Kulera Landscape REDD+ Program for Co-Managed Protected Areas, Malawi

Document Prepared By Terra Global Capital LLC

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1 PROJECT DETAILS

1.1 Summary Description of Project

The Kulera REDD project, Malawi, is being developed as part of the Kulera Biodiversity Project (KBP), funded by the United States Agency for International Development (USAID). The Project Area is located in 5 km zones inside the boundaries of three key protected areas in central and northern Malawi, Nyika National Park, Vwaza Wildlife Reserve, and Nkhotakota Wildlife Reserve. These protected areas having limited resources for governance and are under increasing pressure from local populations, which have intensified and expanded their exploitation of forest resources to unsustainable levels. Increasing rates of deforestation and degradation along the margins of the protected zones threaten remaining forests and the valuable climate, community and biodiversity services they provide. The overall goals of the Kulera REDD project are to reduce deforestation and forest degradation in these three protected areas, and improve livelihoods by managing natural resources as an asset base, creating long-term sustainable alternative livelihoods, improving biodiversity and increasing food security.

The project proponents, the Department of National Parks and Wildlife (DNPW), the Nyika-Vwaza Association (NVA), Nkhotakota Wildlife Reserve Association (NAWIRA), and Terra Global Capital (TGC) have partnered with a Malawi-based NGO, Total LandCare (TLC), to prepare this Project Description (PD). The PD outlines the implementation program that will be used to mitigate the key drivers of deforestation and degradation and generate verified emission reductions. Deforestation drivers include converting forest to small-scale agriculture and settlements, unsustainable collection of fuelwood, grazing livestock inside the forest and setting fires for hunting, honey collecting, and territorial revenge against other land users. Key project actions are to: strengthen land tenure and improve governance of these protected areas, support development of sustainable resource management activities, improve rural livelihoods, and increase rural incomes through natural resource-based enterprises and the development and marketing of carbon assets.

One of the principle objectives of the project is to improve co-management agreements for protected areas and build the capacity of community associations to carry out park management and enforcement activities. The project will also support a number of interventions designed to provide alternative income sources, improve food security, and reduce pressures on natural resources. Project activities include; strengthening land-tenure and protected area governance, support for the development and implementation of sustainable forest and land use management plans, forest protection through patrolling, social fencing and maintenance of forest boundaries, fire prevention and suppression activities, reducing fuelwood consumption and increasing energy efficiency by introducing fuel-efficient woodstoves, creation of alternative sources of fuelwood through agroforestry and farm woodlots management, sustainable intensification of agriculture on existing agricultural land, and development of local enterprises based on sustainably harvested NTFPs such as honey, coffee, macadamia, and livestock.

1.2 Sectoral Scope and Project Type

This project is an Agriculture, Forestry and Other Land Use (AFOLU) project under the Reducing Emissions from Deforestation and Degradation (REDD) project category. Specifically, the project is of the Avoided Unplanned Mosaic Deforestation and Degradation (AUMDD) typology.

This project is a grouped project. Project activities will be carried out to reduce deforestation in the 5km zones inside of the three protected area as detailed in Section 1.9.3 of the VCS PD. Additional project parcels may be added to the project in the future.

1.3 Project Proponent

1.3.1 Roles/Responsibilities of Project Proponents

Kulera REDD Project Proponents are the Department of National Parks and Wildlife (DNPW), the Nyika-Vwaza Association (NVA), the Nkhotakota Wildlife Reserve Association (NAWIRA), and Terra Global, who will work with their implementation partners to develop, implement and monitor the Project. Detailed

roles and responsibilities may be found in the REDD+ Agreement as listed in Section 1.13.3 of the VCS PD.

The Department of National Parks and Wildlife (DNPW) is responsible for the management of the Project Areas.

Department of National Parks and Wildlife, Government of Malawi	
Name of Contact Person:	Brighton K Kumchedwa
Title:	Director
Address:	Department of National Parks and Wildlife ,
Telephone:	265 1 759 832/ 265 888868557/ 265 999868557
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The Nyika-Vwaza Association (NVA) is the Community Associations that represents the villages adjacent in the Project Zone around the Nyika National Park, Vwaza Wildlife Reserve.

Nyika-Vwaza Association, Malawi	
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The Nkhotakota Wildlife Reserve Association (NAWIRA) is the Community Association that represents the villages adjacent in the Project Zone Nkhotakota Wildlife Reserve.

Nkhotakota Wildlife Reserve Association (NAWIRA), Malawi	
Name of Contact Person:	Napoleon Dzombe
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Fax:	N/A
Email:	napoleon.dzombe@gmail.com
Website:	N/A

Terra Global is a project proponent as an investor in the project and supporting the registration, issuance and marketing of emission reductions. Terra Global also acts as an implementing partner for the development and on-going management of the emission reductions generated under the Project (see Section 1.4.2 of the VCS PD).

Terra Global Capital, USA	
Primary Role:	Development of Emission Reductions, Institutional Frameworks Carbon Revenue and Benefit Sharing, and Offset Marketing

Name of Contact Person:	Ms. Leslie L. Durschinger
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1.4 Other Entities Involved in the Project

Kulera Biodiversity Project partner CARE Malawi focuses on supporting the formation of Village Savings and Loan groups including training on economic activities, selection, planning and management.

CARE, Malawi	
Name of Contact Person:	
Title:	
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1.4.1 Total LandCare

Total LandCare (TLC) has extensive experience designing and implementing community-based forest management and agricultural projects and environmental sustainability in rural Malawi. TLC has contributed extensively to Malawi's Agriculture Development Program (ADP) and has been widely consulted by the World Bank and the Norwegian Government in formulating their strategic country frameworks. Many others have sought input from TLC to improve the effectiveness of their programs. These demands stem largely from the successful results of USAID's Chia Watershed Project and its follow-on project, Management for Adaptation to Climate Change (MACC) with the Norwegian Government. TLC is a member of the Civil Society Agriculture Network (CISANET) and heads the Irrigation Thematic Group, whose mandate is to advocate policy reform in the irrigation sub-sector, to promote harmonization of methods/approaches and to share experiences. TLC and its partners will continue leading this forum to share lessons from Kulera, and to enhance awareness and knowledge among implementing agencies and the general public.

Total LandCare is the lead institution for project administration, partner coordination, community mobilization, decentralization-governance and monitoring & evaluation; will also coordinate livelihoods strategies with a focus on community-based natural resource management, diversification, conservation agriculture, irrigation, forestry, and enterprise initiatives based on agricultural & natural products.

Total LandCare	
Primary Role:	Project Identification and Design, Implementation of REDD+ Activities and Livelihoods Programs
Name of Contact Person:	Trent Bunderson
Title:	Executive Director

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1.4.2 Terra Global

Terra Global is the global leader in forest and land-use carbon advisory and finance. Terra was founded in 2006 to provide governments, NGOs and private companies with support for market and payment-for-performance based approaches that benefit rural communities. As proven innovators, Terra provides both technical advisory in the measurement and commercialization of emissions reductions and carbon finance through our dedicated Terra Bella Investment Fund and separately managed investment vehicles. Terra has established itself as a valued partner to a global client base by supporting the sustainable management of natural resources and through the development of rural livelihoods.

Terra's role includes: i) conducting all carbon development work under the VCS and CCB standards for PD development and carbon calculations; ii) support for on-going monitoring and the development of the VCS and CCB monitoring reports; iii) management of the validation and verification process; iv) training for community-based participatory filed data collection; v) establishment of the institutional arrangements for REDD+ legal, operational and financial management; vi) development of web-based monitoring tools; vii) marketing and transaction structuring for emission reductions, and; viii) acting as the general manager for the REDD+ entity for the initial years until local capacity is built.

Terra Global Capital, USA	
Primary Role:	Development of Emission Reductions, Institutional Frameworks Carbon Revenue and Benefit Sharing, and Offset Marketing
Name of Contact Person:	Ms. Leslie L. Durschinger
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	United States of America
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Website:	http://www.terraglobalcapital.com

1.5 Project Start Date

The **project start date is 1 October 2009**. This is when the first project actions took place, and the first financial commitments were established.

1.6 Project Crediting Period

The **project crediting period is 30 years**, starting 1 October 2009 and ending 30 September 2039.

1.7 Project Location

1.7.1 Regional Location

The project is located in three different Protected Areas in the Northern and Central Regions in Malawi: Nyika National Park, Vwaza Marsh Wildlife Reserve, and Nkhotakota Wildlife Reserve (see Figure 1). Nyika National Park (NP) occupies a tract of mountain plateau and associated hills and escarpments in northern Malawi in an area covering 3,200km^2 and bordering Chitipa, Karonga, and Rumphi Districts whilst the western boundary borders Zambia. It is the largest national park in Malawi and is centered upon 10°33'S, 33°50'E. Vwaza Wildlife Reserve occupies a tract of diverse terrain in northern Malawi covering 978 km^2 and it is centered upon 11° 00'S, 33° 28' E. The reserve comprises a region of hills and pediments in the east, and a region of wetland and alluvium in the west. The reserve lies partly in Rumphi and partly in Mzimba District, whilst its western and part of its northern boundary coincides with the Malawi – Zambia border. Nkhotakota Wildlife Reserve is the oldest and largest wildlife reserve covering 1082 km² and is centered upon 12°55′00″ S, 34°18′00″ E. It is located in the Central Region of Malawi. Most of the reserve is comprised of *miombo* woodlands with large patches of grasses bordering wetlands.

Malawi is a landlocked country of high mountains and deep lakes. One fifth of Malawi is covered by Lake Malawi, which fills the trough of the Great African Rift Valley that traverses the country from north to south. East and west of the lake, the land forms high plateaus that reach as high as 2,600 meters in the Nyika uplands, and 3,048 meters at Mount Mulanje (US Department of State 2010). Malawi shares borders with Mozambique to the east and south, with Zambia to the west, and with Tanzania to the northeast. There are four major urban centers: Blantyre, Lilongwe, Zomba, and Mzuzu. Out of a total land area of 9,448,741 ha, 48% is considered arable.

Most of the Project Areas are in the basin of Lake Malawi. Freshwater systems within the basin that are of relevance to the Project Areas include Lake Kazuni (adjacent to the Vwaza Wildlife Reserve), the Bua river (in the central region, in the vicinity of the Nkhotakota Game Reserve), and the Rukuru river (which flows from the Nyika plateau in the northern region).

No new instances were added during this monitoring period. The Project Area remains unchanged since validation.

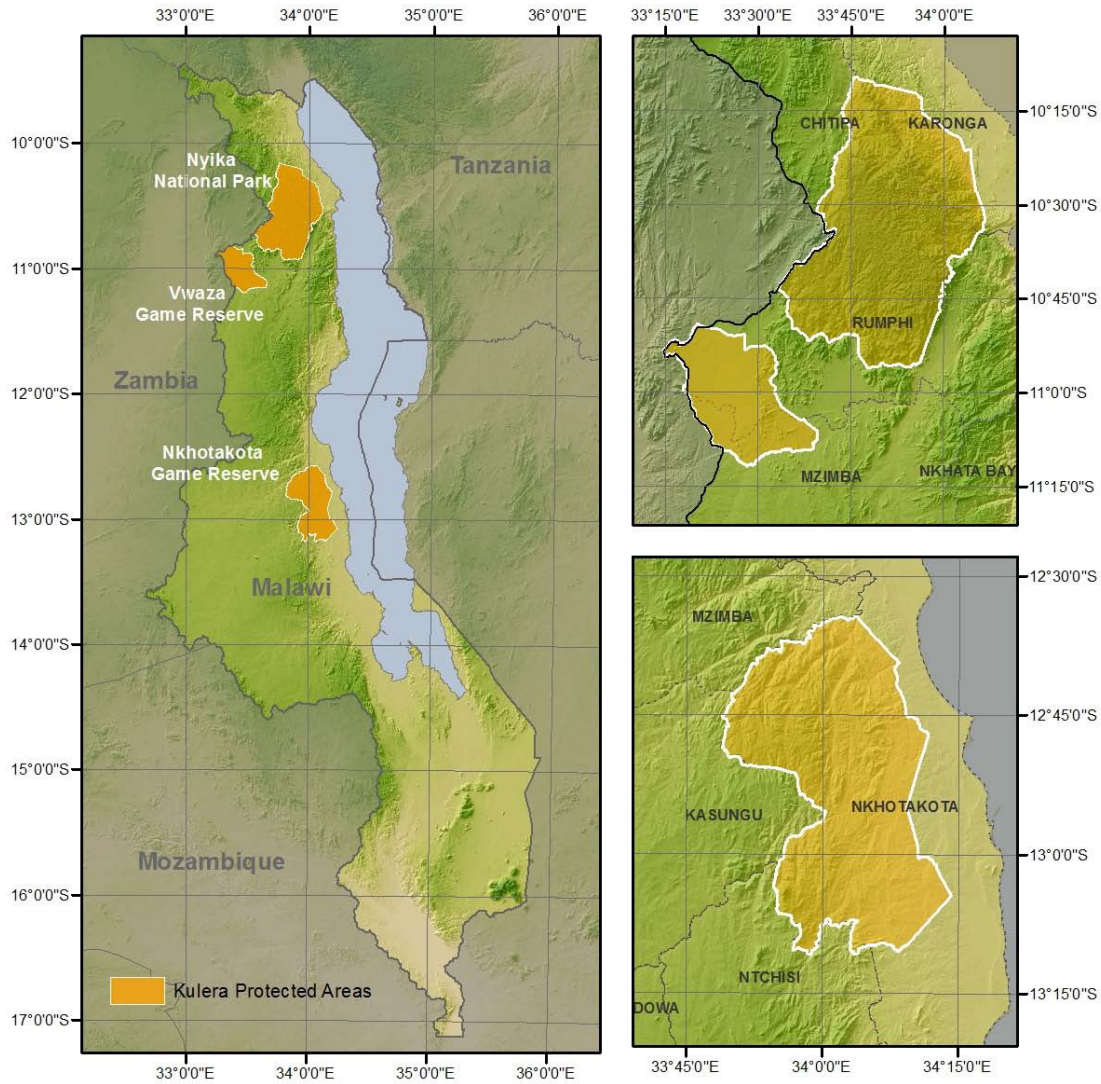

Figure 1. al location of Kulera Biodiversity Project areas in Malawi.

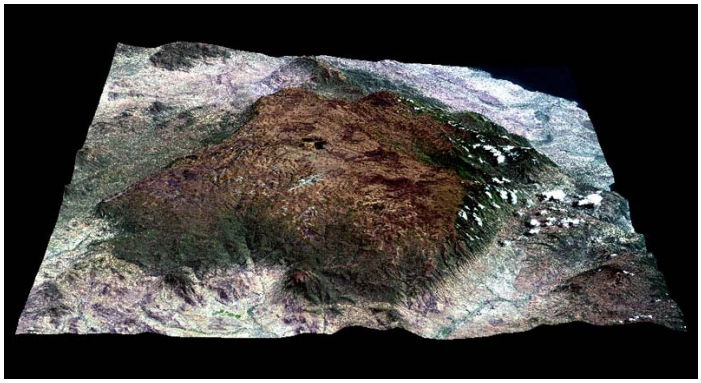

Figure 2. Landsat 8 imagery from 2013 draped over SRTM elevation data.

The Nyika National Park is located on a high dissected plateau that consists of rolling plains with rocky outcrops, with an elevation ranging from 600-2600 m asl. Nyika is in an area of relatively high rainfall (see VCS PD). The name “nyika” means “where the water comes from,” and it is among a number of Protected Areas established to secure water sources. It is an important headwater area and is the source of tributary streams that feed the South Rukuru River. Nyika National Park was established as a reserve in 1948. In order to protect several key water

catchment areas, the park boundary was later extended in 1978 (Department of National Parks and Wildlife 2004a).

Vegetation consists of montane grasslands and evergreen forests with patches of relic montane evergreen forests. Predominantly, expansive rolling grasslands are interspersed with evergreen riverine forests along waterways. On the escarpment and at lower elevations, the vegetation is mainly deciduous *miombo* woodland (*Brachystegia-Julbernardia spp*).

Most streams and rivers are perennial, and stream flow characteristics are ascribed to high overall rainfall with some rain throughout the year, low evaporation (cloudiness and low ambient temperature), good vegetation cover to promote infiltration, and deep, freely draining soils. However, a recent survey of river conditions revealed that rapid bank erosion is occurring in some places. River channels are becoming wider and shallower, and silt is being deposited over gravel beds (Environmental Affairs Department 2006). Soils are of two types: either deep, well drained, red and fine textured with high levels of acidity, or moderately deep to shallow, well drained, medium to fine textured, and stony (Mawaya et al. 2011).

Nyika National Park is a biodiversity hotspot, important for both plants and mammals. According to the GOM Biodiversity Strategy, it has the highest number of large mammals and the highest concentration of Roan Antelopes on the African continent. Important wildlife species include: zebra, roan antelope, eland, reedbuck, bushbuck, common duiker, bush pig, leopard, hyena, and a small population of elephants. It also supports the world's largest breeding population of blue swallow (*Hirundo atrocaerulea*), and has 215 orchid species. Farmers report continued depredations of their crops by wildlife from the park, particularly monkeys, baboons, wild pigs, elephant, and buffalo (Department of National Parks and Wildlife 2004a).

Communities around Nyika practice subsistence farming consisting mainly of maize, beans, cassava, and groundnuts. Cash crops are tobacco, cotton and, on a limited scale, coffee in the Nchenachena area east of Nyika. There is also high potential for honey production and collection of termites and wild mushrooms, which are abundant during the rainy season. Livestock includes cattle, goats and sheep but the tsetse fly found around the southwestern borders poses a risk of trypanosomiasis[1].

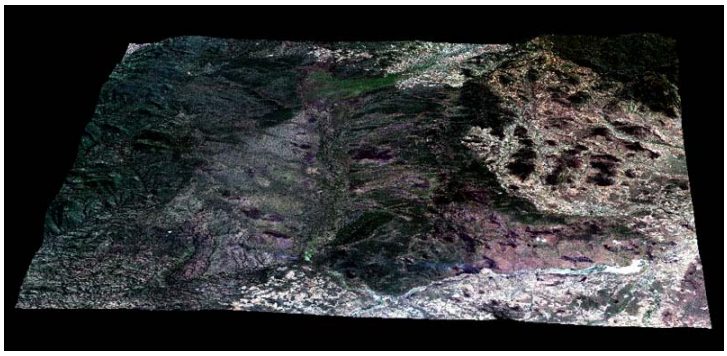

Figure 3. Landsat 8 imagery from 2013 draped over SRTM elevation data.

The Vwaza Wildlife Reserve, at an elevation of 1100-1600 m asl, consists of flat plains with dotted hills and marshy wetlands fed by streams arising on the Nyika plateau. The South Rukuru River on the southern boundary drains into Lake Kazuni, which is located at the south-eastern tip before it turns east. The lowest point is at Lake Kazuni (1,082 m) in the southeast, and the highest point is 1,660 m at Mahobe Hill in the northeast. Vwaza Marsh was declared a protected area in 1941 and expanded to its current size in 1984 (DNPW 2004b).

The vegetation is a mosaic of open to dense woodland dominated by areas of *Brachystegia*, Acacia-*Bauhinia*-*Combretum*, and *mopane* woodlands, with wetland grasslands and marshes in the central lowlands. Soils are very deep, brown, and medium textured, with variable drainage (well drained to poor).

Wildlife species include buffalo, elephants, roan antelope, greater kudu, Liechtenstein's hartebeest, eland, and impala. Lake Kazuni supports large populations of hippopotami and crocodiles.

[1] Human African trypanosomiasis (sleeping sickness) is a parasitic disease of people and animals, caused by protozoa of the species *Trypanosoma brucei* and transmitted by the tsetse fly

Communities around Nyika practices subsistence farming consisting mainly of maize, beans, cassava, and groundnuts.

Figure 4. Landsat 8 imagery from 2013 draped over SRTM elevation data.

The Nkhotakota Wildlife Reserve, found at an elevation ranging from 500-1,700 m asl, consists of rolling to steeply dissected and undulating topography, which is mountainous in the west, where Chipata hill rises to a height of about 1,700 m. The wildlife reserve is an important catchment area for Lake Malawi because three major rivers (Bua, Dwangwa and Kaombe) pass through it.

The vegetation is comprised of dense *Brachystegia* woodland and riverine forests, interspersed with occasional patches of tall *Hyparrhenia-Andropogon* grasses in the low-mid altitudes, and dense evergreen forest in the uppermost elevations. Soils are moderately deep to deep, well drained, coarse to medium textured, and occasionally stony with often a skeletal subsoil.

Wildlife species include: lion, elephant, buffalo, leopard, zebra, hippo, crocodile, warthog, kudu, roan antelope, sable antelope, eight other species of antelope, and over 160 species of birds. The Bua River is a breeding haven for two endemic fish species: Mpasa (lake salmon) and Sanjika.

The human population around the reserve practices subsistence farming of cassava, maize, groundnuts, beans, and rice. They also fish in the Bua River and in Lakes Chikukutu & Malawi. Cash crops grown here are rice, cotton and tobacco. In addition, termites and wild mushrooms are harvested and honey is produced. Livestock include cattle, goats, pigs, poultry, but numbers are low and there is a high risk of trypanosomiasis due to the tsetse fly.

1.7.2 Project Zone and Project Area

The project is located in three different Protected Areas in the Northern and Central Regions in Malawi: Nyika National Park, Vwaza Marsh Wildlife Reserve, and Nkhotakota Wildlife Reserve.

Communities living within 10 km of the Nyika and Vwaza areas have formed Natural Resource Committees, which are cooperating with Malawi's Department of National Parks and Wildlife to collaboratively manage these areas. In exchange, resource user groups from the communities can obtain permits, which allow them to collect NTFPs up to 5km inside of the park. Communities in Nkhotakota are currently organizing a similar Collaborative Management Programme. The Project Area includes the resource use zones 5 km within the park, The Project Zone, 750,898 ha in size, includes the Project Areas (212,272 ha in size) and the communities living 10 km outside of the park boundaries Figure 5 illustrates the spatial distribution of the Project Areas and the Project Zone.

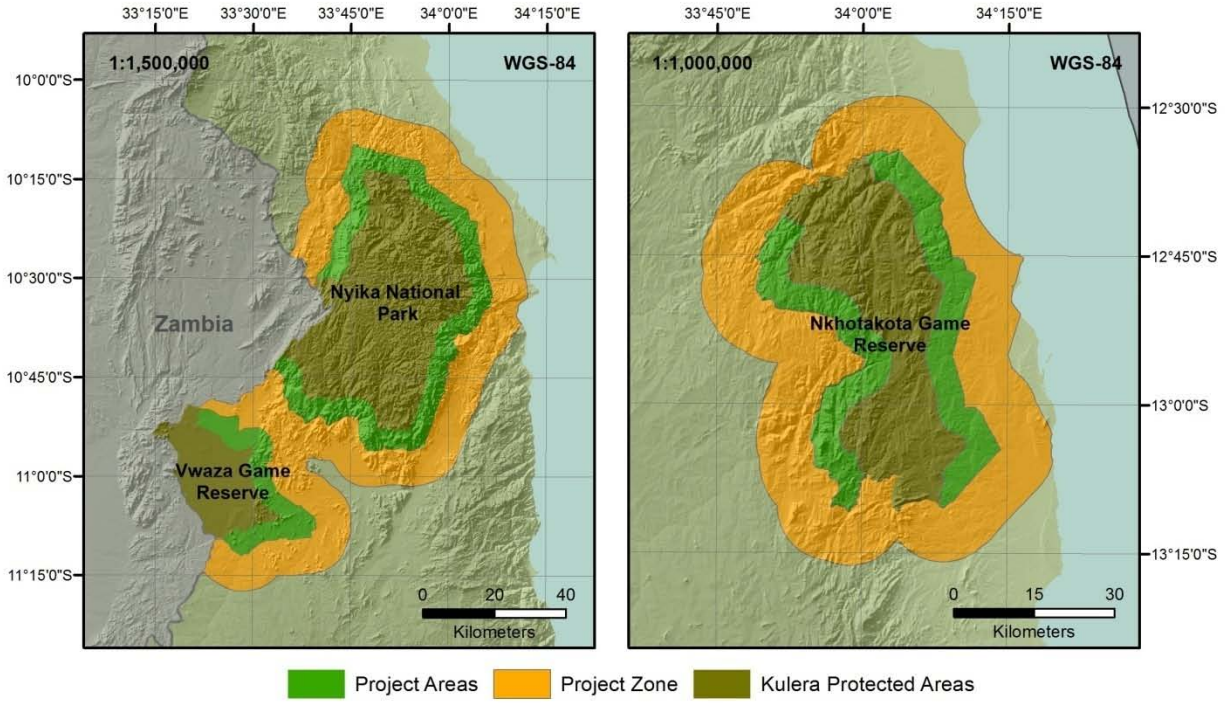

Figure 5. The Project Areas of the Kulera Biodiversity Project consist of a 5 km buffer area inside the protected areas and the Project Zone is 10 km buffer outside of 3 protected areas in Malawi

1.8 Title and Reference of Methodology

"Carbon Accounting for Mosaic and Landscape-scale REDD Projects" VM0006 revised, developed by Terra Global Capital.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The following activities have been implemented during the first monitoring period from the 1st of October 2009 to the 30th of September 2013.

2.1.1 Strengthening Land tenure and Forest Governance

2.1.1.1 Activity Description

Strengthening land tenure and providing clarity on governance structures for Protected Areas management are critical first steps in protecting reserves from illegal encroachment. The project will provide support to strengthening land tenure and forest governance by creating and improving participatory, decentralized governance through co-management of the Protected Areas between the DNPW and Community Associations representing over 45,000 villages adjacent to protected areas.

The activities to enforce the Protected Area tenure and establish formalized co-management governance structures include:

- Clarification of Protected Area boundaries and where necessary facilitation of zoning/re-zoning in collaboration with stakeholders;
- Formation of formation of functional democratically-elected Community Associations with formalized governance through there bi-laws and constitutions;
- Facilitate the transfer of rights and access to natural resources in Protected Areas, including where appropriate revenue sharing in the protected areas from the DNPW to local communities through co-management agreements, and;
- Facilitate development and execution of REDD+ agreements between DNPW and Community Associations to define roles and responsibilities under REDD+ program, carbon tenure and financial and operational governance arrangements.

2.1.1.2 Implementation Status

During the first year of the monitoring period, progress under this Project activity was limited. The process of identifying and demarcating target areas and communities in the Project Zone around the Protected Areas was still in progress at the close of the first year, with 450 villages in the 10 km area around Nyika and Vwaza identified. The Project also facilitated the formation of one functional, democratically-elected Protected Area committee.

During the second year, the Project identified and demarcated an additional 1,220 communities in the Project Zone around the Protected Areas. The Project also facilitated the zoning or re-zoning of 52 GVH (zones). One additional Protected Area committee was formed during this year, and its governance structure legitimized. The identification of key natural resources and areas for the development of co-management agreements was still in progress at the end of year two.

With regard to building capacity of the Protected Areas governance structure in year two, the Project recruited and trained 20 community workers to support natural resource management (NRM) institutions in law enforcement, training, and other areas. 24 village umbrella committees (VUCs) were formed and trained.

During year three, the outcomes of some activities were not captured for reasons unknown at the time of this report. With regard to strengthening the governance structure, the Project facilitated the formation of an additional Protected Area committee during the third year and supported its legitimization. One review was completed of legal and institutional frameworks for their compatibility with Protected Area governance structures. There was no progress to report regarding the creation of co-management agreements.

With regard to capacity building within the Protected Area governance structure, the Project recruited and trained nine additional community workers to support NRM institutions. 50 Protected Area officials were recruited and trained in corporate governance, team building, fundraising, project write-ups, resource assessments, natural resource rights, and conflict resolution. An additional 81 individuals representing a variety of Protected Area, legal and law enforcement groups were trained in community mobilization and participatory law enforcement. Logistical support for communication and mobility was also provided to one Protected Area.

During the monitoring period the Nyika-Vwaza (NVA) democratically-elected Community Associations with formalized governance through there bi-laws and constitutions was formed including the acceptance of the REDD Project. And August 2013, the Nkhotakota Association (NAWRIA) completed the election of leaders, and they are in the process of formally submitted their bi-laws and constitutions.

In September 2013, the DNPW, NVA and Terra Global signed the REDD+ Agreement which covers all the roles and responsibilities of the parties, confirms carbon tenure and established the full support for the project during the crediting and longevity period.

2.1.2 Support for the Development and Implementation of Sustainable Forest and Land Use Management Plans

2.1.2.1 Activity Description

Building on strengthened tenure and protected area governance structures in place, the project supports the development of co-management plans that define allowable land uses inside the protected areas. The co-management plans signed between the DNPW and the Community Associations:

Obligate the communities to ensure compliance with the National Parks and Wildlife Act (2004), as amended, and pertinent laws of Malawi with terms of this agreement, and with approved Nyika National Park and Vwaza Marsh Wildlife Reserve Management Plans, on the part of the Association members and employees of the Association and the members of the public in general;

In the event that the Association is unable to ensure compliance, the Association shall inform the appropriate government agency in writing (DNPW, Malawi Police etc), which shall take action to ensure compliance, and;

- Renew co-management agreements to enable communities to share benefits from park entrances and concession fees.
- The co-management plans obligated the DNPW to:
  - Build capacity in relevant fields in the Association, and;
  - Facilitate wildlife-based and other income generating activities for the Association.

At the village level, forest management plans are created and submitted to the district commissioner. In these plans, the village level rules for land and forest uses are adopted by the community and included in the village by-laws, which prescribe penalties for not following the agreed upon uses. When the village level forest management plan is signed off by the district commissioners, this gives the chiefs the formal support needed to impose penalties.

2.1.2.2 Implementation Status

During the first year of the project, there was no progress of note made with regard to this activity, as communities and households were still being made aware of the project.

Progress was also limited during year two given the legal review that needs to take place before the co-management agreements can be made and signed. The Department of National Parks and Wildlife (DNPW), the Nyika-Vwaza Association (NVA), and Total LandCare (TLC) had an ongoing dialogue during the year regarding the co-management agreements, and drafts were completed pending US and Malawi legal review.

As of year three, all activities related to the development and signing of co-management agreements were pushed to the no-cost extension period. The implementation of co-management agreements was deemed contingent on the establishment of NAWIRA.

2.1.3 Forest Protection through Patrolling, Social Fencing, and Maintenance of Forest Boundaries

2.1.3.1 Activity Description

The capacity of law enforcement authorities is too limited to defend the boundaries of each of the Protected Areas. Therefore, the Project will provide training and capacity building for communities to engage in participatory forest protection. Once these institutional structures are established and adequate training has been delivered, DNPW and the Community Associations will be able to oversee and enforce community-based co-management of the Protected Area. This approach to improved governance aims to stimulate forest stewardship through "social fencing"[2] of forest resources that are co-managed by local communities (Henkemans 2000).

The activities that mobilize community-based NRM in the Protected Areas through increased awareness and capacity include:

- Recruit and train community workers to support Community Associations in law enforcement, training and other needs;
- Provide training for Protected Area and Community Association officials in NRM institutions in corporate governance, team building, fund raising, project write-ups, resource assessments/problem analysis, basic NR rights and conflict resolution;
- Provide training for Protected Area and Community Association officials in community mobilization, participatory law enforcement, etc.;
- Provide logistical support to Protected Area officials to improve communications and mobility with GPS and radio units;
- Provide motor bikes and bicycles to allow communities to access better facilities for communications;
- Provide support for establishment of village umbrella committees and provide training for community development of NRM activities, and;
- Conduct awareness campaigns through training of primary school teachers in environmental education, facilitate the establishment of youth conservation clubs, Protected Area visits for youth clubs, initiation of the development of environmental education curricula for primary schools and adults.

2.1.3.2 Implementation Status

During the first year, a series of awareness campaigns were initiated in Rumphi and Nkhotakota zones. However, activities related to social fencing and participatory law enforcement, etc., were pushed back to year two.

During year two, the Project began the process of recruiting community workers for training to support NRM institutions in law enforcement, training, and other needs. The Project established a target of 40 individuals, but only 20 had been recruited by the end of the year as recruitment was still in progress. A workshop on community mobilization and participatory law enforcement for Protected Area officials and their counterparts was planned for year three.

Nine additional community workers were recruited during year three to receive training to support NRM institutions. The workshop that was planned in the previous year for Protected Area officials and their counterparts was held, and 81 individuals were trained among Protected Area executives from the Nyika-Vwaza Association (NVA), NRCs, DNPW officials from Nkhotakota Wildlife Reserve, Vwaza Wildlife

[2] the protection of forests from external threats through organization and social control

Reserve, and Nyika National Park, community policing forums, local judiciary, and law enforcement officers. The goal of the workshop was to provide a clearer understanding of the issues, responsibilities, and roles of all stakeholders in addressing illegal resource use and poaching within Protected Areas.

2.1.4 Fire Prevention and Suppression Activities

2.1.4.1 Activity Description

The DNPW will develop jointly with the Associations a fire management plan, and implement fire management activities within the protected areas, including: installation of fire breaks, instituting early warning systems (e.g., use of mobile phones), clearing the forest of dead wood, discouraging fire for hunting, and warding off revenge-based fires. The project will implement a fire control and management plan campaign to increase understanding and awareness of the program.

Activities aimed at preventing and suppressing bush fires include:

- Provide Training and education within the conservation agriculture component on fire reduction;
- DNPW develops a fire management plan in collaboration with associations;
- Implementation of fire management activities inside of protected areas, including controlled burns, fire breaks, weed control, and fire management based on sound ecological principles;
- Implementation of a fire control and management campaign for communication and to increase awareness.

2.1.4.2 Implementation Status

With regard to preventing the establishment and spread of bush fires, conservation agriculture techniques play an important role by improving and retaining soil moisture and nutrients; this is especially critical in preventing and reducing fires that could be started outside of the Project Areas that have the potential to spread inside the Project Areas.

Fire reduction strategies and activities have been promoted through both the conservation agriculture and regeneration and tree planting components; promoted activities include the creation of fire break, as well as weed control. One way in which these activities are promoted is through community sensitization meetings on conservation agriculture, tree planting and regeneration. During the first monitoring period, the project consistently met or surpassed established targets for land maintained under conservation agriculture techniques.

The levying of penalties against those that start bush fires is essential to enforcing best practices in fire prevention and suppression. Co-management agreements between communities and DNPW have established penalties for setting fires within protected areas, which are further reinforced by responsibilities undertaken by local leaders to establish additional precedents for punitive actions at the village level. These include rules adopted by the community and included in the village by-laws, as well as village-level forest management plans that are signed off on by district commissioners, which give chiefs the formal support necessary to be able to impose penalties.

2.1.5 Reduce Fuelwood Consumption and Increase Energy Efficiency by Introducing Fuel-Efficient Cookstoves

2.1.5.1 Activity Description

The project will deliver/establish a fuel-efficient cookstove to a targeted number of 35,000 households to reduce fuelwood consumption. TLC has experience with cookstoves from other projects and has selected a particular design that is efficient, low-cost and uses readily available locally-sourced materials and is

built into the kitchen. The stove is constructed of mud and bricks and can be built in a convenient fireplace within traditional kitchens. The current design yields efficiency in terms of wood use ranging between 30-50%.

The ultimate goal is to improve the design to reduce wood use and/or increase efficiency by 50%. In this regard, TLC is working with other designers to produce a more efficient low-cost stove for rural households. Each stove is made by hand by the users; therefore only very interested parties are willing to bear the time-production cost. The stoves are stationary, and therefore built into the location to be used. Because the creation is time consuming and fuelwood conserved is so observable, stoves promoted by the project are adopted at a much higher rate than moveable metal stoves often provided by donors.

Activities to promote reduced fuelwood consumption and increased energy efficiency include:

- Training of trainers on construction of cookstoves, often through women's groups;
- Introduce improved kitchen stoves to reduce firewood consumption and impacts of deforestation in communities surrounding NV and NKK, including through community sensitization meetings.

2.1.5.2 Implementation Status

During the first monitoring period, the project established a cumulative goal of 5,000 households to be the install improved cookstoves. Community sensitization meetings have taken place over the course of the monitoring period to promote adoption of this improved technology. During year two of the monitoring period, the project more than doubled this goal, with 10,485 households in 847 villages in Nyika-Vwaza, Ntchena Chena, and Ntchisi. Improved cookstove construction and use was also demonstrated during year two of the monitoring period at the Kulera Biodiversity and WADA joint project launch.

During the third year of the monitoring period, an additional 10,754 households in 669 Kulera sites received improved cookstoves. Training and extension support was also provided on their construction, use, and maintenance. An additional 6,255 cookstoves were adopted during year four, for a cumulative total to date of 27,494 improved cookstoves adopted.

Improved kitchen stoves were designed to respond to calls on reducing deforestation by reducing amount of fuel wood used when cooking and subsequently reducing frequency of firewood fetching. One Dorothy Kondowe, a 52 year old married Malawian woman from Chisiza Village, GVH Mwakwawa in TA Wasambo has experienced exactly what the designer of these stoves intended to do. The woman who has a household size of 7 people (4M: 3F) comes from Vinthukutu Agriculture Extension Planning Area EPA at Lweza site. Her exact location globally is 0628920/8831493. The husband of a primary school level of education woman is a pensioner and earns bread through pension money and assistance from children with approximately K58,000 (173 dollars) as support and also from their selling of cassava which is produce every year.

Villagers from Dorothy's village and surrounding which is 100 meters away from Lake Malawi Beach fetch firewood from a 2 hour walking distance one way. The situation becomes critical when it is wet season when they have to fetch and store more bundles of firewood for their households use during this period. Approximately one bundle takes one week to finish when one uses open fire as per Dorothy's experience and could collect 75 bundles at least to get her through the wet season, close to 4 months period. Because of this tough experience Dorothy thought of making a brick stove, own design with one hole on top and a wire stand on top with one hole for firewood. This was done to reduce amount of firewood spent per cooking session. "The Stand which I was using with firewood from three sides pained me so much

when I thought of the distance to where I collect firewood, taking 4 hours to get a bundle" Complained Dorothy.

With her own designed stove made of bricks and mud only, she observed and experienced that reduction in fuel wood as compared to open fire. *At the time of capturing the story the three stand rod was not there and her own design stove was already demolished hence no picture captured.*

Figure 6. Field Officer for Vinthukutu EPA, Charity Pakhosi posing with Dorothy & household members

Involvement with TLC

Dorothy started getting involved in improved kitchen stove use in 2012 September when a Community Extension Worker working with TLC on KBP not from her section visited her as a relative. The influential worker Isaac Harawa observed that Dorothy is using her own design stove in cooking which prompted him to sensitize her about the improved kitchen stoves being trained by TLC. Dorothy did not hesitate by requested for immediate demonstration of how it is made. Isaac responded by demonstrating it to her and destroyed it deliberately to allow Dorothy make her own. "After observing once, I made my own stove of Isaacs's type and I completely gained the knowledge" Dorothy explained. Despite agreeing that the Field Coordinator visited her village to demonstrate the making of the stove before Isaac came she said no one adopted because people never showed interest as she was not within the village during the demonstration hence she had no idea of its benefits but after Isaacs demo she valued it and took it as a task to train others too.

Figure 7. Dorothy with her household members around the stove

Upon using the improved kitchen stove Dorothy experienced differences in heat released to cook with the later doing extremely well with reduced time spent in the kitchen, Reduced labor in cleaning pots as pots could take time to get dirt with smoke, also observed that the stoves keep fire and no need to look for matches to set fire every morning. She also noted that with using two holes it takes two pots at a time. She finally observed that there is total reduction in use of firewood. “In 2012/2013 rainy season I used only 25 bundles from 75 in previous years for more than 4 months” Attributed reduction of firewood also to size of hole where firewood is placed because small size. Hence there is total reduction in labor on fetching firewood.

2.1.6 Creation of Alternative Sources of Fuelwood through Agroforestry and Farm Woodlot Management

2.1.6.1 Activity Description

This set of activities focuses on creating an alternative source of fuelwood through establishment of sustainably managed woodlots to provide fuelwood to local communities and tobacco farmers. Under the Project, woodlots will be planted in communal village areas to produce fuelwood. Similarly, the management of existing woodlands will be improved through workshops and capacity building sessions. The increase in biomass in woodlots and improved woodlands is accounted is not directly accounted for under this Project. However, the effects on the protected forest areas from a reduction in fuelwood collection due to the existence of woodlots and woodlands is accounted for in the REDD project.

Activities to create alternative sources of fuelwood include the following:

- Community sensitization and training on nursery creation and management, and outplanting;
- Village-level nurseries established and maintained in communities surrounding NV and NKK;
- Outplanting of seedlings, and;
- Community management of natural woodlots

2.1.6.2 Implementation Status

Central to achieving progress under this project activity during the first monitoring period has been defining the area size and key activities in avoided deforestation, forest management of woodlands and woodlots. This process began in year one and was fully completed during year three, allowing for improved harmonization of activities aimed at creating alternative sources of fuelwood.

During the first monitoring period, there was significant progress achieved in relation to tree planting, nursery establishment, and outplanting of seedlings. During the first year, the Project established a target of 1,000,000 trees planted to impact 10,000 households. 876,128 trees were ultimately planted during year one, impacting 2,801 households in Nkhotakota and Rumphi zones. During year two, the Project once again established a target of 1,000,000 trees planted to impact 10,000 households. 1,208,266 trees were planted, and 7,837 households were impacted. Over years one and two of the Project, a cumulative total of 2,084,394 trees were planted, impacting 10,638 households. The year three target for trees planted was significantly more ambitious than the previous two years of the Project; 11,000,000 trees planted to benefit an additional 10,000 households. During year three, the Project planted 6,344,511 trees across 21,222 households. Overall, the Project to date has planted 8,428,905 trees, which has impacted 31,860 households.

The Project has also had success in catalyzing community management of natural woodlands during the first monitoring period, due in part to a high level of willingness by communities to manage these areas as the Project has progressed. During year one, progress was nominal, with 132 ha of land being placed under management by 53 communities. A target of 1,000 ha managed by 100 communities was set for year two. The Project achieved an additional 446.9 ha of land under management by 149 communities. In year three, 2,794 ha were targeted for community management by 216 communities. While the Project fell short of achieving the targeted number of hectares, with an additional 335 ha during year three, the project vastly exceeded the targeted number of communities based on a final household count of 40,668. These outcomes are attributed to the fact that while plots per household were smaller, on average, than anticipated, the number of households involved in community management far surpassed the target. To date, the Project has achieved a cumulative 913.9 ha of natural woodlands under community management.

Community management of natural woodlands was also supplemented during the third year of the Project through training and extension support on nursery management and natural woodland regeneration. The Project trained 10,154 farmers against a year three target of 35,000.

Figure 8. Stock taking mission undertaking the assessment with beneficiaries involved in woodlots and tree natural regeneration

2.1.7 Sustainable Intensification of Agriculture on Existing Agricultural Lands

2.1.7.1 Activity Description

Agricultural intensification activities are essential to improving productivity of agricultural lands and increasing the yields of crops supported by those lands. Distributing higher-yield varieties of crops grown locally, such as cassava, results in faster maturation times over traditional varieties. Improving irrigation access and efficiency promotes more productive irrigation seasons that support a higher diversity of crops, with as many as three crops supported per year. Resulting improved water efficiency and residual soil moisture due to irrigation interventions also improves agricultural yields, while the distribution of pumps reduces the opportunity costs associated with other methods of water collection. Conservation agriculture techniques also improve the viability and yield of vegetable crops, as well as improve residual soil moisture and nutrient content. The Kulera project will promote an increase in productivity and agricultural yields on existing agricultural lands through the following activities:

- Community sensitization meetings focused on the use and installation of treadle pumps and other irrigation methods to produce vegetables;
- Diversify farming using improved crops and varieties with high yielding, disease resistant, drought-tolerant characteristics adapted to the local agro-ecology.
- Introduction of improved crops will include training in sound agronomic practices with special attention to land preparation, early planting and weeding.
- Integrate conservation agriculture as a standard farming practice with agroforestry, organic manures, intercropping, and legume rotations to produce higher and more stable yields with significantly less labor, while dramatically reducing environmental degradation from the effects of soil erosion and runoff and;
- The distribution of higher-yielding, improved cassava bundles.

2.1.7.2 Implementation Status

The Project has taken steps to engage communities in activities related to sustainable intensification on existing agricultural lands during the first monitoring period.

2.1.7.2.1 Irrigation and Pumps

During the first year, interventions were primarily focused on irrigation, targeting 250 ha and 2,000 households as beneficiaries of improved irrigation techniques. A total of nine hectares was under irrigation with Kulera funding at the close of the first year, with 64 households impacted by these new projects. During the fourth quarter, treadle pumps were procured, distributed, and installed.

During the second year, the Project once again targeted 250 ha of land for irrigation interventions, and increased the targeted number of households to 2,500. Through a combination of stream diversion and treadle pumps, the Project added an additional 46.2 ha under irrigation, impacting 361 households (26.2 ha treadle and 20 ha stream diversion, respectively). In addition to these interventions, Renewable Energy Solutions (RES) provided a three week consultancy focused on RAM pumps and stream diversion irrigation technologies in Rumphi Zone.

2.1.7.2.1.1 Case Study - Mr Kondwani's

Mr Kondwani within one irrigation season expanded his irrigation garden to four times to have 0.09 hectares. He planted on 98 beds of maize with SC 403 variety. He explained that much effort was put on the field so that he could repay the pumps loan balance. Watering was very easy as he could just lead water into feeder canals and could find the pump easy to operate together with his wife. "This was my first time to have such a big area for irrigation utilized" he added.

Figure 9. A Treadle pump operation training session at Kondwani's garden assisted by the Zone Manager with Kondwani on a pump

Figure 10. Mr Kondwani's irrigated maize field

2.1.7.2.2 Crop Diversification and Soil Quality Improvements

During year two, the Project also began activities to address crop diversification through the planting of cassava, groundnuts, beans, and soy beans. Though the Project targeted 500 ha for diversification impacting 1,000 households during year two, a total of 133.6 ha were ultimately planted, impacting 3,292 households.

Soil and water conservation activities under the 'conservation agriculture' umbrella also began during year two. 50 ha and 1,000 households were targeted to benefit from these strategies, which included the application of organic manure, interplanting with soil-improving trees, intercropping with perennials, and the planting of fallows and vetiver grasses. These strategies have the benefit of decreasing erosion through increasing infiltration capacity and residual soil moisture, as well as through the improvement of soil health via increased soil nutrient content. During year two, the Project vastly exceeded its target outputs. 677.8 ha of land were managed under soil and water conservation strategies, impacting a total of 2,378 households.

During year three, some of the targets for irrigation and crop diversification were deemed to be unrealistic based on the outcomes of some of these interventions. 323 ha were targeted for improved irrigation technology, while just 68 ha were added during this period. 362 households were impacted against a target of 2,152. During the third year, two RAM pumps were installed in Rumphi to provide irrigation for crop diversification. Targets for total crop diversification across all crop types were not established for year three, but the Project exceeded targets established for soy beans, groundnuts, maize, and cassava. A total of 177.7 ha were targeted to be planted with beans, but this target was deemed to be unrealistic and only five hectares were ultimately planted. Targets, results and completion status for crops planted during year three can be viewed in the following table:

Table 1. Area placed under cultivation by target crops during Year 3

Crop	Year 3 Target	Year 3 Achieved	Complete?
Beans	177.7 ha	5 ha	no
Groundnuts	133.25 ha	201.35 ha	yes
Maize	322.24 ha	344 ha	yes
Soy beans	133.25 ha	433 ha	yes
Cassava	300 ha	433.1 ha	yes

The Project also exceeded its established targets for soil and water conservation. 1381.8 ha and 4,316 households benefited from soil and water conservation techniques, against targets of 1,221 ha and 2,121 households, respectively.

2.1.8 Development of Local Enterprises Based on Sustainably Harvested NTFPs, Such as Honey, Coffee, Macadamia, and Livestock

2.1.8.1 Activity Description

The development of rural enterprise through the promotion of ecotourism activities and the production, processing and marketing of sustainably produced non-timber forest products is critical to transforming livelihoods away from subsistence and improving rural livelihoods through increased self-sufficiency. The NTFPs being most heavily promoted include honey, coffee, and macadamia. Small livestock husbandry is also an important skill for diversifying and increasing protein sources available in communities while reducing hunting pressure and encroachment on protected areas.

Activities to support the development of local enterprise based on ecotourism and sustainably harvested NTFPs include:

- Promote the development of new eco-tourism sites and projects;
- Collaborate with Wilderness Safaris to organize ecotourism activities in and around Protected Areas;
- Provide training to local communities, including community sensitization meetings, on the construction and management of beehives for honey production;
- Purchase and distribute apiary equipment to households in the Project Area;
- Identify markets for the sale of local honey produced from NRMAs, and facilitate the distribution and sale of honey;
- Conduct community sensitization meetings in agriculturally appropriate areas, such as Ntchena Chena and Ntchisi, on the benefits of coffee production;
- Conduct extension work with farmers in order to teach them how to produce and maintain seedling outplants and coffee plants;
- Assist smallholder farmers in finding markets for their products;
- Support program facilitate entry into low cost & fast returns (rapid growth & reproduction) livestock with poultry, guinea fowl, rabbits, pigs and goats;
- Provide training through extension services in animal husbandry and animal health' and

- Promotion of producer groups and MSME with production, processing, business and marketing skills and access to finance.

2.1.8.2 Implementation Status

2.1.8.2.1 Year 1

Before being able to focus on enterprise development through the identification and sustainment of markets, the Project needed to provide support for the production of sustainable NTFPs through the procurement and distribution of materials, as well as through trainings and sensitization meetings. During the first year of the monitoring period, the Project promoted beekeeping and honey production alongside coffee production. The Project procured and distributed 400 beehives, suits and smokers to 40 farmers, meeting its target for year one. The Project also planned to have two training sessions on beekeeping to benefit 40 farmers. Mzuzu Coffee, a cooperative union of coffee producers, conducted training on beekeeping that was attended by 68 farmers.

Year one activities aimed at coffee producers included training for farmers and staff, maintenance of a mechanized hand pulper, and the formulation of a board of trustees for the coffee cooperative, which was facilitated by Mzuzu Coffee. Mzuzu Coffee also promoted the creation of five zonal boards and 12 business center boards.

Activities promoting small livestock interventions during the first year included sensitization meetings, staff training, the creation of farmer contract agreements, farmer group formation and training, and familiarization visits by staff to Kulera project sites. Training manuals for viable livestock species in Malawi were prepared for distribution. The Project also briefed village umbrella committees (VUCs) and village development committees (VDC) on the Kulera project. The Project achieved its target of three familiarization visits to Project sites, as well as its target of four briefings for VUCs and VDCs.

During year one, 453 farmers attended sensitization meetings. Four staff training sessions were planned but just one was completed; 17 staff members were trained in piggery, poultry, and goats. 2,000 farmers had been previously identified for possible participation in the livestock component of the Project, but due to first year procurement restrictions on livestock and the desire to avoid disappointment on the part of the farmers, 650 farmers were selected to go ahead with their participation in this component.

Committees for livestock were formed that are similar to those formed for coffee producers, with 23 out of 50 targeted committees created and trained during the first year. Farmers chosen to participate in the livestock component received training in animal husbandry and the construction of *kholas*, or stockades, for livestock.

There was no progress to report regarding macadamia production or enterprise development during the first year of the monitoring period.

2.1.8.2.2 Year 2

During year two, the Project continued the promotion of beekeeping by training an additional 134 farmers in two sessions. The Project also aimed to double its distribution of apiary equipment to farmers but was 25% short of its goal, providing 300 hives to 30 additional farmers. Extension support services began more earnestly during year two, particularly those directed at beekeepers and coffee producers. In total, seven monthly visits were conducted, as well as 11 review meetings.

The Project supplied 194 kgs of coffee seeds with a 95% germination rate during the second year, resulting in a total of 432,032 seedlings planted in farmers' fields. One eco-pulper was procured and installed. 503 farmers were trained in coffee husbandry and business development, with a total of 13,869

farmers receiving training and extension support. A variety of other trainings and meetings also took place during the second year, including: a field day with the Ntchisi Mountain Business Zone; one board meeting; one annual general meeting (AGM) for the coffee growers' cooperative; six zonal AGMs, and; 21 business center AGMs. The Ntchisi cooperative is now registered with 155 members, 65 of whom have bought shares in the cooperative.

The viability of smallholder macadamia producers and the market for their products was investigated during year two through efforts from Renewable Energy Solutions (RES) and Washington State University's Dr. Tom Byers. RES developed a business plan to create organizational sustainability for the Highlands Macadamia Cooperative Union Ltd. (HIMACUL), an association of macadamia producers in Malawi. RES also conducted research and made recommendations related to value-added interventions for smallholder macadamia producers. A separate value chain analysis was conducted by Dr. Byers, which indicated that viable markets for macadamia products are "significant," resulting in a recommendation that Project funding be more directly leveraged for macadamia production in year three.

A variety of activities to promote small livestock production took place during the second year, including a baseline study on livestock production in all Project sites, the results of which are available in the Kulera Socio-Economic Baseline Survey. The Project established a goal for three sites around the four Protected Areas to be the focus of the baseline studies; during year two and over the course of the Project to date, just one baseline study has been conducted. Complimentary to this baseline study was the evaluation and documentation of local extension services for livestock, including the availability of veterinary medicine. The Project target is five areas around the four Protected Areas but produced just one baseline study. The results of the extension service baseline study are also available in the Kulera Socio-Economic Baseline Survey.

In addition to the 650 farmers selected from the group of 2,000 for participation in the livestock component during the first year, the Project targeted an additional 2,500 farmers for participation during year two. With guidance from the Department of National Parks and Wildlife (DNPW) and the local communities, the Project identified and selected an additional 500 farmers based on established criteria, for a Project total to date of 2,500 farmers. The Project also supported the creation and training of an additional 44 livestock committees for a cumulative total of 67 committees at the close of year two. 11 committees were formed with a focus on pigs, 19 with a focus on goats, and 37 with a focus on poultry. In addition to these three types of livestock, training was also carried out on rabbit husbandry and care, as well as different aspects of livestock management such as feeding, housing, parasites and disease control, and breeding. 1,206 farmers were trained in these topics during year two, for a cumulative total of 1,856.

2.1.8.2.3 Year 3

During year three, HIMACUL successfully bought 218.5 liters of cooperative-produced honey and sold it locally, surpassing the year three goal of 200 liters. Local household consumption of cooperative-produced honey was very high, but a lack of hives to accumulate large volumes of honey hindered regional and national marketing opportunities for this product. This was partially addressed through the distribution of an additional 760 hives, 13 suits, and 14 smokers. Three courses were held on beekeeping and attended by 207 participants. The potential for a honey-based micro-, small- and medium-enterprise (MSME) was further explored during year three, with continued support from Kulera partners HIMACUL and RES.

The third year of the Project exceeded all of its goals related to coffee production and processing, with 557 coffee farmers trained in coffee husbandry and business during seven courses and eight community demonstrations. Two farmer field days and open days were also conducted. An additional 24 farmers

were trained in monitoring and evaluation (M&E). Seven review meetings were conducted over the course of the year. 74 growers were trained in two courses on improved coffee processing.

Mzuzu Coffee and the Project also facilitated the production of 2,402,024 coffee seedlings, more than doubling its third year target. One census was also conducted in order to determine the levels of mortality for out planted coffee seedlings. Two courses on cooperative development and management were also held, and were attended by 273 farmers.

The Project also diversified its interventions directed at coffee growers and beekeepers during this year by working with 28 existing local organizations in Ntchisi on issues related to gender, HIV/AIDS, and disaster risk reduction (DRR).

Macadamia production and processing activities were fully underway in year three, with the goal of increasing the volume of macadamia produced, as well as strengthening the governance and technical capacity of the cooperatives and increasing the range of value chains being utilized by smallholder macadamia producers. The Project more than tripled its target for root stock production by propagating 170,500 kg in nurseries throughout the Project zones. Field grafting teams were created and trained, with 95 people participating in four training sessions. Across Rumphi and Ntchisi zones, a total of 47,884 rootstocks were grafted.

19 trainings were held on macadamia tree and orchard management, which were attended by 1,255 participants. An additional five sessions were held on sustainable farming practices for macadamia farmers, which were attended by 55 individuals. The Project more than doubled the targeted number of macadamia trees to be planted, with a total of 81,988 planted during year three. 28 demonstration plots for intercropping of macadamia and coffee were also established in Ntchisi and Rumphi.

The Project established a test target for Macadamia oil processing of 75 liters; a total of 181 liters were processed during year three given the expeller technology available, but a larger expeller will be required to increase production efficiency and the volume of oil produced. In order to market macadamia kernel and sub-products like oil, three potential markets were explored. HIMACUL helped macadamia producers connect to the international market by facilitating a link between farmers and Germany's El Puente.

Figure 11. Facilitated production of 33,300 macadamia root stocks and grafted 1,670 established rootstocks in the field

Small livestock promotion continued in year three. An additional 23 livestock committees were formed and trained, and training of farmers in piggery, poultry, and goat production is ongoing, with 2,270 individuals trained in the third year. *Khola* construction for different livestock classes was demonstrated on 37 different occasions. Through the use of loan schemes, additional heads of livestock (104 pigs, 4,340 chickens, 275 goats) were procured and distributed to farmers. The demand for chickens in particular has remained very high for the duration of the Project. While some Malawians in the Project Area had never been exposed to goats prior to the Project, the low capital investment required and the ease of care has also made them popular.

660 farmer agreements regarding animal care and cooperation with other farmers were developed and signed during the third year, for a Project total to date of 1,113 agreements. Training on feeding, veterinary care, and diagnosis of common diseases was conducted for 2,270 farmers. 26 club committees were also established in order to improve farmer access to veterinary services and medication for their livestock.

Lastly, fodder material was planting and fodder banks established in Rumphi, Nkhotakota and Ntchisi. 10,700 sticks of planting material for Napier grass and other fodder species were procured, and 1,750 fodder banks were established. 12.5 ha in the Project Areas were treated with manure as a benefit of livestock production.

The success of NTFP development during the third year had a positive impact on enterprise development. A value chain study was completed through a joint effort between Washington State University and RES., and 8,013 farmers were trained in microenterprise production and processing with the help of HIMACUL, Mzuzu Coffee, and the Small-Scale Livestock Production Program (SSLPP). An additional 107 entrepreneurs and 50 groups were trained in business skills and marketing. The sustainable harvest and use limits for honey and macadamia were explored, and three potential ventures were explored by HIMACUL and RES for honey, macadamia, and oil extracted from groundnuts and macadamia.

2.2 Deviations

2.2.1 Methodology Deviations

The methodology requires that cookstove efficiency is assessed at least biennially. This requirement was made with the idea that many promoted cookstoves are mobile and built of non-local materials. Often cookstoves promoted by NGOs are given away and not built by the operator. Non-locally made mobile stoves can easily break down, become damaged and loose efficiency over time. The requirement to test biennial is likely due to the fact that the most stoves promoted by NGOs have a high rate of degradation. The “mud-and-brick stove promoted by the Kulera project is stationary and since the operator is trained in stove maintenance, the thermal efficiency does not drop significantly as it is constantly up-kept. Since there has only been one WBT carried out during the monitoring period, this will be a methodology deviation for this monitoring period only. In future verifications WBP will be monitored annually or at least biennial provided that it is demonstrated that the efficiency of the cookstove does not drop significantly. Moreover, the use drop-off rate has been replaced by a default value using literature during this monitoring period. Since this change in monitoring has moved from biennially to triennially, precautions were taken into account to assess the conservativeness of the quantification of GHG emission reductions or removals. Efficiency, usage rate and stove degradation were all taken into account to assess the conservativeness of the stove and stove use over time.

2.2.2 Project Description Deviations

2.3 Grouped Project

The methodology used for this project is VM0006 v2.0, and this is a grouped project. However, no new instances are being added monitoring period, and therefore no eligibility criteria are provided.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

The following data and parameters are defined for standalone projects. For projects that are nested within a jurisdictional REDD+ program, at the time of validation the project will identify any data or parameters in the project document, if any, that will be adopted from the jurisdictional REDD+ program.

Data/parameter [EA1]:	CF
Data unit:	[Mg C (Mg DM)$^{-1}$]
Description:	Carbon fraction of dry matter in wood
Sources of data:	Default value of 0.5 (IPCC GPG-LULUCF 2003)
Value applied:	0.5
Measurement procedures:	
Purpose of Data:	Partitions carbon from biomass data. Used in calculations of annual carbon loss per deforestation driver (VM0006 Section 8.1.3.2, EQ 1-10),calculations of carbon stock density from OM pools (VM0006 Section 8.1.4.4, EQ 24), and carbon accounting for harvested wood products (VM00066 Section 8.4.1.1, EQ 101)
Any comment:	

Data/parameter [EA2]:	E
Data unit:	[-]
Description:	Average combustion efficiency of the aboveground tree biomass
Sources of data (*):	1. Project-specific measurements 2. Regionally valid estimates 3. Estimates from Table 3.A.14 of IPCC GPG LULUCF 4. If no appropriate combustion efficiency can be used, use the IPCC default of 0.5
Value applied:	0.5
Measurement procedures:	
Purpose of Data:	Used in calculations of carbon loss from biomass burning. In VM0006 this parameter is used in the deforestation drivers analysis to account carbon loss from forest fires (Section 8.1.3.2 EQ 10).
Any comment:	

Data/parameter [EA3]:	P
Data unit:	[-]
Description:	Average proportion of mass burned from the aboveground tree biomass.
Sources of data:	GPG-LULUCF Table 3A.1.12
Value applied:	

Measurement procedures:	
Purpose of Data:	Used in calculations of carbon loss from biomass burning. In VM0006 used to account carbon loss from forest fires in the deforestation drivers analysis to (Section 8.1.3.2 EQ 10).
Any comment:	

Data/parameter [EA4]:	GWP_{CH4}
Data unit:	[-]
Description:	Global Warming Potential for CH_4
Sources of data:	IPCC default value of 25
Value applied:	25
Measurement procedures:	
Purpose of Data:	Used to convert CH4 emissions to CO2 emissions. Methane accounted in calculations that include prescribed burning for firebreaks (VM0006 Section 8.2.3 EQ 70) prescribed burning for ANR (VM0006 Section 8.2.4.5 EQ77) and flooded rice agriculture (VM0006 Section 8.3.4.2.2 EQ 100
Any comment:	

Data/parameter [EA5]:	ER_{CH4}
Data unit:	Proportion
Description:	Emission ratio for CH_4
Sources of data:	Table 3A.1.15 in IPCC GPG-LULUCF 2003
Value applied:	IPCC default value of 0.012
Measurement procedures:	
Purpose of Data:	Used in CH_4 calculations that include prescribed burning for firebreaks (VM0006 Section 8.2.3 EQ 70) and ANR (VM0006 Section 8.2.4.5 EQ77)
Any comment:	

Data/parameter [EA6]:	sc_1
Data unit:	[-]
Description:	First shape factor for the forest scarcity equation; steepness of the decrease in deforestation rate (greater is steeper).
Sources of data:	Statistical fitting procedure. Using remotely sensed forest cover data in heavily deforested areas close to the project area such as neighboring provinces, states or countries
Value applied:	20
Measurement procedures:	
Purpose of Data:	Use model-fitting procedures described in VM0006 Section 8.1.5.4
Any comment:	Used in calculation of class/stratum transition rates. One of two parameters that determine the shape of the forest scarcity factor curve (VM0006 Section8.1.5.4, EQ 40).

Data/parameter [EA7]:	sc_2
Data unit:	[-]

Description:	Second shape factor for the forest scarcity equation; relative deforested area at which the deforestation rate will be 50% of the initial deforestation rate.
Sources of data:	Statistical fitting procedure. Using remotely sensed forest cover data in heavily deforested areas close to the project area such as neighboring provinces, states or countries
Value applied:	0.7
Measurement procedures:	Use model-fitting procedures described inVM0006 Section 8.1.5.4
Purpose of Data:	Used in calculation of class/stratum transition rates. One of two parameters that determine the shape of the forest scarcity factor curve (VM0006 Section 8.1.5.4, EQ 40).
Any comment:	Higher values of sc_2 result in lower deforestation and are therefore conservative.

Data/parameter [EA8]:	$\rho_{wood,j}$
Data unit:	[Mg DM m^{-3}]
Description:	Average basic wood density of species or species group j
Sources of data:	GPG-LULUCF Table 3A.1.9. or published data/literature.
Value applied:	0.60
Measurement procedures:	
Purpose of Data:	Used to calculate total carbon stock from harvested timber volume (VM0006 Section 8.4.1.1, EQ 101)
Any comment:	Average density value of African tree species.

Data/parameter [EA9]:	BEF_2
Data unit:	[-]
Description:	Biomass expansion factor for converting volumes of extracted round wood to total aboveground biomass (including bark).
Sources of data:	IPCC GPG LULUCF Table 3A.1.10 or published data from scientific peer reviewed literature
Value applied:	3.4
Measurement procedures:	
Purpose of Data:	Converts wood volume to biomass. Used in calculations of annual carbon loss per deforestation driver for logging, wood collecting and fuelwood collecting (VM0006 Section 8.1.3.2, EQ 4,5,6,7),
Any comment:	Value 3.4 from IPCC GPG LULUCF Table 3A.1.10 for tropical, broadleaf forest for trees >10cm DBH

Data/parameter [EA10]:	$NCV_{biomass}$
Data unit:	[TJ (Mg DM) $^{-1}$]
Description:	Net calorific value of non-renewable biomass that is substituted.
Sources of data:	IPCC default value.
Value applied:	not used - substitute non-renewable biomass not part of project activities
Measurement procedures:	0.015 TJ (Mg DM) $^{-1}$
Purpose of Data:	Parameter used to quantify emissions from CFE activities (VM0006 Section 8.2.5, WE 108)

Any comment:	

3.2 Data and Parameters Monitored

* Lower-ranked options may only be used if higher-ranked options are not available.

3.2.1 Land Transitions in Project Area and Leakage Areas

In Table 3 are the ex-post transitions for each of the Project Areas.

Table 2. Ex-Post Monitored Transitions in the Project Area Nyika (in hectares)

	Project Ex-Post			
	DF		RF	
From	MI1	EVG	BAR	BAR
To	BAR	BAR	MI1	EVG
Nyika				
2009	213	62	0	0
2010	213	62	0	0
2011	213	62	0	0
2012	213	62	0	0

Table 3. Ex-Post Monitored Transitions in the Project Area Nkhotakota (in hectares)

	Project Ex-Post			
	DF		RF	
From	MI1	EVG	BAR	BAR
To	BAR	BAR	MI1	EVG
Nkhotakota				
2009	101	1	0	0
2010	101	1	0	0
2011	101	1	0	0
2012	101	1	0	0

Table 4. Ex-Post Monitored Transitions in the Project Area Vwaza (in hectares)

	Project Ex-Post			
	DF		RF	
From	MI1	EVG	BAR	BAR
To	BAR	BAR	MI1	EVG
Vwaza				
2009	184	0	0	0
2010	184	0	0	0
2011	184	0	0	0
2012	184	0	0	0

3.2.1.1 Land Transitions in the Leakage Area

In Table 5, Table 6, and Table 7 are the ex-post transitions in the Leakage Areas for each of the three areas.

Table 5. Ex-Post Monitored Transitions in the Leakage Area in Nyika (in hectares)

	Leakage Ex-Post			
	DF		RF	
From	MI1	EVG	BAR	BAR
To	BAR	BAR	MI1	EVG
Nyika				
2009	520	8	1216	14
2010	520	8	1216	14
2011	520	8	1216	14
2012	520	8	1216	14

Table 6. Ex-Post Monitored Transitions in the Leakage Area in Nkhotakota (in hectares)

	Leakage Ex-Post			
	DF		RF	
From	MI1	EVG	BAR	BAR
To	BAR	BAR	MI1	EVG
Nkhotakota				
2009	585	0	1297	0
2010	585	0	1297	0
2011	585	0	1297	0
2012	585	0	1297	0

Table 7. Ex-Post Monitored Transitions in the Leakage Area in Vwaza (in hectares)

	Leakage Ex-Post			
	DF		RF	
From	MI1	EVG	BAR	BAR
To	BAR	BAR	MI1	EVG
Vwaza				
2009	294	0	908	0
2010	294	0	908	0
2011	294	0	908	0
2012	294	0	908	0

3.2.2 Sizes, Areas, and Transitions

Data/parameter [MN1]:	$size_{projectArea}$, $size_{leakageArea}$. $size_{referenceregion}$, $size_{referenceForest}$
Data unit:	[ha]
Description:	Size of project area, leakage area, reference region, and forest area in the reference region
Sources of data:	Project design
Measurement procedures:	GIS delineation of protected area boundaries based on official records, RS analysis of forest cover
Frequency of monitoring:	$size_{projectArea}$and$size_{leakageArea}$ may be adjusted during crediting period per the rules for grouped projects and updated at verification, but only for the additional instances that were added

	after the project start date, and may be adjusted during crediting period per the rules for grouped projects and updated at verification, but only for the additional instances that were added after the project start date.
Value applied:	See VCS PD for Table 10: Size and Geodetic Coordinates of Individual Project Parcels (WGS-84) and Table 13. Size of Reference Regions and Leakage Areas around each of the Project Parcels
Monitoring equipment:	n/a
QA/QC procedures to be applied:	Visual evaluation and comparison to Google Earth
Purpose of Data:	$size_{leakageArea}$ $size_{projectArea}$ used to calculate the Forest Strata-specific Deforestation and Degradation Rates in the Leakage Belts (VM0006 Section 8.3.2.3, EQ 94, 95) $size_{projectArea}$ used to calculate forest scarcity factor (VM0006 Section 8.1.4.4, EQ 40. $size_{referenceForest}$ and $size_{projectArea}$ used to calculate baseline total deforestation and degradation rates (VM0006 Section 8.1.4.1, EQ 37, 38). $size_{referenceregion}$ used to test applicability conditions for the reference region
Calculation method:	GIS delineation of boundaries
Any comment:	Required for PD

Data/parameter [MN2]:	$\Delta area_{projectAreaEAH,projectScenario}(t,i)$
Data unit:	[ha yr^{-1}]
Description:	Area (ha) undergoing transition i within the project area, excluding the ANR area, and harvest areas, under the project scenario for year t.
Sources of data:	Land-use change modeling (ex-ante) Remote sensing analysis (ex-post)
Measurement procedures:	Calculate based on the LULC classification
Frequency of monitoring:	At least once before verification
Value applied:	See Table 3.
Monitoring equipment:	Land-use classification
QA/QC procedures to be applied:	
Purpose of Data:	Estimate areas undergoing change from one class to another during the project scenario during the monitoring period.
Calculation method:	Follow the procedures described in section 8.1.5 of the methodology.
Any comment:	Required for M1

Data/parameter [MN3]:	$\Delta area_{projectAreaEAH,baselineScenario}(t,i)$
Data unit:	[ha yr^{-1}]
Description:	Area (ha) undergoing transition i within the project area, excluding the ANR area, and harvest areas, under the baseline scenario for year t.
Sources of data:	Historical LULC classification and land-use change modeling

Measurement procedures:	Calculate based on the LULC classification
Frequency of monitoring:	At least once before every baseline. For added instances, may be recalculated at verification.
Value applied:	See VCS PD, not required in this monitoring period.
Monitoring equipment:	n/a
QA/QC procedures to be applied:	
Purpose of Data:	Used to establish LULC transitions in the baseline scenario
Calculation method:	
Any comment:	

Data/parameter [MN4]:	$\Delta area_{projectAreaWithANR,baselineScenario}(t,i)$
Data unit:	[ha yr^{-1}]
Description:	Hectares undergoing transition i within the ANR area under the project scenario for year t and in stratum *i*.
Sources of data:	Land-use change modeling
Measurement procedures:	Calculate based on the LULC classification, summarized in the transition rates analysis described in Section VCS PD 3.1.5.
Frequency of monitoring:	At least once before every baseline update. For added instances, may be recalculated at verification.
Value applied:	N/A
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	Used to predict LULC transitions in the baseline scenario
Calculation method:	
Any comment:	N/A for this monitoring period.

Data/parameter [MN5]:	$\Delta area_{leakageArea,projectScenario}(t,i)$
Data unit:	[ha yr^{-1}]
Description:	Hectares undergoing transition i within the leakage area under the project scenario for year t
Sources of data:	Remote sensing analysis
Measurement procedures:	Calculate based on the LULC classification, summarized in the transition rates analysis described in Section VCS PD 3.1.5.
Frequency of monitoring:	At least once before verification
Value applied:	Table 6
Monitoring equipment:	n/a
QA/QC procedures to be applied:	
Purpose of Data:	Used to predict LULC transitions in the leakage area under the project scenario
Calculation method:	Follow the procedures described in Section 16.3.
Any comment:	Required for M1

Data/parameter [MN6]:	$\Delta area_{leakageArea,baselineScenario}(t,i)$

Data unit:	[ha yr^{-1}]
Description:	Hectares undergoing transition i within the leakage area under the baseline scenario during year t
Sources of data:	Land-use change modeling
Measurement procedures:	Calculate based on the LULC classification, summarized in the transition rates analysis described in Section VCS PD 3.1.5.
Frequency of monitoring:	Once every baseline update. May also be updated at the time of instance inclusion that requires new leakage area.
Value applied:	See VCS PD, not used for this monitoring period
Monitoring equipment:	n/a
QA/QC procedures to be applied:	
Purpose of Data:	Used to predict LULC transitions in the leakage area under the baseline scenario
Calculation method:	See VCS PD.
Any comment:	Required for PD

Data/parameter [MN7]:	$\Delta area_{historical}(CS_1 \rightarrow CS_2, t_1 \rightarrow t_2)$
Data unit:	[ha yr^{-1}]
Description:	Area of transition from LULC class or forest stratum 1 to 2 from time 1 to 2 during the historical reference period
Sources of data:	Remote sensing analysis
Measurement procedures:	Calculate based on the LULC classification, summarized in the transition rates analysis described in Section VCS PD.
Frequency of monitoring:	At least once before every baseline update
Value applied:	See VCS PD, not used in this monitoring period.
Monitoring equipment:	n/a
QA/QC procedures to be applied:	
Purpose of Data:	To calculate the baseline annualize deforestation rate
Calculation method:	See VCS PD.
Any comment:	Required for PD

Data/parameter [MN8]:	$RFRGrate(CS_1 \rightarrow CS_2)$
Data unit:	[yr^{-1}]
Description:	Relative annual forest cover increase and regeneration factor for the transition from class or stratum 1 to 2.
Sources of data:	Remote sensing analysis
Measurement procedures:	Calculate based on the remote sensing-based classification and stratification procedures detailed in section. Multiply with 100 to obtain a forest cover increase and regeneration rate in percentage per year.
Frequency of monitoring:	At least once before every baseline update
Value applied:	See VCS PD, not used in this monitoring period.
Monitoring equipment:	n/a
QA/QC procedures to be applied:	

Purpose of Data:	To calculate the baseline annualized reforestation rate
Calculation method:	
Any comment:	Required for PD

Data/parameter [MN9]:	$area_{historical}(CS_1, t_1)$
Data unit:	[ha]
Description:	Total area of LULC class or forest stratum 1 at time 1
Sources of data:	Remote sensing analysis
Measurement procedures:	Calculate based on the remote sensing-based classification and stratification procedures detailed in VCS PD
Frequency of monitoring:	At least once before every baseline update
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Not used in this monitoring period.

Data/parameter [MN10]:	$area_{biomassLoss}(i)$
Data unit:	[ha yr^{-1}]
Description:	Total annual area of LULC class i that was cleared for creating firebreaks
Sources of data:	Records of implemented activities or management plan
Measurement procedures:	
Frequency of monitoring:	At least once before verification
Value applied:	0
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	No biomass loss occurred from fire breaks in this monitoring period.

Data/parameter [MN11]:	$area_{fireBiomassLoss}(i)$
Data unit:	[ha yr^{-1}]
Description:	Annual area of forest stratum i that was cleared by using prescribed burning
Sources of data:	Records of implemented activities or management plan
Measurement procedures:	
Frequency of monitoring:	At least once before verification
Value applied:	0
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	

Calculation method:	
Any comment:	No biomass loss occurred from burning to clear fire breaks in this monitoring period.

Data/parameter [MN12]:	$area_{fireBiomassLoss,ANR}(t,i)$
Data unit:	[ha]
Description:	Area of biomass removed by prescribed burning within ANR stratum i during year t
Sources of data:	Records of implemented activities
Measurement procedures:	Only to be included if ANR activities are implemented.
Frequency of monitoring:	At least once before verification
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	N/A for this Project

Data/parameter [MN13]:	$area_{projectAreaWithANR,projectScenario}(t,i)$
Data unit:	[ha]
Description:	Amount of land on which ANR activities are planned under the project scenario for year t and in stratum i
Sources of data:	Records of implemented activities
Measurement procedures:	Only to be included if ANR activities are implemented.
Frequency of monitoring:	At least once before verification
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	N/A for this Project

Data/parameter [MN14]:	$area_{harvest}(t,i)$
Data unit:	[ha]
Description:	Area of forest in harvest stratum i that is harvested at time t.
Sources of data:	Project Design Document or Forest/Harvest Management Plan
Measurement procedures:	
Frequency of monitoring:	At least once before verification
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	

Any comment:	N/A for this Project

Data/parameter [MN15]:	$area_{projectAreaWithHarvest,projectScenario}(t,i)$
Data unit:	[ha yr^{-1}]
Description:	Size of strata i within the project area with harvest activities during year t under the project scenario.
Sources of data:	Remote sensing analysis
Measurement procedures:	
Frequency of monitoring:	At least once before verification
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	N/A for this Project

Data/parameter [MN16]:	$\Delta area_{projectAreaWithHarvest,baselineScenario}(t,i)$
Data unit:	[ha yr^{-1}]
Description:	Hectares undergoing transition i within the harvest areas under under the baseline scenario during year t.
Sources of data:	Land-use change modeling
Measurement procedures:	
Frequency of monitoring:	At least once before every baseline update
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	N/A for this Project

Data/parameter [MN17]:	$BetaReg_{DF}(t)$and $BetaReg_{DG}(t)$
Data unit:	[ha yr^{-1}]
Description:	Beta regression model describing the relationship between time and deforestation/degradation rate in the reference region during the historical reference period.
Sources of data:	Historic forest degradation and deforestation modeling
Measurement procedures:	Procedure described in the VCS PD or similar approach from peer-reviewed scientific literature.
Frequency of monitoring:	At least once every baseline update
Value applied:	n/a
Monitoring equipment:	n/a
QA/QC procedures to be applied:	
Purpose of Data:	To determine the future deforestation rate
Calculation method:	

Any comment:	Not applicable for this monitoring period.

3.2.3 Locations, Descriptions, Qualitative, and Social Data

Data/parameter [MN18]:	Area under agricultural intensification
Data unit:	[ha]
Description:	Size of the area of agricultural intensification separated for each agricultural intensification measure
Sources of data:	Participatory rural appraisals
Measurement procedures:	Calculate based on areas of cropland in the leakage and project areas Only to be included if agricultural intensification activities are implemented.
Frequency of monitoring:	At least once before verification
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Required for M1

Data/parameter [MN19]:	Yields under agricultural intensification
Data unit:	[Mg ha^{-1}]
Description:	Harvested yield for agricultural intensification practices
Sources of data:	Participatory rural appraisals
Measurement procedures:	Only to be included if agricultural intensification activities are implemented.
Frequency of monitoring:	At least once before verification
Value applied:	Double the amount of the non-project condition
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Required for M1

Data/parameter [MN20]:	NTFP harvest rate
Data unit:	[m^3 yr^{-1}] or [kg yr^{-1}]
Description:	Annual volumes of non-timber forest products extracted
Sources of data:	Participatory rural appraisals
Measurement procedures:	Estimate among participating communities and communities living in the leakage area.
Frequency of monitoring:	At least once before verification
Value applied:	Abosolute values were not used. 20-30 kg of honey per year per bee hive (TTAL n/d, and FAO

	1999).
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Required for M1

Data/parameter [MN21]:	Local NTFP price
Data unit:	Local currency
Description:	Price of non-timber forest products on local markets
Sources of data:	Participatory rural appraisals
Measurement procedures:	
Frequency of monitoring:	At least once before verification
Value applied:	Our PRA survey did not result in exact quantity of the NTFPs harvest rate. The survey however, reported that the NTFP collection trends have been increasing. This is an important livelihood support and project will continue to support such activities. Trend / % of respondent Decreased: 7.4 Increased: 72.9 Stayed the same: 19.7 (Source PRA)
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Required for M1

3.2.4 Data on Drivers and Actions

Data/parameter [MN22]:	$CFW_{baseline}$
Data unit:	[m^3 yr^{-1}]
Description:	Annual volume of fuelwood gathering for commercial sale and charcoal production in the baseline scenario
Sources of data (*):	5. Participatory rural appraisals 6. Recent (<10 yr) literature in the reference region 7. Recent (<10 yr) literature in an area similar to the reference region
Measurement procedures:	If emission reductions from avoided degradation were excluded due to insufficient accuracy, in which case $u_{classification} = 0$, and emission reductions from fuel-efficient woodstoves are included, $CFW_{baseline}$ may only be measured using the first option, social assessments.

Frequency of monitoring:	At least once before every baseline update
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Not required for the monitoring period.

Data/parameter [MN23]:	$DFW_{baseline}$
Data unit:	[m^3 yr^{-1}]
Description:	Annual volume of fuelwood gathered for domestic and local energy in the baseline scenario
Sources of data (*):	8. Participatory rural appraisals 9. Recent (<10 yr) literature in the reference region 10. Recent (<10 yr) literature in an area similar to the reference region
Measurement procedures:	If emission reductions from avoided degradation were excluded due to insufficient accuracy, in which case $u_{classification} = 0$, and emission reductions from fuel-efficient woodstoves are included, $DFW_{baseline}$ may only be measured using the first option, social assessments.
Frequency of monitoring:	At least once before every baseline update
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Not required for this monitoring period.

Data/parameter [MN24]:	$DFW_{project}$
Data unit:	[m^3 yr^{-1}]
Description:	Biomass (dry matter) of fuelwood collected by project participants under the project scenario.
Sources of data (*):	11. Participatory rural appraisals 12. Recent (<10 yr) literature in the reference region 13. Recent (<10 yr) literature in an area similar to the reference region
Measurement procedures:	If emission reductions from avoided degradation were excluded due to insufficient accuracy, in which case $u_{classification} = 0$, and emission reductions from fuel-efficient woodstoves are included, $DW_{baseline}$ may only be measured using the first option, social assessments.
Frequency of monitoring:	At least once before verification
Value applied:	Same as 95 % of $DFW_{baseline}$
Monitoring equipment:	
Value applied:	

Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	DFW baseline is 2717.21 kg per household for 88,740 households.

Data/parameter [MN25]:	$DFW_{allowed}$
Data unit:	[m^3 yr^{-1}]
Description:	Biomass (dry matter) of allowed fuelwood collection in the project area under the project scenario. This amount is typically fixed in a management plan. [m3 yr-1]
Sources of data (*):	Forest management plan
Measurement procedures:	
Frequency of monitoring:	At least once before every baseline update
Value applied:	Same as $DFW_{project}$
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Required for MN1

Data/parameter [MN26]:	$VG_{baseline}$
Data unit:	[m^3 yr^{-1}]
Description:	Biomass (dry matter) of understory vegetation extraction by project participants under the baseline scenario. [Mg DM yr-1]
Sources of data (*):	14. Participatory rural appraisals 15. Recent (<10 yr) literature in the reference region 16. Recent (<10 yr) literature in an area similar to the reference region
Measurement procedures:	Calculate by multiplying the number of households involved in extraction of vegetation with the average annual extraction rate by household for different vegetation types
Frequency of monitoring:	At least once before every baseline update
Value applied:	Not applicable for this monitoring period.
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	

Data/parameter [MN27]:	$VG_{project}$
Data unit:	[Mg DM yr-1]
Description:	Biomass (dry matter) of understory vegetation extraction by project participants under the project scenario.

Sources of data (*):	17. Participatory rural appraisals 18. Recent (<10 yr) literature in the reference region 19. Recent (<10 yr) literature in an area similar to the reference region
Measurement procedures:	Calculate by multiplying the number of households involved in extraction of vegetation with the average annual extraction rate by household for different vegetation types
Frequency of monitoring:	At least once before verification
Value applied:	Not applicable.
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	Estimate carbon loss from understory vegetation extraction under the project scenario for leakage estimation.
Calculation method:	
Any comment:	Since the underlying driver is not part of the project design, this parameter was not applicable.

Data/parameter [MN28]:	$VG_{allowed}$
Data unit:	[Mg DM yr-1]
Description:	Biomass (dry matter) of allowed as understory vegetation extraction under the project scenario. This amount is typically fixed in a management plan
Sources of data (*):	Forest management plan
Measurement procedures:	
Frequency of monitoring:	At least once before every baseline update
Value applied:	Not applicable
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	Estimate understory vegetation allowed from the project area under the project scenario
Calculation method:	
Any comment:	Since the underlying driver is not part of the project design, this parameter was not applicable.

Data/parameter [MN29]:	$CT_{baseline}(h, j, ty, t)$
Data unit:	[m^3 yr^{-1}]
Description:	Annually extracted volume of harvested timber round-wood for commercial on-sale under the baseline scenario during harvest h by species j and wood product class ty during year t
Sources of data (*):	20. Participatory rural appraisals conducted by project proponents. 21. Recent (<10 yr) literature in the reference region 22. Recent (<10 yr) literature in an area similar to the reference region 23. Recent (<10 yr) non peer-reviewed reports by local organizations
Measurement procedures:	

Frequency of monitoring:	At least once before every baseline update
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	N/A for this Project

Data/parameter [MN30]:	$CT_{allowed}$
Data unit:	[m^3 yr^{-1}]
Description:	Annually allowed volume of harvested timber round-wood for commercial on-sale under the project scenario
Sources of data (*):	Project document and/or management plan
Measurement procedures:	
Frequency of monitoring:	At least once before every baseline update
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	Estimate volume for mixture of species
Calculation method:	
Any comment:	N/A for this Project

Data/parameter [MN31]:	$CT_{project}(h, j, ty, t)$
Data unit:	[m^3 yr^{-1}]
Description:	Annually extracted volume of harvested timber round-wood for commercial on-sale inside the project area under the project scenario during harvest h by species j and wood product class ty during year t.
Sources of data (*):	Project design, surveys, statistical records.
Measurement procedures:	
Frequency of monitoring:	At least once before verification
Value applied:	0
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	N/A for this Project. Project does not allow extraction of timber for commercial sale.

Data/parameter [MN32]:	$DT_{baseline}(h, j, ty, t)$
Data unit:	[m^3 yr^{-1}]
Description:	Annually extracted volume of timber for domestic and local use, round wood under the baseline scenario during harvest h by species j and wood product class ty during year t.

Sources of data (*):	24. Participatory rural appraisals conducted by project proponents
Measurement procedures:	
Frequency of monitoring:	At least once before every baseline update
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Not applicable for the monitoring period.

Data/parameter [MN33]:	$DT_{allowed}$
Data unit:	[m^3 yr^{-1}]
Description:	Annually allowed volume of harvested timber round-wood for domestic and local use under the project scenario
Sources of data (*):	Project document and/or management plan
Measurement procedures:	
Frequency of monitoring:	At least once before every baseline update
Value applied:	77,538.8 Mg DM Per Year
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Estimate for mixture of species same as in the baseline.

Data/parameter [MN34]:	$DT_{project}(h, j, ty, t)$
Data unit:	[m^3 yr^{-1}]
Description:	Annually extracted volume of timber for domestic and local use, round wood inside the project area under the project scenario during harvest h by species j and wood product class ty during year t.
Sources of data (*):	Project design, surveys, statistical records.
Measurement procedures:	
Frequency of monitoring:	At least once before verification
Value applied:	77,538.8 Mg DM Per Year
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Same as in the baseline.

Data/parameter [MN35]:	$contribution_{DF}(d)$ and $contribution_{DG}(d)$
Data unit:	[-]

Description:	Relative contribution of driver i respectively to total deforestation and forest degradation.
Sources of data:	Calculated using procedure described in VCS PD
Measurement procedures:	
Frequency of monitoring:	At least once before baseline update.
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Not applicable for the monitoring period.

Data/parameter [MN36]:	$RelativeDriverImpact_{DF}(t,d)$ and $RelativeDriverImpact_{DG}(t,d)$
Data unit:	[-]
Description:	Relative impact of the geographically unconstrained driver d at time t of the crediting period respectively on deforestation and forest degradation.
Sources of data:	Calculated using procedure described in the VCS PD
Measurement procedures:	
Frequency of monitoring:	At least once before baseline update.
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	

Data/parameter [MN37]:	$leakage_{unconstrained}(d)$
Data unit:	[-]
Description:	Leakage cancellation rate for avoiding deforestation/degradation from geographically unconstrained drivers.
Sources of data:	Valid sources to substantiate a smaller leakage rate include social assessments, scientific literature, and reports from civil society or governments. Sources have to be reliable and based on scientific methods and a good statistical design.
Measurement procedures:	
Frequency of monitoring:	At least once before baseline update.
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	Unless a lower rate can be justified, a default rate of 100% must be used.
Calculation method:	
Any comment:	Not applicable for the monitoring period.

Data/parameter [MN38]:	$effectiveness(a,d)$
Data unit:	[-]
Description:	Effectiveness of every project activity a in decreasing any deforestation driver d relative to that driver's contribution to deforestation and forest degradation
Sources of data:	Literature or expert opinion.
Measurement procedures:	
Frequency of monitoring:	At least once before baseline update.
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	$effectiveness(a,d)$Not applicable for the monitoring period.

Data/parameter [MN39]:	$GR_{allowed}$
Data unit:	[-]
Description:	Number of grazing animals of type g allowed for grazing within the project boundary in the project scenario
Sources of data:	Project management plan
Measurement procedures:	Calculate by multiplying the number of animals taking into account different types of grazing animals.
Frequency of monitoring:	At least once before verification
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	N/A for this Project

Data/parameter [MN39]:	$Fuelwood(t)$, $Fuel(t)$
Data unit:	[m^3 yr^{-1} HH^{-1}]
Description:	Average annual volume of biomass fuel consumed by households in the absence of the project activity in year t for cooking purpose.
Sources of data:	Social assessments results or wood energy statistics applicable to the project
Measurement procedures:	
Frequency of monitoring:	At least once every baseline update
Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	

Calculation method:	
Any comment:	Not applicable for the monitoring period.

Data/parameter [MN40]:	$HH_{non-CFE}(t)$
Data unit:	[-]
Description:	Total number of household in the project area that collect biomass fuel from the project area and do not use CFE in year t.
Sources of data:	Social assessments results or wood energy statistics applicable to the project
Measurement procedures:	Cookstove distribution records.
Frequency of monitoring:	At least once before verification
Value applied:	See 'S_cookstove' worksheet in 2. Calculate emissions sources v0-6 ex-post M1.xlsm workbook'
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Out of 88,740 households, only less than 5% are currently using some form of improved cookstoves. The project expects to distribute new stoves to at least 35,000 households.

Data/parameter [MN41]:	η_{old}
Data unit:	[-]
Description:	Efficiency of the project cook stoves or appliances.
Sources of data:	Default value of 0.10 for three stone stove or conventional stove that lacks improved combustion air supply mechanism and flue gas ventilation systems i.e., without a grate as well as a chimney; for rest of the systems 0.2 default value may be used.
Measurement procedures:	Methodology default for three stone cook stove.
Frequency of monitoring:	At least once every baseline update
Value applied:	0.10
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	Not applicable for monitoring period.

Data/parameter [MN42]:	η_{new}
Data unit:	[-]
Description:	Efficiency of the baseline cook stoves or appliances.
Sources of data:	Values obtained from the manufacturer of the stove. In absence of such value, value may be calculated from field testing using ISO standards.
Measurement procedures:	Based on referenced literature values.

Frequency of monitoring:	Since the stoves used are manufactured by recognized industry (i.e., TLC) that is still in business and provides assures the functional integrity of the product by providing warranty for the stoves stated life, then the monitoring must be done once every baseline update.
Value applied:	0.2
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	The conservative value from MN41 was used as the mud-and-brick stoves promoted by TLC contain an improved combustion air supply mechanism and flue gas ventilation system.
Any comment:	It was stated by TLC that the fuelwood consumption is reduced by 80% compared to traditional three stone stoves in Malawi.

Data/parameter [MN43]:	$U_{CFE}(t)$
Data unit:	[-]
Description:	Fraction of cumulative usage rate for technologies in project scenario in year t. [-]
Sources of data:	Social assessments – distribution records from project proponents
Measurement procedures:	Cumulative adoption rate and drop off rate revealed by usage surveys [-].
Value applied:	1, the stoves are built-in and thus the usage rate is 100%.Project proponents report a 100% usage rate. Literature was used to assume a conservative number of a reduction in usage over time.
Monitoring equipment:	
Frequency of monitoring:	Annual
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	

Data/parameter [MN44]:	$DF_{LeakageCFE}(t)$
Data unit:	[-]
Description:	Leakage discount factor applicable to GHG emissions reduction benefits from CFE activities [-]
Sources of data:	Default value of 0.95 following AMS.II.G CDM methodology. Social assessments or wood energy statistics applicable to the project.
Measurement procedures:	Methodology default value.
Frequency of monitoring:	Since default value was used, this parameter was not monitored.
Value applied:	0.95. Default value used
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	

Calculation method:	
Any comment:	As per the methodology, if the default value of 0.95 is used, no survey is required.

Data/parameter [MN45]:	$EF_{non-CO2,fuel}$, $EF_{CO2,fuel}$
Data unit:	[t CO_2 TJ^{-1}]
Description:	Respectively, non--CO2 emission factor of the fuel that is reduced and CO2 emission factor for the substitution of non-renewable woody biomass by similar consumers.
Sources of data:	Social assessments or wood energy statistics applicable to the project
Measurement procedures:	Emission factor can include a combination of emission factors from fuel production, transport, and use. Both CO_2 and Non-CO2 of the fuel such as emissions factors for charcoal can be estimated from project specific monitoring or alternatively by researching a conservative wood to charcoal production ratio (from IPCC, credible published literature, project-relevant measurement reports, or project-specific monitoring) and multiplying this value by the pertinent emission factor of wood.
Frequency of monitoring:	At least once before verification
Value applied:	30.3 [MgCO2 TJ-1] for EF_Non-CO2, and 122.22 MGCO2 TJ-1 for EF_CO2
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Purpose of Data:	
Calculation method:	Emissions factor for CO2 emissions was derived from recent biomass inventory. For non-CO2 emissions i.e., for CH4 and N2O, IPCC 2006 GL for emission factors and NCVs, IPCC SAR 1996 for GWPs were used.
Any comment:	See 2. Calculate emissions sources workbook, and sheet "S_Cookstove" for additional details.

Data/parameter [MN46]:	EF_{forest}
Data unit:	[t CO_2e]
Description:	Emission factor related to leakage.
Sources of data:	If comprehensive national-level statistics on biomass densities are available, EF_{forest} must be calculated based on the average biomass of the country, if local data is not available. Sources of the data allowed are (1) academic research papers and (2) studies and reports published by the forestry administration or other organizations, including the FAO's Forest Resource Assessment reports, (3) the upper range of biomass in the GPG-LULUCF (2003) Table 3A.1.2.
Measurement procedures:	
Frequency of monitoring:	At least once before verification

Value applied:	n/a
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	To estimated emission factor for unconstrained leakage.
Calculation method:	
Any comment:	There is no unconstrained leakage. See parameter 'Maximum biomass emissions' in worksheet "8. Emissions factor' in workbook '1. Gross Emissions Reductions"

3.2.5 Data on Organic Matter and Carbon Densities

Data/parameter [MN48]:	$OM_o(i)$
Data unit:	[Mg DM ha-1]
Description:	Plant-derived organic matter of LULC class or forest stratum i in pool o. [Mg DM ha-1]
Sources of data:	Field measurements using sampling plots in forest strata or LULC classes.
Measurement procedures:	The average biomass stock density in applicable organic matter pools: aboveground tree - $OM_{AGT}(i)$, aboveground non-tree - $OM_{AGNT}(i)$, lying dead wood - $OM_{LDW}(i)$, standing dead wood $OM_{SDW}(i)$, belowground $OM_{BG}(i)$, and soil organic matter $OM_{SOM}(i)$
Frequency of monitoring:	At least once before every baseline update
Value applied:	See Table 28 of the VCS PD
Monitoring equipment:	
QA/QC procedures to be applied:	Follow uncertainty deduction procedures described in methodology. Re-measure plots by independent teams.
Purpose of Data:	
Calculation method:	
Any comment:	Summed across multiple pools and divided into $OM_{plant}(i)$ and $OM_{soil}(i)$

Data/parameter [MN49]:	$proportion_{DF}(d)$ and $proportion_{DG}(\mathrm{d})$
Data unit:	[-]
Description:	Proportion of the gradual carbon loss that leads to deforestation or forest degradation, respectively, due to driver d
Sources of data:	Estimate using the procedure detailed in VCS PD
Measurement procedures:	
Frequency of monitoring:	At least once before every baseline update
Value applied:	Not required for the monitoring period.
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	

Calculation method:	
Any comment:	

Data/parameter [MN47]:	$C(t,i)$
Data unit:	[Mg C ha^{-1} yr^{-1}]
Description:	Carbon stock density at time t in stratum i.
Sources of data:	Estimate within the biomass inventory plots
Measurement procedures:	
Frequency of monitoring:	At least once before verification
Value applied:	Not applicable as no ANR activities planned.
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	Used in estimating change in carbon stock density such as in ANR areas.
Calculation method:	
Any comment:	

Data/parameter [MN48]:	$f_{allometric}(y)$
Data unit:	Equation
Description:	Allometric relationship to convert a tree metric such as DBH or tree height into biomass
Sources of data (*):	• Allometric equations developed locally by groups other than project proponents
Measurement procedures:	
Frequency of monitoring:	May be updated at baseline update
Value applied:	Not monitored in this period.
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	

Data/parameter [MN49]:	$f_{belowground}(y)$
Data unit:	Equation
Description:	Relationship between aboveground and belowground biomass, such as a root-to-shoot ratio
Sources of data (*):	25. A relationship obtained from the local/national studies that closely reflect the conditions of the project activity
Measurement procedures:	
Frequency of monitoring:	May be updated at baseline update
Value applied:	Not monitored in this period.
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	

Calculation method:	
Any comment:	

Data/parameter [MN50]:	$u_{classification}$
Data unit:	[-]
Description:	Discounting factor for NERs from avoided deforestation, based on the accuracy of classification, i.e. dividing land into broad land use types.
Sources of data:	
Measurement procedures:	Section 8.1.1.3.7
Frequency of monitoring:	At least once before verification
Value applied:	1
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	

Data/parameter [MN51]:	$u_{transition}(i)$
Data unit:	[-]
Description:	Discounting factor for the emission factor for the transition from LULC class or forest stratum 1 to class 2 according to the uncertainty of the biomass inventory.
Sources of data:	
Measurement procedures:	Section 8.1.2.4.3
Frequency of monitoring:	At least once before verification
Value applied:	See Table Emission factors and discounting factors for LULC transitions in the PD.
Monitoring equipment:	
QA/QC procedures to be applied:	
Purpose of Data:	
Calculation method:	
Any comment:	

3.3 Monitoring Plan

This project will monitor all required components according to the methodology. In general, the following components for calculating actual GHG benefits generated by the REDD project, or Net anthropogenic Emission Reductions (NERs) are included in the monitoring plan.

- Monitoring of deforestation drivers, project activities and emission sources related to REDD project activities inside and outside of the project area.
- Monitoring LULC class and forest strata transitions in the project area, leakage area and reference region using remote-sensing technologies and validated with ground-truthing data.
- Monitoring carbon stock densities in LULC classes and forest strata.

- Monitoring carbon stock increases in the area on which ANR is performed.
- Monitoring of any natural disturbances regardless of the cause of the loss.

Before every verification event, a monitoring report will be produced which contains all of the information above, and which outlines the calculations for actual NERs generated. At every verification event, project proponents will attest that no other land-based carbon projects registered under any other carbon trading scheme (both voluntary and compliance-oriented) are present in the project area.

3.3.1 Organizational Structure, Responsibilities and Competencies

- **Total LandCare**. During the first five years after validation of the project, the implementing partner (TLC) is responsible for managing, outsourcing and collecting the results of (1) biomass inventory measurements, (2) social assessments, (3) recording action activity implementation, and (4) any other data required to be monitored under this methodology. TLC will execute first-pass of quality assurance and quality control (QA/QC) checks on all of the data collected by them or any other partner. TLC will keep records of all field inventory and social appraisal data sheets and all other evidence demonstrating the correct execution of project implementation.
- **Department of Parks and Wildlife**. During the first five years of the project, the DPW will provide assistance in the annual field inventory measurements, and review the monitoring reports. The DPW will be trained to become the responsible party for all monitoring requirements five years after validation of the project.
- **Terra Global Capital**. During the first five years after validation of the project, Terra Global Capital is responsible for verifying that the required elements are monitored, overseeing or executing all modeling and calculations, and performing second-pass QA/QC checks. In addition, Terra Global Capital is responsible for developing the monitoring reports during the first five years after validation of the project.
- **NAWIRA and the Nyika-Vwaza Association** projects, report natural disasters and all challenges related to forest protection to the implementing organization.

Table 8. Monitoring data sources and methods

Category	Method/Data Source	Frequency	Reporting	Responsibility
Social Assessment	Participatory Rural Appraisal (PRA)	Annually after first verification	VCS / CCB	TLC, Terra
	Household Survey (HHS)			
Biomass inventory	Sample plot field survey	Annually after first verification	VCS	TLC, TGC
Land use land class (LULC) change	Remote sensing	Every year	VCS	TGC
Biodiversity assessment	Field observation	Ongoing	CCB	TLC, Consultant
Project documentation	Activity reporting	Ongoing	VCS / CCB	TLC, TGC

Standard Operating Procedures (SOPs) developed by TGC and TLC will be used to collect all data required for VCS. There are three levels of data collection tools including:

- Standard operating procedures (SOP)

- Protocols
- Data collection forms

The purpose of SOP's and Protocols is to provide a standardized and consistent basis for data collection, management and reporting. SOP's and protocols are therefore an important aspect of quality control and assurance.

TLC has also implemented a comprehensive Monitoring and Evaluation Plan (see CCB Monitoring Plan), that performs extensive project activity, community and biodiversity monitoring. Please see this plan for detailed monitoring of this Project.

3.3.2 Managing Data and Data Quality

The data quality will be maximized and ensured during all aspects of the monitoring process by quality assurance and quality control (QA/QC) procedures. To monitor field inventory data, data analysts, and involved individuals/institutions in evaluating the quality of analytical data, rigorous QA/QC procedures are developed relevant to this project. The QA/QC procedures include specific criteria to evaluate the quality of analytical data that has been gathered. The QA/QC procedures are therefore an absolutely essential part of monitoring.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

This section summarizes the ex-post calculations of the GHG benefits for the current monitoring period. Baseline Emissions Project years are based on the project start date of October 1, 2009. Hence project year and vintage year 2009 starts 1 October 2009 and ends on 30 September 2010.

4.1 Baseline Emissions

Table 9 shows baseline emissions from 2009 to 2012 based on the requirements of the methodology as reporting in the VCS PD.

Table 9. Baseline Emissions during Monitoring Period

Nyika		Nkhotakota		Vwaza		Total	
YEAR	Estimated baseline emissions or (removals) (tCO2e)	YEAR	Estimated baseline emissions or (removals) (tCO2e)	YEAR	Estimated baseline emissions or (removals) (tCO2e)	YEAR	Estimated baseline emissions or (removals) (tCO2e)
2009	169,272	2009	134,877	2009	70,593	2009	374,742
2010	176,643	2010	147,207	2010	72,794	2010	396,643
2011	184,700	2011	155,321	2011	75,616	2011	415,637
2012	189,621	2012	163,319	2012	78,234	2012	431,174
Total	720,235	Total	600,724	Total	297,237	Total	1,618,197

4.2 Project Emissions

Table 10 shows actual GHG emissions or removals observed after project implementation (ex-post) from 2009 to 2012. Negative numbers represent small net regeneration in the Project Areas.

Table 10. Ex-Post Project Emissions or (Removals) during the Monitoring Period

Nyika		Nkhotakota		Vwaza		Total	
YEAR	Ex-Post Project emissions or removals (tCO2e)	YEAR	Ex-Post Project emissions or removals (tCO2e)	YEAR	Ex-Post Project emissions or removals (tCO2e)	YEAR	Ex-Post Project emissions or removals (tCO2e)
2009	99,552	2009	13,210	2009	23,196	2009	135,958
2010	104,652	2010	14,075	2010	24,734	2010	143,461
2011	109,752	2011	14,939	2011	26,273	2011	150,964
2012	114,852	2012	15,804	2012	27,812	2012	158,467
Total	428,808	Total	58,028	Total	102,015	Total	588,850

4.3 Leakage

Per the VCS Project Document that Project is subject only to activity shifting leakage from geographical constrained drivers. Table 11 shows the leakage deductions as monitoring in the Leakage Areas for geographically constrained leakage.

Table 11. Ex-Post Leakage during the Monitoring Period

Nyika		Nkhotakota		Vwaza		Total	
YEAR	Ex-Post Leakage emissions (tCO2e)	YEAR	Ex-Post Leakage emissions (tCO2e)	YEAR	Ex-Post Leakage emissions (tCO2e)	YEAR	Ex-Post Leakage emissions (tCO2e)
2009	0	2009	0	2009	0	2009	0
2010	0	2010	0	2010	0	2010	0
2011	0	2011	0	2011	0	2011	0
2012	0	2012	0	2012	0	2012	0
Total	0	Total	0	Total	0	Total	0

4.4 Net GHG Emission Reductions and Removals

4.4.1 Cookstoves

Based on the data reported for number of cookstoves installed in each year of the monitoring period (see 2.1.5.20), Table 12 provide the emission reductions from the Project's cookstoves activities.

Table 12. Emission Removals from Cookstoves

YEAR	Cookstove emissions (removals) (tCO_2e)
2009	-
2010	27,796
2011	48,805
2012	49,010
Total	125.611

Table 13. GHG Emission Reductions and Removals

YEAR	ΔGHG from avoided deforestation	ΔGHG from deforestation due to leakage	GHG from improved cookstoves	GHG from Emission sources	NER	Risk Buffer	Buffer	VCU
	[tCO2e]	[tCO2e]	[tCO2e]	[tCO2e]	[tCO2e]	[%]	[tCO2e]	[tCO2e]
2009	238,784	-	-	-	238,784	10	(23,878)	214,906
2010	253,182	-	27,796	-	280,978	10	(25,318)	255,660
2011	264,673	-	48,805	-	313,478	10	(26,467)	287,010
2012	272,707	-	49,010	-	321,717	10	(27,271)	294,447
Total	1,029,346		125,611		1,154,957	40	(102,935)	1,052,022

5 APPENDIX

Steps for processing of Landsat imagery was followed as stated in the Project Document however the inclusion of THEOS (Thailand Earth Observation System) imagery required an additional step of corregistration to the Landsat imagery and demonstration of similarity of spectral properties to the Landsat imagery (Table 4). For the Nkhotakota region, sufficiently cloud-free Landsat imagery was not available for the verification period. Therefore alternate multispectral sources were investigated. THEOS imagery met the resolution, and spectral criteria to match Landsat properties. THEOS multispectral imagery was tasked from GISTDA (The Geo-Informatics and Space Technology Development Agency). Suitable imagery of the Nkhotakota region was collected on 18 August 2013. The imagery was received orthorectified at 15 meter resolution from GISTDA with top of atmosphere radiometric correction applied. The THEOS imagery was then manually corregistered to the Landsat L1T standard using 106 ground control points collected through comparison of the THEOS with Landsat imagery. A 2nd degree polynomial nearest neighbor warp was used to apply the corregistration. The imagery was then resampled to the Landsat 30m pixel size and cropped to the same dimensions as the historic LULC series. The band ranges used by THEOS (Table 14 THEOS band ranges) are nearly identical to those used by Landsat.

A second difference to Project Description methods, due to leaf-off conditions (from natural phenology) of some forest areas in the Nyika project area, was the use of an alternate Landsat date to create an ancillary layer to help identify this leaf-off forest. Landsat 8 imagery from July 1, 2013 which exceeded the 20% cloud cover requirement (therefore was not suitable as the monitoring scene) was sufficient to enhance the Nyika classification by allowing for phenology-related leaf-off forest to be identified within the August 18, 2013 monitoring image. The July date preceded the dry season dropping of leaves which occurred between July 1 and August 18. This Landsat 8 scene was classified using the ISODATA unsupervised classification algorithm. This classified scene was then used as an ancillary layer to assist in the identification of leaf-off forest during the Random Forest classification of the THEOS imagery by allowing for training of leaf-off areas as forest in areas classified as forest in the July 1 scene. The Random Forest classification process was the same as used for creating the historic LULC series as detailed in the Kulera VCS Project Description.

Table 14. THEOS band ranges

Band nr.	Resolution (m)	Band name	Wavelength(µm)	
			from	to
1	15	Blue	0.45	0.52
2	15	Green	0.53	0.60
3	15	Red	0.62	0.69
4	15	Near Infrared	0.77	0.90

Table 15. Overview and characteristics of remote sensing data

Source	Date Range	No. Scenes	Type	Sensors	Processing Level
USGS Landsat Glovis	2013	2	Satellite	ETM+, OLI Landsat 8)	• Basic radiometric corrections • L1T
THEOS	2013	2 (Mosaic)	Satellite	Thaichote	Basic radiometric corrections geometric corrections for systematic effects projected to UTM 36S

Table 16. Wavelengths of Landsat 8 OLI bands that correspond to THEOS

Band nr.	Resolution (m)	Band name	Wavelength (µm)	
			OLI	
			from	to
2	30	Blue	0.45	0.51
3	30	Green	0.53	0.59
4	30	Red	0.64	0.67
5	30	Near infrared	0.85	0.88

Table 17. Landsat scenes used for producing LULC classifications. Supporting scenes for evaluation of temporal cover transitions and not classified to the same degree of precision as the baseline scenes.

Date (YYYYMMDD)	Path/Row	Project Region	Satellite	Purpose
20130602	168/69	Nkhotakota	Theos	Monitoring
20130701	169/67	Nyika	Landsat 8	Supporting
20130818	138/375	Nyika	Landsat 8	Monitoring
20130530	169/68	Vwaza	Landsat 8	Monitoring