

LAKE CHILWA BASIN CLIMATE CHANGE ADAPTATION PROGRAMME IMPACT: 2010 – 2017

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Cover Page Photos: The youth actively participating in tree planting around Zomba Mountain slopes (Photo credit: Sosten Chiotha) and Fishing related activities at Kachulu Beach on the shores of Lake Chilwa in Zomba (Photo credit: Patrick Likongwe)

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EXECUTIVE SUMMARY

Lake Chilwa Basin Climate Change Adaptation Programme (LCBCCAP) hereafter referred to as the Programme, set out from 2010 to 2017 to secure the livelihoods of 1.5 million people living in the Lake Chilwa Basin districts of Machinga, Phalombe and Zomba. The choice of the Lake Chilwa basin was influenced by a number of factors. First, previous reports (Njaya *et al*, 1996) had argued that the basin population lives under constant threat of extreme and highly variable weather while eking out a living from a declining natural resource base. Second, with a population density of 321 people per Km², the Lake Chilwa basin is considered one of most densely populated areas in Malawi and Southern Africa (NSO, 2008), a major factor in the vulnerability equation of the basin. Third, the basin has international significance, declared a Ramsar site in 1997 under the Ramsar Convention and designated in the year 2000 as Man and Biosphere (MAB) Reserve by the United Nations Education Scientific and Cultural Organization (UNESCO).

In its implementation, LCBCCAP used the Ecosystem Approach (EA) which according to the Convention on Biological Diversity (CBD) is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (Secretariat of the Convention on Biological Diversity, 2004). The Programme followed all the twelve (12) EA principles with involvement of all key stakeholders from start to end and it is the first programme to apply EA in Malawi on such a wide temporal and spatial scale. The interventions were implemented in ten (10) hotspots, and consistent with EA principles, these hotspots were selected based on their vulnerability status, with full participation and consent of all relevant stakeholders.

This report has clustered impact outcomes under four (4) themes namely; building ecosystem resilience, building social resilience, natural resource monitoring and innovative communication and outreach.

Under ecosystem resilience, the report highlights afforestation through seedling and truncheon planting, natural regeneration among other natural resource management activities. Through prudent stewardship, the Programme achieved 71% of seedling survival above the national average of 55% (<http://www.manaonline.gov.mw/>). Tree planting and natural regeneration resulted in 6,760 hectares of tree cover along degraded land including river banks.

Under Social resilience, the report highlights capacity enhancement in agribusiness and livelihood income generating activities like small livestock pass-on scheme, conservation agriculture, fish value addition, village savings and loan schemes and integrated agriculture aquaculture. For instance, within the Programme period, yield from conservation agriculture increased from 1,500 Kg/ha baseline to 3,500 Kg/ha.

Because most of the livelihoods of the target communities in the basin are based on agriculture and fishery, both of which are climate sensitive, this report has included a third cluster of activities aimed at enhancing the capacity for participatory natural resource monitoring to inform practical decision making from grassroots to policy levels. The communities, for example, were trained to record data related to weather, river discharge, lake water levels, fishery, and wetland bird populations. Through this monitoring, the Programme was able to forecast the Lake recession of 2012, thereby providing stakeholders with practical early warning. Similarly, the river gauge monitors have been able to

provide early flood warning to downstream communities along the Domasi River.

With an ambitious social change agenda, targeting 1.5 million people across three districts and ten hotspots, the Programme developed a robust innovative communication and outreach strategy, hence the fourth cluster in this report. Channels included interpersonal communication such as individual and group discussions through lead farmer approach, farmer field days, exchange visits, and demonstration sites on conservation agriculture. Other channels included mass media communication such as electronic media, e.g. radio, television, social media and print e.g. brochures, leaflets, posters, newspaper feature articles and calendars. Among the key outcomes under communication and outreach was the establishment of the Chanco Community Radio (with a 100 Km radius coverage throughout the basin and neighboring districts) and the creation of ten (10) radio listeners clubs. The radio listeners clubs were a form of citizen journalism involved in documenting and disseminating the experiences of communities and providing a platform for generating community based solutions and creating a sense of community participatory learning through storytelling.

The effectiveness of the Communication and Outreach Strategy resulted in replication of best practices from LCBCCAP within the Programme but were also tested and replicated in other programmes within and outside the Lake Chilwa basin through mutual synergy and feedback loops. Examples included the solar dryers for fish being replicated along Lake Malawi under Cultivate Africa Future Project (CultiAF), and the EA being adopted by the MAJI (More Action for Just Initiative) project implemented by VSO (Voluntary Service Overseas) in some districts in Central and Northern Malawi, Fisheries Integration for Society and Habitats (FISH) project implemented in Lakes Malawi, Malombe, Chilwa and Chiuta and the ASSETS (Attaining Sustainable Services from Ecosystems through Trade-off Scenarios) research project implemented in Zomba.

LCBCCAP was implemented with funding from the Royal Norwegian Embassy (RNE) for which the partners are most grateful.

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ACRONYMS AND ABBREVIATIONS

ASSETS	Attaining Sustainable Services from Ecosystems through Trade-off Scenarios
BHCs	Bird Hunting Clubs
CA	Conservation Agriculture
CABS	Centre for Applied Biodiversity Science
CAS	Catch Assessment Surveys
CBCCC	Community Based Child Care Centre
CBD	Convention on Biological Diversity
CBNRM	Community-Based Natural Resource Management
CBPAC	Community Based Problem Animal Control Strategy
CCR	Chanco Community Radio
CSA	Climate Smart Agriculture
DCCMS	Department of Climate Change and Meteorological Services
DCDO	District Community Development Offices
DHO	District Health Office
DSOER	District State of the Environment and Outlook Report
EA	Ecosystem Approach
EBAFoS	Ecosystem Based Adaptation for Food Security
EPAs	Extension Planning Areas
FAO	Food and Agriculture Organisation
FISH	Fisheries Integration for Society and Habitats
FRIM	Forestry Research Institute of Malawi
FS	Frame Survey
GTA	Gender Transformative Approaches
IAA	Integrated Agriculture Aquaculture
IK	Indigenous Knowledge
LCBCCAP	Lake Chilwa Basin Climate Change Adaptation Programme
LCBMT	Lake Chilwa Basin Management Trust
LEAD	Leadership for Environment and Development
MACRA	Malawi Communications and Regulatory Authority
MAJI	More Action for Just Initiative
MBC	Malawi Broadcasting Cooperation
MEET	Malawi Environmental Endowment Trust
MOMS	Management Oriented Monitoring System
NGO	Non-Governmental Organisations
NTDs	Neglected Tropical Diseases
PMC	Programme Management Committee
PSC	Programme Steering Committee

PSP	Participatory Scenario Planning
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RLCs	Radio Listeners Clubs
SEMUs	Soil Erosion Management Units
SLEMSA	Soil Loss Estimator for Southern Africa
ToT	Training of Trainers
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
VFAs	Village Forest Areas
VNRMCs	Village Natural Resource Management Committees
VSL	Village Savings and Loan
VSO	Voluntary Service Overseas
WALA	Wellness and Agriculture for Life Advancement
WATERS	Water Futures: Towards Equitable Resource Strategies
WESM	Wildlife and Environmental Society of Malawi
WHO	World Health Organisation
WMO	World Meteorological Organisation
YFM	Yoneco FM

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THE LAKE CHILWA BASIN PROGRAMME

A group photo in 2010 when the Programme was being launched at Chancellor College's great hall and an aerial view of Kachulu Beach in Zomba district as captured by a drone in February 2017. Photo credit: LCBCCAP and Mathews Tsirizeni.



1 INTRODUCTION

The Lake Chilwa Basin Climate Change Adaptation Programme (LCBCCAP) implemented activities from 2010 to 2017 in the three basin districts of Machinga, Phalombe and Zomba. It used the Ecosystem Approach (EA) to implement the activities in ten (10) hotspots as focal sites to optimize impact. The hotspots were selected in a participatory manner with full involvement of both district and community members in the decentralised system. These hotspots were areas that required urgent attention based on their level of vulnerability to climate change and state of environmental degradation (Plate 1). The ecosystem approach is “a strategy for the integrated management of land, water and living resources that promotes their conservation and sustainable use in an equitable way” as defined by the Convention on Biological Diversity (CBD) (Secretariat of the Convention on Biological Diversity, 2004). It is the primary framework for action under the CBD. The EA was the approach of choice because the Lake Chilwa basin is a Ramsar site, as well as a Man and Biosphere (MAB) reserve. In this respect the Ecosystem Approach offered the best strategy for addressing human-environment interactions across the basin landscape, being a fragile ecosystem, vulnerable to regular extreme climate shocks. At 321 people per square Kilometre, the basin has the highest population density in Malawi and Southern Africa (NSO, 2008).

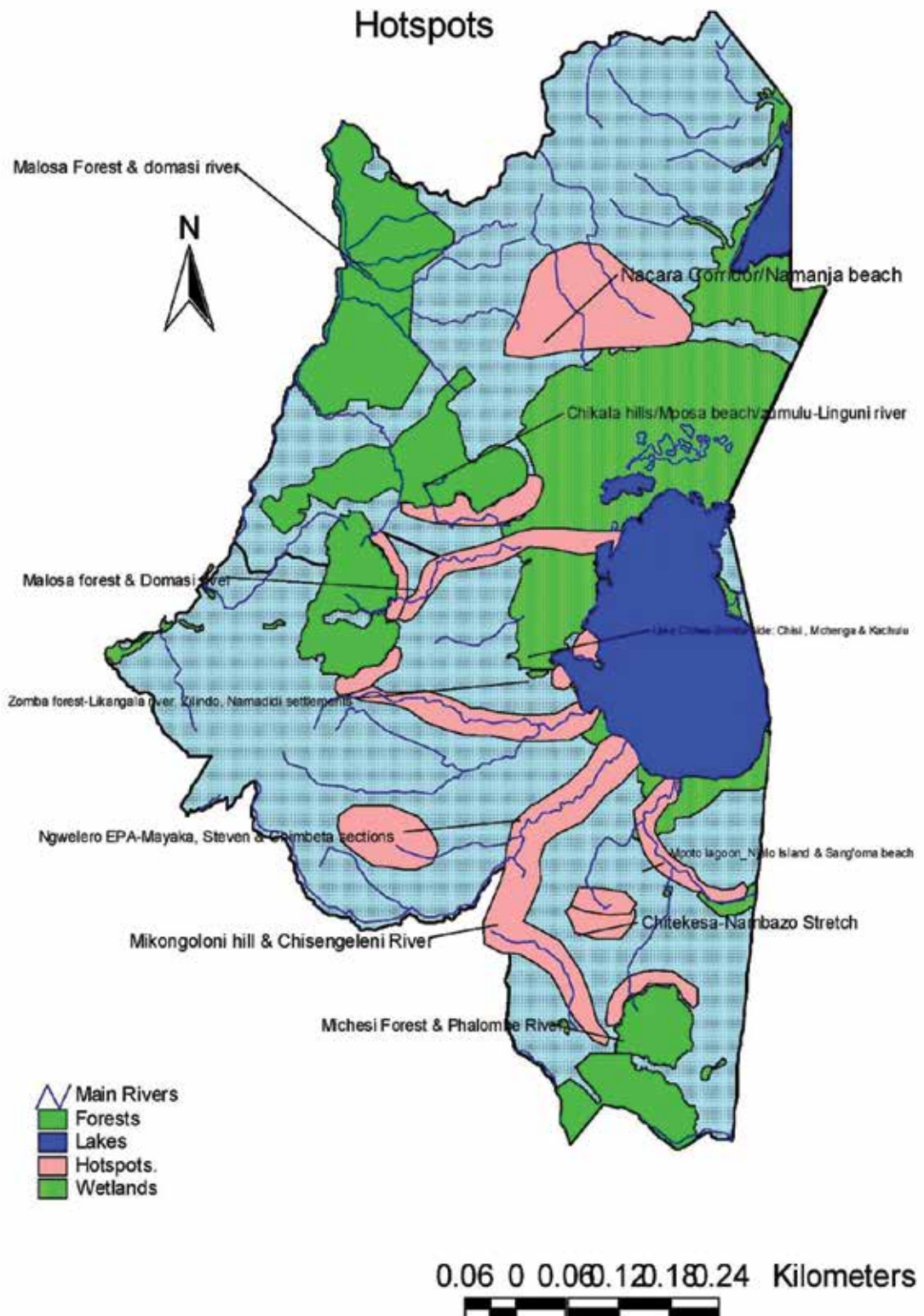


Plate 1: Lake Chilwa Basin vulnerability map showing the hotspots

2 STRATEGIC OBJECTIVES

The goal of the LCBCCAP was to secure the livelihoods of 1.5 million people in the lake Chilwa basin and build resilience of their natural resource base. The Programme undertook a holistic approach as it focused its efforts on four strategic objectives which were to:

1. Strengthen local and district institutions to better manage natural resources and build resilience to climate change;
2. Facilitate and help build cross-basin and cross-sector natural resource management and planning for climate change throughout the Basin;
3. Improve household and enterprise adaptive capacity in Basin hotspots; and
4. Mitigate the effects of climate change through improved forest management and governance.

3 LCBCCAP KEY IMPACTS

The Programme impacts have in this report been clustered in four thematic areas, namely:

- i. Building Ecosystem Resilience
- ii. Building Social Resilience
- iii. Natural Resource Monitoring
- iv. Innovative Communication and Outreach

This report, therefore, is a summary of the impacts and lessons learnt during the implementation period.



BUILDING ECOSYSTEM RESILIENCE

Stream restoration in terms of improved biodiversity and functioning following the management of emergent aquatic weeds (picture above) and river bank afforestation by Mtende VNRMC (picture below).

Photo credit: Sosten Chiotha and Patrick Likongwe



3.1 Building Ecosystem Resilience

Ecosystem services such as water supply, biodiversity and climate regulation are benefits that human beings derive from nature (UNEP, 2005; Boyd and Banzha, 2007). Climate change and variability can undermine the quality and value of these services. Similarly, unsustainable natural resource exploitation can in the long run deprive people of ecosystem benefits and undermine the quality of available livelihood options. The Lake Chilwa basin faces environmental challenges such as drought and floods, deforestation, soil erosion and reduced fishery among others (Njaya *et al*, 2011). It is against this background that the LCBCCAP recognised that building social resilience can only be sustainable if the natural capital is resilient to both climate change and environmental degradation. In this regard, the LCBCCAP built ecosystem resilience through different afforestation, energy-efficient technologies and other natural resource management interventions.

3.1.1 Afforestation

Strengthening Natural Resource Governance

The LCBCCAP formed and registered 51 Village Natural Resource Management Committees (VNMRCs) to successfully raise seedlings, plant and manage indigenous and exotic tree seedlings for afforestation and re-afforestation. These interventions targeted degraded sites including river banks. A total of 124 woodlots and Village Forest Areas (VFAs) were established under the Programme.

Tree Planting from Seedlings

Cumulatively over a 6 year period, 3.8 million tree seedlings were planted, of which 2.7 million trees survived representing a survival rate of 71% (Figure 1) way above the national average of 55% (<http://www.manaonline.gov.mw/>). This survival rate was achieved as there was ownership by the communities, planting on small portions of land that were easy to manage, good governance structures and use of high quality seeds and well hardened off seedlings (Plate 2). However, challenges included pest infestation (Plate 3), theft, and damage by livestock, fire and floods. Communities addressed these problems in various ways through extension support. Despite these challenges, the Programme planted an equivalent of 2,935 hectares on degraded hill slopes, water catchments, farmlands/crop fields, homesteads and bare sites in selected hotspots and 73 running kilometres of river and stream banks.



Plate 2 Tree seedlings in a nursery managed by Nambwinda VNRMC in Machinga. Photo credit: Michael Likoswe.



Plate 3 A tree under termite attack in one of the VFAs in the basin as one of the challenges in afforestation.
Photo credit: Sosten Chiotha.

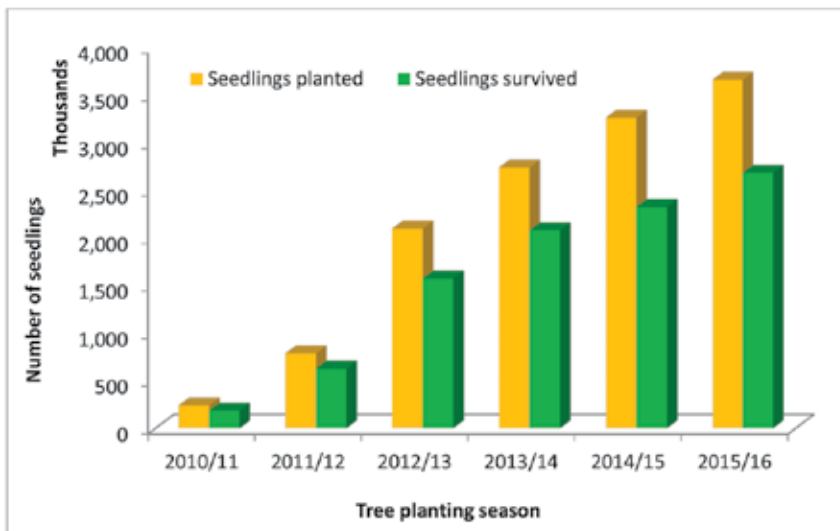


Figure 1 Cumulative number of tree seedlings planted and survived during the project period (Source: LCBCCAP data).

In reclaiming Chirunga Forest (Plate 4), Chancellor College staff alumni, college management and Malawi Environmental Endowment Trust (MEET) contributed even before the Programme through different phases in the establishment and management of the forest. Encroachers who were growing crops in the degraded forest were asked to take care of the planted trees and regenerants while managing their crops for

three years. The people were trained in conservation agriculture practices and were provided with technical advice and support. And they were later awarded with certificates as incentives for taking care of the trees in the agreed arrangement. By the time the people moved out of the forest, the trees were established with a good canopy cover.



Plate 4 Three arrows pointing to Chirunga Forest and one arrow pointing to the riverine afforestation along the Mponda River. Photo credit: Mathews Tsirizeni.

Tree Planting from Truncheons

In addition to seedlings, the Programme also grew trees from vegetative propagation of tree branches (1-2 metres long) called truncheons (Plate 5). This technique builds on indigenous knowledge because communities have conveniently used the technology to increase tree propagation because it can be done throughout the year and it is the method of choice for some trees that are not easy to raise from seeds. Examples of trees raised from truncheons included *Sclerocarya birrea* (Mfula/Mtondowooko), *Commiphora africana* (Khobo), *Pterocarpus angolensis* (Mlombwa), *Moringa oleifera* (Cham'mwamba) and *Breonardia salicina* (Mchonya), some of which are important timber tree species. A total of 5,400 truncheons were planted with survival rate of 98%.



Plate 5 Truncheons sprouting from a demonstration plot planted at Nambwinda VNRMC in Machinga. Photo credit: Sosten Chiotha.

Planting Bamboos

Bamboo is a plant that provides considerable environmental and economic benefits, used for ecological purposes such as soil stabilization and erosion prevention on hill slopes and verges beside the different economic uses. The LCBCCAP promoted the growing and protection of bamboo in the basin as well as Thuma Forest Reserve. A total of 10,950 bamboo seedlings were raised and distributed to communities in Zomba, Machinga and Phalombe Districts for planting. They were planted in Village Forest Areas (VFAs), around homesteads, on farms and along rivers to protect against soil erosion (Plate 6). In all these plantings, survival rate was high (over 70%). In addition to planting, existing bamboo culms were

managed to enhance natural regeneration in the VFAs. The Programme intensified awareness on the importance of growing and managing bamboos.



Plate 6 Integrating bamboos in afforestation as part of natural regeneration with other indigenous tree species to enhance forest biodiversity (above) and a pure stand of well managed mature bamboos (right). Photo credits: Sosten Chiotha and Clifford Mkanthama

Agroforestry

Agroforestry systems offered opportunities for realising higher productivity, more dependable economic return and a greater diversity of outputs and benefits on a sustainable basis. The importance of agroforestry lies in the multi-purpose uses of woody plants as well as their products such as fruits, fodder, fuelwood, timber, poles and medicines.

The LCBCCAP combined agro-forestry with conservation agriculture to reduce soil erosion from cultivated fields and, therefore, reduce the siltation problems in the downstream area. Agroforestry tree species like *Gliricidia sepium* (locally known as Girisidiya), *Faidherbia albida* (Msangu), *Albizia lebbeck* (Mtangatanga) and *Albizia adianthifolia* (Mtangatanga wa m'madzi) have been planted in the basin farm land to restore soil fertility. The synergy between CA combined with fertilizer trees surpasses "CA minus trees". Some of the trees planted by the Programme have matured and able to produce tree seed for tree planting and sale. For instance, Horo VNRMC has been supplying high quality *Gliricidia sepium* seed (Plate 7) at a cost to the National Tree Seed Centre at FRIM, benefiting financially from the trees they planted.

Other legume crops such as pigeon peas work like fertilizer trees and under CA, experience has shown that farmers tend to prefer food based legumes such as *Mucuna* and pigeon peas to non-food based legumes such as *Tephrosia* (Wombwe) and *Gliricidia* species. However, meeting with farmers and market observations revealed an increasing demand for fruit trees.



Plate 7 A mature *Gliricidia* spp. stand as part of Horo VNRMC for seed multiplication.
Photo credit: Michael Likoswe.

Fruit trees come in two types: indigenous and exotic fruit trees. Within the basin, exotic fruit trees were either planted around homesteads as individual or community orchards. The Programme supplied 30,000 fruit tree seedlings of different species and varieties (mangoes, citrus, papaya, guava, and avocado pears). Among these, 10,000 seedlings were grafted stock, benefiting a total of 1,000 households in the basin. The Programme also promoted propagation of selected indigenous fruit trees in the basin and they included *Uapaca kirkiana* (Masuku), *Parkia filicoidea* (Nkundi) and *Syzygium cordatum* (Nyowe or Jambura). A training manual on propagation guidelines of the selected indigenous fruit tree species is available and is being used by the communities.

Natural Regeneration

Through the synergy created by tree planting or straight zoning for management to stimulate and enhance natural regeneration over 10 million trees of various indigenous species (Plate 8) were protected and managed, covering up to 3,825 hectares. For river banks, the management included planting and or natural regeneration of key wetland grasses such as reed grass, locally known as Bango (*Phragmites mauritanus*), Elephant grass, locally known as Nsenjere (*Pennisetum purpureum*), and sedge grass locally known as Chetsa (*Cyperus alternifolios*). The grasses establish much faster than trees and should be integrated in river bank rehabilitation.



Plate 8 A naturally regenerating village forest area managed by Mpumbe VNRMC under Group Village Headman Mpumbe, Traditional Authority Kawinga in Machinga. Photo credit: Michael Likoswe.

Ecosystem Benefits

Ecosystem benefits derived from woodlots and village forest areas are many. These include increased plant and animal biodiversity, opportunity for honey production, increased availability of edible indigenous mushrooms (including fruits and insects). These benefits enhanced livelihood options and supplemented the nutrition of the people. In some areas such as Mtende and Nambwinda, the afforestation improved the hydrological regime of the areas under management (such as reduced surface run off and improved river flow), thereby opening up new opportunities for adaptation such as irrigation and integrated agriculture- (Plate 9).

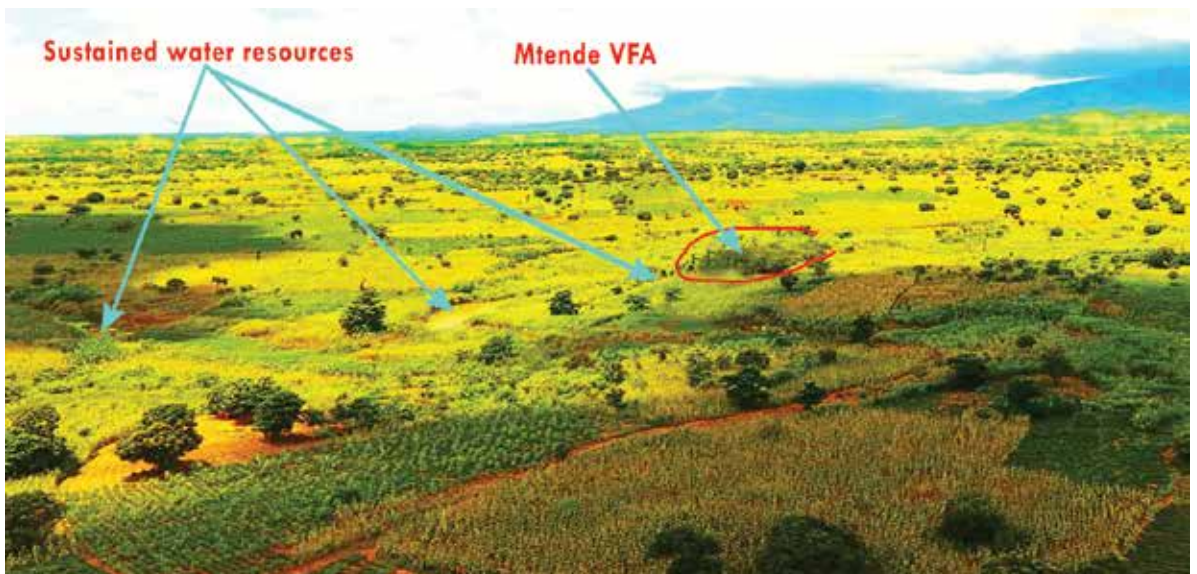


Plate 9 Aerial view of Mtende VFA showing the impact of the Makungulu stream restoration. Photo credit: Mathews Tsirizeni.

3.1.2 Other Natural Resource Management Activities

Law Enforcement for Forestry Management

A total of 5,800 hectares of forest land in Zomba and Machinga districts has been brought under forest co-management arrangement by the Department of Forestry and of this, 2,750 hectares was under the LCBCCAP management to control fires and illegal forest activities. For example, patrols were undertaken jointly by the Department of Forestry and the Malawi Police Service personnel with the support of the LCBCCAP to curb the illegal forestry activities. To this effect, there was a reduction of illegal forestry activities such as logging (Plate 10) by 61%, saving at least 2,410 hectares of forest land from destructive fires and illegal harvesting.



Plate 10 Illegal logging at Zomba Mountain Forest Reserve which the Programme addressed.

Photo credit: Michael Likoswe

Energy-efficient Technologies

Cook Stoves

To encourage mass participation in the adoption of energy-efficient fuelwood cook stoves as a contribution to forest resource management in the basin, LCBCCAP promoted *Chitetezo Mbaula*. A total of 12,700 cook stoves were distributed to rural households to get them started. For long term sustainability, 1,420 people (870 women) were trained on how to select, test, cure, and mould the cook stoves for household use as well as for sale (Plate 11). The average user rate on cook stove usage in Zomba, Minama Group Village Headman area was 27% in 2012 and tripled to 71% by end of 2015. *Chitetezo Mbaula* is one of the improved cooking stoves fabricated out of fired clay and being promoted in Malawi.



Plate 11 A demonstration showing that green maize cooked faster with less firewood in the improved cook stove (*Chitetezo Mbaula*) compared to the traditional three stone. Photo credit: Sosten Chiotha.

Efficient Fish Smoking Kilns and Solar Fish Dryers

The Programme also introduced improved fish smoking kilns and solar fish dryers which were efficient because fish were smoked with a small amount of wood as more fish were smoked through several stacked trays. The smoking kiln studies showed reduced firewood use by 30% and hence contributed to forest conservation and also labour saving through reduced wood demand (Plate 12 and Plate 13). Technical studies by the Programme showed that solar fish dryers reduced fish drying time from 24 to 12 hours while improving fish quality being an environment without dust and flies (Plate 14). Similarly studies from the improved fish smoking kiln indicated that the smoked fish were healthier as they had less smoke particles.



Plate 12 An open fish smoking kiln with several trays replaced the three stone open air kiln that used to smoke one fish tray at a time.
Photo credit: Sosten Chiotha.



Plate 13 An improved fish smoking kiln with more and bigger trays in an enclosed chamber increases efficiency by confining the heat and smoke resulting in less firewood used. Photo credit: Joseph Nagoli.



Plate 14 The initial pilot solar fish dryer was smaller (left) that was later enlarged and modified (right) following lessons learnt and increased demand from women fish processors from Kachulu beach, Lake Chilwa in Zomba. Photo credit: Welton Phalira and Precious Mwanza.

Biogas

Within the basin, the Programme piloted and tested a new polyethylene biogas technology at Technology Centre at Chancellor College which was later piloted successfully in Mtogolo village by students from the Swedish University of Agricultural Sciences (Eckerwall, Jansson and Larsson, 2015). Outside the basin, the LCBCCAP piloted the dome-shaped biogas plant at Kachitsa Community Based Child Care Centre (CBCCC) with an aim of providing energy for cooking porridge to feed an estimated 120 kids. Pig manure from Tiyanjane Women's Group Piggery Project was used as raw material for production of biogas Kachitsa. This piggery group was also supported by the Programme and the members were trained on basic biogas technology including site selection for a biogas plant, feeding the biogas plant, testing the gas for flammability and how to mix dung with water.

Briquette

Briquettes are forms of compressed biomass fuel, used often as a direct replacement for charcoal. They can be made by compressing waste charcoal fines with a binder material e.g. starch. Multiple types of waste biomass such as maize, groundnuts, tobacco and cotton stalks; rice husks; sugar cane leaves; dried tree leaves; grass, sawdust and waste paper, have been used for briquetting (Kers *et al.*, 2010; Demirbas and Sahin-Demirbas, 2004).

LCBCCAP piloted briquette making with communities surrounding Chirunga Forest at Chancellor College's technology center in Zomba District using re-cycled paper. Briquettes were produced and sold in small numbers due to inadequate supply of raw materials. The centre was visited by local schools on a number of occasions and they were greatly inspired. For example, a visit by Sir Harry Johnston International Primary School, children were so inspired to the point that they asked the communities to sell the briquettes on their behalf. Apart from the briquettes, the technology centre also recycled paper for other artistic use (Plate 15). The Technology Centre at Chancellor College was established by LCBCCAP and handed over to the Faculty of Science.



Plate 15 Recycled paper for artistic work and making of stationery products like folders being displayed at the Technology Centre after recycling used paper. Photo credit: Sosten Chiotha

3.1.3 Testing and Screening of Tree Species

The testing and screening of pine species on the mountain is an on-going activity. Some of the species and provenance trials are very old while others are just in the early stages (Chanyenga, 2014). However, in the context of global climate alterations, the productivity of plantation forests are going to be affected negatively in the coming decades (Leibing *et al* 2009). To ensure the supply of the expected wood products and services from pine plantations under limited plantable areas, changing climate as well as increasing demand, plantation forest management needs to be adapted accordingly.

In addition to pine species screening, efforts are being made to screen indigenous fine hardwood timber species on their suitability to be propagated and managed under plantation conditions on Zomba Mountain Timber Plantation. In this respect, LCBCCAP established a test plantation for M'bawa on Zomba plateau (Plate 16). In addition, the Chirunga forest close to Chancellor College sports ground included a number of indigenous trees in order to provide opportunities for research by students and staff. Other unique valuable indigenous timber tree species that were tested under community management included *Burtt-davya nyasica* locally



Plate 16 Communities appreciate a three year old M'bawa stand at the test plantation on Zomba Plateau to learn that high value indigenous timber trees can easily be propagated. Photo credit: Sosten Chiotha.



BUILDING SOCIAL RESILIENCE

The Programme facilitated introduction of mobile banking services following increased value added fish sales by women and other business traders.

Photo credit: Sosten Chiotha.



3.2 Building Social Resilience

The Lake Chilwa basin population lives under constant threat of extreme and highly variable climate thereby undermining social resilience. According to Neil *et al* (2013), social resilience is defined as the ability of individuals and communities to absorb and deal with climate change shocks and to re-organise without undesirable or catastrophic changes to individuals or communities. In this regard, building social resilience became one of the pillars of the LCBCCAP based on recommendations of the 1995 consultative meeting on the drying of Lake Chilwa (Njaya *et al*, 1996) and in line with strategies in the National Adaptation Programmes of Action (Environmental Affairs Department, 2006).

Considering that climate and other economic shocks either deplete household assets or predispose households to future asset depletion (Ngigi and Birner, 2013) resulting in reduced social resilience, the Programme response included appropriate interventions such as conservation agriculture, agribusiness, fish value addition, small livestock pass-on scheme, village savings and loans and honey production. These activities were aimed at promoting adaptation through enhancing household and community financial and productive assets.

3.2.1 Conservation Agriculture

Conservation agriculture (CA) was implemented as a component of Climate Smart Agriculture (CSA) in eleven (11) Extension Planning Areas (EPAs) by promotion of minimum tillage, improved soil cover through mulching, and legume intercropping with maize. Sixty (60) extension workers and 248 lead farmers were trained and supported roll-out to 3,420 farming households. The support included provision of farm inputs to recruited farmers during the formative years to enhance soil productivity because by then CA practice had not established itself. The area under CA was 520 ha and maize production gradually increased from a baseline of 1.5 Mt/ha to 3.5 Mt/ha within 4 years.

Farmer adoption was improved up to 2,050 households through enhanced extension system supported by a robust communication strategy discussed in detail below. Beside the yield benefits, ecological benefits included improvement in soil carbon storage and bulk density (Plate 16 and Plate 17). From the soil analysis done at start and end of programme in CA fields on average, soil bulk density improved from 1.52 g/cm³ in 2010 to 1.36 g/cm³ in 2015 although the change was not significant. Low bulk density is an important soil parameter as it influences water filtration and plant root health. Soil pH also improved from 5.69 in 2010 to 4.94 in 2015 (Figure 2). Slightly acidic soils (between 4 and 5) influence the nature and quantity of nutrients available in the soil for plant use (Brady and Weil, 2002).

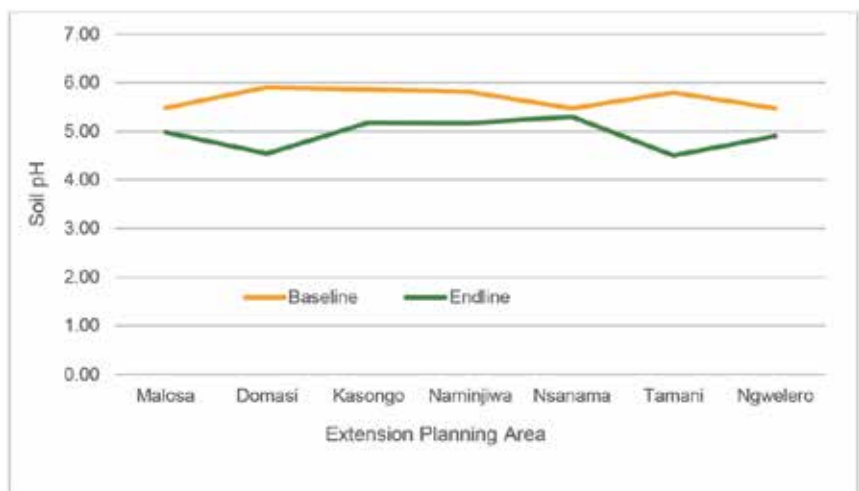


Figure 2 Improvement in soil pH for maize crop fields under conservation agriculture (Source: Programme data).



Plate 17 A conservation agriculture site with good mulch in Kasongo EPA, Phalombe.
Photo credit: Willie Sagona



Plate 18 A conservation agriculture demonstration site run by a lead farmer in Machinga, Nsanama EPA.
Photo credit: Sosten Chiotha.

3.2.2 Collective Marketing on Agricultural Produce and Fish Value Addition

Agricultural Produce

The Programme promoted agricultural diversification and value addition of selected key agricultural commodities. Through a participatory value chain analysis of these commodities (rice, fish, chillies, pigeon peas and firewood), potential market constraints and opportunities were identified and addressed in collaboration with the Wellness and Agriculture for Life Advancement (WALA) programme. This was done by strengthening and expanding markets for specific goods and design innovations for increasing participation in the value chain.

The Programme worked with 33 existing clusters (producer and marketing groups) and created 25 new ones where opportunities existed. The groups had a 72% composition of women and inclusion of the marginalized groups (youth) was encouraged. Some of the constraints identified by the Programme included low literacy levels, little or no experience in quality control of products, and lack of better market opportunities. To address these constraints, the Programme enhanced the farmer's capacity through training and coaching in crop management at all levels, value addition, pricing and market identification (Plate 19). With these interventions, for instance in the 2015/2016 season, producer and marketing groups produced and sold to better markets a total of 26 MT of chilies valued at MK52m; 400MT of rice valued at MK60m and 100MT of pigeon peas valued at MK195m.



Plate 19 A field day organised by the Programme for farmer networking and interaction with extension staff and private sector for access to better markets. Photo credit: Sosten Chiotha.

Fish Value Addition

The National Fisheries and Aquaculture Policy of 2016 claims that fish postharvest losses can be as high as 40%. This is why the 2016 Lake Chilwa Fisheries Management Plan suggests that increased cash income to the fishing communities would result, from among other strategies, through fish handling and processing that increases shelf life of the fish to expand the market as achieved by the LCBCCAP. For example, the Programme constructed twelve (12) solar fish dryers and 4 improved fish smoking kilns to reduce fish post-harvest losses and to improve the quality of the fish processed through the two improved technologies. The women were also trained in fish value addition and provided with facilities for packaging the fish in 100g labelled plastic packets, further creating the appeal of their products by lucrative markets (Plate 20).

These technologies were used by 10 women fish processing and trading groups comprising of 100 members and helped to increase their competitive business edge in the markets as they sold fast. Of interest is the joining of 25 men from Beach Village Committees in the fish value addition initiatives in the basin, increasing the membership to 125. For instance, in the 2014/15 season, the market price of Matemba fish (*Barbus spp.*) processed under the improved technologies increased by a magnitude of 170% from MK1, 000 to MK2, 700 per kg and were sold in Peoples Trading Centre

and other Supermarkets in Blantyre, the main commercial city of Malawi. Apart from taking part in value addition, the men will help in facilitating smooth acquisition of fish from fishermen on the lake and maintenance of the fish processing units where necessary.

3.2.3 Small Livestock Pass-on Scheme

Livestock production was introduced by the Programme as an agricultural diversification and a risk aversion measure to crop failure due to experienced extreme weather events within the basin. Small livestock enterprises, mainly poultry, piggery and goats were promoted on a pass-on scheme. The choice of livestock was demand driven based on requests from the communities and supported by expert knowledge on suitability by the local extension staff. From an initial supply of 60 pigs to 71 households working in groups of 10 members in 2013, 486 piglets were sired (Plate 21) which were passed on to 79 secondary beneficiaries, indicating doubling the number of beneficiaries within by end of 2016. Net income by the initial recipients amounted to MK 1.85m (US\$2,467.00) within the same period. Proceeds from piggery have benefited the households in many ways including payment for school fees, purchase of farm inputs, manure for crops, and enhanced household nutrition. Households were also supported with 300 Black Australorp roosters that were cross bred with 3,112 local chickens to improve egg size and meat. Poultry production was greatly challenged by Newcastle diseases. Goat farming started towards the end of the 2016 in response to communities' continued demand for livestock support and a total of 212 goats were distributed to RLCs, IAA groups and Naphambo VNRMC.

3.2.4 Integrated Agriculture Aquaculture

Integrated Agriculture Aquaculture (IAA) is generally a farming system that combines aquaculture, crop and livestock production to increase food production, conserve the environment and ensure food security through their capacity to generate synergies between farm enterprises <https://www.researchgate.net>. The Programme engaged two IAA groups of Tikondane and Tigwirane Manja whose membership is dominated by people with disabilities. The IAA group activities involved irrigation, fish farming and livestock production (goats on a small pass-on scheme) to enhance their social resilience. Through irrigation the two groups harvested supplementary maize, sweet potatoes, beans and leafy vegetables for local consumption and sale. Similarly the fish ponds supplemented the dwindling fish supplies from the Lake while ensuring household nutrition and food security (Plate 22). The livestock component was enhanced towards the end of the Programme to complete the synergy that goes with IAA.



Plate 20 Packaging for Lake Chilwa solar dried and smoked Matemba. Photo credit: Welton Phalira.



Plate 21 One of the sowers with a batch of piglets that were targeted for pass-on to the next beneficiaries. Photo credit: Sosten Chiotha.

3.2.5 Village Savings and Loan (VSL) Scheme

Village Savings and Loan (VSL) Scheme were introduced to various groups to promote a saving culture and improve on enterprise diversification. The participating groups included VNRMCs, and those engaged in fish processing, livestock production, conservation agriculture and agribusiness. Benefits included access to cash for household livelihoods, asset acquisition and farm inputs purchase (Plate 23). For example, three fish processing women groups from Kachulu, Swang'oma and Malunguni started with an initial capital of MK 600,000.00 in 2012 that was provided by the Programme as seed money and grew their loanable funds to a total of MK 1,800,000.00 within three years. For VNRMCs, the VSL capital was from the incentives they received based on the trees that survived after planting and subsequent tree management. Mpaniha VNRMC women, for instance, managed to acquire assets such as bicycles using proceeds from the VSL scheme. Payment of incentives to communities could be one way of improving natural resource management. To date, the Programme has supported establishment of 250 VSL groups around the basin.



Plate 22 An enlarged pond anchoring the Integrated Agriculture-Aquaculture for the disabled group in Mposa, Machinga.

Photo credit: Patrick Likongwe.



Plate 23 a) A Village Saving and Loan session from Kachulu Women Fish processors and **b)** women from Mpaniha; proceeds from VSL. Photo credit: Asafu Chijere and Sosten Chiotha.

3.2.6 Honey Production

Following successful establishment of some VFA's and woodlots, some communities saw the need for hanging bee hives in their forests in 2013/14 season for honey production (Plate 24). For such communities, the Programme conducted relevant training and provided the materials necessary to start practising bee keeping. A total of 60 bee hives were distributed between 2013 and 2015 with 90% colonisation by the end of 2015. The amount of honey harvested was 500 kg by 2016 realising K915, 850.00 in revenue from honey sales (Figure 3), improving the household nutrition and income along the way. Bee keeping in the VFAs has furthermore provided security against theft of trees.

3.2.7 Gender, Youth and People with Disabilities

Different interventions implemented by the Programme promoted gender equality and youth involvement including deliberately targeting people with disabilities. Most of the women (over 60% on average) participated in VNRMC, CA, fish processing and livestock groups. Special attention was given to people with disabilities through Integrated Agriculture Aquaculture practices. The



Plate 24 A bee-hive Value added honey from the VFA established by the Programme in the basin and one from Thuma Forest Reserve. Photo credit: Sosten Chiotha.

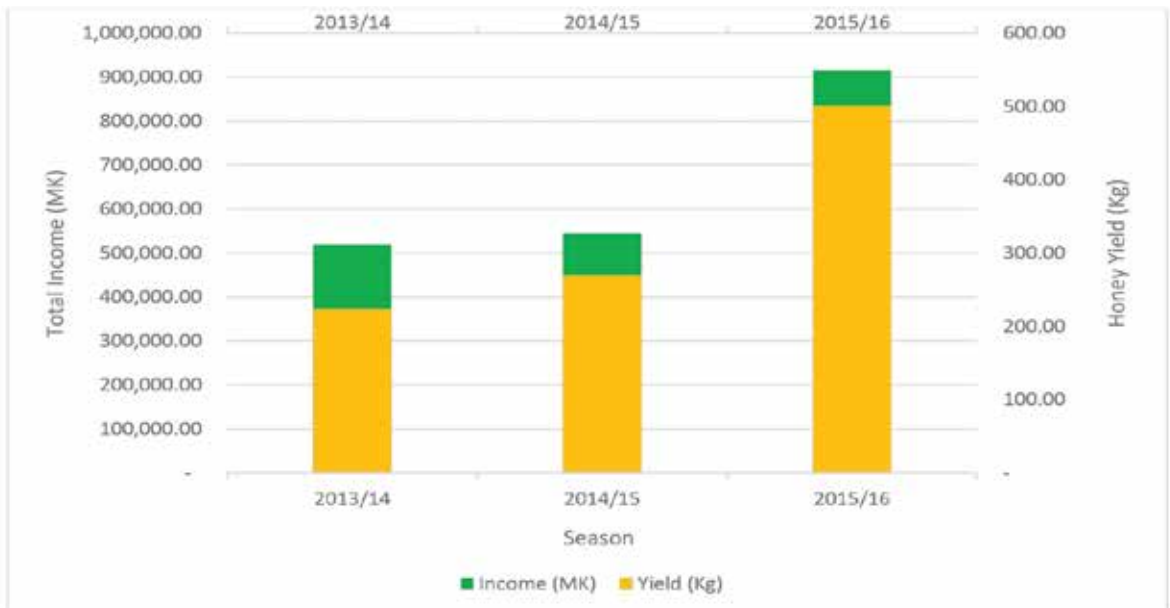


Figure 3 Income from honey realised against the amount of honey harvested (Source: Programme data).

Technology Centre at Chancellor College inspired the youth, mostly from primary and secondary schools on renewable energy and recycling through practical demonstrations on biogas and briquette technologies. The youth were also more active through the Radio Listeners Clubs (RLC), drama, and tree planting exercises. An Environmental Justice and Sustainability Clinic association composed of students and staff from Chancellor College also championed clean College environments through tree planting and waste management.

The programme facilitated Gender Transformative Approaches (GTA) which addresses the underlying causes of gender disparities in access to and control over resources. These are done through a series of gender and social analyses that aim at understanding how stereotypes, behaviours and beliefs embedded within the social norms, values and relationships influence gender disparities on who can do what for both women and men. GTA targeted different programme groups. A total of 110 (51 males) people were trained as GTA Champions in Phalombe, Machinga and Zomba to lead GTA sessions in their respective ‘platforms’ which are also known as discussion forums. For sustainability, the platforms are linked to District Councils through the District Community Development Offices (DCDOs).



MONITORING TO IMPROVE MANAGEMENT AND EARLY WARNING

LCBCCAP and ASSETS project enhanced weather and water monitoring in the basin through rehabilitation and installation of new monitoring instruments. The 2012 recession of Lake Chilwa was thus predicted through this capacity enhancement. The Programme Steering Committee members appreciate the upgraded role the equipment has played in also monitoring pest outbreaks. Photo credit: Sosten Chiotha.



3.3 Monitoring to Improve Management and Early Warning

3.3.1 Participatory Water Resource Monitoring

The absence of high-quality climatic data at the desired spatial and temporal scales has been highlighted among the factors leading to a knowledge gap on understanding of climate change impacts on water resources in the Southern and Eastern Africa regions (Hughes, Kapangaziwiri and Sawunyama 2010). Furthermore, access to reliable climate information is another challenge and hence according to UNDP (2007), there is a need for improved tools for climate change data analysis to provide information that is credible for reinforcing and sustaining climate observation networks if the full potential of climate information is to be realised for individual sectors.

Against the above background, the LCBCCAP in collaboration with the Water Resources Department and Chancellor College (the Department of Geography and Earth Sciences) conducted an assessment on the state of weather and water monitoring in the basin in 2010. The results showed that no data had been collected on water level from Lake Chilwa and many of its major inlets, resulting in missing data for 15 years. A similar assessment in collaboration with the Department of Climate Change and Meteorological Services (DCCMS) and the Department of Geography and Earth Sciences on weather monitoring stations showed that the basin had fewer functional stations, most of which were located in the city of Zomba.

To address such climate monitoring challenges, the LCBCCAP rehabilitated the weather and water monitoring stations around the basin. Eight (8) basic rainfall monitoring gauges including one (1) full weather station were installed in collaboration with the DCCMS to increase the spatial distribution of rainfall monitoring points as recommended by the World Meteorological Organisation (WMO) (Plate 25). Similarly, the LCBCCAP upgraded the water monitoring gauges on strategic points within the lake and along some major rivers in collaboration with the Water Resources Department to ensure compliance with national and international guidelines.

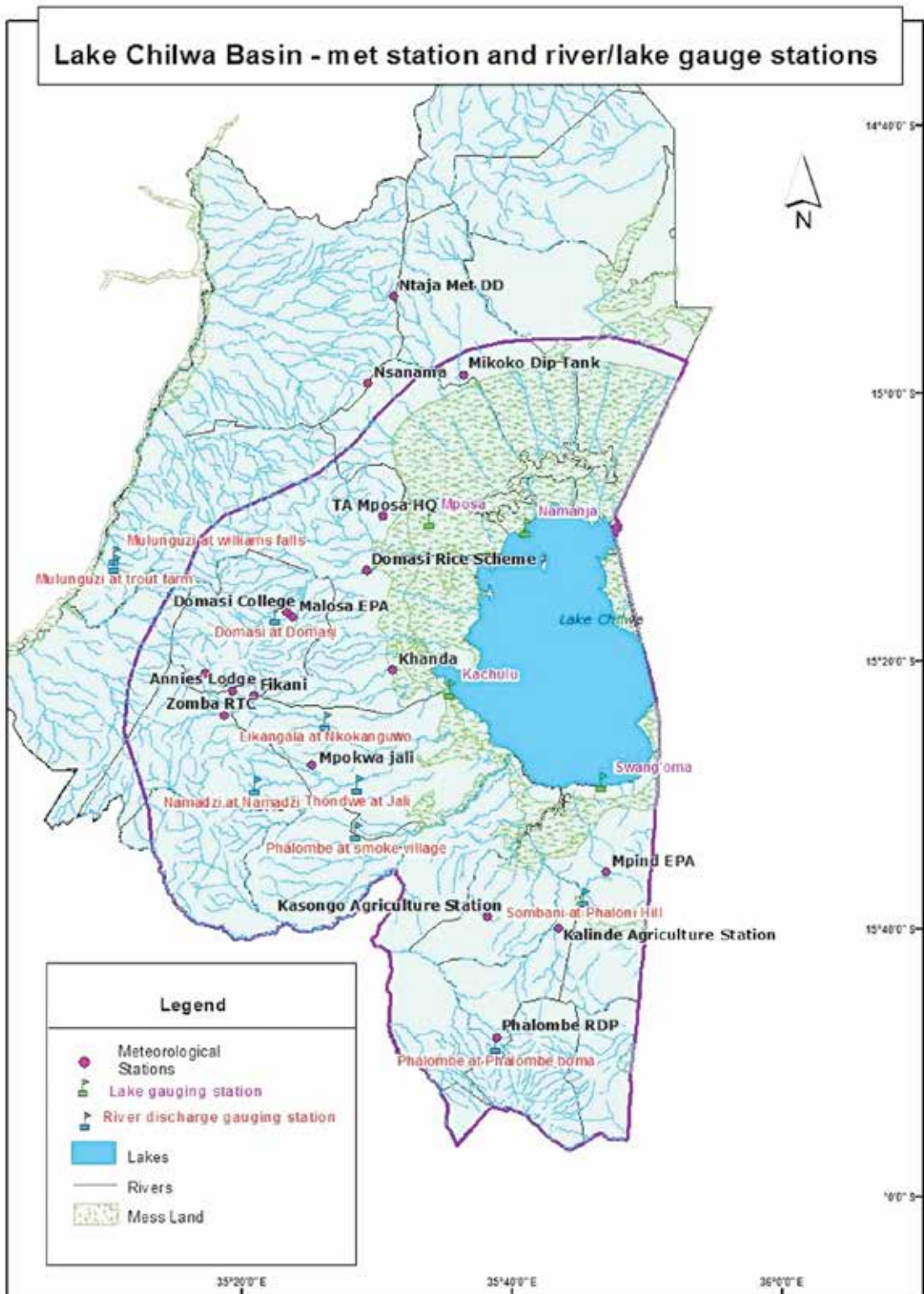


Plate 25 A map showing the rainfall, river gauge and lake level stations installed by the Programme. Source: LCBCCAP data.

For long term sustainability and ownership of the weather and water monitoring equipment, local communities were trained in data recording (Plate 26). Integration of local monitors provided relevance of water resource monitoring. During one of the stakeholder consultative fora, the stakeholders recommended that local communities should be given regular updates on locally generated data to inform their livelihood decisions on activities that may be affected by rainfall pattern, river flow, and lake level.

Rainfall Data

This has been used in guiding extension workers and farmers on ‘When and What to Plant’. For instance, during the 2014/15 season, rainfall onset was later in December followed by floods in January 2015 with early cessation in early March resulting in drought from the short rainfall season (Figure 4). Increasing the number and spread of the rainfall stations demonstrated marked spatial and temporal variations in rainfall across the basin. This intra-basin variability could not be observed easily from the few rainfall stations that were concentrated in the city of Zomba. Using the historical data from Chancellor College station and the additional data being collected by the programme, the 2012 Lake Chilwa recession was accurately forecasted. The data also helped in understanding the manifestation and magnitude of the *El nino* and *La nina* effects on peak rainfall and spread from 2015/16 and 2016/17 seasons respectively. In the long term, water resource managers and decision makers would be able to use this data to come up with evidence based policy making (Plate 27).



Plate 26 Ms Kalulu, a community member taking river gauge readings from the Thondwe River at Jali in Zomba. Photo credit: Patrick Likongwe.

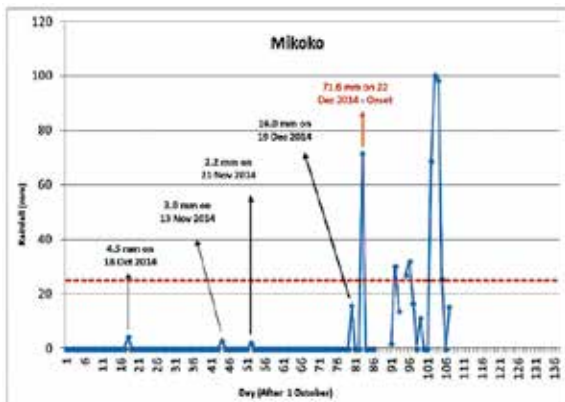


Figure 4 The graph shows delayed on set (Dec 2014), poor distribution (most of the rain in January) and early cessation (early March). (Source: LCBCCAP monitoring data).



Plate 27 National weather bulletin integrated weather monitoring from LCBCCAP and ASSETS sites. Photo credit: DCCMS.

River Data

Perennial river flows in the Lake Chilwa Basin are important because they sustain livelihoods through irrigation, fishing and provision of potable water to urban and rural populations. The most important rivers in Lake Chilwa basin are the Sombani, the Namadzi, the Likangala, the Thondwe, the Domasi and the Phalombe which discharge water to Lake Chilwa and the wetlands. The data revealed interesting trends in relation to river flow. Most of the rivers could not sustain good flows throughout the year as shown by steep decline in river flow from peak levels (Figure 5). These results require further analysis with long term data but observations indicate that deforestation in forest reserves and river courses have disturbed the hydrological cycle by increasing runoff and reducing recharge of groundwater aquifers. Similarly, bad agricultural management practices enhance runoff and reduce water infiltration. The National Disaster Management Plan for Malawi lists the Likangala and the Thondwe rivers as being very vulnerable to flood hazards (Chavula and Chirwa, 1987) and hence the importance of data collection on these rivers and others cannot be overemphasized.



Figure 5 Monthly mean water discharge in rivers monitored showing response peak discharge and steep decline from the peak levels. The peak river discharge corresponds to peak rainfall (Source: LCBCCAP Monitoring data).

Lake Chilwa Water Level Data

Being an inland lake with no outlet, the major source of water is the direct rainfall into the lake and from in-let rivers. The LCBCCAP monitored Lake Chilwa water levels at Kachulu, Mposa, Namanja and Swang’oma gauging sites that have been in operation since January 2011.

The lake water levels have varied between recession to complete drying twelve times between 1900 and 2012 (Njaya, *et al.*, 2011; Jamu, *et al.*, 2012). The past recessions had taken communities and policy makers by surprise and unprepared. The LCBCCAP analysed past data and argued that mean rainfall amounts below 1,000mm for two consecutive seasons indicate a high probability of a lake recession and hence for the first time the LCBCCAP was able to accurately forecast the 2012 recession and to prepare communities and decisions makers to come up with contingency plans. The monitoring also helped to characterise the relationship amongst the rainfall, river discharge and lake level during the *El nino* and *La nina* episodes.

Peak rainfall is normally recorded in January while that of river discharge in February and March followed by peak mean lake levels that are recorded around April every year. The year 2015 was a deviation from the normal since the peak was recorded in March instead of April. At a mean lake level of 2.75m, the 2015 was the highest in recent years but for Swang'oma and Mposa beaches,

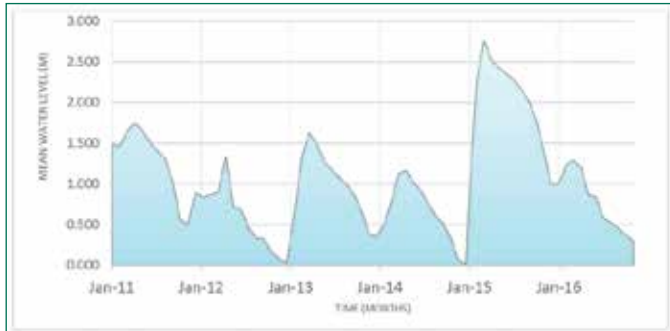


Figure 6 Mean monthly lake water levels from four points monitored in Lake Chilwa
(Source: LCBCCAP Monitoring data).

all the three water level gauges were submerged and the Programme had to extrapolate the water level using the pegs that were marking the new water levels (Plate 28). In response to the new lake water level, the Programme installed a fourth water gauge to help in lake water level readings should the water get to this level again.

3.3.2 Fishery Resource Monitoring

Lake Chilwa is one of the most productive water bodies in terms of fish production per unit area (Kalk, McLachlan and Howard-Williams, 1979; Chiotha, 1996). Conventional monitoring of the Lake Chilwa fishery is done through a combination of annual frame surveys (FS) and a monthly sample-based catch assessment surveys (CAS) (Manase, 2012). However, these methods are quite demanding in terms of budgetary and logistical needs and hence the LCBCCAP sought to test alternative participatory fisheries monitoring systems. This was done by providing fishers with logbooks in which they entered data on the type and quantity of fish caught, type of gear used and where the fish was caught. At the landing sites, weight of fish leaving the beach was recorded by the Fisheries Extension Officers through the fish weighing point data forms. Sample results from the data analysed and compared between CAS and logbook between January and December 2011 revealed that CAS estimated 7.346 Mt of fish landed versus a total of 15,716 Mt from the logbook data.

However, the 2012/13 recession, at which the lake is estimated to have lost 80% of its water, the fishery was significantly reduced (Jamu, *et al.*, 2012). While the filling of the lake has been slow in previous recessions, taking up two to three years of good rainfall, this time the lake filled in one season (2014/2015) as shown above (Figure 6). Despite this quick turnaround in water levels, the fishery has been slower in recovering as it is currently dominated by Catfish. Monitoring by the LCBCCAP



Plate 28 Water level pegs that measured water level on 1st August and 15 August 2015 with a new water gauge installed after the lake water level receded.
Photo credit: Sosten Chiotha.

has revealed serious shortfalls in governance and fishing practices. In addition, the LCBCCAP has observed escalation in the use of illegal fishing gear prior and after the recession which removes fingerlings and juvenile fish thereby undermining recruitment for future fish stocks (Plate 29, Plate 31 and Plate 32). Another damaging practice is the clearing of weeds from breeding sites and nursery habitats (Plate 30).



Plate 29 The use of mosquito nets and other illegal fishing gear results in catching fingerlings and juveniles, leading to negative implications on recruitment for sustaining future stocks.

Photo credit: Sosten Chiotha.

The LCBCCAP has engaged relevant stakeholders to enhance local capacity for coordinated response at different levels of decentralised structures. In Phalombe, for example, the LCBCCAP supported community dialogue at which it was resolved that the problem of illegal practices should be nipped in the bud with the traditional leaders and beach village committees taking a tough stance, supported by local councillors. This commitment was demonstrated when over 400 fish traps and 20 nets were confiscated and later burnt to send a strong signal to would be future perpetrators (Plate 31).



Plate 30 Fishing by clearing weeds is unsustainable as it leads to loss of fish breeding sites and nursery habitats. Photo credit: Sosten Chiotha.



Plate 31 Traditional Authorities Chiwalo and Kaduya displaying the mosquito-netted fish traps confiscated in Phalombe. Photo credit: Sosten Chiotha.



Plate 32 A concentration of fish traps at Mpoto lagoon, obstructing the recruitment of fish into Lake Chilwa. Photo credit: Sosten Chiotha.

3.3.3 Monitoring of Birds

The Lake and its associated wetland supports about 164 bird species, 43 of which are seasonal (Kabwazi and Wilson, 1996). Lake Chilwa is one of the few Wetlands in Africa that supports an estimated waterfowl population of 354,000 for a selected group of important species (Wilson and van Zegeren 1996, 1998; Wilson 1999) exceeding the 20,000 waterfowl Ramsar criteria (Birdlife International 2002). The birds in Lake Chilwa are hunted for food or for sale and an unknown number of fishermen and subsistence farmers are also considered to be part-time hunters and hence intimately linked to livelihoods (Figure 7). The hunting season coincides with the closed season of the fishery and the period when most households experience seasonal food shortages (i.e. November to February) and hence a key coping mechanism for climate change. van Zegeren and Wilson (1997) estimated that 1.2 million birds were trapped annually by at least 460 trappers with an estimated economic value of US\$215,000 (MK17.2m).

Because the wetland is under customary tenure, the government of Malawi with the assistance of the Danish Hunters Association adopted community-based natural resource management (CBNRM) approach as a conservation strategy in the year 1999. In 2011, the LCBCCAP adopted 20 Bird Hunting Clubs (BHCs) after the Wildlife and Environmental Society of Malawi (WESM) which pioneered the Management Oriented Monitoring System (MOMS) stopped supporting the clubs following the phasing out of the DANIDA project in 2004. Being participatory, the MOMS empowers local communities to monitor their own resources and promotes community ownership of the data collection process, including the results. The focus of MOMS was to monitor number of birds killed through trapping and shooting and also to learn on the impact of extreme weather directly and indirectly.

There are three steps in the monitoring process which are colour coded yellow, blue and red for ease of identification of the monitoring stage by the local communities. Yellow level is the first one and is done on a daily basis. Blue level is the second and is done on a monthly basis with information presented graphically. Red level is done on an annual basis with data also presented in graphs. Presented below is a graph showing number of preferred and non-preferred birds killed between 2009 and 2014. The 2012 Lake Chilwa recession resulted in exposure of birds due to habitat destruction which resulted to a disproportionately large number of birds killed. The major bird species killed included

Fulvous whistling ducks (*Dendrocygna bicolor*) and White-faced whistling ducks (*Dendrocygna viduata*), both known locally as Zipiyo (Plate 33). The birdlife of Lake Chilwa also contributes to tourism and there is potential to transform the bird hunting communities into ecotourism associations for long term sustainability (Plate 34).



Fulvous whistling ducks

White-faced whistling ducks

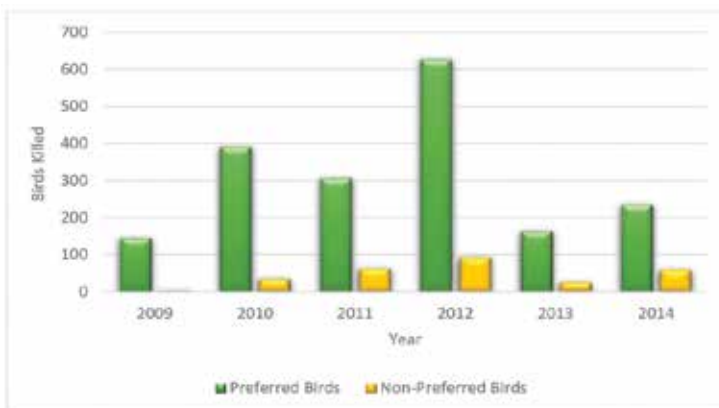
Plate 33 Three White-faced and several Fulvous whistling ducks being recorded after a kill during the Lake Chilwa recession period: Photo credit: John Wilson.



Plate 34 Some of the bird species found in the wetland that support eco-tourism. Photo credit: John Wilson and Deepa Pullanikkatil.



Figure 7 Number of birds preferred and non-preferred trapped between 2009 and 2014 (Source: MOMS data Gibson 2014)



3.3.4 Documents produced to support monitoring and management

District State of the Environment and Outlook Reports

The environmental management Act (2004) recommends the production of District State of the Environment and Outlook Reports (DSOER). The Programme supported the three basin districts to produce the DSOER in 2012. The DSOERs serve as a baseline for monitoring trends in environmental change and are essential to guide planning and natural resource management in the face of climate change and environmental degradation.

Fisheries and Forestry Management Plans

The Programme reviewed and finalized the Lake Chilwa Fisheries Management Plan (2016-2021) following the expiry of the 2005 plan. The new plan will enhance management of the fishery resource in the basin. Three (3) forestry management plans were produced for Mpyupyu, Chikala and a review of Zomba Mountain Forest Reserve management plan. Indigenous woodlands are major sources of fuelwood, poles and many non-timber forest products such as mushrooms, thatch grass, traditional medicines, fodder and fruits. The forest management plans produced will provide the guiding framework in the sustainable management and use of these forest resources.

3.3.5 Tree Survival Incentive Scheme

The benefits of tree planting in degraded sites are enjoyed by the broader community and not specific to the individuals involved. Lack of interest to participate in tree planting activities was witnessed by the Programme in some communities over time. This issue has been compounded by the fact that other NGO and government-led projects such as the Local Development Fund in the area were providing short term incentives like cooking oil and small financial payments to community members, including those not taking part in afforestation activities. The lack of a standard approach between different programmes and projects in the same geographical area led to the withdrawal of some communities. To enhance tree planting and subsequent management, in 2012, the LCBCCAP piloted tree survival incentive scheme where communities were paid K5.00 for each tree that survived after 2 years from planting. This meant the more the trees survived, the more money paid to the community. The assessment was done by the forestry extension staff and programme staff together with the communities themselves.

3.3.6 Monitoring Fires and Illegal Activities

Forest fire is one of the major challenges to forest plantation and forest reserves management in Malawi. With the increasing frequency of droughts, risks of wildfires increase. In order to enhance fire monitoring and management system, the LCBCCAP maintained and rehabilitated three (3) fire observation points (fire towers) on Zomba Mountain which were being manned by fire standby crew during the dry season. The Programme further constructed a road block shelter on the way to the mountain. In addition, the Programme assisted with fire-fighting equipment such as pack pumps (Plate 35 and Plate 36), fire beaters, hoes, slashers and watering cans including provision of food stuffs to the fire standby crews. To improve the communication system, the Programme installed a hand-held radio communication system within the reserve. Observed fire incidences by the communities within the basin were also reported through Chanco Community Radio which would send an alert to the forest authorities for action.



Plate 35 Fire-pack pumps which the Programme bought to support forest fire fighting.
Photo credit: Michael Likoswe.



Plate 36 Fire-fighting crew using fire-pack pumps to put off forest fires. Photo credit: Willie Sagona

3.3.7 Monitoring soils

Past studies (Jamu, Chimphamba and Brummett, 2001) have shown that soil erosion is one of the major problems in the Lake Chilwa Basin with most severe rates ($>110 \text{ t}\cdot\text{ha}^{-1}\cdot\text{yr}^{-1}$) on the foot hills of the Zomba Mountain due to a combination of steep slopes, poor vegetation cover and high kinetic energy of runoff. High soil erosion rates reduce crop yields, increase river sedimentation and negatively impact fish breeding and ultimately may impact fish production in Lake Chilwa. High river sediment yield and runoff may also affect the effectiveness of irrigation structures and cause floods which can negatively impact productivity of irrigation schemes and destroy infrastructure such as roads and bridges.

Against this background, the LCBCCAP monitored soil erosion using the Soil Loss Estimator for Southern Africa (SLEMSA) where soil loss is estimated in soil erosion management units (SEMUs), a mapping unit of a homogeneous area brought about by a unique combination of the three sub models, topographic factors, soil erodibility, and vegetation canopy cover used in the SLEMSA. This approach has been demonstrated in the Lake Chilwa basin to be useful and convenient in estimating soil loss and communicating impacts of soil erosion to communities and development practitioners. As a strategy for creating community awareness of the effects of different land use and management practices on soil loss, sediment collection pits were constructed in selected SEMUs located in mini-catchments within the basin hotspots. Thirty nine (39) sedimentation pits were constructed in five hotspots of the Lake Chilwa



Plate 37 An empty soil sedimentation pit under conservation agriculture as compared to a pit that was completely filled up with soil under conventional agriculture. Photo credit: Patrick Likongwe.



Basin Project and these were used to sensitize the communities around on the effects of different management practices on soil erosion. The pits under forest and conservation agriculture were almost empty as compared to the pits under conventional agriculture practices (Plate 37), sending a strong message on the need to cover the soils wherever possible.

3.3.8 Participatory Scenario Planning

Participatory Scenario Planning (PSP) is a process for collective sharing and interpretation of seasonal climate forecasts and is conducted as soon as a seasonal climate forecast is made available by meteorological services. It is useful for decision making and planning, combining local and scientific knowledge systems, making climate information relevant locally. In mid-October, 2016, the LCBCCAP engaged communities and extension workers (fisheries, forestry and agriculture) in PSP at district level in each of the three basin districts soon after the release of the national and district level seasonal forecasts by the Malawi Government.

From the interactive process, it was clear that the communities in the three basin districts share similar Indigenous Knowledge (IK) for short term forecasts (one to five days- Plate 38), medium term (expected on set) and long-term (seasonal forecast). It was noted that there were fewer indicators of long-term seasonal forecast (beyond three months) compared to short term (few hours to a few days), justifying the need for both scientific and indigenous knowledge systems. The PSP was recommended following the *Early Warning Training Workshop* that was held in Lilongwe from 4th to 5th August 2016.



Plate 38 Ripe Typha grass showing the sausage-like fruits that when they disperse seed, communities know that the rains are close. Photo credit: Sosten Chiotha.



INNOVATIVE COMMUNITY OUTREACH AND ENGAGEMENT

The Programme established Chanco Community Radio as part of its Communications and Outreach Strategy with a coverage radius of 100km, reaching the three basin districts of Phalombe, Machinga and Zomba including the neighbouring districts of Mangochi, Mulanje, Blantyre and Chiradzulu.

Photo credit: Sosten Chiotha.



3.4 Innovative Community Outreach and Engagement

The LCBCCAP had an ambitious social change agenda, targeting 1.5 million people across three districts and ten hotspots. The Programme developed a robust innovative communication and outreach strategy. Channels included interpersonal communication such as individual and group discussions through lead farmer approach, farmer field days, exchange visits, and demonstration sites on conservation agriculture. Other channels included mass media communication such as electronic media, e.g. radio, television, social media and print through brochures, leaflets, posters, newspaper feature articles and calendars.

The LCBCCAP's community outreach and engagement activities were informed by two closely related theoretical concepts, namely Communication for Development, otherwise known as Development Communication and Communication for Social Change. The understanding is that planned use of communication techniques, activities and media gives people powerful tools, not only to experience change but also to guide that change.

3.4.1 Capacity Building

According to Niels Mellmann (2015), some impact outcomes of programmes on ecosystem approach to climate change adaptation are long-term and he argues that such programmes may not be of much help to local people if the benefits are limited to the lifespan of the programme.

It is for this reason that the LCBCCAP significantly invested into capacity building. As Niels Mellmann (2015) has rightly argued, capacity building institutionalizes knowledge, creating benefits that outlive the lifespan of a programme. In this respect, the Programme developed a toolkit on Climate Change for District Level Staff and extension workers to facilitate training of trainers (ToT) sessions to ensure consistency in content and delivery of key messages during and beyond the programme life span.

The Programme offered scholarships to two Master of Science and one PhD students all from FRIM as one way of building capacity for government personnel. Other training sessions focussed on natural resource and climate change management for key agents of change. These included Members of Parliament in the basin and national (Parliamentary Committee on Climate Change and Natural Resource Management), national Faith leaders (Plate 39), media personnel, Radio Listeners Clubs (RLCs), various performing artists, youth groups including the CCAP Blantyre Synod Youth Forum, farmers and natural resources governance committees. The Programme also trained decentralised local governance structures on climate change adaptation and mitigation. These included the District Environmental Sub-Committees, the Areal Development Committees and the Village Development Committees. In hotspots vulnerable to floods, the Area Civil Protection Committees were also trained as an input into revision of their Disaster Contingency Plans such as TA Mwambo. The training assisted in better advocacy and implementation of natural resource management and climate change adaptation by the targeted stakeholders.

Members of Parliament training was evaluated by "a letter to myself" whereby each participant wrote commitments to be accomplished within a period of one year. These letters were sent back to the members through the Clerk of Parliament's office. Some members made great strides to fulfil their promises such as Hon. Vyazi. The clergy also wrote letters of commitment to themselves and fulfilled their commitment. One such example is Rev. Chifungo of Nkhoma Synod who rehabilitated approximately 5 hectares of Nkhoma hill and published an article in a newspaper on environmental

stewardship by the clergy. A representation of the faith leaders trained initiated tree planting in Zomba Mountain Forest to put to action what they had learned during the training sessions (Plate 40).



Plate 39 National faith leaders during one of the capacity building sessions in Zomba.
Photo credit: Mathews Tsirizeni.



Plate 40 A pine stand planted in 2012 by the Faith Community on the outer slopes of Zomba Mountain Forest Reserve. Photo credit: Sosten Chiotha.

3.4.2 Establishment and Development of a Community Radio

Among the key outcomes under communication and outreach was the establishment of the Chanco Community Radio (CCR), with a 100 Km radius coverage throughout the basin and neighboring districts. CCR went on air on 6th July 2013 but was officially opened on 22nd July 2013 by the then Minister

of Environment and Climate Change Management Hon. Halima Daudi. CCR was the first radio station to be based in Zomba. The minister was able to connect on live broadcast twice during the launch and a follow up visit to inspire and dialogue directly with the communities.

The initial proposal to establish a radio station as a means for overcoming challenges of communication and outreach in the Basin was made in 1996 at a stakeholder workshop held in Zomba from 11th – 12th January. The workshop deliberated on the impacts of the complete drying of Lake Chilwa in 1995 on the basin's ecosystem and local communities. The recommendation was to establish a hub studio broadcasting from Chisi Island to ensure communication with the mainland during recessions and when travel between the two was difficult or impossible for island residents.

With advancement in information and communication technology the proposal benefited from the Malawi Government agenda of supporting establishment of stand-alone community radio stations. Engagement with Malawi Communications and Regulatory Authority (MACRA) was positive, citing the uniqueness of the application to focus on climate change adaptation among other development themes. MACRA also issued a license for television broadcasting along the same lines. The radio transmission tower also supported a pilot 'white space internet project' by Chancellor Colleges' Physics Department through a free internet connection to Pirimiti Health Centre and St Mary's Secondary School.

3.4.3 Empowering Communities through Citizen Journalism

Communication for social change is a concept based on the theory that community dialogue leads to collective action. In order to achieve this, LCBCCAP formed and trained community groups – Radio Listener Clubs (RLCs). The radio listeners clubs were a form of citizen journalism involved in documenting and disseminating the experiences of communities and provided a platform for generating community based solutions and creating a sense of community participatory learning through storytelling.

LCBCCAP initially established five (5) RLCs in the Lake Chilwa Basin. Through supplementary support, five (5) RLCs were established around Thuma Forest Reserve. Due to increased demand for more radio programmes to feed into Chanco Community Radio, five (5) additional RLCs were formed and trained within the Lake Chilwa basin. Hence the Programme has established fifteen (15) RLCs within the basin and beyond. The RLCs predominantly produced programmes on climate change and the environment and gradually broadened coverage to include health, education and culture. To date a total of 450 radio programmes have been produced and aired on MBC Radio one, YFM and CCR.

3.4.4 Other Communication Strategies

Here channels included interpersonal communication such as individual and group discussions through lead farmer approach (Plate 41), farmer field days, exchange visits, and demonstration sites on conservation agriculture, participation in national and international conferences and discussion fora/ panel discussions. Other channels included mass media communication such as electronic media, e.g. radio (in addition to Chanco Community Radio), television, programme website and print through brochures, leaflets, posters, newspaper feature articles and calendars (Plate 42).



Plate 41 A female lead farmer who is also the Group Village Head Gowelo engages in a one-on-one discussion after a community field day on CA practice in Domasi EPA. Photo credit: Sosten Chiotha.



Plate 42 A sample of some of the calendars the Programme has been producing since 2011. Photo credit: Patrick Likongwe.

3.4.5 Responding to climate shocks and other community priorities

While the LCBCCAP had developed a robust work plan, some flexibility was necessary in implementation. Such flexibility is supported by UNDP (2007) which suggests the need for an approach that includes learning, where incentives to use information are built-in and programme designs allow low-cost switching of method or components when initial assumptions are called into questions. It is further argued that such flexibility is a vital characteristic of developing responses to the uncertainties around climate change. Within a resilience framework, the ADAPTIVE project assessed household ability to absorb shocks and buffer disturbance, self-organise, and innovate and learn.

Schistosomiasis (Bilharzia) Testing and Treatment

Schistosomiasis is endemic in the Lake Chilwa basin (Chiotha, McKaye and Stauffer, 1991) and is one of a diverse group of communicable diseases classified by WHO as Neglected Tropical Diseases (NTDs). These prevail in tropical and subtropical conditions in 149 developing countries and mainly affect populations living in poverty, without adequate sanitation and in close contact with infectious vectors and domestic animals and livestock (<http://www.who>). During the inception consultative meetings of the LCBCCAP in 2010 in Lake Chilwa Basin, communities wondered why schistosomiasis had not been included among the issues to be addressed by the Programme. In response, the LCBCCAP informed the communities that it had been left out due to a process of prioritisation. However, the issue was raised again in follow up community dialogue in 2011. Approval was sought and granted from the Royal Norwegian Embassy on adjustment to the budget to address this community concern. In this respect, the LCBCCAP conducted a schistosomiasis prevalence survey in five (5) villages in Zomba District where the concern had been raised. The survey was undertaken in collaboration with Zomba District Health Office (DHO) and the Biological Sciences Department of University of Malawi using World Health Organization (WHO) recommended approaches (WHO, 2013).

The highest prevalence rates were registered at Mukhweya village (49%), attributed to its location in a wetland area associated with irrigated farming. The lowest prevalence was in Machemba village (23%) close to Lake Chilwa shores (Pullanikkatil *et al.*, 2013). According to WHO standards, prevalence rates above 20% justify mass drug administration to all persons aged 6 and above within the affected catchment area (WHO, 2013). Therefore, the LCBCCAP provided drugs to 9,095 persons from 54 villages surrounding the areas surveyed. Furthermore, based on the results of this study the WHO provided additional drugs (worth MWK 3.2 million in 2013) through the Programme to the Zomba District Health Office to support their efforts. Through this collaboration between the LCBCCAP and the DHO, the Bilharzia drugs previously earmarked by Malawi Government for primary school children were extended to the wider community.

Cholera Outbreaks

The Lake Chilwa Basin is one of the focal points for regular cholera outbreaks in Malawi for a number of reasons. First the Lake Chilwa water is always turbid supporting a diverse copepod and cray fish population. Cholera is known to survive in copepods and crayfish and cause subsequent outbreaks (Huq *et al.*, 1983). Second Lake Chilwa hosts fishermen staying in temporary floating huts locally called Zimbowera used for a few months before the fishermen return to their home districts with the fish catch accumulated and preserved through drying. The floating huts do not have sanitation facilities and this leads to contamination of the same water used for drinking and other domestic needs. Third, due to high water table the fish landing sites have no toilet facilities and open defecation is common

(and this was made obvious in as late as October 2016 to shocked group of Journalists following up on the LCBCCAP work).

In 2012, Lake Chilwa experienced a recession and this most likely induced the dry season cholera outbreak, affecting mostly fishermen who live in the floating huts and demonstrating clear eco-health linkages. Through outreach programmes of the LCBCCAP, the recession and its impacts on communities, including the cholera outbreak, received wide publicity and resulting in wider community interest in the phenomenon. One outcome of this was the provision of water purification supplies by concerned journalists to be distributed to affected communities through the Zomba DHO (Plate 43). The journalists, therefore, paid special tribute to Chikala RLC by paying a visit to the club for professionally informing the nation on various climate shocks including cholera outbreak.



Plate 43 Zomba DHO Representative in the middle receiving the water purification pack from a representative of the journalists. Photo credit: Deepa Pullanikkatil.

Flood/Drought Response

Rural communities exhibit resilience to shocks in general and to climate change in particular through a number of coping strategies. Coping is a reactive response over a short-time frame, facilitated by informal networks of dependence from within or outside villages, developed to facilitate daily livelihood activities, including those associated with generating economic income and support (UNDP 2007). When shocks affect entire villages and neighboring communities, these coping mechanisms are incapacitated and this would undermine attempts and effectiveness of activities intended to build long-term resilience. Such a scenario was experienced in 2013 when some communities in Phalombe experienced floods that swept away crops and damaged houses. Crops that had been spared from the flood suffered from water logging leading to leaching of fertilizers (Plate 44).



Plate 44 Floods that washed away crops and left some fields water logged. Photo credit: Sosten Chiotha.

Responding to the call from the three basin district councils for assistance, the Programme supported smallholder farmers in programme hotspots with orange fleshed sweet potato vines (966 men and 1,195 women) and cassava cuttings (693 men, 848 women), representing 2,161 and 1541 smallholder farmers respectively (Plate 45). The vines were planted on an estimated 41 ha and the cuttings on 32 ha. In total 4,240 bundles of cassava cuttings were distributed.

The suggestion for the potato vines and the cassava cuttings was made by the district councils because they are drought tolerant as it was too late in the season to replant maize and the Programme acquired certified disease-free planting materials from Bvumbwe research station. Yield from the sweet potato ranged from 8,040 kg to 15,936 kg per hectare, while for the cassava was between 13,400 kg to 14,800 kg/ha in line with acceptable yield range for the basin based on experiences by Crop Officers from District Agriculture Offices in the basin. The support was one way of promoting crop diversification and building community resilience to climate change by providing alternative sources of food and income to affected households.



Plate 45 Community members receiving cassava cuttings (insert) and sweet potato vines.
Photo credit: Sophie Mahonya.



Plate 46 A healthy maize crop production by a group with disabled members in Mposa through dry season irrigation (September 2016) to supplement low rain-fed production due to *El Niño*.

Photo credit: Sosten Chiotha.

Following the crop failure due to drought as a result of the 2015/16 *El Niño*, the Programme supported seven groups including two which have some members with disability with farm inputs in form of 80 packs (25kgs each) of NPK and 80 packs (25kg each) of Urea fertilizers. The input helped to increase the area under winter cropping to 20 hectares (Plate 46). The maize yield realised was enough to take them through to the next crop harvesting season, rescuing them from food insecurity as faced by

other nearby communities in the area. This was the best option unlike providing them with handouts that could not have lasted them till the next crop harvesting season.

Red Locusts

The introduction of citizen journalism through Radio Listeners Clubs and establishment of Chanco Community Radio facilitated timely raising of alarm and early warning on hazards such as breeding of red locusts (Plate 47) in TA Mposa in 2014 and cholera outbreak in 2012 within the basin. These received positive response from government and donor community. With funds from Food and Agriculture



Plate 47 The red locust in Traditional Authority Mposa in Machinga that was controlled following the alert by the local radio listeners clubs.

Photo credit: Sosten Chiotha.

Organisation (FAO) and USAID, the Regional Red Locust Centre in Ndola, Zambia conducted aerial spraying to the breeding grounds thereby averting spread of the pest to maize and rice fields in the basin and neighbouring Mozambique and Tanzania.

Innovations Award

Following the Programmes inclusiveness through working with the vulnerable and people with disabilities, two persons with disability (visually impaired) received national recognition through the 2016 MBC Innovations Award in the categories of disability and agriculture (Plate 48). The disability

awardee, Mr. Kuchaga who is visually impaired is chairman for Tigwirane Manja disability group from Mposa which is practising Integrated Agriculture Aquaculture, making their households food secure. The agriculture awardee Mr. E. Witman is also a visually impaired farmer who practices conservation agriculture and practices rice farming. He harvests more than the household demand and has always some for sale. Able-bodied people flock to buy from him when their fields have not produced enough. Apart from practising CA, he applies a mixture of organic and inorganic fertiliser that he makes for his garden while selling the surplus to other farmers.



Plate 48 Mr. Kuchaga (left) from Mposa and Mr. E. Witman (right) from Saidi Mataka village in Nsanama, both visually impaired showcasing their MBC Innovations Award trophies. The two were empowered by LCBCCAP through integration of people with disabilities in its activities. Photo credit: Patrick Likongwe.



A workshop on carbon market capacity building in Malawi, knowledge sharing, capacity diagnosis and road map, supported by LEAD and World Bank Institute. Photo credit: LEAD SEA

LCBCCAP AS A CHANGE CATALYST



A capacity building workshop for tertiary education practitioners (Malawi, Zimbabwe, and South Africa) in collaboration with University of Agder in Norway provided hands on skills on transforming pedagogy for education for sustainable development focusing on climate change adaptation and mitigation.

Photo credit: LCBCCAP.

3.5 LCBCCAP as a Change Catalyst

The effectiveness of the Communication and Outreach strategy resulted in replication of best practices from the LCBCCAP within the Programme but were also tested and replicated in other programmes within and outside the Lake Chilwa basin for mutual synergy and feedback loops.

3.5.1 Thuma Forest Reserve

The Programme supported the Malawi Government in 2013 through conducting a biomass accumulation survey in the Thuma Forest Reserve where following the Programme's approach, interventions in form of Community Based Problem Animal Control Strategy (CBPAC), Community Based Child Care Centre (CBCCC), afforestation and biogas (discussed on page 15 under efficient energy technologies) were rolled-out with formation and registration of RLC (discussed on page 37 under empowering communities through citizen journalism) to carry the messages for the people living around the forest reserve.

Community Based Problem Animal Control Strategy (CBPAC)

The CBPAC is strategy that engages and empowers local communities in decision making on matters relating to handling of problem animals. The CBPAC approaches complement conventional PAC techniques and effectiveness in curbing problem animals. The approach targeted Thuma Forest Reserve (TFR) to address problem elephants that used to kill people and destroy property. A total of 60 local community members were trained on the CBPAC approaches to enhance their capacity to deal with elephants through several means including fence-lines (e.g. solar fence, grease and chilli pepper oil fences, sisal fence, fire crackers, bee-hive fences and chilli pepper dung bricks). As a way of translating theory into practice, a bee-hive fence (Plate 49) was piloted north of the reserve along the Lilongwe River which was identified as an elephant hot-spot. As reported by Wildlife Action Group (WAG) in 2012, elephants completely stopped causing problems in the area fenced, suggesting that the fence was effective.



Plate 49 Bee-hive fence piloted by LCBCCAP in the north of Thuma Forest Reserve. Photo credit: Gibson Mphemo.

As a way of translating theory into practice, a bee-hive fence (Plate 49) was piloted north of the reserve along the Lilongwe River which was identified as an elephant hot-spot. As reported by Wildlife Action Group (WAG) in 2012, elephants completely stopped causing problems in the area fenced, suggesting that the fence was effective.

Kapiri Community Based Child Care Centre

The Programme constructed Kapiri Community Based Child Care Centre (CBCCC) inclusive of a classroom block, modern kitchen and toilets at Kachitsa Village, Salima in 2014. The construction was a response to local community demands since the original shelter (Plate 50) used as a class-room for the under-fives was in extremely bad state, posing a health hazard to the kids. The CBCCC is managed by a ten (10) member executive committee consisting of eight (8) women and two (2) men.

Since completion of the CBCCC in 2014, number of children enrolled has increased from 120 to 300 in 2016, more than double the baseline enrolment within two years.



Plate 50 Improvement of Kapiri Community Based Child Care Centre from a mud to modern house was done as part of building resilience of women who run the centre in addition to afforestation, livestock and crop production. Photo credit: Sosten Chiotha.

3.5.1.3 Thuma Forest Reserve Afforestation

As one way of rehabilitating the forest reserve, the Programme together with local communities planted 611, 941 assorted tree seedlings. The Programme further supported 175 households from 15 villages residing at least 2 km away from the Thuma Forest Reserve with a total of 14,000 bamboo seedlings for planting in Village Forest Areas and along river banks. Bamboos were specifically targeted for promotion as they are fast growing; and provide better returns as an alternative source of income as compared with regular trees. The work done around the Thuma Forest reserve was in its bordering districts of Salima, Dowa, Lilongwe and Dedza.

3.5.2 Stakeholder Platform for Knowledge Sharing and Improved Planning

Many of the factors that make climate change unique also make it complex because it is a multi-scalar environmental and social problem, which affects different sectors (UNDP 2007). In this respect it is important to build communication channels and forums to support information/skills transfer and social learning (UNDP 2007). It is further argued that improved communication offers opportunities for equitable pathways and decision making by poor people and that success depends on structured forums for sharing knowledge, technologies and skills, especially those that improve education and reinforce traditional networks (UNDP, 2007).

Against the background presented above, the LCBCCAP provided a platform for regular update of key achievements to relevant stakeholders in the basin and beyond through discussion fora to facilitate cross-basin and cross-sector natural resource management and planning for climate change adaptation. This platform allowed for the actors to convene and think beyond their traditional boundaries and develop a shared sense of purpose. The impact of this platform is that it shaped the implementation of the Programme because of the feedback from the stakeholders as well as allowing the stakeholders to exchange knowledge. The discussion fora were recorded and aired on the Malawi Broadcasting Cooperation (MBC) television providing an opportunity for other key players to address the challenges in the basin (Plate 51).

The importance of the basin-wide platform was eminent during the response to 2012 Lake Chilwa recession in terms of early warning, management of dry season cholera outbreaks, and resolving

conflicts due to migrant fishermen. Key sector management plans on fisheries and forestry have also benefited from these discussions. The recorded programmes have also been used as resource materials for different training sessions.



Plate 51 Panellists in front of the audience during one of the discussion fora organised by the Programme.
Photo credit: Deepa Pullanikkatil.

3.5.3 Knowledge Sharing on Ecosystem Approach (EA) to Enhance Best Practices

While there have been earlier attempts to use the EA in Malawi, the LCBCCAP is the most significant application in temporal and spatial scope. A number of projects using the approaches have drawn inspiration from the LCBCCAP. These include United States Agency for International Development (USAID) Fisheries Integration for Society and Habitats (FISH) Programme targeting fisheries management in Lakes Malawi, Malombe, Chilwa and Chiuta; the Water Futures: Towards Equitable Resource Strategies (WATERS) and Minimum Action for Just Initiative (MAJI) Programmes by Voluntary Service Overseas (VSO) in some key climate hotspot districts of Malawi such as Zomba, Chikwawa, Karonga, Dowa and Salima; Attaining Sustainable Services from Ecosystems Through Trade Off Scenarios (ASSETS) implemented by the LCBCCAP partners with the University of Southampton, Conservation International Foundation (CI), Centre for Applied Biodiversity Science (CABS), International Centre for Tropical Agriculture (CIAT), Rhodes University and University of Dundee; and Ecosystem Based Adaptation for Food Security (EBAFoS) implemented at Changali (Mangochi) with funding from United Nations Environment Programme (UNEP).

The LCBCCAP was also one of 10 case studies selected from at least two hundred entries pioneering the Ecosystem Based Adaptation (EBA) in Africa for presentation at the first and second Africa Food Security and Adaptation Conference in Nairobi organized by UNEP and Food and Agriculture Organisation (FAO) in 2013 and 2014 respectively (Plate 52). These two conferences led to the

formation of Ecosystem Based Adaptation for Food Security Assembly (EBAFOSA) at Pan African level with national branches. The Malawi branch was launched on 5th June 2016 during the commemoration of World Environment Day and Climate Change Week (Plate 53).

Furthermore, the solar drying and energy efficient fish smoking technologies from the LCBCCAP have been adapted and adopted by Capacity Building for Management of Climate Change (CABMACC) project implemented by Lilongwe University of Agriculture and Natural Resources (LUANAR) projects and Cultivate Africa (CultiAF) project funded by the International Development Research Centre (IDRC). Chanco Community Radio is an example of value for money. The station is used for training students but also provides relevant development services to the basin community. Examples include *Tsogolo Langa*, a programme promoting girl child right to education implemented by Pakachere Institute of Health and Development Communication; *Tiyende* an Interactive Radio Instruction (IRI) for Community Based Child Care Centres (CBCCCs) which was implemented by Save the Children International (SCI); and programmes implemented by Farm Radio Trust, which foster rural and agriculture development in Malawi through radio and other information and communication technologies.



Plate 52 A cross-section of participants during the 2nd African Ecosystem Based Adaptation for Food Security Conference at UNEP in Nairobi at which LCBCCAP was one of the case studies presented.

Photo credit: Mathews Tsirizeni.

The impact of the RLCs included partnerships fostering effective networking on issues of climate change, livelihoods enhancement and natural resource management across a wide range of stakeholders and environmental interest groups in rural, urban and peri-urban areas. For example, Concern Universal provided a borehole in Phalombe after a programme by Chitsanzo RLC of TA Jenala Phalombe influenced installation of two (2) boreholes one at Njalo Island and the other at GVH Chimombo with funding from World Vision and Local Development Fund respectively in 2013. Mpyupy RLC influenced Zomba District Council and development partners to construct flood control structure at TA Mwambo along the Likangala River from 2015. More than 25 girls were withdrawn from early marriages and sent back to school at TA Mposa between 2014-2016 due to policy and advocacy programmes recorded by Chikala RLC and aired on CCR.



Plate 53 The State President of the Republic of Malawi, Prof. Arthur Peter Mutharika in the middle with the First Lady discussing with Prof. Sosten Chiotha to his left at a LEAD SEA stand during the EBAFOSA launch. Photo credit: Jafali Ntaja.

3.5.4 Contribution to National REDD+ Strategy

The LCBCCAP championed and initiated the Reducing Emissions from Deforestation and Forest Degradation (REDD+) readiness processes by convening national stakeholders in order to develop the appropriate frameworks to guide government and stakeholders. Through these consultative processes, stakeholders noted that the LCBCCAP had sufficiently made a case through the preliminary ground work for the development of a national REDD+ strategy. Hence the stakeholders recommended that the Department of Forestry should take over and lead the process on behalf of Malawi Government. In 2013, the Department of Forestry supported by the United States Forest Service (US-FS) took over the coordination and facilitation of the REDD+ development process. The role of the LCBCCAP then changed from coordinating to supporting the initiative.

3.5.5 Conference Participation

The Programme participated in local, national and international conferences sometimes inviting community members to showcase the Programme outcomes through displays and posters where necessary. During such conferences, lessons from the LCBCCAP have been shared with the conference participants.

4 TOP TEN LESSONS LEARNT FROM THE PROGRAMME

Despite progress made on several interventions, some of the lessons that can be shared include:

- i. Some communities implementing interventions that did not bring immediate social benefits created demand for support on short term income generating activities to sustain their livelihood. With this in mind, the Programme already had an integrated approach for activities that brought short term and long term benefits. This integrated approach included access to opportunities for capacity building, seed money for VSL, access to land under afforestation for crop production for a period up to three years, exchange visits and participation in livestock pass-on scheme.
- ii. Success in afforestation programmes is a combination of good tree seedlings, good management and the willingness of the community to take part in such programmes. Management and community willingness was expressed through different actions. For example, some VNRCs

successfully controlled termites by soaking tobacco leaves in water and irrigating the area attacked. Other VNRCs soaked goat dung in water and applied the mixture to the growing seedlings to deter the goats from eating the seedlings. These claims need to be validated scientifically.

- iii. The Programme noted that more effort is needed to increase uptake of conservation agriculture, targeting farmers that are still sitting on the fence. Such farmers would be inspired by success stories such as increased chilli production during a drought year (2015/16 season) in a field that was rotated with maize previously under CA. In addition, CA was disturbed for some farmers by the 2014/15 floods due to water logging and white grubs resulting in lower than expected crop yields. As a result, some CA farmers reverted to the conventional farming and hence there has to be continued advocacy. Some farmers abandoned CA having adopted expecting to receive input support. There is need for harmonisation of key messages related to CA so that adoption is based on the principles rather than expecting input support.
- iv. The small livestock pass-on scheme was a success in a sense that there were secondary and tertiary beneficiaries in some communities. The communities were able to sell the livestock to support their livelihood needs and the livestock cushioned them against the impact of low food production from floods and droughts experienced from 2014 to 2016 El niño period. Despite having a drug-revolving fund for managing small livestock diseases and building capacity on feed production, some households still had challenges in maintaining their livestock as a result of the climate shocks.
- v. Addressing social and ecosystem resilience requires robust weather and water resource data. For example, weather data collected by the Programme and historical data played a pivotal role in forecasting the 2012 recession, thereby providing early warning to the communities and decision makers in time. However, cases of vandalism and theft in some areas were a setback in building complete climate and water resource monitoring database.
- vi. Capacity building is an integral part of any programme focusing on building ecosystem and social resilience. For example, training of policy makers and faith leaders was an effective approach to advance climate change and natural resource management agendas at local and national level. Considering that office bearers change, capacity building should be continuous and informed by regular training needs assessment.
- vii. A bottom up approach is essential to provide participation at grassroots on development issues. In this respect, the Programme effectively integrated citizen journalism through the Radio Listeners Clubs in its outreach and communication strategy. In addition to citizen journalism, the Programme was able to reach out to more beneficiaries through the establishment of a dedicated community radio but also partnering with other electronic and print media outlets.
- viii. The impact of climate change is influenced by local context. In this respect, the Programme integrated relevant indigenous knowledge systems with scientific knowledge to foster effective Programme implementation. For example, in addressing the challenge of when and what to plant, the Programme utilised the Participatory Scenario Planning tool which integrates both indigenous knowledge and science.
- ix. Because climate change impacts create vulnerability through complex drivers, it is important that Programmes on building resilience should create partnerships with stakeholders from different disciplines and sectors. This was achieved by the Programme by having implementing partners from academia, government and non-governmental organisations. In addition, the Programme

created partnerships with the private sector stakeholders such as Malawi Bureau of Standards, the banking sector, Ex-Agris Limited on specific activities.

- x. Building resilience to climate change using an ecosystem approach is a long term initiative and should integrate a process of continuous learning to improve impact outcomes. For example, the solar fish dryers and fish smoking kilns were modified to improve on efficiency based on lessons learnt.

5 SUSTAINABILITY

As a way of sustaining the Programme interventions beyond its lifespan, a number of sustainability elements have been implemented. These include capacity building, working with the established structures, mass communication and formation of a trust. Capacity building was done at all levels of the programme activities with relevant key personnel. The knowledge and skills gained through the different capacity building sessions will continue being used even after the end of the Programme. The established structures that the Programme worked with included the three district councils and Chancellor College since the Programme was implementing the interventions on behalf of the Malawi Government. From each of the three district councils, the Programme involved extension workers from the different line ministries and departments like agriculture, forestry, fisheries, water among others. These were empowered to implement activities on the ground which included conservation agriculture, livestock pass-on scheme, afforestation through the VNRCs, fisheries activities and water resource monitoring among others. As such, these are left with the district councils and are incorporated in their development plans and decentralised system for continuity. While the district councils will continue with impact activities, Chancellor College will oversee the management of Chanco Community Radio and the RLCs. Furthermore, the Programme management teams at both technical and policy level recommended for the formation of a Lake Chilwa Basin Management Trust (LCBMT) which is in the registration phase (Plate 54). The Trust will synchronize and coordinate planning across sectors and groups in the Lake Chilwa basin besides continuing the efforts initiated by the LCBCCAP.



Plate 54 Participants to a stakeholder's discussion forum on the formation of Lake Chilwa Basin Management Trust, an important step towards registration of a trust. Photo credit: Patrick Likongwe.

6 CONCLUSION

The Lake Chilwa Basin Climate Change Adaptation Programme managed to secure the livelihoods of the people in the Lake Chilwa basin by building resilience of their natural resource base. This has been achieved through different interventions that have enhanced ecosystem resilience, social resilience while monitoring the resource base and building capacity of the basin communities. Innovative community outreach and communication has been instrumental in delivering key messages to the basin population and beyond. The Programme understood adaptation as defined by the Inter-governmental Panel on Climate Change. It used the ecosystems approach which integrates management of land, water and living resources while promoting conservation and sustainable use.

Restoration of an ecosystem while adapting to climate change needs patience as most of the fruits could be realised well beyond programme intervention period. The problems of climate change and environmental degradation are complex requiring coordination among stakeholders from different sectors and disciplines. The use of ecosystem based approach has proved to be effective in tackling different social and environmental challenges by taking advantage of the existing interconnectedness and priority setting to maximise gains with available resources. Therefore, the approach has potential for replication in similar situations like that of the Lake Chilwa basin.

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Intercropping maize with pigeon peas was promoted for crop diversity, dietary diversity and supplementary biomass energy.

Nambwinda VNRMC women from Machinga in a jovial mood while welcoming the LCBCCAP staff to their village forest area.

Photo credits: Sosten Chiotha.

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