the stratum Open Woodland accounts for 508’928 ha.

4.3.3 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 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 (2011) 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, soil carbon, ground truth and leakage points.
- As many more ground truth points are needed for remote sensing classification for forest cover map creation (SOPs on Forest Cover Maps) 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 (see above) 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 as outlined in the SOPs on Forest Cover Maps.

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, but the values are consolidated by taking the average before the data analysis.
- A pit or core of 30 cm depth is excavated. If a rock layer is encountered before 30 cm depth, it is noted on the data sheet. The rock layer is conservatively assumed to have a carbon density of 0 per cent.
- Bulk density and soil carbon samples are taken using a metal ring of known volume both from the highest and the lowest 10 cm of the core/pit. Weight of the bulk density sample is recorded in the field, but corrected for soil water content in the lab. If the soil is too sandy to use a metal ring, samples are brought to the lab and bulk density is assessed using the FAO approved method to determine the bulk density of disturbed soil samples.[74] Carbon samples are analyzed in the lab for their relative carbon content.
- The excavated soil is thoroughly mixed and big lumps are smashed. Afterwards, it is sieved with a 2 mm sieve to exclude pieces of gravel. Gravel is collected in a bucket. The volume of the core or pit is measured by lining it with a plastic wrap, putting in the sieved

[74] http://neareast.fao.org/App_Uploads/NE2010050597/Files/Analysis-English.pdf, page 35.

gravel and filling up with water of recorded volume. The added volume of water represents the volume of fine soil. Gravel is then removed and additional water added until the pit/core is full again. The additionally added volume of water represents the volume of rocks. If no obvious pieces of gravel are present, this step is omitted. However, 10 per cent relative rock content is assumed during data analysis in this case.

- A detailed Standard Operating Procedure has been produced and is provided to the Auditors.

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.[75]
- When arriving to the starting point of the first plot, a permanent marker (metal fencing standard) is hammered into the ground.
- Plot size and plot type:
  Biomass plot:
  - 8.9 and 9 m radius circle for trees

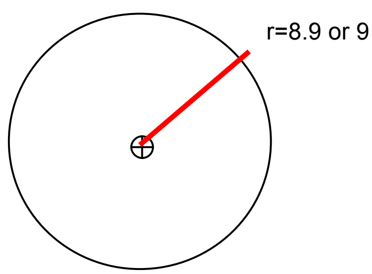


Figure 4: Schematic representation of a sample plot and the clockwise measurement

  - In case of thicket woodlands, transects of 6 m x 42 m are implemented.[76]

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

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

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

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

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 shown in Table 19 is determined for each plot. The leakage plot is recorded in a GIS system. A Standard operating procedure for leakage plots is applied.[77]

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:

Table 19: Factors recorded on leakage plots.

Factor	Proportion of degradation and deforestation
0.0	0%
0.2	0-20%
0.4	20-40%
0.6	40-60%
0.8	60-80% (severe degradation)
1.0	80-100%(including complete deforestation)

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. The forest inventory manual has been provided separately to the auditor.

4.3.4 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.

[77] "121130_SOP leakage area data collection.pdf" in the supporting documents.

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.

4.3.5 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 will be developed 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. 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. 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.

4.3.6 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[78,79,80]. The plan that describes specific QA/QC procedures is as follows:[81,82]

- 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 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. 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 will be 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. For this purpose CGI will designate a QA/QC coordinator.

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

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

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

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

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

4.3.7 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. A list of allometric equations is provided separately to the auditor.

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 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.

4.3.8 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[83] 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

[83] “130724_SOP FOR TREE DATA COLLECTION FINAL.doc” provided in the supporting documents.

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.

5 ENVIRONMENTAL IMPACT

The project area lies within the Zambezian biome of the Zambezi basin.[84] The major ecosystems include mopane[85] and miombo[86] woodland. The project area is an important wildlife area, showing significant populations of African elephants, lions, impalas, hippos 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. An extensive biodiversity assessment in an adjacent area found a total of 150 mammal, 504 bird, 133 reptiles and 274 butterfly species.[87] An extensive list of common species in the project area is listed in Annex 2 to the present document.

The area hosts several threatened species. They are listed in Table 20. This qualifies the project area as a HCV1: "Areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, refugia)".[88]

Table 20: Endangered species in the project area. Levels of threat refer to the classification by the IUCN[89]

English Name	Scientific name	Comments
Critically endangered species (CR)		
Black rhino	*Dicero bicornis*	Probably none left in the project area, but a few in adjacent national parks. These could move back into the project area once rigorous anti-poaching activities are in place.
Endangered species (EN)		
African wild dog	*Lycaon pictus*	Only very few still remain in the area.
Vulnerable species (VU)		

[84]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.

[85] Mopane woodland is a varied vegetation type found on deep grey-to-brown sandy clay loam to clay soils formed from Karoo mudstone. It is characterized by a dominance *Colophospermum mopane*.

[86] Miombo is the vernacular term for the seasonally dry, deciduous woodlands that are widespread across southernAfrica. These woodlands are dominated by *Brachystegia,Julbernadia* and/or *Isoberlinia.*

[87]Timberlake, J. & Childes, S. (2004), Biodiversity of the Four Corners Area: Technical Reviews. Occasional Publications in Biodiversity No. 15. Biodiversity Foundation for Africa,Bulawayo & Zambezi Society, Harare, Zimbabwe. Available online under http://www.biodiversityfoundation.org/publications.htm.

[88]See http://www.hcvnetwork.org/

[89] http://www.iucnredlist.org/

Lion	*Panthera leo*	The project area is a perfect habitat for lions, but there are very few in the area.
Southern ground hornbill	*Bucorvus cafer*	The project is prime breeding ground for the ground hornbill and a healthy number still exists in the area.
Common hippo	*Hippotamus amphibius*	There is a large amount of hippo in Kariba Lake.
African elephant	*Loxodonta africana*	The populations in the project areas have been seriously depleted by poaching and overhunting in the last decade, but there are still substantial numbers in the National Parks Estate (NPE). During the rainy season some herds move out of NPE to raid crops in nearby fields.
Cheetah	*Acinonyx jubatus*	Probably none left in the area; there used to be a fair number in the past decade.
Lappet-faced vulture	*Torgos tracheliotos*	There are still a few lappet-faced vultures in the region but they are on the decline.
White-headed vulture	*Trigonoceps occipitais*	There are still a good number of white-headed vultures in the area.

The *Kariba REDD+ Project* will serve as a corridor between existing national parks, namely Mana Pools, Matusadona and Chizarira national parks, to assure connectivity (cf. Map 3). By providing a corridor for wildlife, the project will have a positive impact on biodiversity not only within the project area but also outside the project area. This positive impact could include improvement of the habitat conditions for such threatened species as the Black Rhinoceros (*Dicerosbicornis*), of which few individuals are left in the adjacent national parks.

In the past, the natural resources of the project areas supported significant populations of wildlife, including elephants. In turn this supported a variety of tourism and safari activities. However, the economic and political crisis over the past decade has led to a decrease in tourism. Poaching has also escalated in the project area. As a result, wildlife populations have been severely reduced. By implementing the project activities to address the deforestation drivers and agents and therefore decrease deforestation and assure connectivity by the corridor between the project and existing parks, the project will result in positive environmental impacts.

The project has been validated under the Climate Community and Biodiversity Standard by February 8th 2012. Positive climate, community and biodiversity impacts have been proven in the CCBS PDD.[90]

[90] http://www.climate-standards.org/projects/index.html

6 STAKEHOLDER COMMENTS

Within all four affected RDCs, CGI has sought early support for the *Kariba REDD+ Project* by holding meetings to inform the local communities and receive their feedback on the planned project activities. This was done prior to signature of the agreements between the communities and CGI, in order to ensure their support at an early stage. Additionally, a local stakeholder consultation was held in each of the four RDCs between September 20 and October 7, 2011. In compiling the list of local stakeholders, the following groups were included:

- Community members affected by the project
- Community leaders, including:
  - Representatives of local associations
  - Representatives of RDC administration and RDC councils
  - Traditional leaders (Chiefs)
  - Local NGOs working on related projects

The goals of the stakeholder consultations were to discover and assess opinions and views about the project, and to obtain locals' viewpoints about the project during open discussion sessions. Stakeholders were identified and invited two weeks before the consultation took place. Invitations were printed in English and the local language Shona and were accompanied by a non-technical project description.[91]

Relevant stakeholder comments and their answers are listed below:

- Tribal elder: How would the communities be rewarded? Answer: the council would attain an additional revenue stream directly; communities would be assisted to build various projects. (project activities: Improved agriculture, irrigation, education beekeeping and infrastructural development etc.)
- Councilor: How are funds managed and distributed? Answer: All districts funds will be managed through a trust; there will be representatives of community, council and CGI on the trust. There will be absolute transparency for anyone interested to have access to such information.
- Teacher: How will the people in the community cook and build huts when we cannot cut trees down? Answer: 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.

At the end of each stakeholder consultation, the council chairman and councillor asked the floor if people wanted the project to go ahead of which there were chorus to the affirmative. The communities however wanted some of the projects to start being implemented as soon as possible even before the final validation of the project. All the chiefs pledged to give support for the success of the project.

To guarantee an ongoing communication a grievance procedure was implemented as part of the project. The procedure includes four different options to the communities, by which they provide

[91] Both invitation and non-technical project description are available online under http://www.southpolecarbon.com/dev-gold.htm.

potential grievances regarding the project in written or verbal form: directly to CGI, via the OGM teams, via the Liaison Officer or via the RDC. By providing four different options, we attempted to “widen the net” to include the views of all stakeholders. We are committed to provide a written response to any grievance with 30 days. Furthermore, all grievances and our feedback will be published in our quarterly newsletter that will be distributed to the stakeholders in the project area (see section 1.8 of the present document).

Annex 1: Project VCS non permanence risk assessment

Internal Risk

Project Management		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Species planted (where applicable) associated with more than 25% of the stocks on which GHG credits have previously been issued are not native or proven to be adapted to the same or similar agro-ecological zone(s) in which the project is located. *Not applicable.*	0
b)	Ongoing enforcement to prevent encroachment by outside actors is required to protect more than 50% of stocks on which GHG credits have previously been issued. *The deforestation and degradation agents in the project area are the local population due to the conversion of forestland to cropland or grazing land for subsistence and small-scale farming, logging of timber for domestic use and fuelwood collection.* *With regards to encroachment of the local population to the project area's forest, the OGM teams ensure an ongoing enforcement to prevent encroachment to protect more than 50% of stocks of which GHG credits have been previously been issued. Diverse activities will strengthen the actual and perceived presence of the project proponents in the area, including the following:* *Active exchange with community members via the newsletter or consultations* *Implementation of the project activities to address the deforestation drivers and agents* *Direct support from the education and health* *These activities will mitigate potential risk of encroachment by outside actors to a minimum. As these activities are ongoing and necessary, a risk rating of 2 is applied.*	2
c)	Management team does not include individuals with significant experience in all skills necessary to successfully undertake all project activities (i.e., any area of required experience is not covered by at least one individual with at least 5 years experience in the area). *The management team has significantly more than 5 years of experience in the area.* *Carbon Green Investments Guernsey (CGI) is the project proponent and the project's central entity involved in project management, development, implementation and operation — both from a technical and a financial perspective. Expertise in project*	0

	development, carbon monitoring and accounting is provided by South Pole Carbon Asset Management Ltd. ("South Pole")[92], a globally active carbon project developer and consultant with a successful track record in forest-based carbon projects. CGI cooperates with several local partners. Black Crystal Consulting ("Black Crystal")[93] is a Zimbabwean environmental consulting agency that supports the biodiversity component of the project. Environment Africa[94] is an NGO working in Southern Africa, contributing its expertise and experience to the community engagement aspects of the project. Environment Africa also is responsible for the implementation of the project activities.	
d)	Management team does not maintain a presence in the country or is located more than a day of travel from the project site, considering all parcels or polygons in the project area. *The Kariba REDD+ Project maintains a strong presence 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 are recruited locally. There will be one OGM team per RDC, where they have a steady office/camp that will also serve as a contact point for the local population.*	0
e)	*Mitigation: Management team includes individuals with significant experience in AFOLU project design and implementation' carbon accounting and reporting (e.g.' Individuals who have successfully managed projects through validation' verification and issuance of GHG credits) under the VCS Program or other approved GHG programs.* *South Pole Carbon Asset Management is responsible for the complete carbon asset development of the project. South Pole's forest team has successful managed – or is in the process to manage – about 20 forestry projects (REDD, A/R and IFM). A track record is available upon request.*	-2
f)	*Mitigation: Adaptive management plan in place.* *Decreasing deforestation shall be achieved through a series of activities that are designed to significantly improve the livelihoods such as improved agriculture, beekeeping, fuelwood plantations and fire management. In addition, a significant share (20% of net profit) of the project's carbon income will be invested in general activities ensuring the project's sustainability. The fund will be used to improve health and education in the project area. These activities are designed to mitigate potential risks to the project.* *An adaptive management plan has been provided separately to the auditors. The plan defines internal responsibilities and ways of communication and reporting defining an ongoing monitoring and adaptation process for the project. This will ensure the project management adapts to future challenges and includes any*	-2

[92] http://www.southpolecarbon.com/
[93] http://blackcrystal.co.zw/
[94] http://www.environmentafrica.org/

	lessons learned from earlier experiences into future decision-making.	
Total Project Management (PM) [as applicable, (a + b + c + d + e + f)] Total may be less than zero.		**-2**

Financial Viability		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Project cash flow breakeven point is greater than 10 years from the current risk assessment *Not applicable.*	0
b)	Project cash flow breakeven point is between 7 and up to 10 years from the current risk assessment *Not applicable.*	0
c)	Project cash flow breakeven point between 4 and up to 7 years from the current risk assessment *Not applicable.*	0
d)	Project cash flow breakeven point is less than 4 years from the current risk assessment *The financial projections show a project cash flow break even in 2014. The cash flow is provided separately to the auditor.*[95]	0
e)	Project has secured less than 15% of funding needed to cover the total cash out before the project reaches breakeven *Not applicable.*	0
f)	Project has secured 15% to less than 40% of funding needed to cover the total cash out required before the project reaches breakeven *Not applicable.*	0
g)	Project has secured 40% to less than 80% of funding needed to cover the total cash out required before the project reaches breakeven *Not applicable.*	0
h)	Project has secured 80% or more of funding needed to cover the total cash out before the project reaches breakeven *This is the case.*	0
i)	***Mitigation**: Project has available as callable financial resources at least 50% of total cash out before project reaches breakeven* *This is the case.*	0
Total Financial Viability (FV) [as applicable, ((a, b, c or d) + (e, f, g or h) + i)] Total may not be less than zero.		**0**

[95] „Cash Flow 2012-2041.pdf" in the supporting documents (commercially sensitive information).

Opportunity Cost		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	NPV from the most profitable alternative land use activity is expected to be at least 100% more than that associated with project activities; or where baseline activities are subsistence-driven, net positive community impacts are not demonstrated *Not applicable.*	0
b)	NPV from the most profitable alternative land use activity is expected to be between 50% and up to100% more than from project activities *Not applicable.*	0
c)	NPV from the most profitable alternative land use activity is expected to be between 20% and up to 50% more than from project activities *Not applicable.*	0
d)	NPV from the most profitable alternative land use activity is expected to be between 20% more than and up to 20% less than from project activities; or where baseline activities are subsistence-driven, net positive community impacts are demonstrated *This is the case.*	0
e)	NPV from project activities is expected to be between 20% and up to 50% more profitable than the most profitable alternative land use activity *Not applicable.*	0
f)	NPV from project activities is expected to be at least 50% more profitable than the most profitable alternative land use activity *Not applicable.*	0
g)	Mitigation: Project proponent is a non-profit organization *Not applicable.*	0
h)	Mitigation: Project is protected by legally binding commitment (see Section 2.2.4) to continue management practices that protect the credited carbon stocks over the length of the project crediting period *Not applicable.*	0
i)	**Mitigation**: Project is protected by legally binding commitment (see Section 2.2.4) to continue management practices that protect the credited carbon stocks over at least 100 years *Not applicable.*	0
Total Opportunity Cost (OC) [as applicable, (a, b, c, d, e or f) + (g or h)] Total may not be less than 0.		**0**

The baseline activities over the length of the project crediting period are subsistence-driven; an NPV analysis is therefore not required. A Participatory Rural Appraisal (PRA) has been elaborated through questionnaires and focus group discussions to assess the social baseline of the project zone. The study targeted all four districts that are involved in the project: Binga, Nyaminyami, Hurungwe and Mbire. The results of the study are shown in Table 21,

Table 22 and Table 23. Most of the interviewees indicated at least primary education, while around 50% also went to a secondary school. Around 85% of the households were reported as headed by males.

Table 21: Characteristics of households by district

Characteristic		**Hurungwe**	**Nyaminyami**	**Binga**	**Mbire**
Total population		65’378	34’374	118’824	115’952
Questionnaires		103	79	92	98
Gender	male	71.8	40.5	42.9	81.4
	female	28.2	58.2	57.1	18.6
Marital Status	Married	76.7	83.5	81.5	92.9
	Single	6.8	6.3	7.6	0
	Divorced	2.9	1.3	3.3	1
	Widower/Widow	13.6	8.9	7.6	6.1
Education	Primary	35	34.2	29.3	40.8
	Secondary	51.5	50.6	45.7	41.8
	Tertiary	5.8	1.3	16.3	3.1
	None	7.8	13.9	8.7	14.3
Household	Female headed	17.6	14.1	17.6	10.2

head	Male headed	82.4	84.6	82.4	87.8
	Child headed	0	1.3	0	0

Field crops are the most important source of income. Fishery is also significant in the districts along the shore of Lake Kariba. Livestock, however, only provides very limited income. Formal and informal employment is very rare in the area.

Table 22: Most important sources of household income

Most important income source	**Hurungwe**	**Nyaminyami**	**Binga**	**Mbire**
Field crops	80.4	68.8	74	100
Garden crops	3.1	3.1	0	0
Livestock	3.1	3.1	8	0
Fishery	0	10.9	14	0
Informal work	3.1	9.4	2	0
Formal employment	1	0	0	0
Remittances	9.3	4.7	0	0

Table 23: Annual household income from various sources

		Income Source							
District	**Income range in USD**	**Field**	**Garden**	**Livestock**	**Fishing**	**Informal Employ-**	**Formal employ-**	**Remit-tances**	**Curio curving**
Hurungwe	0-50	11	35	38	100	35	10	30	33
	50-200	15	46	24	0	24	30	25	33
	200-500	30	13	21	0	12	10	35	33

	500-1000	14	6	10	0	18	50	5	0
	>1'000	31	0	7	0	12	0	5	0
	Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Nyami-nyami	0-50	31	67	48	100	45	67	50	0
	50-200	48	29	52	0	27	0	50	0
	200-500	18	5	0	0	18	0	0	0
	500-1000	2	0	0	0	0	0	0	0
	>1'000	2	0	0	0	9	33	0	0
	Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**0**
Binga	0-50	58	77	56	0	75	73	77	0
	50-200	28	20	22	0	15	20	8	0
	200-500	12	3	17	33	5	0	8	0
	500-1000	0	0	5	67	5	0	8	0
	>1'000	2	0	0	0	0	7	0	0
	Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**0**
Mbire	0-50	66	19	21	0	21	42	44	0
	50-200	11	48	61	0	53	33	22	0
	200-500	7	26	13	0	11	17	28	0
	500-1000	10	7	3	0	11	0	0	0
	>1'000	6	0	3	0	5	8	6	0
	Total	**100**	**100**	**100**	**0**	**100**	**100**	**100**	**0**

For further detail of the PRA please refer to section 2.4.

A series of activities are designed to significantly improve the livelihoods and decrease deforestation 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 promoting and guaranteeing sustainability of the project. The fund will be used to improve health and education in the project area. The projects net impacts on the social and economic well-being of the communities who derive livelihoods from the project area are therefore positive.

The project has been successfully validated under the CCB Standard and achieved double gold for outstanding climate change adaptation benefits and exceptional biodiversity benefits. The mitigation requirement is therefore satisfied.

Project Longevity		
a)	Without legal agreement or requirement to continue the management practice *Not applicable.*	0
b)	With legal agreement or requirement to continue the management practice *Applicable. Contracts have been signed with RDCs and leaseholders. The contracts cover the entire project lifetime of 30 years. The contracts give CGI the rights to develop, establish and market the project with support of the RDCs and establish a benefit sharing of the carbon revenues.*	= 30 - (30/2) = 15
Total Project Longevity (PL) May not be less than zero		**15**

Internal Risk	
Total Internal Risk (PM + FV + OC + PL) Total may not be less than zero.	**(-2)+0+0+15=13**

External Risks

Land Ownership and Resource Access/Use Rights		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Ownership and resource access/use rights are held by same entity(s) *Not applicable*	0
b)	Ownership and resource access/use rights are held by different entity(s) (e.g. land is government owned and the project proponent holds a lease or concession) *The ownership is hold by the local communities, represented by four Rural District Councils (RDCs) in the project area. The project proponent has*	2

	established long-term contracts with the RDCs, which include the full carbon rights. Where safari operators have leasing rights over parts of the land, these have been included in the contractual framework. Copies of all these contracts have been provided to the auditors.	
c)	In more than 5% of the project area, there exist disputes over land tenure or ownership *Not applicable.*	0
d)	***There exist disputes over access/use rights (or overlapping rights)*** *Not applicable.*	0
e)	***Mitigation**: Project area is protected by legally binding commitment (e.g., a conservation easement or protected area) to continue management practices that protect carbon stocks over the length of the project crediting period* *CGI, RDCs and leaseholders signed an agreement for 30 years.*	-2
f)	***Mitigation**: Where disputes over land tenure, ownership or access/use rights exist, documented evidence is provided that projects have implemented activities to resolve the disputes or clarify overlapping claims* *Not applicable.*	0
Total Land Tenure (LT) [as applicable, ((a or b) + c + d + e+ f)] Total may not be less than zero.		**0**

Community Engagement		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Less than 50 percent of households living within the project area who are reliant on the project area, have been consulted *Not applicable. Local Stakeholder Consultations have been done in the entire project area; locals have been informed about project details through the newsletter published by CGI. Therefore it can be assumed that more than 50% of households living within the project area who are reliant on the project area have been consulted. In addition, the project passed the validation of the CCB Standard.*	0
b)	Less than 20 percent of households living within 20 km of the project boundary outside the project area, and who are reliant on the project area, have been consulted *Due to the project size it is assumed that the households living within 20 km of the project boundary outside the project area are not reliant on the project area.* *However, stakeholder consultations have been elaborated for the entire boundaries of the RDCs of 1'077'930 ha. The VCS project area (forested area) is about 784'987 ha. Stakeholder consultations have therefore been conducted on 27% of land in addition to the project area. It can therefore been assumed that more than 20% of households living within 20 km of the project boundary outside the project area, and who are reliant to the project area, have been consulted (=1-784'987 /1'077'930 = 27%)*	0

c)	***Mitigation***: *The project generates net positive impacts on the social and economic well-being of the local communities who derive livelihoods from the project area* *Applicable. For further details please refer to the risk factor of the opportunity costs of the non-permanence risk assessment.* *The project has been successfully validated under the CCB Standard and achieved double gold for outstanding climate change adaptation benefits and exceptional biodiversity benefits.*	-5
Total Community Engagement (CE) [where applicable, (a+b+c)] Total may be less than zero.		**-5**

Political Risk		
Risk Factor	Risk Factor and/or Mitigation Description	Risk Rating
a)	Governance score of less than -0.79 *Applicable. The mean of Governance Scores across the six indicators of the World Bank Institute's Worldwide Governance Indicators (WGI), averaged over the most recent five years of available data (2006-2010) is -1.54.*	6
b)	Governance score of -0.79 to less than -0.32 *Not applicable.*	0
c)	Governance score of -0.32 to less than 0.19 *Not applicable.*	0
d)	Governance score of 0.19 to less than 0.82 *Not applicable.*	0
e)	Governance score of 0.82 or higher *Not applicable.*	0
f)	***Mitigation***: *Country is implementing REDD+ Readiness or other activities, as set out in this Section 2.3.3.* *Not applicable.*	0
Total Political (PC) [as applicable ((a, b, c, d or e) + f)] Total may not be less than zero.		**6**

External Risk	
Total External Risk (LT + CE + PC) Total may not be less than zero.	**0+(-5)+6=1**

Natural Risks

Explain the significance and likelihood of the natural risk and any mitigation activities implemented, (copy table for each natural risk).

Natural Risk (Fire)	
Significance	Minor (5% to less than 25% loss of carbon stocks) For further details please refer to section 1.8: Fire Management
Likelihood	Less than every 10 years
Score (LS)	5
Mitigation (M)	Mitigation factor 0.5: Prevention measures applicable to the risk factor are implemented

There are no further natural risk such as pests, extreme weather or geological risk.

Score for each natural risk applicable to the project (Determined by (LS × M)	
Fire (F)	5 x 0.5 = 2.5
Pest and Disease Outbreaks (PD)	0
Extreme Weather (W)	0
Geological Risk (G)	0
Other natural risk (ON)	0
Total Natural Risk (as applicable, F + PD + W + G + ON)	**2.5**

Overall Non-Permanence Risk Rating and Buffer Determination

Risk Category	Rating
a) Internal Risk	13
b) External Risk	1
c) Natural Risk	2.5
Overall Risk Rating (a + b + c)	**16.5 %**

Annex 2: Biodiversity Information

List of common species in the project area

Plants	*Acacia karoo* *Acacia nigrescens* *Acacia nilotica* *Adansoniadigitata* *Adeniakaribaensis* *Albiziaantunesiana* *Andropogongayanus* *Aristidabrainii* *Aristidameridionalis* *Aristidapilgeri* *Aristidastipitata* *Brachystegiaboehmii* *Brachystegiaspiciformis* *Chlorisvirgata* *Colophospermummopane* *Combretumapiculatum* *Combretummolle* *Commiphoraglandulosa* *Commiphoramollis* *Commiphoramossambicensis* *Cyclantheropsisparviflora* *Digitariaeriantha* *Digitariamilanjiana* *Digitariaternata* *Diospyrosmespiliformis* *Diplorhynchuscondylocarpon* *Eragrostisviscosa* *Erythroxylumzambesiacum* *Euphorbia cooperi* *Euphorbia decidua* *Euphorbia persistentifolia* *Faureasaligna* *Faureaspeciosa* *Flacourtiaindica* *Heteropogoncontortus* *Heteropogoncontortus* *Hippocrateavolkensii* *Jamesbritteniamyriantha* *Julbernadiaglobiflora* *Kirkiaacuminata*

	Loudetiasimplex *Maeruasalicifolia* *Maeruasalicifolia* *Monotesglaber* *Pavoniarogersii* *Pogonarthriasquarrosa* *Selaginella imbricata* *Stereochlaenacameronii* *Strychnoscocculoides* *Strychnosspinosa* *Terminalia pruniodes* *Terminalia sericea* *Terminalia stuhlmannii* *Trichiliaemetica* *Tristachyalualabaensis* *Tristachyarehmannii* *Tristachyasuperba* *Uapacakirkiana* *Vangueriainfausta*
Mammals	*Acinonyx jubatus* *Aepyceros melampus* *Aethomys chrysophilus* *Aethomys namaquensis* *Canis adustus* *Canis mesomelas* *Cercopithecus aethiops* *Crocuta crocuta* *Dicero Bicornis* *Elephantulus brachyrhynchus* *Equus burchelli* *Felis caracal* *Felis serval* *Genetta genetta* *Graphiurus murinus* *Hippopotamus amphibius* *Hippotamus amphibius* *Hippotragus equinus* *Hippotragus niger* *Hystrix africaeaustralis* *Kobus ellipsiprymnus* *Lepus saxatilis* *Loxodonta Africana* *Lycaon pictus*

	Mus minutoides *Oreotragus oreotragus* *Ourebia ourebi* *Panthera leo* *Panthera pardus* *Papio ursinus* *Paraxerus cepapi* *Phacochoerus africanus* *Potamochoerus larvatus* *Raphicerus sharpei* *Redunca arundinum* *Saccostomus campestris* *Steatomys pratensis* *Sylvicapra grimmia* *Syncerus caffer* *Tatera leucogaster* *Taurotragus oryx* *Thallomys paedulcus* *Tragelaphus scriptus* *Tragelaphus strepsiceros*
Birds	*Apalisflavida* *Bucorvuscafer* *Camaropterabrevicaudata* *Cisticolagalactotes* *Egrettavinaceigula* *Eremomelascotops* *Hyliotaaustralis* *Monticolaangolensis* *Nectariniamanoensis* *Priniaflavicans* *Trigonocepsoccipitalis* *Agapornisnigrigenis* *Lamprotornischloropterus* *Lamprotornismevesii* *Thamnolaeaarnoti* *Tockuserythrorhynchus* *Torgostracheliotos*
Butterflies	*Acraea acrita* *Acraea atergatis* *Acraea atolmis* *Appias epaphia contracta* *Bicyclus angulosus selousi*

	Bicyclus ena *Charaxes bohemani* *Charaxes druceanus* *Charaxes guderiana* *Charaxes penricei* *Charaxes saturnus* *Colotis celimene amina* *Colotis eris* *Colotis ione* *Colotis vesta* *Dixeia doxo parva* *Junonia actia* *Junonia cuama* *Lepidochrysops glauca* *Melanitis leda* *Nepheronia buquetii buquetii* *Nephronia argia* *Nephronia thalassina* *Neptis kiriakoffi* *Neptis penningtoni* *Papilio constantinus* *Pentila pauli obsoleta* *Pentila tropicalis* *Tagiades flesus*
Reptiles	*Arthroleptis stenodactylus* *Bufo fenoulheti fenoulheti* *Causus defilippii* *Crocodylus niloticus* *Dalophia pistillum* *Elapsoidea boulengeri* *Elapsoidea guentheri* *Gerrhosaurus nigrolineatus* *Heliobolus lugubris* *Ichnotropis capensis* *Leptotyphlops incognitus* *Monopeltis rhodesiana* *Pachydactylus oshaughnessyi* *Panaspis maculicollis* *Rhinotyphlops mucruso* *Thelotornis capensis oatesii* *Tomopterna krugerensis* *Trachylepis punctulata* *Trachylepis wahlbergii*

	Xenocalamus bicolor

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