A Lake without Water

Livelihood coping strategies during the Lake Chilwa water recessions in Malawi

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Abstract

This thesis explores the human-environment interaction within the climate-sensitive socio-ecological system of Lake Chilwa in Malawi. It uses the livelihoods framework to analyse various coping strategies to resource scarcity due to lake recessions. The main aim is to understand the processes by which decision-making takes place and the influence of various agents of change on coping with environmental shocks, i.e. water recessions. Lake Chilwa undergoes periodic water recessions with up to twelve incidents recorded between 1900 and 2012. While the lake and its wetland is an economic aquatic-agriculture system in between recessions, it is unclear how households around the system survive during the periods of water recessions. Qualitative and quantitative studies were conducted between March 2012 and December 2013 on Chisi Island of Lake Chilwa to evaluate the coping strategies and their major drivers in responding to the periodic lake recessions. Using interpretive analysis, the findings show that people from the Lake Chilwa socio-ecological system have lived in anticipation of periodic environmental shocks due to their deep historical knowledge of the lake level and its fluctuations. This knowledge has been passed from generation to generation. Results further show that the main coping strategies that have stood the test of time for every recession are based on reciprocity and redistribution. These include sharing through kinship ties, hunting wild birds and farming. In many cases coping strategies for each specific recession are driven by political, social and economic factors prevailing at that particular period. Given these conditions, different agents (individuals or communities) make choices designed to maximise their own interests as they scramble to access scarce resources. Although natural resources in these systems are fundamental assets in rural livelihoods, accessing them in times of scarcity requires better governance systems that consider social, political and economic contexts.

Keywords: coping, ecosystem, Lake Chilwa, livelihoods, natural resources, recessions, scarcity.

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Dedication

To my loving father and mentor, late Wilson Bishop Nagoli (Sr), *Mphitho Khunyelhiwa*.

Dad - I have fought a good fight,
I have finished the race,
I have kept the faith.

Everything you've ever wanted is on the other side of fear
George Addair

Acknowledgements

First and foremost, I thank my beloved wife Esther for standing firmly by my side and enduring all the social pains from my intermittent availability for four solid years. You cared for the whole family amidst your workload at the hospital. I am so thankful to my lovely children – Reneck, Elhanive, Olhika (Mercy) and Chifundo. You missed Dad but continued to work hard in your education. I am proud of you all. I hope that you can all read this book and understand why I spent so much time in front of my computer. My dear mother, *Mayi* Nagoli, my brother and sisters, I say *Mulhuku waphaama, khanoona ekhove*! Thank you so much for your vision, patience, generosity and encouragement. I also owe much gratitude to the family of Erik and Linley whose support and love for me was beyond my imagination. The chats and the cooking felt very much like a home away from home. It has been a special experience discovering my hidden values and social change with you – *mwasalipa sana*! I am also grateful to the families of Erik and Jeanette; Henrik and Lena for your hospitality during my stay in Sweden. And to Wijnand and Ann-Sofie, your generosity and friendship has been an immense support.

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I am grateful to the Department of Urban and Rural Development at SLU for the support and stimulating working environment. I got enormous administrative support from: Cecilia Waldenström, the Head of Department, Eva Stephansson, the Head of Division and Kristina Marquardt, the Director of PhD Studies. I acknowledge the delights and discontents that I shared with: Prof. Nadarajah Sriskandarajah, Margarita Cuadra, Seema Arora-Jonsson, Lars Hallgren, Malin Beckman, Emil Sandström and Thomas Norrby. It wouldn't have been an easy

going without the generosity and timely support from David Halim, Elinor Carlbrand and Per-Arne Klasson – thank you so much. Special thanks to Anni Hoffrén for the fabulous expertise in bringing this book to its current form. *Hey! Mzee* Opira Otto, the laughter even without a *malwa* was so refreshing. I will miss the injera from Tadesse Amera. I say 'Tack så mycket' to my wonderful colleagues: Jovita Amurwon, Cristián Alarcón Ferrari, Dil Khatri, Patrick Cras, Martin Paju, Kyla Krogseng, Chad Ellingson, Murat Sartas and Nicia Giva. I am greatly indebted to too numerous people to name them all at LAG, for the distinguished roles they played during my study.

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My sad memories when I was writing this book were on Emma Kambewa who was my strong supporter but alas, we lost her. "Passed years seem safe ones, vanquished ones, while the future lives in a cloud, formidable from a distance".

Kwa mafumu ndi anthu onse a pa chilumba cha Chisi, ndikuti zikomo kwambiri. Ndikuthokoza chifukwa cha nthawi yanu, chimwemwe ndi chisangalalo chanu komanso zonse zomwe munandiuza ndi kundithandiza mu nthawi yonse ndinakhala nanu pa kafukufukuyu. Ambuye adzikudalitsani.

Ndalemba bukhuli poyang'ana ntchito zanu komanso umoyo wanu mu nthawi imene nyanja ya Chilwa imakhala itaphwela. Ngakhale kuti moyo wa tsiku ndi tsiku umakhala wovuta pamene nyanja yaphwela, anthu a mu chigwa cha Chilwa makamaka anthu a pa Chisi pamene kafukufukuyu anachitika, amakhala ndi njira zambiri. Mwa njira zimenezi, yosililika ndiyo yokhala ndi ma ubale abwino pomagawana zakudya komanso kuthandizana pa zosoweka za anthu ena.

Ndipepese ngati zina zomwe munandiuza sizinalembedwe molondola mu bukhuli.

Contents

Acronyms

ADC	Area Development Committee – lowest level in decentralisation governance
AIDS	Acquired Immunodeficiency Syndrome
FAO	Food and Agricultural Organisation of the United Nations
GoM	Government of Malawi
HIV	Human Immunodeficiency Virus
IPCC	Intergovernmental Panel on Climate Change
NSO	National Statistics Office of Malawi
UNICEF	United Nations Children's Fund
USD	United States Dollar (currency)
VDC	Village Development Committee

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II **Nagoli, J**., Mulwafu, W., Green, E. and Chiwona-Karltun, L. (Forthcoming). Conflicts over natural resource scarcity in the aquatic ecosystem of the Lake Chilwa. Forthcoming in *Environment and Ecology Research.*

III **Nagoli, J**., Green, E., Mulwafu, W. and Chiwona-Karltun, L. (under review) Coping with the Double Crisis: Lake Chilwa Recession and the Great Depression on Chisi Island in colonial Malawi, 1930-1935. Resubmitted with revisions to *Human Ecology.*

IV Ratner, B. D., Cohen, P., Barman, B., Mam, K. **Nagoli, J**. and Allison E. H. (2013). Governance of Aquatic Agricultural Systems: Analysing Representation, Power, and Accountability. *Ecology and Society*, 18(4): 59.

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Photo gallery

The following selected images provide a historical visual aid to the empirical and theoretical discussions about the Lake Chilwa socio-ecological changes. I selected these images that were taken from almost same positions to show changes in landscape and socio-economic differences over the years. The images specifically capture the lake water recessions and the economic activities in the system which this book analyses. Though we use all our senses to learn, seeing is the sense where most of our learning comes from. These images should therefore give you the first glimpse and orient your thoughts on why this book is titled *Lake Without Water*.

Lake Chilwa drying in 1967 as seen from Kachulu fish landing site. Photo compliments by Howard-Williams.

Early stages of Lake Chilwa recession in 1971 at Kachulu. Dug-out canoes (bwato) packed because the lake was muddy. Photo by Howard-Williams.

A man stranded as he wants to cross over to Chisi Island from the mainland because transport boats can no longer operate due to recession in 1972. Photo by Howard-Williams.

Lake Chilwa completely dried up in 1995. Fishing and transport boats no longer in use. Animals and people walked on dry lake bed. Photo by Sosten Chiotha.

Dried canals where boats moved through marshes to open waters in the northern part of Lake Chilwa (Mposa) in May 2012. Photo by Joseph Nagoli.

Complete drying of Lake Chilwa in the northern part by July 2012. Floating houses (Zimbowela) sitting on dry ground. Photo by Joseph Nagoli.

Lake Chilwa shrunk by close to 80% of its normal size by December 2012. Photo by Joseph Nagoli.

Lake Chilwa refills after good rainfall in April 2013. Photo by Joseph Nagoli.

Chisi Island (where the study was conducted) with Namakwaila Village beneath the hill as seen from Kachulu after lake refilled in April 2013. Photo by Joseph Nagoli.

Fishing business recovers by March 2014 at Kachulu. Photo by Joseph Nagoli.

1 Introduction

Mu nyanja mulibe madzi chaka chino […] *Nyanjayi imauma*

Mu nyanja mulibe madzi chaka chino [The lake has no water this year]; *Nyanjayi imauma* [this lake dries up] were the words I heard so frequently from my key informant at Chisi Island, Mr Radson. Mr Radson lived in Tchuka Village which is located at the opposite end of Kotamo, the village where I stayed for my direct observations (see Picture1). He was my foremost contact person at Chisi Island who called me on his smart phone anytime something was happening in his area. Mr Radson is a prosperous and innovative fisherman. He has tried every new technology that experts bring to the lake such as seine net fishing. He has also tried brushparks and cage culture technologies of farming fish in Lake Chilwa.

Picture 1. Chisi Island Google map showing positions of Kotamo and Tchuka Villages.

The two phrases firstly surprised me because they portrayed the *lake* as an object that gets filled and drained. I was particularly startled as to why Mr Radson calls it a *lake* when it is dry? His answer to my confusion was simple: "the drying is never permanent. I have seen two complete dry ups in 1967 and 1995 and so many serious recessions. This year (March 2012) is not different from how drying of the lake starts". Further reading of literature confirmed that there had been worse conditions of seasonal fluctuations of the lake level and periodic recessions of the lake as highlighted in the photo gallery above. These periodic recessions can sometimes be complete drying up of the lake that may last two to three years. The dilemma for me was how do the communities from the Lake Chilwa ecosystem survive the long resource scarcities? Second, why do they continue to live in this precarious system with the vulnerability it brings in their livelihoods?

The challenges of sustaining livelihoods for the people in the Lake Chilwa ecosystem are not different from those of other communities depending on aquatic-agricultural systems (AAS). Livelihoods in this case are defined as ways in which people make a living. Livelihoods within AAS may be more vulnerable to a range of factors caused by high reliance on natural resources as well as social, political and economic factors (Sarch and Allison, 2000). Livelihood coping strategies under AAS are therefore not solely actions of survival but purposeful and deliberate activities taken in response to or in anticipation of the adverse effects of the vulnerability factors (Adger, 2003). This thesis sets out to understand the process by which decision-making takes place and the influence of the various agents (both humans and other entities) of change on coping with environmental shocks.

1.1 Research overview

This thesis is about coping with natural shocks such as periodic water recessions of Lake Chilwa. It uses the livelihoods lexicon by Ellis (1998; 2000) and Devereux (1999) to distinguish the terms *coping strategies* and *risk management strategies*. Within a rural development context, risk management strategies involve *forward planning* and *diversifying* into farm, off-farm, or non-farm activities that enable households or communities to spread risk. Coping strategies, on the other hand, consist of approaches that households or communities employ to *survive* an unusual event or seasonal scarcity. The thesis emphasises the latter based on the assumption that livelihoods in the Lake Chilwa socio-ecological system are very much threatened by lake recessions,

which to a degree occurs without any formal institutionalised early warning system. However, during the lake recessions, alternative livelihoods can be identified not only for survival but for people's well-being. Well-being in this case is a satisfaction of surviving. It encompasses both the psychological well-being and subjective well-being for positive self-acceptance (Keyes et al. 2002).

The thesis applies an iterative dynamic approach by combining qualitative, quantitative and archival studies to acquire a deeper understanding of livelihoods within climate-sensitive ecosystems. Figure 1 highlights the thesis development pathway with four themes generated from four research questions. The four research questions are elaborated in section 1.2. These questions were complementary in delineating the key themes of the research namely: ecosystem services, coping strategies, social structure and gender inequalities and power relations. Data from the questions was analysed and showed some gaps in the way certain phenomena were captured. This required an in-depth examination of literature which also supported the writing of four scholarly peer reviewed papers (I-IV). Each of these papers used data from a combination of research questions, as shown by dotted arrows in Figure 1. Further analysis of the results from the papers has generated five major conclusions that are discussed in chapter six. Like most experiences, the data analysis, write up, and several attempts at publishing the papers in scholarly journals taught me more than I ever envisaged. This growth in knowledge forms the bulk of the content that comprises the last chapter of the thesis.

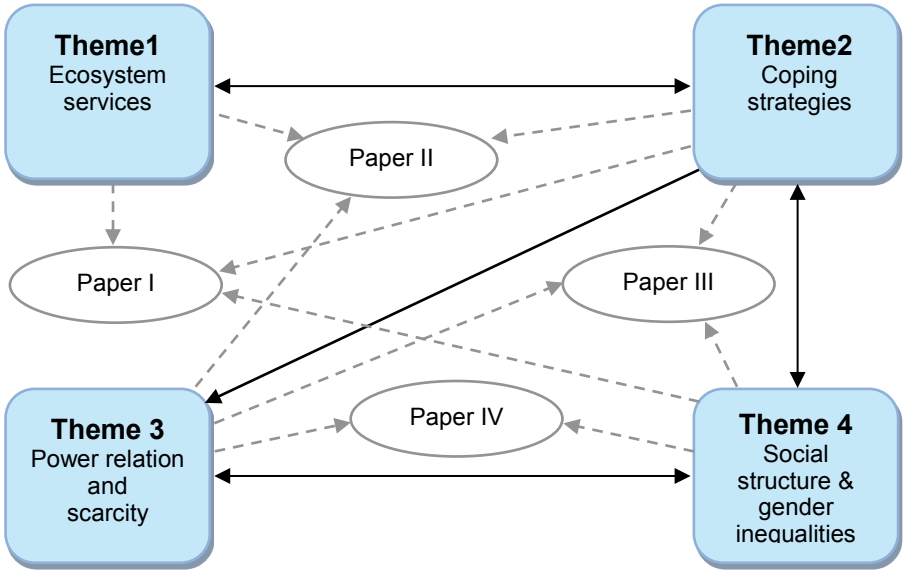


Figure 1. Study Framework and thesis development.

1.2 Research questions

This study aims to explain the human-environmental interactions within the climate-sensitive socio-ecological system of Lake Chilwa. It seeks to understand how rural livelihoods coping strategies are structured, their short-term and long-term changes in response to opportunities or threats and the major drivers to the changes. In order to provide empirical evidence on this broader objective, the research was specifically guided by the following questions:

1. What are the major ecosystem services from Lake Chilwa that communities have depended on for their livelihoods?
2. What are the coping strategies that have occurred during different periods of the Lake Chilwa recessions and what drives these strategies?
3. How are the coping strategies structured in response to new opportunities or threats?
4. How does environmental scarcity influence power relations and how are power relations displayed during environmental scarcity?

1.3 Study area

The study was conducted at Chisi Island of Lake Chilwa situated in the Zomba District of Malawi. Malawi is bordered by Tanzania to the north, Zambia to the west and Mozambique to the east and south (Figure 2). Malawi has a total area of about 118,484 square kilometres (km^2) of which 94,276 km^2 is land, with water occupying 20% of the total area (GoM, 2001). Lake Malawi is the biggest body of water and covers most of the eastern boundary (refer to Figure 2). According to the latest population census, which is conducted every ten years, the population in 2008 was estimated at 13.1 million and growing at the rate of 2.6% per annum. This translates to a national population density of 1.45 people per hectare (NSO, 2008).

Figure 2. Map of Malawi showing national boundary and location of Lake Chilwa.

Lake Chilwa (Figure 3) has three main islands namely Chisi (formerly known as Nchisi by the colonialists), Thongwe, and Njalo. Chisi (Picture 1) is the largest island located between 30° 35′ and 30° 38′ east of Greenwich Meridian and 15° 18′ and 15° 21′ south of the Equator. It is situated in Traditional Authority (TA) Mkumbira of Zomba District, southern Malawi. Chisi Island has an area of approximately 21 km^2 and is surrounded by marshes to the west and open waters to the east. The choice of Chisi Island for this study was based on the premise that livelihoods of people on the island are highly dependent on the lake and they are therefore greatly impacted by lake water recessions. Furthermore, Chisi Island, located in the central zone of the lake (Figure 3), lies in the main water route to Mozambique, and as such, it is economically vibrant. Additionally, Chisi Island has not been spared from the continuously growing population trend in the Chilwa Basin and in Malawi as a whole. In 2008 Chisi Island had a total population of about 3000 people. However, the population can swell to over 10000 people, during peak fishing periods as a result of migrations of people from other parts of Malawi who come to fish and participate in other activities in the value chain like fish processing, trading and transportation. The island's population is highly dependent on fisheries with 90% of the economically active group (men and women above 18 years) employed as fishers, fish processors, fish traders or as sellers of firewood and food. The other 10% of the population depend on agriculture and other non-fish related livelihoods.

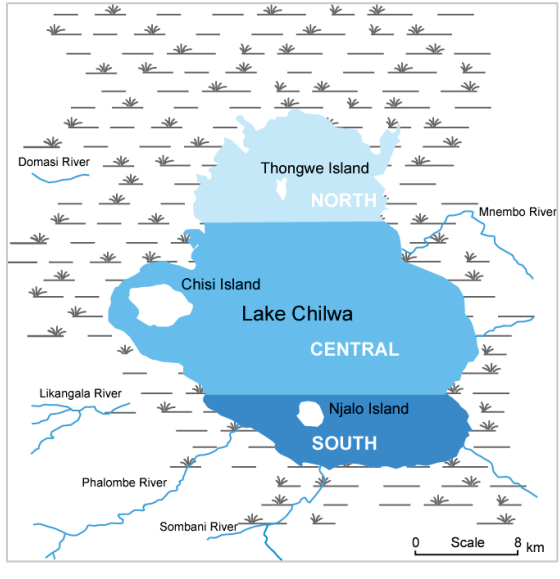


Figure 3. Lake Chilwa ecosystem demarcated in three zones: North, Central and South. Map redrawn by Anni Hoffrén and Joseph Nagoli.

1.4 Structure of the thesis

The thesis has six chapters. The opening chapter (introduction) provides a general perspective of the study, how the idea of the study evolved and the justification for choosing Chisi Island and Lake Chilwa socio-ecological system for this study. Chapter two is the background providing an overview of related studies done and other fundamental information. It sets the baseline knowledge of the study. The third chapter outlines a conceptual framework for studying 'livelihood coping strategies' in resource-fluctuating ecosystems. Here the theoretical and conceptual frameworks for the thesis are formulated and contextualised in relation to relevant perspectives by providing relevant definitions of concepts as they relate to the study. The methods used in the study are contained in chapter four as descriptive presentations of the fieldwork. Chapter five presents the summaries of four papers which lead to the discussions in the chapter six. The final chapter discusses the major findings and how these findings are applicable to dealing with uncertainty. It also suggests possible ways of addressing some challenges in the Lake Chilwa socio-ecological system.

2 Background

> If there is not much fish from the water we do not have money and our lives [livelihoods] suffer. Then we do *ganyu* [selling labour]. […] when rains come late and we have no money from fishing, then things don't work on both sides [farming and fishing] then there is no happiness (Mr Lungu[1]).

The quote above came from a member of Kachulu Beach Village Committee, the main fishing outlet of Lake Chilwa summarising the conversation of a Focus Group Discussion (FGD) in 2012. The statement indicates that seasonal changes of Lake Chilwa have profound effects on the livelihoods of people in the Lake Chilwa socio-ecological system. This is likely due to the close connection between fishing and farming as people's main livelihoods. Lake Chilwa provides an opportune case study for examining current challenges faced by many rural poor. It demonstrates how people are affected by the resource variation, food fluctuations, wetland habitat degradation and water management in trans-boundary socio-ecological systems (Nihoul et al. 2004). In such a system, people's livelihoods can be characterised paradoxically as both precarious and as immensely robust (Ellis, 1993). Part of this paradox is the observation that decision making by such people on what to do when there is a water recession can be either extremely risk-averse, or in other cases, highly optimised in dealing with natural resource scarcity and other risks (Ellis, 1993; Francis, 2000). Nevertheless, the decision making process is complex and made within a mix of ecological, social, political and economic contexts (Scoones, 2009).

[1] These are not actual names. Actual names are only used where they represent chieftaincy.

2.1 The socio-economic underpinnings of livelihoods in Malawi

This thesis looks at the livelihoods of people who depend on ecosystem services and are normally regarded as *poor* and *disadvantaged*. Poverty in Malawi is pervasive (GOM, 2002a). About 65% of Malawians live below the poverty line, which is defined as the expenditure needed to afford minimum nutritional requirements and a basket of basic non-food goods and services (FAO, 2003). Approximately 55% of the rural population, most of them smallholders are unable to meet basic needs (Harrigan, 2003). In 2008, it was estimated that 40% of the country's population was poor, with 15% of them categorised as ultra-poor[2]. These figures show a significant improvement from those recorded in 2004, which were at 52% and 22% respectively (NSO, 2009). The prevalence of stunting, considered as a long-term indicator for child health has also declined modestly from about 33% in 2010 to 30% in 2013. However, at national level nearly 8% of children aged 6-59 months are still underweight (NSO, 2013). The World Bank estimated the country's Gross Domestic Product (GDP) at USD4.258 billion in 2014, equivalent to per capita income of about USD255 with agriculture contributing a third to the national GDP. GDP measures both the economic performance of a nation and the relative contribution of a particular sector.

In rural areas such as the Chilwa socio-ecological system poverty is more severe compared to urban areas (NSO, 2008). Some of the key causes of poverty are limited access to land, low education, poor health status, limited off-farm employment, lack of access to credit, and lack of access to agricultural inputs (GoM, 2002b; FAO, 2003). Social indicators show that national infant mortality (under 1 year) currently stands at 46 deaths for every 1000 births[3]. The effects of HIV and AIDS also add to infant mortality. The HIV and AIDS prevalence rate for adults in 2012 was 10.8%. While land shortage and other social-economic factors are highlighted as underlying causes of poverty, literature also shows that Malawi's poverty is due to its

[2] Individuals whose per capita total consumption is lower than the total poverty line are considered poor, while individuals whose per capita total consumption is lower than the food poverty line are considered ultra-poor. The total poverty line comprises of two principal components: food and non-food. The food poverty line represents the cost of a food bundle that provides the necessary energy requirements per person per day i.e. 2,400 kilocalories per person per day. The non-food poverty line represents an allowance for basic non-food needs. It is estimated as the average non-food consumption of the population whose food consumption is close to the food poverty line.

[3] UNICEF http://www.unicef.org/infobycountry/malawi_statistics.html.

economic and development policies before and after independence in 1964. In all these timeframes (pre and post-independence), the policies have been very economistic with social development side lined as an outcome of economic growth (Chilowa and Chirwa, 1997; Kishindo, 1997). Often ignored in policies are the distribution of resources such as land and water, and other means of production in society (Kambewa, 2006).

Smallholder farming production was restructured in the 1900s, which saw women in rural households producing the labour-power for food production (Vail, 1975; O'Laughlin, 2002). Most productive men migrated to other countries to work in plantations or mines in southern Africa as a result of the colonial poll tax. The rural areas of Malawi became a place for absorbing the old, the incapacitated and the temporarily unemployed in moments of market crisis (O'Laughlin, 2002). The situation got worse for rural society with the oil crises in the 1970s and the World Bank's Structural Adjustment Program (SAP) in the 1980s. These trends resulted in high transportation costs and removal of input subsidies on agriculture respectively. SAP aimed at establishing and supporting formal institutions through privatisation, contraction and reconstruction of government services (World Bank, 1992). As a result, internal and external trade was liberalised and new foreign exchange regimes were introduced that were premised on severe devaluations and cost sharing for state supplied services. The elimination of fertiliser and other subsidies resulted in little or no use of purchased inputs in smallholder farming. At the same time, the dismantling of state delivery agencies such as the Agricultural Development and Marketing Cooperation (ADMARC) prior to the emergence of domestic private capacity brought about sporadic geographical availability of agricultural inputs especially in remote locations. As a result, the 1980s witnessed stagnant or declining agricultural productivity and deepening rural poverty (Havnevik et al. 2007).

The Government of Malawi in its development roadmap, the Malawi Growth and Development Strategy (MGDS II, 2011-2016), chose poverty reduction as its main development agenda. The MGDS provides the overarching medium-term framework for poverty reduction. The MGDS aspires to attain the Malawi Vision 2020 and the Sustainable Development Goals (SDGs) by localising internationally set targets. More specifically, the MGDS recognises that sustained growth requires that Malawi conserve its natural resource base (fisheries, forestry, wildlife and the general environment) through sustainable use and management regimes. Thus, from an ecosystems perspective, the goal is to maintain biodiversity and reduce environmental

degradation while contributing to economic growth. The current contribution of natural resources (fisheries and forestry and wildlife) to GDP is at 12.8% (GoM, 2011).

2.2 The history of Lake Chilwa water level fluctuations

The environmental history of Lake Chilwa (formerly known as Shirwa) can be described in terms of time and space. To begin with the former, there are two predominant timescales governing the ecosystem variability: (a) Inter-decadal and (b) seasonal. The lake surface area periodically expands or contracts several-fold in years of extreme high or low rainfalls. Similarly, the lake level changes in wet and dry seasons within a year. The water level of Lake Chilwa has a long history of fluctuations mainly due to the balance between rainfall and evaporation (Nicholson, 1995). Figure 4 shows that Lake Chilwa had dried up during the period before 1850 as confirmed by lithological evidence (Owen et al. 1990). Stegman (1953) reported of the Village Headman Chendombo's story of a great drought and famine which forced the *Mang'anja* people, the main ethnic group of the Chilwa area, to flee to the Shire River while escaping the invading *Yao*. The *Yao* raids of the 1860s also support the early history of Lake Chilwa water recessions (Ajayi, 1989). The *Mang'anja, Yao* and *Lhomwe* are currently predominant ethnic groups in the Chilwa socio-ecological system. There is also an account that around 1900 one could walk across the dry floor of the lake to Chisi Island from the evidence of well-mixed sandy clay, hard pan layer in sediment cores from the lake (Nicholson, 1998). It has also been recorded that some of these droughts happened concurrently or at different times with those of Lake Malawi and the Tchiri (Shire) River (Mandala, 1990).

Official documentation of Lake Chilwa water levels shows twelve recessions between the early1900s and 2012. The Scottish explorer, David Livingstone was the first to document the Lake Chilwa water level changes in 1879. Since then, Lake Chilwa has had severe recessions in 1879, 1900, 1914-15, 1922, 1931-32, 1934, 1954, 1960-61, 1967, 1973, 1995 and 2012 (Kalk et al. 1979; Njaya et al. 1996; GoM, 2000; Jamu et al. 2012). Some of these recessions were complete dry-ups such as in 1934, 1967 and 1995.

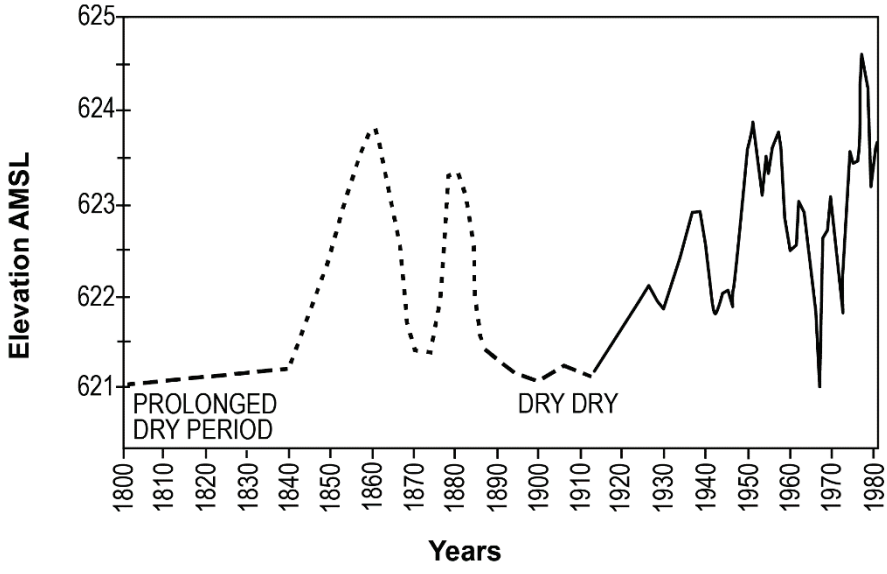


Figure 4. Lake Chilwa water levels since 1800, based on historical and geographical information beginning in 1949 and modern records. Source: Nicholson Sharon E. 1998.

There are four major spatial characteristics of the natural history of Lake Chilwa as provided by Kalk et al. (1979). These spatial characteristics are: (i) the Chilwa-Chiuta sandbar that closed off the Chilwa drainage basin, separating Lake Chilwa from Lake Chiuta about 8000 years, and eliminating the lake's outflow; (ii) the shallowness of the lake which over 200 years ago, the lake is said to be deeper than its current average depth. Lake Chilwa was once nine metres deeper than its current average depth of 2.5 metres and had an outlet into the Ruo River valley (Crossley et al. 1984); (iii) The dominance of the *typha* swamp which covers half of the flooded area of the lake and is ringed with an almost equal area of seasonally inundated floodplain (iv) the existence of deep pools in the inflowing rivers which serve as critical refuge for fish during lake drying periods. These pools may have been formed through reduction in the lake size. Some of the pools are deeper than the lake itself such as the *Mulera Nkhwazi* pool on Likangala River that is over five metres deep (Table 1). All pools over four metres deep (highlighted) are near the lake: four on the Likangala River and one on the Phalombe River, suggesting that these might have been part of Lake Chilwa at one point in time.

Table 1. Water pools as fish refuge along the major rivers of Lake Chilwa Catchment

Name of River (north to south)	Location (Village)	Name of Pool	Depth (m)
Zumulu River			1.90
Lingoni River			3.10
Likangala River	Namitapa	Mbede	3.25
		Sambaifa	4.00
		Namitapa	4.80
		Chidyambeya	4.00
	Mbalu	Mbalu 1	3.15
		Mbalu 2	2.70
	Nyangu	Namichimba	3.50
		Namasinde	2.40
	Matope	Nyendo	3.20
		Mazengeza	3.00
	Thunya	Misonje	3.00
		Chigumikire	3.85
	Mkungwi	Mkungwi	2.30
	Ramusi	Makhala Chaje	3.00
	Chiliko	Mulera Nkhwazi	5.10
	Chilunga	Matiti	1.50
		Upala	2.00
		Sinji	2.75
		Chisutu	1.20
		Chiiko	2.00
Sombani River	Mtemanyama	Papuli	3.60
	Nang'ona	Nang'ona	2.50
Phalombe River	Malambwe	Dzadala	4.70
	Chilima	Namadidi	3.20
	Kimu	Scheme	3.40
Mbugwe River (Mozambique)	Kanzimbi	Mozambique border	2.40
	Kanzimbi	"	2.80
Mnembo River (Mozambique)	Thom	Nankuyu	3.40
	Zomera	Zomera	2.80

Sources: John Wilson and additions by Joseph Nagoli in July 2013

2.3 Natural resource fluctuations in the Lake Chilwa ecosystem

Human beings benefit from a multitude of resources and processes that are supplied by natural closed ecosystems such as that of Lake Chilwa. Closed ecosystems are self-sustaining where bio-resources flow within the system without relying on organisms outside the system. Closed ecosystems can be highly productive and provide a number of services that bring both physical and non-physical benefits to people. Together, these benefits are known as ecosystem services. The Millennium Ecosystem Assessment (2005) grouped ecosystem services into four broad categories: *provisioning*, such as the production of food and water; *regulating,* which include the control of climate and disease; *supporting*, such as photosynthesis, nutrient and water recycling and crop pollination; and *cultural*, covering spiritual and recreational benefits. The Lake Chilwa closed ecosystem in particular provides a number of services that bring both physical and non-physical benefits to people valued at over USD 21 million per annum on average (Schuijt, 1999). A unique characteristic of the Lake Chilwa ecosystem is the presence of a large coat (500–600 km^2) of aquatic grass (swamp) covering the open water. A large flood plain area of marshes containing flowing perennial rivers and seasonally inundated floodplain of grassland between the rivers provides special attributes to the functioning of the ecosystem (van Zegeren, 1998).

However, recent advances in ecological research suggest that more closed systems than previously believed, are characterised by high variability in time and space. Although it is among the most productive fishery ecosystems in the tropics, Lake Chilwa, similar to other shallow lakes in Africa, is prone to periodic lake level fluctuation, and complete drying out during low-rainfall years (Talling and Lemoalle, 1998). In particular, the Lake Chilwa closed system is extremely sensitive to climate variability and changes in inflows and evaporation. As an emerging and imminent threat to the Lake Chilwa ecosystem, climate change projections for the region where Lake Chilwa ecosystem is located indicate a decrease in available water resources (IPCC, 2007). Some studies indicate that surface air temperature will increase by 2.6-4.7 degrees Celsius by 2075 (Chavula, 1999). Sarch and Allison (2000) note the greater importance of climate change in driving dynamics of fish stocks in African inland lakes such as Lake Chilwa. Fish stocks and their distribution will greatly affect people's livelihoods.

Fluctuating natural resources from the Lake Chilwa ecosystem are driving demand for wetland farming, water, energy and fish. The lake ecosystem is

under increasing pressure from the expansion of agriculture (in both the catchment and the floodplain) as human population rises and demand for food increases. The lake water is also used for irrigation as well as for domestic purposes. There are two large irrigation schemes in the Lake Chilwa floodplain (Domasi and Likangala) that provide water and space for the production of rice and other crops through intensive farming all year round (Ferguson and Mulwafu 2007). The vegetation is also used for thatching houses including construction of temporary homes both upland and for the lake's floating houses, locally known as *zimbowela*. These demands are causing conflicts of interest among the different ecosystem users and increasing competition for water (Kambewa, 2006). Conflicts also arise from differing interests reciprocally exerting social power in an effort to conserve natural resources or prevent other competitors from attaining them. For example, Lake Chilwa is an important site for biodiversity conservation under the Ramsar convention (2005). It was designated as a Ramsar wetland of international importance in 1996 to protect large numbers of nationally and internationally vital flora and fauna, including 153 species of resident birds and 30 species of migratory palearctic birds (Njaya et al. 2011a). Table 2 lists some of the natural resources identified as important in Lake Chilwa and its surrounding wetland. Following the Ramsar declaration, a comprehensive and multi-sectoral plan was developed which focused on treating natural resources as economic goods. Access to birds by the residents in the ecosystem during recessions became limited by this declaration. In this case both power relations and economics played an important part in accessing scarce resource during low production periods. Peluso and Watts (2001) have attested that when conflict occurs around access to natural resources, its influence is typically mediated by social, political, and economic factors. This is a rather different view than Homer-Dixon (1999) who saw conflicts over natural resources as a consequence of resource scarcity.

Table 2. The main natural resources from the Lake Chilwa ecosystem

Resource	Species (scientific name)	Local name
Fish		
	Oreochromis. shiranus chilwae	Makumba
	Barbus paludinosus	Matemba
	Clarius gariepinus	Mlamba
Vegetation		
False bulrush	*Typha domingensis*	Njeza
Flotters	*Aeschomene pfundi*	Mabungwa
Sedge	*Cyperus articuulatus*	Mlulu
……..	*Typha sp*	Mabawe
Hippo grass	*Vossia cuspidate*	Duvi
Reeds	*Phragmites mauritianus*	Bango
Nile cabbage	*Pistia stratiotes*	Chipiri
Hornwort	*Ceratophyllum demersum*	Kakombwe
Water hyacinth	*Eichornia crassipes*	Namasupuni
Animals and reptiles		
Hippos	*Hippopotamus amphibious*	Mvuwu
Crocodile	*Crocodylus niloticus*	Ng'ona
Snakes (lowland swamp viper)	*Antheris superciliaris*	Njoka
Soft –shelled turtle	*Cyloderma frenatum*	Nombo
Birds - waterfowl		
Fulvous whistling ducks	*Dendrocygna bicolour*	Chipiyo
White-faced whistling ducks	*Dendrocygna viduata*	Chipiyo
Reed cormorant	*Phalacrocorax africanus*	Mphipi
Lesser moorhens	*Gallinula angulata*	Nthutuwiri
Lesser gallinule	*Porphyrio porphyrio*	Nadititi
Spur-winged goose	*Plectropterus gambensis*	Sekhwe
Pink-backed pelican	*Pelecanus rufescens*	Chikovili/Vuo
Great white pelican	*Pelecanus anocratalus*	Chikovili/Vuo
Little egret	*Egretta garzetta*	Kakowa
Cattle egret	*Bubulcus ibis*	Kakowa
Yellow billed egret	*Egretta intermedia*	Kakowa
Grey-headed gulls	…..	Nkhalakata

Source: Updated from the Lake Chilwa Climate Change Adaptation Program.

2.4 Livelihoods in the Lake Chilwa Aquatic Agricultural system

Aquatic Agricultural Systems are highly productive and important for the livelihoods of poor people. In Malawi specifically, AAS support about two million people who live along lakes, river basins and flood plains. Aquatic Agricultural Systems (AAS) combine activities that harness the natural productivity of freshwater and coastal ecosystems with intensive farming (GoM, 2000, Kabwazi and Wilson, 1998). The farming is often a complex and seasonally dynamic mix of annual and perennial crops, livestock rearing and fisheries.

The Lake Chilwa AAS, comprising of the inland lake, rivers and the fertile floodplain, is an important source of food, employment and income to over a million people. When barriers to accessing natural resources are low and other local economic activities have been eroded by the general macro-economic conditions, AAS provide livelihood safety-nets for the rural communities (Béné and Neiland, 2005). In the Lake Chilwa Basin, the high population growth rate of approximately 3% (NSO, 2008) exacerbates the presssure on natural resources and has resulted in an immense loss of forest cover decreasing the forest area from 5084 hectares to less than 1,000 hectares between 2001 and 2011(Chanyenga et al. 2011). Furthermore field surveys by Mankhambera et al. (2011) showed that indigenous tree species such, as *Pterocarpus angolensis, Khaya anthotheca* and *Afzelia quanzensis,* were facing extinction due to high demand for their wood in the construction and furniture industries. In addition, tree species of high medicinal values such as *P. angolensis*, *Prunus africana*, *Psorospermum febrifugum*, *Olax obtusifolia* and *Ormocarpum kikii* were also facing local extinction (Chanyenga, 2004) Firewood gathering and charcoal production is placing further pressure on tree stocks in the Lake Chilwa Basin. Many people in the Chilwa AAS and surrounding cities of Zomba and Blantyre use firewood for cooking. In general 90% of Malawi's energy for cooking comes from firewood and charcoal (Ngulube et al. 1999) and in particular about 6500 tons of wood fuel is used annually to smoke fish (Kabwazi and Wilson, 1998) in the Lake Chilwa AAS. Earlier livelihood and ecological studies indicate that the Lake Chilwa ecosystem is under extreme pressure from the on-going deforestation and fires in its catchment, on top of the periodic complete recessions of the lake (Njaya et al. 1996; Jamu et al. 2003; Kambewa et al. 2007).

People in the Lake Chilwa Basin are subjected to frequent and sudden climatic shocks with few supporting services. The Lake Chilwa AAS often has

poorly distributed annual rainfall. It may not be surprising to have floods and drought in the same year. Like the whole of Malawi, the area, has one annual rainfall season that normally runs from November to April. A single seasonal crop production and lake dry-ups have devastating impacts on communities' livelihoods (GoM, 2000). Despite the vulnerability of the Lake Chilwa AAS, those who are dependent upon it benefit from the system's high productivity, which provides food and income generating opportunities during normal years. According to Schuijt (1999), fishing is the foremost occupation in the system and contributes about USD18 million per year on average. Agriculture in the Lake Chilwa ecosystem is valued at USD 1.2 million per year, the lake grasslands at about USD 640,000, surface water at USD 400,000 and birds at USD 215,000 annually. However, the worth of ecosystem services provided by Schuijt may be an undervaluation. There are other cultural values such as swimming and shrines on the main islands that are not included in the valuation of the ecosystem. Similarly, the ecological value of the vegetation to provide both space for feeding and breeding of fish and water filtration to reduce water turbidity (Mloza-Banda, 2005) is missed in the valuation.

In normal years (without a recession), livelihoods are secured through diversification. The people's diverse sources of livelihoods include farming on the wetland, fishing and fish-related businesses, wage labour from both from formal employment and selling labour during peak farming seasons. Livestock is owned by about 12% of the households (Figure 5). At Chisi Island, the average household had a combination of at least four livelihood strategies including fishing, fish trading or processing, making handicraft and farming.

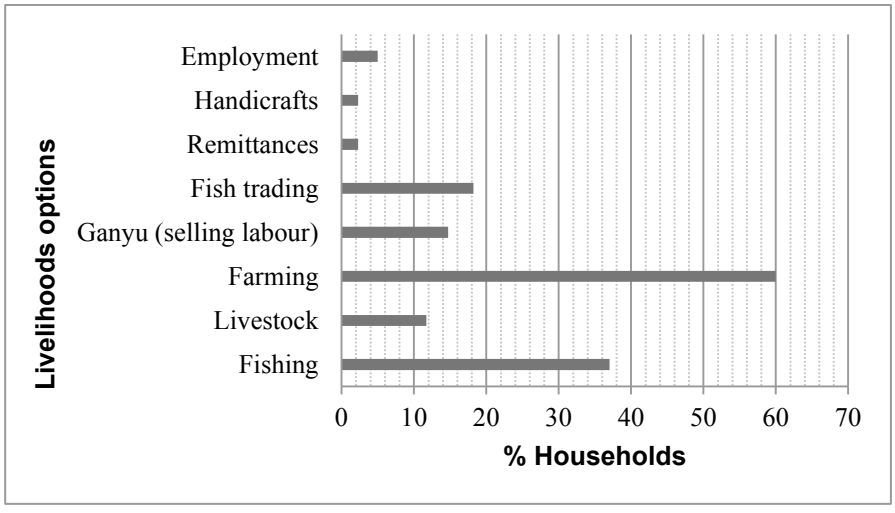


Figure 5. Livelihood diversification in the Lake Chilwa AAS.

Diversification is also common within farming through the growing of numerous crops and different varieties of each crop. The study found over 20 different crops being grown in the Lake Chilwa Basin (Table 3). Aside from maize, the importance of each crop varied among different areas. For example pigeon peas economically were more important in the middle basin, while rice was important in the lower basin. Sorghum was important food crop in Machinga (second to maize) as compared to cassava in Zomba and Phalombe.

Table 3.Crops and their importance in the Lake Chilwa socio-ecological system

Crop	Perceived importance (%)
Maize	37
Pigeon peas	15
Rice	10
Sweet potatoes	7
Groundnuts	6
Cassava	6
Common Beans	5
Sorghum	4
Peas (green peas, cow peas, chick peas)	2
Tobacco	2
Sunflower	2
Leafy vegetables	2
Millet	1
Others (sugarcane, cotton, okra)	1

As illustrated above, all livelihood options are natural-resource based and are thus affected by shifts in resource availability. This implies that communities' livelihoods are affected by both seasonal and periodic variations brought about by disparities in rainfall amounts and distribution, temperatures changes and macroeconomic conditions. The main livelihoods sources: farming, fishing, and businesses, were seasonal. It was particularly pointed out during FGDs that fish trading was highest in June because this is the period that people have high catches of *Barbus spp* (commonly known as *matemba*) and high incomes from farm products. Households had the lowest income levels in January and February (Figure 6) as this is the period when the lake is closed for active fishing resulting in less incomes sources for people. Furthermore, this is also a period with high farm labour demands due to weeding maize fields and transplanting rice requiring high cash demand.

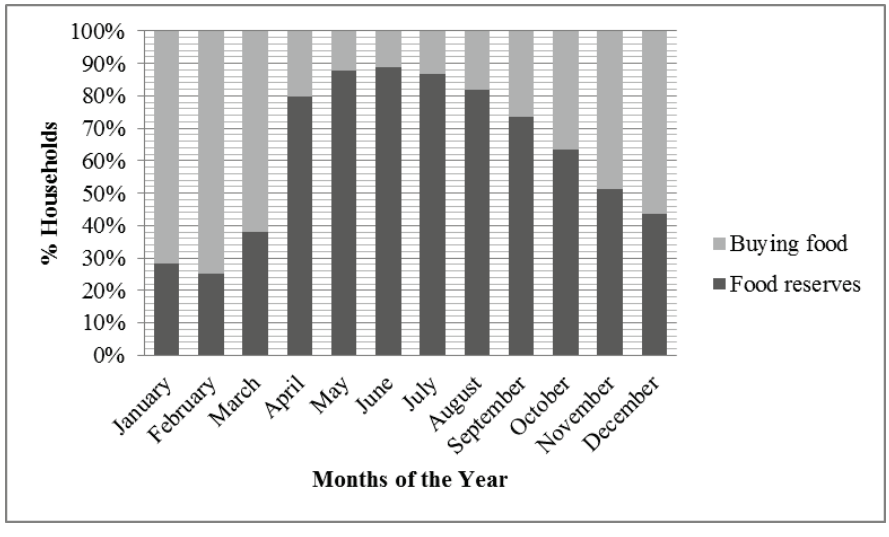


Figure 6. Household food accessibility by households at Chisi Island (N=150).

2.5 Gendered division of labour in the Lake Chilwa socio-ecological systems

The gender division of labour is a central feature of gender inequality, both in economic aspects and in the social construction of gender identities (Huber, 1991). Although the importance of involving women in environmental and natural resources management in the developing world has long been acknowledged, women continue to be discriminated against when it comes to rights and access to natural resources (Agarwal, 1989). Gender inequalities between men and women around access rights to resources reduce women's ability to harness the benefits from ecosystem services for the household (Chiweza, 2005, Mulyoutami et al. 2013). Similarly, gender ideologies and stereotypes of the expected characteristics of a particular gender group provide barriers for women to gain resource rights and equitable status. In the fisheries sector, stereotypes result in gender dynamics and governance regimes that determine differential access to, and control of, resources between women and men. For example, women dominate the production, processing and marketing of fish species regarded as uneconomic species and the bigger fish species are expected to be traded by men. As a result relevant information and production resources are not reaching women and benefiting them in fish value chains (Chiwaula et al. 2012; Satia and Wetohossou, 1996).

However, research findings on gender show women as better custodians of natural resources than men. Arora-Jonsson's (2013) analysis of women's activities in Nayagarh and Drevdagen clearly illustrates that when women are given opportunities to govern natural resources, they look beyond the economic benefits of the resource to consider sustainability and social value. Research has further shown that women's status in the society and their bargaining position could improve if they were given rights to land and water (Chiweza, 2005; Agarwal, 1994).

In Malawi, women comprise 52% of the country's total population and the majority live in rural areas (NSO, 2008; FAO 2011). However, gender studies related to land-use show varied roles of males and females in the agricultural production chain, from land preparation to marketing (Kiptot and Franzel, 2012; Meinzen-Dick et al. 2012). Although women comprise 70% of the full-time agricultural labour force, they have limited access to agricultural extension services, training, and legal representation (GoM, 2008). At the same time women's labour supply is also constrained by their multiple roles in reproduction and household chores (Elson, 1992). More often than not, women

are responsible for water and fuel wood collection, child care, caring for the sick and the elderly and food preparation, while being expected to contribute equal amounts of agricultural labour (GoM, 2008). The amount of labour demand from women drastically increases as resources deplete. For example, during the 1996 Lake Chilwa dry-up, women and children from Chisi Island walked long distances to look for food from the mainland (see picture below). Similarly, deforestation makes it increasingly difficult for women to collect wild herbs, fruits and natural medicines or fuel wood for cooking.

Picture 2. Chisi Island Women and children collecting food from the mainland during 1996 Lake Chilwa drying. Photo by Sosten Chiotha.

In the fisheries sector, gender issues are viewed from the perspective of gender roles and involvement in development activities of the sector (Satia and Wetohossou, 1996). In the Lake Chilwa fisheries sector, the actual fishing activity is done by men while women have traditionally been occupied in pre and post harvesting activities, such as processing and marketing of the predominant fish species –*Barbus spp* (Chiwaula et al. 2012). Women are the major fish processors, and yet access to fish processing technologies seems to be limited. Similarly, the African Development Bank [2006] reported that fish

processing in the form of drying, smoking or salting was almost exclusively done by women in Zambia. In West Africa, Satia and Wetohossou (1996) found that the processing and selling of fish in fishing communities is a gendered activity. In cases where women are involved in the actual fishing activity, the large boats used to fish off-shore and in deep-sea waters have male crews, while women manage smaller boats and canoes.

The fact is that Women's economic well-being in Africa is inextricably linked to natural resources availability. However, the endowments and exchange entitlements on natural resources including land are mediated by social relations (Sen, 1990). Thus, entitlements are legally and socially defined rights to resources (Fortmann and Rocheleau, 1997; Djoudi and Brockhaus, 2011). Furthermore, the analysis of the household economy tends to suggest gender differentiated roles in implementation and preferences as stereotypes linked to knowledge (Villamor et al. 2014).

Women's access to land and general decision-making in the Chilwa ecosystem may appear slightly better than other parts of the country. This is due to its matrilineal society and uxorilocal residence (whereby husbands come to live in their wives' villages). The matrilineal system in Malawi and Lake Chilwa ecosystem in particular provides women with relatively strong rights over land allocation and use. The value of women in regards to land ownership in matrilineal system has not significantly changed. Hirschmann and Vaughan (1983), studying land tenure in the matrilineal society in the north of Zomba District in the 1940s found that women had a high degree of security of tenure, whilst men had very little. Similarly, Hirschmann and Vaughan also found that 80% of women in Zomba would not lose their land in the event of a divorce or separation. The situation is similar to the Chewa matrilineal society from the central region of Malawi (Phiri, 1983).

2.6 Introduction to present study

Lake Chilwa is an ecological system as well as an economic network. There are complementary flows of income between fishing and farming where income from fishing is used to buy farm inputs and food. Furthermore, food from agriculture supports the fishing communities especially those living on Chisi Island. In general, the lake and its wetland provide a diversity of livelihoods for the people around it. But what happens when the ecosystem is no longer able to support these livelihoods during recessions? How do people survive the lake water recessions? Research conducted on Lake Chilwa,

summarised in Table 4 below, falls short of linking livelihood coping strategies to water level changes. Recent findings, especially those on the limitations of Lake Chilwa fishers to migrate to other lakes (Njaya, 2009) and the limited access to Lake Chilwa wetlands for farming (Kambewa, 2006), in addition to the current restrictions of the wetland resources as a Ramsar protected site, reveal knowledge gaps in the understanding livelihoods coping strategies in the Lake Chilwa socio-ecological system. While it is recognised that people who depend on the Lake Chilwa ecosystem have coped with past recessions and that the increase in population is putting new pressure on renewable resources (Sarch and Allison, 2000; Njaya et al. 2011a), there is a dearth of empirical data explaining changes in coping strategies over time.

While records of the environmental history of Chisi Island have been described in the 1994 Malawi National Environmental Action Plan (GoM, 1994), the social and economic aspects of environmental scarcities are not well-understood. Furthermore, while the periodic recessions of Lake Chilwa generated considerable research by ecologists and environmentalists, the lake's social and economic history languishes in relative obscurity. A general analysis of the impact of fisheries management on the livelihoods of communities in the Lake Chilwa socio-ecological system is lacking. Sarch and Allison (2000) observed discrepancies between fisheries management in the climate-induced fluctuations of Lake Chilwa and that of the people's livelihoods. I therefore hypothesise that previous research in the lake ecosystem has led to undermine the historical achievements of the communities and damaged prospects for further development along indigenous lines. Without validation of social changes in the Lake Chilwa socio-ecological system, local knowledge will not be recognised in government or NGO policy or practice. Nowadays, indigenous knowledge is pivotal in discussions on sustainable resource use and balanced development. There is growing recognition that indigenous peoples are disproportionately affected by the economic, social and environmental impacts of climate change and that their traditional knowledge may be critical for effective coping strategies (Pelling, 2011; IPCC, 2007; IPCC, 2014).

Table 4. Research conducted and documented in the Lake Chilwa ecosystem between 1960 – 2009 indicating significant decisions related to use of the lake.

Year	Main Research issues	Researchers
Biological studies		
1960	Study on gillnet selectivity. The research recommended 100mm as the minimum mesh size for fishing *Oreochromis shiranus chilwae*. Later on, a trawling experiment recommended trawling as a commercial fishing operation on the lake, but because of the variable nature of the ecosystem in terms of water level changes, the operations did not justify its economic sustainability.	Department of Fisheries formerly called Department of Game, Fish and Tsetse fly Control
1979	Biological and socio-economic dimensions of the Lake Chilwa fishery: fisheries resources including biological characteristics of catfish (*Clarias gariepinus*) in surviving recessions; impacts of water level changes on the fish species and chemical and physical processes of the ecosystem; and social change in terms of human settlement in relation to their dependence on fishing, trading and farming activities.	Kalk et al. (1979)- University of Malawi
1996	Ecosystem studies with a focus on community involvement in the management of the lake's natural resource including birds and fish. The study also found that the ecosystem harbours 153 species of resident and 30 species of palearctic (migratory) water birds, which led to the declaration of the Lake Chilwa wetland as a Ramsar Site No 869 in 1997 (Ramsar Convention Bureau, 1999).	Department of Parks and Wildlife and the University of Malawi
2000 - 2001	Land use studies by Malawi Germany Fisheries and Aquaculture Development Project (MAGFAD) and Danish International Development Agency (DANIDA). Recommended protection of vegetation along the lake in order to maintain breeding and feeding grounds for juvenile *Barbus sp* in the dry season.	DANIDA, MAGFAD
Social studies		
1983, 1999 - 2002	Lowore (1999) observes the lack of justifiable reasons for introducing management measures for Lake Chilwa within the fabric of co-management framework. Sarch and Allison (2000) argued that co-management could be a basis for the establishment of user and access rights and hence restrict other resource users. Allison and Mvula (2002) highlighted importance of migration and that any regulatory mechanism that focused on migration of fishers was counterproductive to their livelihood. Landes and Otte (1983) observe that migration has been common on Lake Chilwa including 'periods of stable water level'.	Allison and Mvula 2002; Lowore and Lowore (1999); Landes and Otte (1983); Sarch and Allison (2000);
2001-2003	Institutional analysis, examining the contextual variables and outcomes of the co-management arrangement. The key finding of the study was that the Lake Chilwa co-management was largely consultative[4].	Wilson et al. (2005). Innovative Fisheries Management (IFM)
2002 - 2005	Kambewa observed that user rights of wetlands are in the hands of chiefs and other elite households. In this case, people have to negotiate their access through the chiefs or the elite households. The findings refute the current assertion by government that the Lake Chilwa wetland was unallocated land with open access.	Kambewa, 2006
2004 - 2009	Study of the patterns of fisher migrations within Lake Chilwa and between the lake Chilwa and other lakes. The study showed that majority of the resident fishing households do not migrate from Lake Chilwa to other lakes even during recession times because their gears and fishing techniques are limited to shallow water ecosystem.	Njaya, 2009

[4] The co-management typology has five distinctions namely: *instructive, cooperative, advisory, informative and consultative* - in this scenario, the partners consult, but the government makes final decisions.

3 Conceptual Framework

The study of livelihood coping strategies of the communities in the Lake Chilwa ecosystem was guided by the livelihood approach. The livelihood approach looks at *the way of life* or the making of a living. In understanding the way of life, especially during environmental scarcity as in the case of Lake Chilwa recessions, other concepts were used such as political ecology to understand power relations and governance over access to the natural resources. The fusion of livelihoods and political ecology approaches results in a detailed understanding of the complexities that shape human-environment interactions especially for livelihoods that depend on natural resources whose availability fluctuates seasonally and periodically.

My approach is therefore influenced by this understanding of the link between coping strategies and livelihoods. If coping strategies should reflect the dynamics of peoples' livelihoods, then coping must be seen as a process that changes and is in itself adaptive and flexible in order to address locally-specific and changing circumstances such as the Lake Chilwa water recessions. Livelihood coping strategies are not only a result of complex interplays between consumption and production decisions, but they are shaped by complex and locally specific social considerations (Adger and Kelly, 1999; Pelling and High, 2005; Bohle et al. 1994). Smit and Wandel (2006) show that 'coping capacity' and 'coping actions' become integral parts of everyday decision-making about livelihoods. This makes coping and livelihoods inseparable in a setting where individual experiences challenge their well-being.

However, my point of departure is that instead of just looking at consumption and/or socio-cultural means of earning a living (Long, 1997 and Blaikie et al. 1994), this thesis attempts to explain the drivers to coping actions in particular recessions. In this context, I recognise *coping* as not only a change

in a single behaviour, but also change in the suite of beliefs and practices related to overcoming a shock that take shape under locally specific conditions of uncertainty. The research also recognises that different institutions and agents will facilitate people's livelihood coping strategies during environmental shocks at different levels, from household to society to national levels. The scale at which different institutions operate, will determine the resources and entitlements that allow resource use. Douglas North (1990:1) defined institutions as a set of rules and norms and referred to them as "humanly devised constraints that shape human interaction". North takes this conception of rules to argue that sustainable utilisation of natural resources requires well-defined institutions and institutional frameworks. Institutional frameworks include the rules and beliefs as well as the relational networks that arise in the broader societal context (Meyer and Scott, 1992).

3.1 The Livelihoods Approach

Rural communities of Africa use diverse means of livelihood strategies in order to enhance their coping capacity (Smit and Wandel, 2006; Morduch and Sharma, 2002; Pahl-Wostl, 2002; Moss et al. 2001; Ellis, 2000). Bebbington (1999) conceptualised rural livelihoods as being "the diverse ways in which people make a living and build their worlds." Similarly, Long (1997) explained that the livelihoods concept expresses the idea of individuals or groups striving to survive. Livelihoods are meant to meet people's various consumption and economic necessities, cope with uncertainties, respond to new opportunities and provide alternatives between different value positions. Blaikie et al. (1994) extend the concept of livelihood to include social and cultural means, i.e. "the command an individual, family, or a social group has over an income and/or bundles of resources that can be used or exchanged to satisfy its needs". Livelihoods in this case may involve information, cultural knowledge, social networks and legal rights as well as tools, land and other physical resources. However a livelihood can only be sustainable when it can cope with and recover from stress and maintain or enhance its capabilities and assets in both short and long terms without undermining the natural resource base (Chambers and Conway, 1992; Scoones, 1998). In other words, sustaining livelihoods is not just what people do in order to make a living, but also caring for the resources that provide them with the capabilities to build a satisfactory living. This includes the risk factors that people must consider in managing

their resources, and the institutional and policy context that either helps or hinders people in their pursuit of a viable or improved living (FAO, 2004; Ellis, 1998; 2000).

3.2 Power relations in accessing natural resources

Power relations in this thesis are analysed through a political ecology perspective whereby power is seen as influencing control and access to natural resources (Wolf, 1972). Campbell and Olson (1991) have observed that decisions regarding which resources to develop for which industries and where such activity will occur are not arbitrary, but rather reflects the objectives of the powerful interest groups whose power is mediated through political, social and economic institutions. Power and politics determine the access and distribution of specific resources and thus create scarcity for the society at large especially for common pool resources. Common pool resources are regulated by user groups by collective ownership or through customary tenure (Feeny et al. 1990; Sandström, 2008). Common pool resources have user rights and have mistakenly been regarded as open access. In contrast, an open access situation describes unregulated use of an undefined group of users (Bromley, 1991).

The concept of access is central in understanding how power distribution is structured, how it determines the distribution of the means of production, and ultimately how it influences people's livelihood opportunities as well as natural resource management. Ribot and Peluso (2003) defined access as "the ability to derive benefits from things." Access involves the ability to use resources that are required to secure livelihoods of communities or individuals in the community (Blaikie et al. 1994). For the purposes of this thesis I am using the categorisation by Raik et al. (2008) of how power is operationalised in natural resource use and management: (i) coercive power where decisions made by a single authority are forced on local people in resource use and management; (ii) constraint power where knowledge by resource managers limits negotiations; (iii) power that produces consent and accounts for structural changes. This type of power is demonstrated through use of persuasive speech or communication to influence or reproduce pre-existing power relations.

3.3 Definitions of main concepts of the thesis

3.3.1 Household and community

Coping with shocks such as the lake recessions can be done at different levels: household, community and/or societal. The definitions of household and community and their differences have been contested in rural development studies (Guyer, 1981; Guyer and Peters, 1987). Austin (2005) defines a household as a group of people living together and eating from the same pot. Frank Ellis (1998) defines a hosehold as "the social group which resides in the same place, shares the same meals and makes joint or coordinated decisions over resource allocation and income pooling," and Niehof (2004) defines the household as "a family based co-residential unit that takes care of resource management and the primary needs of its members". From these definitions, it can be seen that the household is an elusive unit and difficult to universally define. This study therefore does not attempt to define the household, but recognises it as a social unit in decision making that is beyond the control of the individual decision-maker. Similar to the findings of Vaughan (1983), the principle of household self-sufficiency is very strong in southern Malawi. More importantly, where most jobs in Malawi do not pay enough for an individual to live on, the household becomes the centre of the economy. A household is where members mix and pool all types of income from wages, handicrafts, farming, and small business; it is the place where 'the economic' and 'the social' interact every day (Wilk and Cliggett, 2007).

The use 'household' in this study mainly focuses on the household relationships in a *community*. A community is a social entity with tight and cohesive family and kinship ties (Messing, 2009). The concept of 'community' is sometimes used when referring to 'village'. Villages in Malawi are commonly composed of one lineage descent. However, the concept of community can be problematic if it is assumed to include homogeneity of interests, conditions and relations. In this study community is used to emphasise the collectiveness and cohesiveness of households. By studying how communities cope with a disaster, we get insights into households' organisation especially the social networks and collective responsibility (Folke et al. 2005) in coping with the Lake Chilwa recessions.

3.3.2 Coping and adapting

Coping and adapting are both concerned with responding to perturbations that threaten livelihoods. However, the major distinction between the two is related to the time scale along which each occurs. Davies (1996) defined coping and adapting broadly as the actions, short-term and long-term respectively, that humans use to overcome a disturbance within changing environments. According to Smit and Wandel (2006), coping and adaptive strategies can be classified according to their: timing (anticipatory, concurrent, reactive); intent (autonomous, planned); spatial scope (local, widespread); and form (technological, behavioural, financial, institutional, informational).

On one hand, coping deals with immediate actions oriented towards survival and can thus be described as a suite of responses taking place in short-term decision-making based upon the consequences for the livelihood asset base (Davies and Hossain, 2000). According to Ellis (1998), livelihood asset base is understood as the totality of human capital, liquid capacity and productive assets that household members deploy to reproduce and sustain the household. Usually coping involves households drawing on their savings or consuming fewer meals first, then disposing of more productive assets (e.g., tools) and finally responding in ways that merely enable their survival such as migrating to another area for assistance (Corbett, 1988; Devereux, 1999).

On the other hand, 'adapting' is associated with planned action, either anticipating a threat or averting its impacts and infers some measure of consistency of response (Smit and Skinner, 2002). Adaptation has been used to answer key questions in Human Dimensions of Global Change (HDGC) research, ranging from concerns on how particular hypothetical actions might moderate the impacts of modelled changes in the future to the facilitation of certain adaptation initiatives at the local level (Smit and Wandel, 2006). In understanding human responses to environmental stresses, O'Brien and Leichenko (2007) define 'adaptation' as the capacity of social systems to respond to the effects of climate variations or change by being sensitive to changes in the social, political, economic and environmental context. Another typology of adaptation by West and Gawith (2005) distinguishes between: (a) 'building adaptive capacity' - generally considered to include elements such as economic wealth, technology, infrastructure, information, knowledge and institutions (b) 'taking adaptive action', with the latter assumed to follow the development of the former. In further defining the distinction between 'adaptive capacity' and 'adaptive actions', Oppermann (2011) defines 'adaptive capacity' as considerations of particular kinds of knowledge and

practice limited to a scientific framing of climate change; and 'adaptive actions' to be sensitive to the connections between and within society.

People have used *coping* and *adapting* interchangeably as modes of response to environmental shocks. This thesis is aligned to coping as a distinctive strategy. This is because responding to a shock such as the Lake Chilwa recessions is a short term means of survival. Sarah Berry (1993) in her book *No Condition Is Permanent* shows how multiple and shifting institutional frameworks for accessing land and labour created coping strategies that were not adaptive to long term survival but rather caused a decline in resource base for farmers. Agrawal (2008) says that coping to a shock is highly local, and its effectiveness depends on local institutions through which incentives for individual and collective action are structured. The choice of specific livelihood coping strategies is therefore dependent on social economic endowments of people and their ecological location, social networks, institutional relationships and power (Agrawal, 2008). However, the question of what shapes decision-making as an issue for understanding strategic responses across this broad range of purposes, remains unresolved in literature.

3.3.3 Ecosystems and socio-ecological system

This thesis looks at social dynamics within an ecosystem hence emphasising on 'socio-ecological system.' Ecosystem is defined as the network of interactions among organisms, or between organisms and their environment (Odum, 2007) and is drawn from systems ecology on the thermodynamics of self-organising processes. It is based on the premise that living and non-living things in nature are regarded as linked together through nutrient cycles and energy flows (Odum, 2007). However, social-ecological system refers to a set of critical resources (natural, socio-economic, and cultural) whose flow and use is regulated by a combination of *social* and *ecological* systems (Redman et al. 2004; Adger, 2000). Social and ecological systems are deeply interconnected and co-evolving. Social–ecological systems have links across temporal and spatial scales where levels of organisation and decisions in one place affect people and environments elsewhere (Gunderson and Holling, 2002).

This thesis does not analyse ecosystem energy flows and socio-ecosystem links. The concepts of ecosystems and or socio-ecological system are rather used to understand the dynamics and the ability to generate services while accounting for the human dimension that shapes and is shaped by nature (Folke, 2006). Studies have shown that humans show great ability to cope with change in a system if examined through the social dimension lens (Berkes et al. 2003;

Walker and Meyers, 2004). This is important to understand, as coping strategies can be implemented at the expense of sustaining the ecosystems and can generate traps and breaking points in socio–ecological systems.

3.3.4 Vulnerability

Livelihood coping strategies are often associated with high vulnerability. The often-cited definition of vulnerability is one conceptualised by Chambers (1989) that defines vulnerability as "exposure to contingencies and stress, and difficulty in coping with them." According to Chambers, vulnerability is generally considered to have two dimensions: the external (the risks, shocks, or stressors) and the internal (the inability of a particular entity to respond to perturbations). Vulnerability, like coping, occurs at multiple levels of human organisation – individual, households and community. At the individual level, Adger (2006) associates vulnerability to limitations in accessing resources, diversity of income sources and social status within the community. At the household and community level, Wisner et al. (2004) define vulnerability as "the characteristics of groups of people and their situation that negatively influence their capacity to anticipate, cope with, resist and recover from the impacts of a hazard." Vulnerability at community level is therefore seen as determined by a host of complex social processes and economic factors, from access to resources through informal and formal social security.

Communities throughout rural sub-Saharan Africa frequently encounter numerous shocks or stressors that can impact their level of vulnerability such as droughts, flooding, pests, disease and political instability (Casale et al. 2010). The *space of vulnerability model* by Watts and Bohle (1993) is particularly useful in this case because it recognises the risk of exposure to shocks or stressors and the risk of having insufficient means to cope, including the risk of becoming severely burdened and incapable of fully recovering from crises. Leichenko and O'Brien (2002) argue that patterns of vulnerability in communities are becoming more dynamic due to rapidly changing institutional, environmental, and socioeconomic contexts.

However, discussing the vulnerability of communities obscures the fact that the impact of a hazard is not evenly distributed within a community. For example, even though lake recessions may have affected the whole population in the Chilwa socio-ecological system, the impact may differ depending on variations in individual or household assets.

4 Research methodology

The methodology used to carry out studies for this thesis utilised both qualitative and quantitative methods. Qualitative methods included Focus Group Discussions (FGD), in-depth interviews with key informants, direct observations and the study of archives. The quantitative method comprised a structured household questionnaire survey. The theoretical approaches described in the theoretical framework chapter guided the process in ensuring that questions were well framed and relevant for understanding the human-environment interaction.

In working through the complexity of the study, a pragmatic approach was adopted where multiple studies were conducted in three phases:

- Phase 1: a household questionnaire survey coupled with FGDs conducted in August 2010. The questionnaire was adapted from previous research by the Lake Chilwa Climate Change Adaptation Program to fit the current context. It included questions to understand livelihoods such as status on food and nutrition security, socio-economics, social networks and institutions.
- Phase 2: a study of the Malawi National Archives (MNA) conducted from March to June 2012. The study reviewed periodic data and other historical reports from government departments during the recession periods on fisheries, agriculture, meteorology and demography.
- Phase 3: conducted from August 2012 to March 2013 involved direct observation, in-depth interviews and FGDs.

This pragmatic approach was supported by wider trends of interpretive perspectives that increased the understanding of critical, social and

organisational issues related to coping strategies at household and community levels (Walsham, 2006; Bernard, 2011). The interpretive approach operates under the assumption that access to reality is possible through social constructions such as language and shared meanings (Walsham, 2006). Critical theorists assume that people can consciously act to change their social and economic conditions. They also assume that social reality is historically constituted and that it is produced and reproduced (Ngwenyama, 1991; Walsham, 2005; Hirschheim and Klein, 1994). When conducting interpretive research it is generally accepted that researchers interact directly with the subjects of their research over a period of time.

4.1 Household survey

The household survey used a structured questionnaire that inquired on a wide variety of information relevant to rural livelihoods (Appendix I). The survey consisted of questions on:

a) Basic socio-economic information: such as composition of the household, occupation of its members (or the main way of finding cash), ethnicity, literacy levels and ages of the household members.
b) Food and nutrition security: information on food and cash crops grown, total land size, fertiliser use and livestock ownership.
c) Access to natural resources: such as group participation, trust, and aspects of community cohesion and support.
d) Vulnerability and coping strategies: included migration patterns, social networks and household assets.

The questionnaire was administered to 150 households representing more than 30% of total households from the villages of Kotamo, Chilima, Tchuka, Khumali and Mkumbira. The villages were purposively sampled based on their differences in socio-economic profiles such as presence and distance to schools, markets and health facilities. Households were randomly sampled using household registers from village heads. The questions were originally developed in English, the official language of Malawi and asked in the national language, *Chichewa,* after consent was granted by the interviewees or heads of the family. The household survey used two additional research assistants to help in administering the questionnaire following a training that included pre-testing the questions on a different community in Zomba. The questionnaires

were completed in a structured interview, where we read and interpreted the questions to the respondent and wrote down the answers as described by Iarossi (2006).

4.2 Focus group discussions

Many of the topics discussed through focus groups were similar to those included in the household survey, but were explored in greater depth using the community as a unit of analysis. When conducting FGDs, questions were presented as guidelines for discussion using five participatory research tools namely: resource mapping (Figure 7), institutional analysis, cause-effect analysis, seasonal calendars, and well-being or ill-being analysis (see Appendix II). FGD were conducted along with household surveys and in-depth interviews. To facilitate openness, women and men formed separate groups. Each group had an average of 18 people. In all villages, the FGDs involved fishers, fish processors, traders, transporters, farmers, natural resource governance leaders, and traditional leaders. All groups consisted of local Chisi residents and migrants of all gender groups including women, men, and youths. The FGDs generated deeper knowledge on past recessions of Lake Chilwa, food security status during recessions and during normal lake levels, common challenges that people face in each village, and consensus discussions of household assets as a proxy of well-being. Groups also discussed on their perceptions of vulnerability including people's hopes and fears for the future.

Figure 7. Map drawn by Women Focus Group showing resources in Maluwa Village on Chisi Island.

4.3 Direct observations

The aim of direct observation was to observe livelihoods strategies, social networks, governance issues and customs and interpret deeper meanings to social actions (Walsham, 1995). Direct observation provided rich data through an interpretive approach on the social reality and subjective meanings held by people by eliciting and observing what is significant and important to them (Bernard, 2011). During observations, it is not necessarily reporting evidence or realities, but interpreting of other people's interpretations (Walsham, 1995).

Observations on Chisi Island were done by residing with the community at Kotamo Village (Picture 1) from August 2012 to March 2013. Kotamo village is the main hub for fish processors and traders with high levels of migration and mobility. During my early days in the village, I was suspected to be a new fish trader, locally known as *kasitomala watsopano.* As a result I had many people coming to advertise their fish to me in my 'Room 5' of the fish mongers hostel (Picture 5). After two weeks in Kotamo, I had almost become accepted in the

community. At this time I began observing and enquiring about social networks, governance issues and customs. Notes on the observations were compiled every evening (sometimes under a candle light) to inform the next cycle of observations (Yin, 1994).

I walked every morning to fish landing sites, markets, the health clinic, and schools. I observed children receiving porridge in schools through the World Food School Feeding Program. Chisi Island had two primary schools with an enrolment of 130 boys and 80 girls taught by seven male teachers and one female teacher. There was also an early childhood development project that had three nursery schools managed by three volunteer instructors (uncertified) of which one was woman. I also participated in funeral ceremonies and went to church on Sundays. I visited 20 households as an invited guest. This was after a month in the village when my relationship with people in the village had improved greatly. I observed numerous fish trading transactions including fish transportation to the mainland. I travelled back to town once a week to replenish my food reserves, most importantly water. I found the water at Chisi Island not safe for me to drink although the residents drank it. As of March 2013, Chisi Island had ten boreholes for its thirteen villages with only six boreholes that were working. The island had one clinic which offered maternity, and family planning services, antiretroviral therapy and HIV testing and counselling. All these services were provided by one male nurse and three female Health Surveillance Assistants.

Picture 3. Accommodation apartment at Kotamo Village during direct observation: Joseph and Erik near Room 5. Photo by Precious Mwanza, 2014.

4.4 In-depth interviews of key informants

Through the process of individual consent, 25 elderly residents on Chisi Island and the mainland were interviewed. These informants were selected based on their experiences of at least two of the last lake recessions (1967 and 1996). A 'snowball' technique was used in choosing informants where each informant was used to identify and locate one or two other possible informants through networks (Bernard, 2011). I therefore got additional informants from each informant and the sampling size grew with each subsequent interview. Eventually, the sampling size became saturated where no significant new information was gathered. Interviewees were chosen for their relevance to the conceptual questions rather than their representativeness. By mere coincidence the informants included village headmen, women processors and fish traders. My eldest informant was a sister to the former Traditional Authority Mkumbira. The choice to interview her was deliberate as I wanted to gain an understanding of the matrilineal society in detail and kinship ties in this system. All the interviews were conducted in *Chichewa* and provided a deeper understanding of the complexities in the social structure and the intricate of fishing business and its governance.

4.5 Malawi National Archives study

A comprehensive study on the history of Lake Chilwa in Malawi was carried out at the Malawi National Archives (MNA) from March to June 2012. However, subsequent intermittent visits were made in order to check particular narratives from the in-depth interviews. The Malawi National Archives was established in 1947 as a regional branch of the then Central African Archives and later became known as the National Archives of Rhodesia and Nyasaland. Nyasaland, now called Malawi, was a British protectorate from 1907 to 1964. MNA is therefore the official repository of public records as well as records belonging to private institutions and individuals who had connections with Nyasaland territorial activities.

The study of national archives helped to understand major events during the periods of past recessions that may have had a bearing on the decision-making of the people. The archive study provided the groundwork and support for the primary data collection by identifying key areas of interest for further exploration during interviews and cross-checking of oral recalls. The MNA study described major environmental events, technical details, historical decisions and identified

the main organisational players and their roles in environmental management. The main archives studied included Secretariat Records of Nyasaland for the period 1891–1939: Blue Books[5] and administrative annual reports on agriculture, livestock and fisheries, demographic data, climatic data, government policies on agriculture, trade, labour and migration. In general, useful information was available for the periods 1920s to early 1940s; some records were destroyed by fire in the 1960s.

4.6 Data analysis

The qualitative studies used *critical discourse analysis* (Fairclough et al. 2006) and *content analysis* (Bryman, 2001). Critical discourse analysis and content analysis helped to identify dominant themes from the research and relate them to the objectives of the research questions. The analysis did not have a ready-made procedure, but was an iterative approach, open to suit a particular research theme (Fairclough et al. 2006; Yin, 1994; Walsham, 1995). The process of qualitative data analysis was a repetitive cycle of data collection and analysis, with the intention that results of the analysis would help guide the subsequent collection of data (Walsham, 2006; Yin, 1994). Therefore, when listening and documenting narratives from interviews and observations, simultaneously there was documentation and interpretation with all their contradictions, rather than finding the 'correct' interpretation (Yin, 1994). These narratives were later grouped in terms of content to understand the effects of the lake recessions on the people of Chisi Island.

The only statistical data analysis technique employed was on the quantitative structured household questionnaire survey. The Statistical Package for Social Scientists (SPSS) was used to analyse livelihoods in the context of capital assets, the available practices, institutions and processes. Data was cleaned and entered into the SPSS software through coding of different variables. For any inconsistencies, variables were cross-tabulated with inconsistencies against question numbers. Descriptive statistical tables and graphs were developed on major livelihoods proxies (activities) such as food availability and seasonality, access to social services, occupation and those specified in section 4.1 above.

[5] The colonial 'Blue Books' were annual statistical returns sent to governors in British colonies. They comprised information on population growth, agricultural production and marketing and weather patterns.

4.7 Possible methodological limitations

Household questionnaire language and interpretation

The questions for the household survey were written in English and translated directly to *Chichewa* when asking the respondents. Although the two research assistants were trained and the process was first piloted in another village, there could be possible errors of translation by the assistants and understanding by the respondents. Similarly, questionnaires may have been standardised to the point that it may not have been possible to explain any issues in the questions that participants might have misinterpreted. Considering that questionnaires are structured instruments they may provide little flexibility to probe for more information, especially when using assistants. Such relevant information as visual communication - gestures and other visual cues, is not included in questionnaires. However, the methodology used multiple methods to limit this bias.

Use of recall information

The Focus Group Discussions and in-depth interviews relied on recalled information. In asking people for information of the past, there may be differences in accuracy or completeness of the recollected information. Different people experience the same event differently, known as *recall bias* representing a major threat to the internal validity of self-reported data without formal documentation. This potential problem was overcome by increasing the sample size through snowball sampling. The limit to stop recruiting interviewees was reached when no significant new information was gathered.

Sample distribution and size

Apart from the quantitative survey where the sample size exceeded the least prescribed size of 30%, the other methods had limited control on sample size. The representativeness of the sample was also not seriously considered. For example, efforts to recruit more immigrants were always inhibited by their secretive movements and fear when they were being interviewed in a situation of an existing conflict. However, sample size may be less relevant in qualitative research. The most important point is reaching saturation (Bernard, 2000; 2011).

Use of Archival information

Archival data comprised of records or documents of the activities of individuals, groups, institutions and governments. Some of this information may represent the views of the colonial authorities with particular perceptions and interests. In the Malawi National Archives one possible problem may relate to selective depositing and survival of materials. Records on Lake Chilwa after independence when the 1967 drying occurred were not readily available and some archival materials were also destroyed by fire. Additionally, not all individuals or institutions, such as religious missionaries, archived their records in the National Archives. For example, it was reported that there were archival pieces of information by the English and Scottish missionaries that were still being kept by Livingstonia mission in northern Malawi, Blantyre mission in southern Malawi, the Anglican Dioceses in north, east and southern Malawi and the British main repository, the Public Record Office in London It was difficult to go to all archives for this study due to time limitations.

Self-reported data

Data on qualitative research was collected, analysed and reported by the author with limited options for independent verification. There may be potential error on selective memory where one mostly remembers experiences or events that occurred at some points and not others. However, some sources of error were already identified and where possible data gathered was properly triangulated.

5 Paper summaries

The main results of the PhD research are presented in papers I to IV. The papers provide deeper analysis of how contexts matter, how livelihoods are moulded by larger political and economic forces, how people might assimilate to the diverse and ever-changing socio-ecological systems they live in, and how livelihoods are impacted by different ways in rural Malawi and Southern Africa. There are synergies and overlaps among all the papers as presented in Figure 1. Papers I and II use the 1996 lake dry-up and the recent 2012 water recession to understanding the local context. Paper I, in particular, sets the scene by describing the general social dynamics in the Chilwa socio-ecological system in form of social networks. Paper II explains the Lake Chilwa changing ecological system and socio-economic environment. It discusses conflicts that arise from the decline of ecosystem services due to water recessions. Paper III uses a particular historical period of the 1933-34 recessions, which provide a unique opportunity to study the impact of water scarcity in the context of a depressed economic state of affairs. The last paper IV describes governance systems of natural resources. It explores rights to access and use of natural resources: land, water, wetlands, and fisheries that are essential to rural livelihoods. The methods used in each paper were equally broad, holistic and mixed to ensure that aspects of people's livelihoods were adequately understood. Table 5 summarises these methods for each of the papers.

Table 5. Application of research methods to peer reviewed publications

Research Methods	Paper I	Paper II	Paper III	Paper IV
Household surveys	√			
Focus group discussions	√	√	√	√
Key informant Interviews	√	√	√	√
Direct observations	√	√	√	
Malawi National Archives		√	√	

5.1 Paper I: Uncovering Human Social networks in coping with Lake Chilwa recessions in Malawi

Joseph Nagoli and Linley Chiwona-Karltun. Submitted to *Journal of Environmental Management.*

The paper provides insights into how people in Lake Chilwa and other social-ecological systems prepare for and cope with periods of shocks through social networks. Social networks are important in unifying different stakeholders to effectively deal with natural resource problems and dilemmas (Gunderson, 1999; Hahn et al. 2006; Folke et al. 2005; Olsson et al. 2008). Networks bond people by bridging their diverse norms and promote reciprocity (Dekker and Uslaner, 2001; Uslaner, 2001). Thus, social networks can be seen as having the potential to improve natural resource governance processes by facilitating the mobilisation and allocation of key resources and conflict resolution, especially in managing common pool resources (Carlsson and Sandstrom, 2008; Hahn et al. 2006). Analysing networks at the community level therefore helps to understand how social structures enhance or hinder coping strategies.

The paper used both qualitative and quantitative methods. Qualitative methods included Focus Group Discussions (FGD) and key informant interviews. FGDs had separate groups of men, women and the youth with an average of 18 people in each group. Discussions focused on knowledge of past recessions of Lake Chilwa, food security status during recessions and during normal lake levels, common challenges that people face in each village, consensus discussions of household assets as a proxy of well-being, and perceptions of vulnerability including people's hopes and fears for the future. In-depth key informant interviews used a snowball technique to identify informants who had witnessed at least past two past recessions of 1967 and 1996. The qualitative methods were preceded by a household questionnaire survey of 150 households, which addressed household histories, food and nutrition status, access to natural resources, income generation activities and coping strategies including their enablers such as migration and social networks.

The results of this paper show that during periods of water recessions and natural resource scarcity, coping strategies by people in the Chilwa ecosystem varied with every recession. The differences were based on social and economic factors prevailing at that point in time. However, in every recession, poor households cushioned each other through lineage tracing and networks. There was a strong tradition through kinship ties where the generic term

mwambo wathu (our tradition) embraced a group of formative norms enforced *via* a series of rules and rituals. The lineage networks were mostly built on survival strategies such as food sharing during scarcity, conflict resolution, control of land rights and collective decision-making in matters concerning the whole community. Additionally, Lake Chilwa had a matrilineal society which provided women with strong rights over land allocation and use, and in which the female sorority group called *mbumba* was perhaps the most stable unit. Almost all women especially in the same lineage lived close to each other although each woman ran a separate household. There was great deal of reciprocal aid and food-sharing among the households in over 65% of the households within a village during times of scarcity. However it was not clear whether social networks were effective coping strategies during normal years when the urge to seek support from others may not be as important.

Institutional and social networking in the Chilwa ecosystem was very complex in its conceptualisation and operationalisation. In this study 13 formal and informal and informal organisations were identified. The formal organisations such as Beach Village Committees and Village Natural Resource Management Committees were formed under the co-management arrangement which represent a pluralist approach to managing natural resources by involving a variety of partners in different roles. These types of organisations engaged local communities in the management of natural resources in partnership with government agencies. Agrawal (1997) refers co-management as "putting communities in conservation." This style of management is also widely referred to as 'community-based conservation' or 'participatory management' (Western and Wright, 1994). Although co-management involved people at the grassroots, its effective implementation was often inhibited by power relations between traditional leadership and the leadership of governance committees. The analysis of reliability and trustworthiness of formal organisations in the study area showed common agreement that formal committees were not as effective as informal networks in governing natural resources.

Despite the amount of natural resources governance policies dealing with land, water, forestry and fisheries resources, Lake Chilwa ecosystem still experienced a decline in natural resources due to overexploitation and environmental degradation. The overexploitation of natural resources was said to be rampant during lake recessions. The decline may be linked to gaps and conflicts among government policies and their poor enforcement (Njaya, 2009).

5.2 Paper II: Conflicts over natural resource scarcity in the aquatic ecosystem of the Lake Chilwa

Joseph Nagoli, Wapulumuka Mulwafu, Erik Green, Linley Chiwona-Karltun. Forthcoming in *Environment and Ecology Research.*

Paper II examines the linkages between resource scarcity and conflicts among various social groups – fishers, farmers and political groups in the Lake Chilwa ecosystem during the 2012 Lake Chilwa water level recession. The paper defines causal links between environmental scarcity and conflict during lake recessions. Conflicts over natural resources involve multiple social agents and occur at varying geographical scales (Pierre and Peters, 2000). While it is possible to identify particular instances in which scarcity and conflict may be correlated, the deeper question is how they are linked, and the specific transmission mechanisms through which scarcity can lead to conflict or vice versa.

The paper draws its analysis of field work undertaken from July to December 2012 that included in-depth interviews and ethnographic observations. In understanding the social and economic factors that affect conflict under scarce resources, the study answered the following questions: Who are the main actors in conflicts during resource scarcity? What are their interests, goals, capacities and relationships? The study mainly targeted users of the ecosystem: fisher folks, water users, farmers, and natural resources governance institutions such as Beach Village Committees (BVC), Village Natural Resources management Committees (VNRMC) and Bird Hunters Committees (BHC).

The findings show that the Lake Chilwa ecosystem provides important ecosystem services. These services brought both physical and non-physical benefits in the form of *provisioning services* such as food, water, and construction materials; *regulating services* in form of cleansing water and air and regulating the climate. *Cultural services* were provided through recreation, medicinal plants and important places (shrines) for worship; and *supporting services* such as soil formation, photosynthesis, and nutrient cycling. In normal years, the ecosystem is reported to provide services valued at over USD 21 million per annum on average (Schuijt, 1999). In order to maintain these services the people have been involved in conservation practices throughout history. These practices include designating some areas of the lake as sacred sites where cutting of *Typha* locally known as *njedza* or *mabawe* and fishing were restricted or were totally prohibited. Fishermen

also used locally made gears that were very selective in catching fish and ensured that only mature fish were allowed to be taken out of the water. Another important conservation practice was the banning of poisonous herbs for fishing. These practices had been part of the traditional norms based on historical knowledge of the lake's ecology and its periodic turbulence in water levels. The knowledge of the importance of vegetation in the productivity of Lake Chilwa was well entrenched in the community and had existed for generations (Njaya et al. 2011b).

However, the recession of 2012 brought vulnerability through reduced incomes from declined fishing, food insecurity, and health hazards. The coping strategies by different actors to the vulnerabilities and the need to conserve the ecosystem resulted in conflicts. These conflicts were exhibited at two levels: within governance arrangements and within the coping strategies that various actors used. In the governance systems, it was found that there were over 13 organisations working with natural resources governance whose legitimacy and effectiveness were questionable. Similarly, the sheer number of diverse policies affecting resource management made natural resources users uncertain as to which regulatory or policy framework was supreme or which policies had a positive impact on lake resources. The legal frameworks include: the Environment Management Act (EMA) of 1996, the National Fisheries and Aquaculture Policy (NFAP) of 2001, the National Water Policy (NWP) as revised in 2005, Wildlife Policy (WP) of 2000 and the Ramsar Convention. Different natural resources in the Chilwa ecosystem are managed by different legal frameworks. For example, although fisheries legally fall under NFAP and managed by the Fisheries Department, the vegetation in the lake where fish breed is under the NWP and managed by the Department of National Parks and Wildlife while the water itself is under NWP and managed by the Water and Irrigation Department.

Conflicts related to coping strategies in the 2012 recession were mostly between the people of Chisi Island and migrant fishermen. These conflicts were manifested through tensions over space, sanitation and cultural values. Migration was a coping mechanism often adopted when environmental factors turned harsh. As such, there were migrants from the northern zone (Figure 3) where the recession was most severe that came to fish in the middle part of the lake, which still had some pools of water. However, these migrants were not allowed residency on the island. The migrants therefore established temporary villages on the lake made of temporary grass floating houses - *zimbowela* (see Picture 6). The lake villages had poor sanitation and were perceived to be the main cause of a cholera outbreak that happened during the fieldwork in 2012.

Picture 4. Traditional *zimbowela* on middle Lake Chilwa built by migrant fishers from the Northern Zone of Lake Chilwa. Photo by Joseph Nagoli, 2012.

Migrants were also blamed for using banned fishing gear and fishing in forbidden sacred sites. The conflict between the two groups became serious such that one migrant was killed. Other conflicts arose from violation of traditional norms and rules. In the past, women were not allowed to fish in open waters. However, many women were forced to fish in open water because of their perceived roles as care givers of the household. This created conflicts around cultural values between traditional leaders who are considered custodians of culture and civil rights agencies that were protecting women's rights to food and access to scarce resources.

In summary this paper emphasises the negative effects that ecosystem decline and resource scarcity have on many poor people that are reliant on aquatic systems such as river floodplains and wetlands. Recognising that climate variability is likely to increase the frequency of the Lake Chilwa recessions, the paper concludes that addressing these challenges may require reforms in the governance of the lake resources, taking into account contextual factors such as authority, legitimacy and capacities of local and government institutions to effectively deal with resource scarcity.

5.3 Paper III: Coping with the double crisis: Lake Chilwa recession and the Great Depression on Chisi Island in colonial Malawi, 1930-1935

Joseph Nagoli, Erik Green, Wapulumuka Mulwafu, Linley Chiwona-Karltun. Resubmitted with revisions to *Human Ecology.*

Paper III analyses the relationship between environment, economics and power relations in dealing with natural resource scarcity. The paper bridges the gap between environmental history and political ecology perspectives to argue that both power relations and environmental scarcity matter in understanding competing interests for coping with natural resource scarcity. It explores the conflicting coping strategies between people of Lake Chilwa and the colonial authorities to economic and environmental crises happening between 1930 and 1935. During this period two events happened concurrently - the global economic crisis, commonly known as the Great Depression, and the local water recession of Lake Chilwa. These two crises happening together and negatively impacting on the livelihoods of people in the Lake Chilwa socio-ecological system are termed as 'double crisis'.

The analysis is drawn from archival materials, focus group discussions and key informant interviews from Lake Chilwa on two basic questions: does scarcity affect power relations or conversely how does power relation affect scarcity? To what extent is scarcity affected by other exogenous social and economic factors? Power as a paradigm of political ecology becomes a derivative of either influence over or control of the means of production (Wolf, 1972). Blaikie and Brookfield (1987) have also argued that political ecology is nested structurally and spatially. Those with power act to increase their wealth, which in turn creates limiting conditions for the poor and less powerful.

In 1931, the levels of Lake Chilwa began to decline due to insufficient amounts of rainfall leading to a complete dry-up in 1933[6]. The people in the Lake Chilwa ecosystem began to suffer from the decline in fish trade and that trend continued into 1933 when the fishery completely collapsed. At the same time the domestic and export markets of colonial Nyasaland (now Malawi) were in a depressed state following the economic slump of the Great Depression. The decline in European production as a result of deteriorated export markets implied a significant loss of tax revenues and hence it accelerated the colonial authorities'

6 Malawi National Archives MNA, S1/247F/34, Zomba District Administration Reports 1933.

ambitions to push for African cash crop cultivation[7]. One suitable area identified by the colonial state for cotton expansion was the dry Lake Chilwa.

Findings from this study show that the people of Chisi Island successfully resisted the state-led initiative of cotton farming on dry Lake Chilwa. For the islanders, the drying of the lake was temporary and could be endured as long as they had other natural resources such as birds that provided food in place of fish. The 1933 drying was mostly perceived as a problem of limited and temporary access to natural resources rather than a problem of absolute scarcity. Through historical ecological knowledge of the lake recessions, the islanders had developed traditional early warning systems of interpreting impending lake recessions. However, the skills for predicting recessions were only with few elderly people. In addition to ecological knowledge as the main driver to the resistance of cotton on the lake, people also feared land alienation and forced labour associated with the introduction of a highly labour intensive cash crop such as cotton (Brass, 1999; Mandala, 1990; Fukuyuma, 1999). The colonial directive for introducing cotton challenged the matrilineal tradition of land tenure and cultural integration such as sharing through kinship ties. The colonialists narrowly focused on economic consequences of the depression without considering the continuity of beliefs, the existence of institutions and the strategic options available to the indigenous people. The Lake Chilwa fisheries and all the natural resources at Chisi and the entire ecosystem were at that time managed through traditional systems (Ratner et al. 2013).

The paper contributes to emerging literature on coping with scarcities by understanding local reactions to policy initiatives amidst environmental scarcities that require the understanding of both power relations and scarcity. It shows that understanding conflict at the society level during times of environmental scarcity requires both the understanding of power relations and economic pressures. The islanders, although perceived as weak in a political sense, collectively possessed the capacity to withstand scarcity through ecological knowledge to resist the state's demand. The colonial authorities, with limited knowledge of the physical and social dynamics on the island, introduced a new commodity as a survival strategy for the people and as a potential means of generating government revenue. The 'double crisis' is consistent with Ribot's assertion that environment is an arena of struggle for power (Ribot, 2003) i.e. how the weaker groups can challenge the perceived powerful groups through collective identities and common purpose. Furthermore, the double crisis has shown that political ecology is primarily

7 Malawi National Archives MNA, S1/88F/35, Zomba District Administration Report 1934.

concerned with the ways in which scarcity and its framing as an economic phenomenon is discursively employed to serve the interests of those with political power (Otero et al. 2009).

5.4 Paper IV: Governance of Aquatic Agricultural Systems: Analysing Representation, Power, and Accountability

Blake D. Ratner, Philippa Cohen, Benoy Barman, Kosal Mam, Joseph Nagoli and Edward H. Allison – Published in *Ecology and Society*, 2013, 18(4): 59

Paper IV provides a framework for analysing governance contexts for Aquatic Agricultural Systems (AAS). The governance context of AAS refers to the domain in which people's authority to use, manage, or otherwise influence natural resources is exercised. This includes the formal legal and institutional framework as well as informal sets of norms, social networks, and power relations that guide and constrain stakeholder interactions with one another and with the natural environment (Olsson et al. 2006; Kooiman et al. 2008). AAS in developing countries face increasing competition from multiple stakeholders over rights to access and use of their natural resources: land, water, wetlands, and fisheries, which are essential to rural livelihoods.

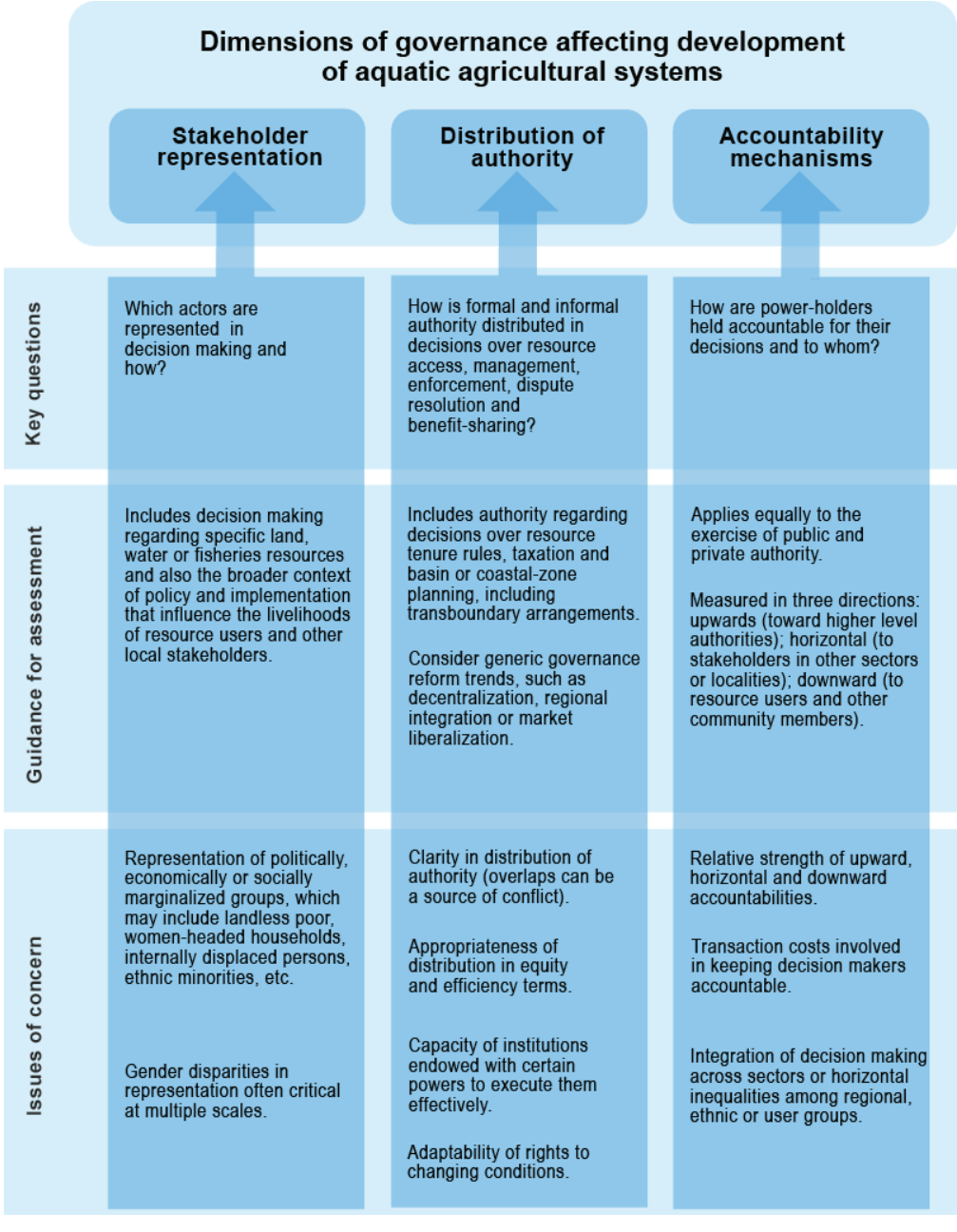
Pursuing improvements in the governance of natural resources in aquatic agricultural systems is not merely a technical process involving choices among designed options, but a contested process of change, requiring deliberations and negotiations over goals and underlying values among stakeholders (Armitage, 2008). Therefore, building more inclusive stakeholder representation is critical given the diversity of stakeholders involved in AAS and the marginalisation that many poor resource-dependent households in these systems face (Allison et al. 2012). There are promising opportunities at local levels, requiring deliberation over locally determined *best-fit* options as opposed to *best practices* from other countries (Carothers and de Gramont, 2011). Learning from such local innovations can provide a foundation for policy reforms and institution building at larger scales.

In contextualising better governance for AAS, the paper focuses on three dimensions of representation, authority and accountability. These three dimensions combine to characterise the governance context; understanding one without the others gives an incomplete picture and therefore yields little insight into pathways for change. For example, decentralisation reforms (a

redistribution of authority) that increase local government responsibility for common pool resource management, while neglecting to provide channels for community voice (stakeholder representation) and systems of redress in the case of abuse of power (mechanisms of accountability) may create incentives for elite capture rather than equitable or sustainable management (Agrawal and Ribot, 1999). Table 6 provides key questions to help orient analysis of each of these three dimensions of governance, and highlight issues of particular concern that often merit attention in AAS governance.

The paper illustrates how assessing the governance dimensions of representation, power relation, and accountability can yield practical insights into opportunities for improving local livelihoods. This is deduced from diverse AAS case studies from the Stung Treng wetlands of Cambodia, seasonal floodplains of Bangladesh; Lake Chilwa Basin, shared by Malawi and Mozambique and coastal communities in the Solomon Islands. From analysis of these case studies, the paper illustrates that conflicts exist among competing users of land, fisheries, water, and wetlands, emphasising the need for multiple routes to hold decision makers accountable as provided in Table 6. The framework provides a practical utility of analysis oriented to identifying pathways for change within a diversity of settings. Similarly, the dynamic and unpredictable challenges faced by fishers, farmers, and other rural resource users highlights the central importance of building the capacity of these communities to adapt in the face of future change, to participate in enhancing social-ecological resilience, and to proactively influence transformations in the institutions that maintain poverty and marginalisation. In building capacity to resolve disputes over tenure and resource management authority, it is often useful to support linkages between parallel institutions. For example, comparative research on co-management institutions in multiple lake and river systems in Malawi, suggests that where local government and sectoral agencies collaborate with the traditional leaders, fisher folk are able to access multiple avenues of recourse in clarifying resource claims and resolving disputes (Russell and Dobson, 2011). Measures that protect or equitably redistribute rights to access, manage, and retain benefits from AAS are especially important in areas where marginalised groups have seen those rights eroded in the face of increased competition. Robust mechanisms of accountability are especially important at times when rights to access and use natural resources are reallocated or negotiated. Governance institutions for common pool resources have power asymmetries both within groups of resource users and between local users and state actors.

Table 6.Framework for analysing the governance context for development of aquatic agricultural systems



Sources: Ratner et al. 2013

In the Chilwa case, power becomes clear in the ways in which (a) the rural people's collectives chose to work with ideas about livelihoods and local governance (b) political systems through legislation or governance structures affect natural resources access during recessions and (c) how economic motives influence a change in mode of production during complete drying of the lake.

6 Discussion of major findings

This section elaborates the major findings from the thesis as analysed from the four papers summarised above:

6.1 Importance of socio-ecological systems for rural livelihoods in Southern Africa (Paper I and II)

In Southern Africa natural resources are vital to livelihoods of people especially those in aquatic-agricultural systems. These systems provide integrated opportunities for direct natural resource harvesting such as fish, birds, grass and water. Some of the wetlands in these systems are of international importance as they host migratory birds apart from providing water cleaning functions. In the Lake Chilwa ecological system, there is a direct relationship between the people and the ecosystem. Culturally, the people in the ecosystem are so attached to the system and have their beliefs linked to the water and the system. These values include shrines for worship, medicinal plants and recreation.

The use of the aquatic-agricultural systems by communities is inextricably linked to climatic and hydrological dynamics, population and economic pressures within and outside AAS. It has been shown that the ecosystem services are lost during environmental shocks such as the lake recessions. The question is therefore whether there are technological and social advances that can be made to reduce the impact of ecosystem losses on the people and why people do not have resources to withstand recurrent scarcities. For example, the Lake Chilwa ecosystem has high potential for irrigation development. Can people's livelihoods be improved with new knowledge in irrigation, development and promotion of drought-tolerant and early-maturing crop varieties? As fishing currently provides a cushion during hunger seasons in the ecosystem, what improvements can be made in the fish

value chain to ensure increased fish shelf-life and distribution across seasons and geographies? Are there opportunities for improving the market to ensure that primary stakeholders especially women processors optimise profits and create employment at the local level?

Results of this study show that social advances in networks are extremely important than technological advances for improving rural livelihoods. Additionally, improvements to other alternative income-generating activities such as agro-processing and provision of services can expand the livelihoods base. These developments will need to be supported by well elaborated and timely early warning systems on top of local innovations.

6.2 Social networks in coping with environmental vulnerabilities (Paper I, II and III)

The people living in socio-ecological systems in Southern Africa such as the Lake Chilwa have lived with periodic economic vulnerabilities due to frequent natural resources fluctuation shocks. Some of these shocks declared as disasters attract provisions of alternative livelihoods by outsiders without consulting the people affected. Many alternative livelihood options provided by outsiders and experts during natural resource scarcities such as disasters tend to be supply driven. External organisations often 'supply' a number of options from a 'menu' of activities that they determine, rather than exploring with people's aspirations and options.

The need for better choices for coping is dependent on the applicability and effectiveness of the choices and the levels of vulnerability. Vulnerability may come from a range of factors – social such as gender inequalities; political including regional and ethnic inequality; economic as in the case of economic depression or any national decline in economy including boom and bust cycles; and natural environment such as the lake recessions. It is likely that there will be gendered division of labour in most coping strategies. It is therefore important to understand vulnerability by looking at the interaction of social structures and processes with environmental scarcity. Empirical studies of coping strategies have shown the importance of understanding the experiences of change in particular communities in terms of the means that the communities develop to address their vulnerabilities (Smit and Wandel, 2006; Morduch and Sharma, 2002; Pahl-Wostl, 2002; Moss et al. 2001; Ellis, 2000). Understanding local livelihood coping strategies therefore requires attention to

their gendered nature, economic development and geographical location (Rocheleau et al. 1996).

6.3 Structure and drivers to coping strategies (Paper I and III)

The findings of this thesis have shown that livelihoods of people in socio-ecological systems draw on various coping strategies to reduce the impact of environmental shock. Diversification generally helps to lessen the vulnerability and avoid a livelihood collapse. Similarly, coping strategies are found to be specific for a particular environmental shock. The ability to cope with one lake recession in the case of Lake Chilwa recession did not provide assurance that the same strategy would be successful with another recession. Factors such as age and gender as well as socio-economic status, and education are all argued to drive the choice of coping strategy (Grothmann and Patt, 2005; Deressa et al. 2009; Below et al. 2012). The 'double exposure' as in the 'double crisis' has provided evidence on how environment, economic and politics can compound the decision-making process to cope with a shock (Silva et al. 2010; O'Brien and Leichenko, 2000).

Social structure may be seen to influence important social systems including the economic system, legal system, political system and cultural system. This was evidenced in the successful refusal of the people of Chisi to the demands of the powerful colonialist to grow cotton on the lake and shows the power of social collectiveness. While households or individuals in the Chilwa society may have had different choices for livelihoods, their livelihood choices were embedded in a social, political and economic system that determined their collective advantage to utilise an opportunity or avoid a threat. Folke (2006) further emphasises that social norms are essential in such coping strategies and are expressed in the interplay between individuals (e.g. leadership, teams, actor groups). The emergence of nested organisational structures, institutional dynamics, and power relations bind people together in dynamic social networks where feedback loops are tightened. Investigating the socio-economic drivers of coping strategy, as well the community structure signifies how livelihood activities and the associated coping strategies varied for each recession and why social networks survived throughout all recessions.

Whilst the importance of social, economic and political factors are widely acknowledged, and the range of coping strategies used by people widely known (Below et al. 2012), there are still gaps in understanding the drivers for particular choices for a particular environmental shock. To maintain and

improve rural livelihoods, policies that advocate for proper coping to disasters or shocks need to be sensitive to the social structural and culture of the community in order to effectively support rural communities.

6.4 Power relation and environmental scarcity (Paper II, III, IV)

The Chilwa socio-ecological system has shown that conflicts over scarce resources arise over issues on who should have access to and control over resources, and who can influence decisions regarding their allocation, sharing of benefits, management and the rate of use. The conflict between Chisi Islanders and the state explains how decision-making with respect to resource fluctuations and policies affect livelihoods of rural communities. Similarly the 2012 lake recession demonstrated that climate variability and change is not only going to cause resource scarcity but most importantly economic pressures that may result in social political conflict as people compete to access natural resources for economic gain or survival. Conflicts over natural resources are therefore aggravated by the overlap of many factors such as migration, high levels of inequality, injustice and poor governance which constrain access. Although factors underlying conflicts are multi-causal and should be considered as such, analysing the linkages of these factors deeply is a basis for understanding the linkages between power relation and resource scarcity. Understanding power relation during scarcity would also require examining social agents in decision making.

Power relation in the Lake Chilwa case was demonstrated in three dimensions. Firstly, *coercive power* through which different organisations had power over use of the Lake Chilwa resources. This is evidenced by the restrictions through conventions and policies such as the Ramsar and different Government Acts for conservation such as the Acts on fisheries, wild Life and water. Coercive power was at times displayed by various committees (such as BVCs and VNRMCs) in efforts to protect the natural resources.

The second type *constraint power* as defined by Bachrach and Baratz (1970) exists when power is exercised by one agent to constrain the actions or possible actions of another agent. This power was exhibited by the people of Chisi Island who used all actions possible to restrain migrants from fishing. These actions ranged from denying migrants accommodation space and using violence to stop migrants from illegal fishing. Similar power was also manifested when traditional leaders tried to deny women access to fishing because it violated their traditional norms. In this understanding of power, the

individual is viewed as possessor of power, but no attention is given to the social conditions in which certain individuals act. In the case of Traditional Authority *versus* women's access to open water fishing, an individual or group held power to manipulate other people' behaviours (Raik et al. 2008).

Finally, the results from the research have also shown another type of power - *consent production*. This power account for social-structural processes that shape human relations and interests (Raik et al. 2008). In this case power no longer resides within individuals; it emanates from structural forces (Clegg, 1989; Gramsci, 1995). This is the power that can be explained by the colonial government and people of Chisi over the use of dry lake for cash crop production.

6.5 Managing coping strategies (Papers III, IV)

This thesis shows the need for inclusive and multi-level forms of governance that can deal with the complexity of social-ecological systems and their associated services. Sectoral policies in the Lake Chilwa socio-ecological system such as water, agriculture, fisheries and wildlife can facilitate or constrain coping strategies to natural resource scarcity. The thesis has further demonstrated that simply transferring responsibility to local communities, results in committees that have poor linkages and coordination. The analysis also reveals weak links between the micro-level (communities) and meso or macro-levels (national, international) organisations where communities' participation in natural resource management is passive, consultative and functional. Opening up barriers to facilitate rapid decision-making for communities to cope with sudden shocks therefore ensures communities' active participation in resource management.

Similarly, fisheries governance and conflicts management in Lake Chilwa reveals peoples underlying cultural values and shows that gender dynamics and governance regimes determine differential access to, and control of, resources between women and men. However, abrupt changes in social-ecological systems such as water and economic recessions pose serious challenges of enforcing resource access rules. The management of resource fluctuations and utilisation of common pool natural resources requires not only agreeing on common rules and practices but also coordinating usage, engaging in conflict resolution, sharing information and negotiating various trade-offs (Folke et al. 2005). Understanding the linkages between poverty and the ecosystem is therefore a prerequisite to the sustainable management of fluctuating natural resources.

7 Conclusion and future Research

The thesis has explored the intricate relationship between humans and their changing environments. The Lake Chilwa socio-ecological system provides an excellent case for studying people's responses to climatic variability and natural resources fluctuations in aquatic agricultural systems. The integration of natural resources and farming makes aquatic-agriculture systems particularly important in contributing to the livelihoods of the poor through increased food supply and income. However, people who live in AAS such as along the world's major river floodplains and coastal zones are vulnerable to multiple drivers of change, notably severe extreme weather events, increasingly frequent sea level fluctuations and demographic trends (Allison et al. 2007; Thomas and Twyman, 2005). With predicted global climate change and shifts from traditional economy to market-led economy, the livelihoods of these people continue to be precarious. The ecological knowledge that people in socio-ecological systems relied for a longer time to cope with the ecological changes may no longer apply in the face of impending frequent climate variability. In general, communities living in changing environments have unpredicted planning for the future. The pathways out of poverty therefore heavily depend on the productivity of these systems and the ability to explore *best fit* livelihoods alternatives.

The complexity of different interests – political, social and economic has resulted into conflicts among different actors resulting in increased competition at local, national and regional scales over rights to access and use natural resources such as land, water, wetlands, and fisheries which are essential for rural livelihoods. The need to identify and implement innovative measures to manage the scarce resources in these systems has sometimes resulted in conflicts among the various resource users such as fishers, farmers and

political groups. The people depending on the use of natural resources have therefore used different strategies by adjusting power relations in order to cope with the resource variability. A key implication is the need to strengthen governance to enable equitable decision making amidst such competition

People living in aquatic-agricultural systems such as the Chilwa are not the only people in Malawi and Southern Africa who are exposed to many of the hardships highlighted in this thesis. People, particularly in rural settings throughout southern Africa face very similar circumstances (e.g., hunger or food insecurity shocks), yet they carry out their livelihoods within very different contexts. The dynamic and unpredictable challenges faced by these people highlights the central importance of building the capacity of these communities to cope with future vulnerabilities. The people need to proactively influence transformations in the institutions that are aimed to reduce poverty and marginalisation.

This thesis has shown that the initiatives that tackle poverty and social inequalities using a variety of lenses are needed in order to support those who are less fortunate for better livelihoods. Future research must therefore begin to address the complexity of rural livelihoods by encouraging researchers and scholars working in developing countries to explore both the material and psychosocial experiences that play key roles in advancing livelihoods as well as improving downward accountability of development initiatives by communities. Such assessments should involve local stakeholders in ways that influence future programming priorities by official aid agencies, NGOs, and other development partners in the selection of feasible actions.

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Appendix I: Focus Group Discussion Guide

A. Exploring well-being and ill-being

The concept of well-being is broader than poverty which is usually considered as linked only to economic criteria. The challenge is to understand people's definition of well-being; what kinds of factors do they include in their definitions of well-being and ill-being. The following broad questions need to be explored:

- How do people define well-being or good quality of life and ill-being or bad quality of life?
- How do people perceive vulnerability, risk, security and opportunities? Have these changed over time?
- How do households cope with decline in well-being? How do these coping strategies in turn affect their lives?
- What are people's hopes and fears for the future?

Methodology:

There are different ways in which this analysis can be initiated with a group in the community. However, the following can be tried:

1. Exploring well-being:

In what ways do households differ from each other in this community? Or what is good/bad life? Let the group identify well-being categories.
Then go on to discuss the criteria on the basis of which households are differentiated. Pay particular attention to sources of livelihood and food security. Also ask about the types of crops that these groups grow and the type of food that they eat.

2. **Scoring:**

Obtain proportions of households in each category. (The group may start by first deciding the maximum limit out of which the scores will be given e.g. 100 or 50. Avoid using smaller numbers like 10 for the maximum as it is difficult to show the proportions when there are several categories.)

3. **Trend analysis:**

The use of this method should bring out the changes that have been taking place in the community and people's perceptions about the future. The group can be asked to discuss whether there have been any changes in the well-being of the community over the last 10 years.
Have there been any changes in the number of categories (more or less of them now as compared to the past)?
Have the criteria for defining the well-being categories changed?
Obtain proportions of households in each category 10 years ago (Can also obtain proportion of female-headed households for now and 10 years go.
Have the numbers of households in each category changed (whether some households have become better or worse-off than before)? Have the sources of livelihood changed? Why? How about changes in terms of food security?
What are the factors that have brought about these changes? (Look out for issues of risk, vulnerability, opportunities, and security). Has the environment played any role in this change?
How do different groups cope with these changes?
Which livelihood strategies appear to be best for the people? What are peoples' priorities in terms of investing in assets?
Ask the group whether they perceive any changes in the situation in future and what these changes could be.

B. Resource mapping

Ask the group to draw a map of their area. Tell the group that we would like to understand how life is for members of the community. Ask them to try to draw a BIG map with clear details of the important places. Give them about 15 minutes to draw it, with discussion happening as it is drawn, to make them feel comfortable. Then ask the following follow-up questions:
Which places are important for the people of this community? Do different groups have different places that are important to their lives? (Well-being groups, gender, fishers, farmers, hunters) Why are these places important?
What natural resources are available in this community now?

If you drew a map of this same area 10 years ago, would the map be same as the current one? What would be different?
What natural resources have changed? Have they changed for the better or for the worse?
What sources of livelihood have changed? Have they changed for the better or for the worse?
Are there any customs, rules and norms in this community that facilitate or hinder access to natural resources? How do they facilitate or hinder access?
Were there any customs, rules and norms that used to be practiced but are no longer being practiced now?
Would this map look the same 10 years from now? What would look different?
Will things change for the better or for the worse? If things were to change for the better, what needs to be done?
What strengths and opportunities would there be in order to achieve this? How about threats and weaknesses?

C. Institutional analysis: Matrix Scoring and Ranking; Venn Diagrams

This aims to explore the most important formal, informal, government, and non-government institutions within or outside the community that influence people's lives positively or negatively. It is important that before institutional analysis is initiated with a group in the community, there is some discussion on the concept of 'institution'. The main challenge is that the term 'institution' does not easily translate into the local language. However, this should be fairly easy if this discussion comes immediately after Resource Mapping where the group has already identified institutions that support people's lives. The group can be asked to list the different institutions that they have some links with. Pay attention to how the community accesses information.

Methodology:

Ask the group the following questions:
Where do you get help from (advice, instructions, help, and support)?
Which institutions support your livelihood?
Which groups access this information and support?

1. Scoring:

Scoring will enable the institutional analysis to be carried out on the basis of multiple indicators. Place the identified institutions along the first

column of a matrix. The matrix can be prepared on a flip chart using marker pens.
Next ask the group to discuss the basis on which they differentiate among these institutions. Allow the group to generate their own criteria. Also ask the group to consider the following criteria; trust, accessibility, effectiveness, relevance, and reliability.
Ask the group to give scores for all the institutions in the list against each of the selected criteria. Obtain reasons for every score that is given.

The following is a hypothetical example of institutional analysis using the scoring method.

Institutions	**Criteria** *(scoring out of 50; the higher the score, the better the performance of the institution)*			
	Trust	Effectiveness	Relevance	Reliability
Headman	30	50	40	40
Radio C	50	5	40	50
Lake Chilwa	25	30	50	10
Chikala Hills	20	30	50	15

NOTE: Do not add up the scores in the cells along the rows. This total is not a true reflection of the importance of the institutions, since the criteria do not carry equal weight.
Draw a Venn diagram to show the interaction and relationships of these institutions. The institutions can be ranked at the end.

D. Cause-effect analysis

Cause-effect analysis helps to understand an issue in a more complete form. Since we are interested in understanding people's perception on access to natural resources, we can use this method to open discussions on the subject (i.e. rights, structures, and processes). Ask the group the following questions:
Are there any problems that you face in relation to the environment?
Ask the group to identify problems that they face in relation to the environment. Ask them to identify one important problem. Ask them to describe some of the causes of the problem. Place these causes on one side the 'problem'.
Similarly, ask about the effects of the 'problem' and place them on the other side of the 'problem'

Next, ask the group if there are any links between the different causes and effects. These links should be shown by arrows.
Have there been any conflicts over resources? Which groups were involved?
Over the years, have there been any changes in the rainfall pattern? How about changes in terms of temperatures?
Are there frequent dry spells now than in the past? Who gets affected? How do they cope?
What has brought about these changes? What are people doing about these changes?

E. Seasonal calendar

What are the sources of livelihood for the people of this community?
During which months in a year are these sources productive?
Compared to 10 years ago, has the production been changing? Why?
In terms of food availability in the home, which are the lean months? How do people cope?
During which months do people have surplus food in the home?
In a year, are there any conflicts in terms of access to resources?
How can the productivity of the sources be improved?

Appendix II: Household Questionnaire

Livelihood Analysis Household Questionnaire

Name of Household:…….	No. Respondents/HH……..
Hotspot name: …….....	Village…….....
District:……..	T/A:……
Date:……	Enumerator:……

A. LOCATION

(Give a description of the location of the compound/house, considering :)

1. Route (How to find the dwelling – indicate coordinates and any other features)
   .....
2. Compound clustering: .....
   (1= <3 houses; 2= 3-10houses; 3= >10 houses)
3. Distance to market (in meters/kms/miles – please indicate unit):
   .....
4. Distance to track/road:
   .....
5. Distance to Health facility:
   Main Hospital [……..] Clinic/Health centre [……]
6. Distance to School:
   JP School […….] FP School […….] Secondary School [……]

B. HOUSEHOLD HISTORY

Use these questions in a flexible way to describe the settlement and family history of the household.

1. When and how did you start your own household?
   Year [.....] How: [.....]
   (1=got married willingly, 2=forced into marriage, 3=orphaned, 4=others: specify ……..……)
2. Where was that?[……]
   (if in present village: Go to 5; if not: Go to2)
3. What were your main economic activities in that place? [.....]
   (1= farming, 2=fishing, 3=employment, 4=selling labour/ganyu, 5=others :specify…….....)
4. When did you leave that place? [.....] *year*
5. Why did you leave that place? [.....]
   (1= search for better soils, 2=search for enough land, 3=changed economic activities, 4=employment transfers, 5=thefts/insecurity, 6=others: specify……..…….……..)
6. Have you and your household also lived in any other place? . Yes / No
   (If 'yes': Go to 6; if 'no' go to Section C)
7. Where was that?
   [.....]
8. What were your main economic activities in that place?
   [.....]
   (1= farming, 2=fishing, 3=employment, 4=selling labour/ganyu, 5=others: specify…….....)
9. When did you move to this place? [.....] year
10. When did you leave that place? [.....] year
11. Why did you leave that place? [.....] (As in 4)

C. HOUSEHOLD CHARACTERISTICS

1. Household size: (number) Male ☐ Female ☐
2. Household information:
   Ethnicity [……] Religion [……]

Name of HH Member (Start with the name of HH head)	Relation to HH head	Sex2	Marital Status3	Age	Education4	Can read /write5	Occupation6	
							Primary	Second
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12. Number of other regular members =								

1 Relation to HH Head: 01= H.H. Self, 02=Wife, 03=Husband, 04= Son, 05=Daughter, 06= Father, 07=Mother, 08=Daughter in law/son in law, 09=Brother, 10=Sister, 11=Father in Law, 12=Mother in Law, 13= Nephew, 14= Grandfather 15=Grandmother, 16=Others (specify)…….

2 Sex: 1=Male, 2=Female

3 Marital Status: 1=Unmarried, 2=Married, 3=Widow, 4=Divorced, 5=Separated

4 Education: 1=Junior primary (std 1-5), 2=Senior primary (std 6-8), 3=Form 1-2, 4=Form 3-4, 5=University and any professional training, 6=Non formal education, 7=No education

5 Can read and write: 1=Yes, 2=No,

6 Occupation: 01=Unemployed, 02=Agriculture, 03=fishing, 04=fishing and Agriculture, 05= House helper/maid, 06=Professional (Blacksmith, Carpenter, Sewing, etc.), 07=Business (Specify..), 08=Housewife, 09= IGA at home, 10=NGO worker, 11= Private/govt. service, 12= Student,13= Others (specify).

For all not applicable indicate - 99

3. Are there any absent household members? ..... Yes / No

(Determine whether or not to consider them part of the HH, using question 4, 5 and 6)

4. Why are they absent? [……]
   (1=seasonal labour migration, 2=education, 3=staying with family elsewhere, 4= start own household, 5 =others: specify …….)
5. Are they absent for a period longer than 6 months? .. Yes / No
6. If 'yes' are they part of a household in the place where they stay? Yes /No
   (If 'yes': Do not consider as HH member)
7. Do some present HH members stay in the house for less than 6 months a year? Yes / No

(Determine whether or not to consider them part of the household, using Question 8 and 9)

8. Why do they leave the house […….]
   (1=seasonal labour migration, 2=education, 3=staying with family elsewhere, 4= split-up household, 05= others: specify…….)?
9. Are they part of a household in the place where they usually go? Yes / No
   (If 'yes': Do not consider as HH member) (Make the decision about who to consider as part of the household)
10. How many people are part of this household?.....
    (This will be the research unit for the rest of this questionnaire)

D. FARM CHARACTERISTICS AND LAND TENURE

1. Do you own land? Yes / No
2. Do you farm? Yes / No
3. Do you also farm land that you do not own? Yes / No
   (If 'no': Go to 5)
4. Under what arrangement do you use this land? [.....]
   (1=cash rent, 2=share harvest, 3=use at no cost, 4=others-specify)
5. Do you farm all the land you own?..... Yes / No (If 'yes': Go to 7)
6. What do you do with the land you own and do not farm? [.....]
   (1= rents it to others, 2=use it for animal grazing, 3= as fallow 4= stays idle,
   5=others: specify……...)
7. Could you tell us the long-term changes over time of the following items:
   (Compares with the time that household started - in household history)

Crops	Past (years)						Now					
	Area			Yield			Area			Yield		
Maize	+	±	–	+	±	–	+	±	–	+	±	–
Rice	+	±	–	+	±	–	+	±	–	+	±	–
Millet	+	±	–	+	±	–	+	±	–	+	±	–
Sorghum	+	±	–	+	±	–	+	±	–	+	±	–
Groundnuts	+	±	–	+	±	–	+	±	–	+	±	–
Cassava	+	±	–	+	±	–	+	±	–	+	±	–
Potatoes	+	±	–	+	±	–	+	±	–	+	±	–
Beans	+	±	–	+	±	–	+	±	–	+	±	–
Pigeon peas	+	±	–	+	±	–	+	±	–	+	±	–
Tobacco	+	±	–	+	±	–	+	±	–	+	±	–
Chick peas (Tchana)	+	±	–	+	±	–	+	±	–	+	±	–
Sunflower	+	±	–	+	±	–	+	±	–	+	±	–
Cotton	+	±	–	+	±	–	+	±	–	+	±	–
Other 1……	+	±	–	+	±	–	+	±	–	+	±	–
Other 2……	+	±	–	+	±	–	+	±	–	+	±	–
	+	±	–	+	±	–	+	±	–	+	±	–

+ = has improved, ± has remained the same, – has decreased

8. Farm Plots

Plot No.	Size (acres/ha- specify)	Land Form (a)	Use (past year) (b)	Soil type (c)	Fertility (d)	How acquired? (e)	Crops in order of importance	Planting (Month)	Harvesting (Month)	Amount harvested (kgs/bags)
1							1.			
							2.			
							3.			
							4.			
							5.			
2							1.			
							2.			
							3.			
							4.			
							5.			
3							1.			
							2.			
							3.			
							4.			
							5.			
4							1.			
							2.			
							3.			
							4.			
							5.			
5							1.			
							2.			
							3.			
							4.			
							5.			

(a) Land Form
1) Dambo/Dimba
2) Wetland
3) Upland
4) Not used
5) Given out
6) Other (specify)

(b) Use (past year)
1) Food crop
2) Cash crop
3) Fallow
4) Clay
5) Others (specify)

(c) Soil type
1) Gravel
2) Sand
3) Loam
4) Rented

(d) Fertility
1) good
2) not good
3) medium

(e) How acquired?
1) Inherited
2) Purchased
3) Gift from VH

9. Do you practice irrigation farming?.....Yes/No, If Yes:

Crop	Area	Purpose (a)

(a) Purpose: 1=sale, 2=food, 3= sale+food

E. LIVESTOCK

1. Do you own animals? Yes / No
2. Did you own animals in the past? Yes / No
   (If 1 'yes' and 2 'yes' go to 4. If 1' no' and 2 'yes' go to 3. If 1 'no' and 2 'no' go to section F)
3. How did you lose your animals? [.....]
   (1=diseases, 2=theft, 3=sold them all after crisis, 4=grabbed by debtors, 5=others: specify……)
4. Are you sometimes forced to sell animals in order to support your family Yes/No
5. If Yes what are the critical months this happen?
   .....
6. Why? [.....] (1=buy grain to feed the family, 2=get money to pay school fees, 3= get money to pay for initiation, 4=slaughter to hire farm labour, 5=others: specify……..……..…..)
7. Animal Form

Type of livestock	No. of animals		Use (a)
	10 years ago	Now	
Chickens			
Guinea fowls			
Ducks			
Rabbits			
Goats			
Sheep			
Pigs			
Cattle			
Other 1……			
Other 2……			

(a). Use of livestock
1) consumption- meat/milk/eggs 2) Source of income –meat/milk/eggs
3) Animal traction 4) Manure 5) Social obligations 6) other (specify)

F. FOOD SECURITY

1. How many months the household feeds itself adequately either from their own production, or purchasing from the market, or from other sources?

	Months with adequate food (tick)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
a. From own production												
b. Buys from markets												
c. Months most difficult to find food												
d. Months you normally receive food aid												

2. How many years were you able to sell surplus grains in the past 10yrs (specify period if new household?) ……..
3. 6. Food consumption

Food	Peak	Lean
Carbohydrates		
a) Maize		
b) Rice		
c) Sorghum/millet		
d) Cassava		
Proteins		
e) Fish		
f) Chicken		
g) Wild birds		
Meat (goats/rabbits/beef)		
i) Eggs		
Vitamins		
j) Leafy vegetables		
Legumes		
k) Pigeon peas		
l) Beans		
m) Soya		
n) Chick peas (Tchana)		
Oils		
o) Cooking oil		
p) G/nut seasoning		
q) Sunflower seasoning		
Fruits		

Code:
1=3meals/day,
2=2meals/day
3=1 meal/day
4= 1-3 days/week,
5 = 4-6 days/week,
6=1-3 days/month
7=Never
8=Irregular

4. Did you get any food out of hunting/fishing Yes / No

5. If Yes, what are these foods ……..…..
6. Did you get any food out of gathering (specify)? Yes / No
7. Do you work on other people's farms in exchange for food or any other goods? Yes / No
8. If yes, When [……..…..] Where [……..….] Season [……..…..…]

G. ACCESS TO NATURAL RESOURCES

1. What are the natural resources you have accessed in last 12 months

Resource type	When available												How accessed (a)
	J	F	M	A	M	J	J	A	S	O	N	D	
Forest mushrooms													
Firewood													
Poles													
Wild fruits													
Wild birds													
Fish and other aquatic products													
Marshes													
Others……													
Others……													

a) 1=open/common access, 2=buys license, 3=free permission from managers, 4= from own resource 5=tips govt managers, 6=other

2. How has the quantity accessed of these natural resources changed of the past 10 years(specify period if new household?)?

Resource type	Amount accessed over time		
Forest mushrooms	+	±	–
Firewood	+	±	–
Poles	+	±	–
Wild fruits	+	±	–
Wild birds	+	±	–
Fish and other aquatic products	+	±	–
Area under Marshes	+	±	–
Others……	+	±	–
Others……	+	±	–

+ = increased, ± = remained the same, – = decreased

3. Are there traditional beliefs connected with accessing natural resources?
….Yes/No. If Yes:

Belief	Natural Resource
1.	
2.	
3.	

4. What are your sources of fuel?

Resource	Source (a)	Amount used/ week (b)
Forest wood		
Charcoal		
Planted trees		
Trees of Pigeon peas		
Trees of sunflower		
Maize stalks		
Rice Shaff		
Electricity		
Paraffin		
Others		

1= Forest reserves, 2=Community woodlots, 3=own land/private source, 4=others specify. Try investigating the best way respondents provides the amounts – either cost or cubic meters, please specify

H. INCOME GENERATING ACTIVITIES

1. What are the sources of your household gross income? (tick) Once you have identified the income sources, ask the HH to rank 4 top contributing sources and write them in the extreme right column.

1	Farming		1st	
2	Livestock rearing		2nd	
3	Poultry rearing		3rd	
4	Fishing		4th	
5	Fish culture			
6	Bird hunting			
7	Agriculture wage labour			
8	Non agri. wage labour			
9	Petty business			
10	Business			
11	Urban remittance			
12	House helper/maid			
13	Handicraft			
14	Others (specify)			

2. Did you get any goods (incl. foodstuff) by exchanging them for other goods (bartering) in the past 12 months?..... Yes / No
3. If yes: Which goods did you give and which goods did you get?
   Given: .....
   Received: ……
4. Has the number of income sources for your household increased, decreased or stayed the same over time (describe the period)?
   Increased [.....] Decreased [.....] the same [.....]
5. Has your nonfarm income increased, decreased or stayed the same over time? (tick) Increased [.....] Decreased [.....] the same [.....]
6. In which sector do women work outside home?
   (1= always, 2=Sometimes, 3=Only in crisis, 4=never)

Agriculture labour		Selling labour (ganyu)	
Fish processing and/or trading		Others Specify)	
Firewood selling			
Food selling			
Craft making			
Fetching water for money			
Employment			

I. CASH EXPENDITURE

1. What are the major areas of expenditure over the last 12 months (use the form as checklist – use a convenient recall period – wk, month, year and specify)

Expenditure details		Estimated Cost
Major foods	Maize/Rice/Cassava	
	Meat/eggs	
	Fish	
	Vegetables	
Other foods	Snacks	
	Tea (tea rooms)	
Leisure/beer		
Education		
Health		
Consumables	Clothes	
	Paraffin	
	Salt/sugar/…	
Firewood		
Transport		

Weddings/funerals/initiations		
Gifts		
Housing: repairs/improvements		
Investments	Agricultural inputs	
	Business	
	Equipments	
Loan repayments		
Others:		

10. Which types of expenditure have increased most sharply over time?
    .....

J. SAVINGS

1. Did you or do you have savings? ..... Yes/No
   (If no go to section K)
2. Have you used the money in last 2 years that you have saved? Yes/No
   (If no go to section K)
3. If Yes what have you used your savings for:

1.
2.
3.
4.
5.

K. DETAILS OF LOAN

1. Do you have any loans or have you borrowed money in last 12 months?
   Yes/No (If no go to section L).
2. If yes:

Sources:

Money lender	
Commercial banks	
Community revolving funds	
Microfinance Institutions (Specify)	
Friends/relatives	
NGOs	
Clubs/CBOs	
Others (Specify)	

3. How have you used the loan?

Farming	
Off farm IGAs	
Health	
Housing	
Emergency	
Consumption	
Others (Specify)	

4. What was the repayment period of the loans? and what was (the annual) interest rate? *(from 2)*

Loan	Repayment period *(specify wks/months)*	Interest

L. POSSESSIONS/ASSETS

1. Indicate whether the household possesses the following items, how many and how acquired?

Asset	No.	Acquired	Asset	No.	Acquired
Car/Motorcycle			Plough		
Bicycle			Fishing boats		
House –iron roofing			Seine nets		
TV set			Livestock		
Radio			Modern furniture		
Sewing machine			Treadle pump		
Ox cart			Others:		
Cell phone					

Acquired: 1= Inherited, 2= purchased by owner, 3=remitted by relations, 4= given by well-wishers, 5=Others

2. If the household possesses a radio,

What are the favorite channels/radio stations	Programs	What times of the day do you normally listen to the radio

3. Are you sometimes forced to sell possessions because you need the cash? Yes / No (If no: Go to 5)
4. Have there been years that you were forced to sell much more possessions than usual Yes / No
5. Have your possessions increased, decreased or stayed the same over time? (indicate years)
   Increased [.....] decreased [.....] the same [……]

M. MIGRATION

1. Have any members of this household left the area for over a month in the past year?. Yes / No
   (If 'yes': Go to first form; If 'no': go to Question 2)

Name of migrant	Destination	HH status on food/cash /labour when leaving	Reason for leaving	Period (months)

2. Have any members of this household left the area for over a month in the years? ..... Yes / No
   (If 'yes': Go to second form; If 'no': go to Section M)

Name of migrant	Destination(s)	HH food/cash /labour situation when leaving	Reason for migrating	How often in past 10 years

3. What were the main benefits the migrants brought to the household?
   [ ] (1=cash remittances, 2=food provision, 3=other)
4. Has the importance of migration and remittances for the household increased, decreased or stayed the same over time?
   Increased [.....] Decreased [.....] the same [.....]

N. SOCIAL NETWORKS

		In the village			Outside Village			Outside Malawi		
Do you have relatives (1=yes, 2=No)										
Do you help each other in farm and/or other work? (1=yes, 2=No)										
Do you give or receive food to/from these relatives? 1=give, 2=receive, 3=No (neither gives nor receives)										
Do you give or receive cash to/from these relatives 1=give, 2=receive, 3=No (neither gives nor receives)										
Have these forms of mutual aid increased, decreased or stayed the same over time?	farming	+	±	–	+	±	–	+	±	–
	Food	+	±	–	+	±	–	+	±	–
	cash	+	±	–	+	±	–	+	±	–

1. Household membership in local institutions

Household member/s (indicate number)	Affiliation Type	Affiliation (tick)	Benefits (a)
	Affiliation with political party		
	Membership in community committees (school, church, etc. - specify committee/s)		
	Membership in governance committees (VNRMC, VDC, ADC, BVC) - specify		
	Membership of church/mosque		
	Membership in NGO supported groups (farmers club, irrigation, AIDS etc.) specify		
	Membership in CBO groups (voluntary)		
	Participation in community festivals		
	Other associations (specify)		

Benefits: 1=get help in times of problems, 2=satisfaction in helping others, 3=Recognition, 4=security, 5=social collateral, 6=requirement by donors, 7 others – specify.

5. If household belongs to a donor supported group, does it receive subsidized inputs, or goods from NGOs through the group Yes / No
6. What other benefits do you get from the donor/NGO?
   ……
7. Do you know other households that do not belong to any donor supported group Yes / No
   If Yes How many […….]
8. What is their economic status as compared to you?
   Better [……..] same [……..] Worse [……..]

O. VULNERABILITIES and COPING STRATEGIES DURING PAST 12 MONTHS

1. What kind of crisis did you experience in the last 12 months? (tick)

Flood/Excess rain	
Drought/ Little rain	
Cyclone /Wind damage	
Poor production/ Shortage of food	
Illness	
Death of household member	
Arrest of household member	
Divorce/separation	
Loss of job/ loss of reliable income source	
Theft/burglary	
Eviction	
Property grabbing	
Market fluctuation	
Accident of HH members	
Others (Specify	

2. What were your coping strategies?

Cash loan from neighbors/relatives	
Cash loan from Money Lender	
Food assistance from kins	
Reduced meal frequency	
NGO relief	
Government relief	
Sold/rented land	
Sold household in-house assets	
Sold livestock	
Sold firewood from forest reserve	
Sold grain – rice, maize	
Sold family labour for cash or food	
Changed occupation	
Migrated to sale labour	
Collected leftover grain from paddy field	
Others (Specify	

3. Past health status of household members

Type	Number of days			
	Last 1 Month		Last 12 months	
	Male	Female	Male	Female
Cholera				
Other diarrhea episodes				
Respiratory illnesses				
Malaria				
Other chronic illnesses				
Number of work days missed due to illness				
Number of times HH visited a doctor				
Number of times HH consulted traditional doctors				
Number of times HH visited faith healers				
Amount spent in last month on medicine and fees (MK)				

Indicate a cumulative number of all household members– so if one member 2 days and another 7, answer is 9 days.

4. Do you have access to water for: drinking? ☐ Washing? ☐
   (1=Yes, 2=No)

5. If yes, what are the sources for: drinking? ☐ Washing? ☐
   Source: 1=protected wells, 2=piped water, 3=river, 4=Lake Chilwa, 5=boreholes

THANK YOU